

Bangor University

DOCTOR OF PHILOSOPHY

**Richard Pennant, Samuel Worthington and the mill at Penlan
a history of the Penrhyn Mills on the Lower Ogwen**

Lill, Barrie

Award date:
2019

Awarding institution:
Bangor University

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Archäologische Denkmalpflege

Sonderband 1

Juli 2018

Barrie K. Lill

Richard Pennant, Samuel Worthington, and the Mill at Penlan

A History of the Penrhyn Mills on the Lower Ogwen

<https://archdenk.blogspot.co.uk>

Herausgegeben von **Raimund Karl**

Impressum

Herausgeber:

Prof. PD Mag.Dr. Raimund Karl FSA FSAScot MCIfA

Prifysgol Bangor University
School of History and Archaeology
College Road
Bangor, Gwynedd LL57 2DG
United Kingdom

r.karl@bangor.ac.uk

Die Meinungsäußerungen in dieser Blogschrift sind meine persönlichen Einschätzungen bzw. die von GastautorInnen. Alle AutorInnen sind für die Inhalte ihrer Texte selbst verantwortlich.

Lizenzen

Die Texte dieser Blogschrift stehen unter einer [Creative Commons Attribution-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-sa/4.0/) Lizenz. **Kommerzielle Nutzungen sind erlaubt, ich bitte aber um vorherige Absprache.** Fremdinhalte (insbesondere Bilder) sind ggf. davon ausgenommen. Hier sind die jeweils angegebenen urheberrechtlichen Regelungen / Lizenzen ausschlaggebend.



To Ivy, Jennie, Victoria, Alexandra, Joey and Charlie: *mes raisons d'être*.

Also to my late parents Kenneth and Jenny Lill.

Summary

On 24th March 1800 a lease was signed between Richard Pennant, owner of the Penrhyn Estate in Llandegai, north Wales, and a consortium of Liverpool merchants which included among them Samuel Worthington. The properties covered by the lease included three of the Estate's grist mills and the newly constructed flint mill at Penlan. The signing of this lease signalled a turning point in the industrial development of Llandegai, at the forefront of which was the flint mill. The mill was unique in several ways, being the only flint mill to be built in north Wales; having a direct link with the Herculaneum Pottery in Liverpool; being what probably was the first brick-built industrial building in Llandegai; and having what is believed to be part of the first iron-railed overland edge railway of any length in the world.

During the course of its life, from 1796 to 1955, the mill underwent five phases of development. Beginning life as a flint mill in 1835, it was converted for milling corn, retaining this function until the end of 1901. At around the same time the adjoining stable was built and in 1852 a warehouse extension and private railway siding were added. Further buildings were added in the 1880s. Another unusual feature was its water supply, which was designed not only to provide a power source for the mill itself but also to power the waterwheel, feed the aqueduct, and turn the turbine at the adjacent Felin Isaf site.

The history of Penlan Mill is not just about a building but also about the principal characters who were involved in its construction and development; in particular Richard Pennant and Samuel Worthington. For anyone with an interest in the history of Llandegai and its development it is a story that deserves to be told.

Acknowledgements

I have been fortunate that during the course of researching material for this work I have spoken with many people who have very kindly shared their memories, knowledge and experience. My sincere thanks to them all, including those who sadly are no longer with us. If there are any omissions from the list below, which is in alphabetical order, then I can only apologise. They include the following: David A. Carr, Peter Crewe, Keith Davies, Megan and Elizabeth Ellis, Leslie Foulkes, Vera Goodwin, Dr. David Gwyn, Eirlys and Eirian Griffiths, Mrs Beryl Hughes and family, Emyr Hughes, Vera Hughes, Howard and Cora Hutchinson, Dr Dafydd Alun Jones, Eunice Jones, John Jones, Merfyn Jones, Nerys Jones, Robert Jones, David Manton, Prof. Marc Mulholland, Helen Outram, Donald Owen, Sheila Owen, Vaughan Parry, Edmond Douglas Pennant, David Pritchard, Gladys Roberts, Rev. J. Aelwyn Roberts, Nicholas Taylor, Rita Thomas, Alwena Tomos, Glyn Williams, and William Williams.

Special thanks are due to a number of people without whose help the excavation work at the Penlan Mill site could not have been completed. These include Peter and Gill Bullen, the former owners of the site, who allowed me to carry out the initial excavation work; and also Eric Goulden and Gary Jones from Celtest Ltd, who later purchased the site for industrial development but nonetheless allowed excavation to continue until completion. They all were extremely supportive throughout. So too Gwynfor Jones and Paul Thomas from Celtest, Paul doing his best to ensure that site safety rules were maintained, as well as at times keeping me out of trouble by providing much needed muscle! Mention too should be made of the staff at Hewden's Plant Hire for on occasion providing heavy plant and machine operators. It is impossible to overstate the skill and dexterity of their drivers who seemed to 'feel' the presence of as yet un-exposed structures beneath the surface.

My thanks to the staff at both the Archive and Special Collections Department at Bangor University and Gwynedd County Archive in Caernarfon: the assistance they provided was invaluable. Also to the staff at the Bangor University Library and other Record Offices that I have visited; Isabel Holowaty at the Bodleian Library; staff at the National Library of Wales; the Royal Commission for Ancient & Historic Monuments in Wales; the Chester Records Office; and the Liverpool Records Office. Special thanks are also due to Moira Muir who so kindly allowed me access to her private family papers relating to the Penrhyn Iron Mine; and to David Elis-Williams for allowing me to include his original sketch and photographs of the iron mine site.

Special thanks are also due to Eric Foulkes, historian to the Penrhyn Quarry Railway Society, whose knowledge of the Penrhyn Estate and Quarry is encyclopaedic. We have corresponded over many years and it is thanks to his generosity that much of the material relating to the early life of Samuel Worthington and the photographs of Felin Isaf (the Estate Yard) have been made available. Thanks also to Ted Royle MBE, Trustee of the Cheddleton Flint Mill Industrial Heritage Trust, for generously spending time to enhance my understanding of the flint grinding process and, together with Helen Outram, taking the

Acknowledgements

trouble to visit the site. Thanks also to Chris Copeland, for granting me permission to utilise some of his late father's drawings.

Advice regarding the excavation work at Penlan was freely given by Andrew Davidson from Gwynedd Archaeological Trust; Frances Lynch-Llewellyn (who also inducted me into the dark art of off-set drawing!); and Prof. Raimund Karl. The overall advice and support offered by both Frances and Ray has been instrumental in bringing this work to a successful conclusion, and any mistakes that have been made are my sole responsibility. Mention too should be made of Katharina Moeller who so brilliantly translated my original site plans into a presentable form.

Above all thanks to my wife Ivy, without whom this work would not have been completed. She not only proof-read my drafts and accompanied me on innumerable visits to mills around the country, but also assisted me in draughting the site plans.

Contents

SUMMARY.....	III
ACKNOWLEDGEMENTS.....	IV
PLACE NAMES, ABBREVIATIONS, AND ILLUSTRATIONS	IX
Place names	ix
Abbreviations.....	ix
Illustrations	ix
1. INTRODUCTION	1
1.1. The Arrival at Penrhyn of the Pennant family.....	2
1.2. The arrival of the Entrepreneurs.....	7
1.3. Networking.....	18
2. PENLAN MILL	21
History.....	21
3. LOCATION AND DESCRIPTION.....	35
3.1. Location and overview of the site.....	35
3.2. Description of the Mill complex.....	38
3.3. The Flint Mill (Phase I).....	39
The West Wall.....	42
The South Wall.....	44
The East Wall	46
The North Wall.....	50
The Floor Area.....	52
The Water Wheel Pit.....	60
The Roof.....	66
The Waterways	66
Interpreting the Site.....	67
How Flint Mills Work.....	69
The evidence at Penlan Mill.....	75
How it was transported	75
The Water Wheels	81
Where was the flint burnt?.....	85
Where was the flint crushed?.....	93
Where was it dried?.....	94
Items found on site	98
Conclusion.....	99
3.4. Conversion to a corn mill (Phase 2)	101
How Corn Mills Work	102
The evidence at Penlan Mill.....	103
Where was the grain dried?.....	104
Where was the grain milled?	107
3.5. The Stable (Phase 3).....	108
3.6. The warehouse and siding (Phase 4)	111
3.7. The Upper Yard Extensions (Phase 5)	117
4. THE ASSOCIATED WATERWAYS, ABOVE AND BELOW GROUND	119
4.1. The Leat.....	119
4.2. The spillway.....	126
4.3. The aqueduct	128

The underground water courses.....	131
4.4. The tail race.....	131
4.5. The main drainage tunnel.....	132
4.6. The underground drain.....	134
4.7. The Culvert.....	136
4.8. The turbine pipeline.....	139
5. TRANSPORT LINKS	143
5.1. The Turnpike Trusts	143
The Caernarvonshire Turnpike Trust	143
The Capel Curig Trust.....	146
5.2. 'Occupation' Road.....	147
5.3. The Chester & Holyhead Railway.....	150
5.4. The Penlan Siding.....	153
6. THE UPPER YARD AT BRYN	156
6.1. The Timber Yard.....	156
6.2. The Carter's Cottages (Penlan Cottages)	159
6.3. Amaethwyr Ogwen Ltd	163
6.4. The Penrhyn Iron Mine	163
7. THE PENRHYN MILLS.....	184
7.1. Felin Isaf and the Estate Yard at Trefelin	187
7.2. Cochwillan Mill (Melin Uchaf).....	204
The Fulling Mill.....	209
7.3. Felin Hen	215
7.4. Costs Relating to the Mills	220
A summary of expenditure on the Penrhyn Mills, by year.	221
Expenditure on the Penrhyn Mills, by mill name.....	225
7.5. Other Penrhyn Mills.....	236
8. FINDS.....	238
8.1. Glass.....	238
8.2. Leather	247
8.3. Metal.....	248
8.4. Pottery/Chinaware.....	273
8.5. Slate & Stone.....	285
8.6. Tools.....	286
8.7. Wood.....	288
8.8. Miscellaneous Items	291
9. BIBLIOGRAPHY.....	295
Primary Sources	295
Secondary Sources	302
APPENDICES.....	304
Appendix I: Site Drawings, Coordinates, and Spot Heights	304
I.1 Plans and Elevations	304
I.2 Penlan Mill Co-ordinates and Spot Heights	304
Appendix II: Wyatt's Description of the Penrhyn Tramway	306
PLANS	308

Place Names, Abbreviations, and Illustrations

Place names

As this study relates to the industrial development of a small Welsh-speaking community in rural north-west Wales it is only to be expected that the majority of the places and buildings referred to have Welsh names. One of the problems associated with this is the use of mutations within the Welsh language, coupled with the inadvertent Anglicisation of these names by newcomers to the area. For example, the words 'felin' and 'melin' (both meaning 'mill') mutate depending on context and have sometimes been anglicised to 'velin' (although there is no letter 'V' in the Welsh language). Similarly, words such as 'uchaf' (upper) and 'isaf' (Lower) are often abbreviated to 'ucha' or 'isa'. Throughout this document, particularly where terms are quoted verbatim, the original terms have been maintained.

Place names have also evolved over time. For example, within the Penrhyn Estate records, Penlan Mill is also referred to as the mill at Nant Gwreiddoig, Penrhyn Mill, Penrhyn Corn Mill, Llwynon mill, and Llandegai Mill. Likewise, Felin Isaf was originally known as Melin y Bont, and in later incarnations as Trefelin Mill, the Saw Mill, the Estate Yard or the Estate Works. Cochwillan Mill has also been known as Melin Uchaf. In keeping with the above, throughout this document the original names have largely been retained but, where appropriate, followed by a qualifying name in brackets.

Abbreviations

Where applicable the references quoted in the footnotes are prefixed to denote the institution where the document is held, viz:

BU: Archive and Special Collections Department, Bangor University

C.R.O: Cheshire Record Office

G.A.T: Gwynedd Archaeological Trust

Gwynedd: Gwynedd Archive, Caernarfon Record Office

L.R.O: Liverpool Record Office of the National Archive

N.W.C: North Welsh Chronicle

OS: Ordnance Survey

PRN: Primary Record Number

PRO: Public Records Office

RCAHMW: The Royal Commission on the Ancient and Historic Monuments of Wales

Illustrations

The majority of the photographs contained in this report were taken by the author. The date has been included in the title for reference purposes, the site having undergone a number of changes over recent years. The relevant site drawings are contained at Appendix I, and all other illustrations are referenced and credited in the foot notes.

1. Introduction

In 2004 I came across some documents in the Archive and Special Collections Department at Bangor University relating to an old flint mill at Llandegai, near Bangor in Gwynedd. In the main they comprised copies of correspondence between Brigadier Arthur Trevor, who had a keen interest in local historic buildings, and Frances Llewellyn who under her professional name of Frances Lynch was a lecturer in archaeology at Bangor University. The documents also included a number of drawings which showed the elevations of what remained of the of the mill site, and that Mrs Llewellyn and a group of her students had produced in 1980-81; together with drawings of the nearby large kilns at Port Penrhyn. Following further investigation, the significance of the mill became apparent, particularly in terms of the history of the industrial development of that part of north-west Wales and the legacy that remained after it had closed. It was unique in that it was the only flint mill to be built in north Wales; it had a direct link with the Herculaneum Pottery in Toxteth, Liverpool; was the first brick-built industrial building in Llandegai; and also had what David Gwyn believes to be part of the first iron-railed overland edge railway of any length in the world, and the first iron edge railway built for the mass movement of stone.¹

In the same year, 2004, the mill site and associated land was purchased from the Penrhyn Estate by Peter and Gill Bullen who lived in the adjacent property known as Penlan Mill Cottage. By this time, I had made their acquaintance, and the following year they very kindly allowed me to start clearing part of the site in preparation for carrying out excavation work. At the time the site was largely buried by waste material that had been dumped there over the previous fifty years, and in addition it had very largely reverted to nature, being heavily wooded and overgrown. While some progress was made unfortunately work had to be discontinued in July 2006 and did not resume until the autumn of 2009. In the interim period the site had been sold with planning permission for industrial development to Celtest Ltd, who owned the adjoining land. Fortunately, the new owners appreciated the historic value of the site and agreed for excavation work to continue until its completion at the end of 2011.

It was during the second period of excavation that the full extent of the site gradually became apparent. Originally it had been thought that it comprised merely that section which remained visible above ground and which had been recorded by the Bangor students, which as it transpired was the original flint mill. However, as work progressed it became evident that there was a second area of equal size immediately adjacent to it, and eventually this was extended to include the remains of a stable, a cobbled road, and a number of underground waterways. The description of the site that is contained within this document is very largely based on that excavation work.

Primarily the first part of this report has been written to provide a detailed history of Penlan Mill together with an account of how it featured in local life during the almost 160 years of its existence. Particular emphasis has been placed on its early life when it was a flint mill, as it was during this period that the major innovation and development took place. In addition, it provides a good example of how the combined enterprise and initiative of a number of remarkable people came to be harnessed in order to create what legitimately can be described as a minor industrial revolution, and as a result of which the local economy developed and grew. As there are very few detailed records available an

¹ Dr. D.R. Gwyn, correspondence 20th November 2017.

interpretation of how the mill may have operated is also included, in large part this being based on the excavation work carried out.

Important as Penlan Mill is it cannot be viewed in isolation, and in order to fully appreciate its significance it is necessary to have an understanding of how it formed a part of the wider industrial complex that developed in Llandegai and the surrounding area; as well as an awareness of some of the principal characters and events that played such an important role during the early part of this period. The one constant throughout the narrative is the Penrhyn Estate, together with the various entrepreneurs with whom it inter-acted and who initiated much of the development that took place. Introducing them at the outset helps not only to provide context, but also obviates unnecessary repetition within the main text. Their influence can be seen from the beginning and in particular during the early years of industrialisation that took place around the turn of the 19th century. At this time north-west Wales was largely under-developed. There was little in the way of industry, agricultural methods were relatively primitive, and transportation was extremely limited; due in large part to the poor quality of the barely existing roads. This was to change following the arrival at Llandegai of Richard Pennant.

1.1. The Arrival at Penrhyn of the Pennant family

The history of the Penrhyn Estate has been traced back through the Griffiths family to the thirteenth century, although there was no direct lineage after the demise of the privateer Pierce Griffiths in 1628. Between 1592 and 1616 he had mortgaged various parts of the Estate and in 1617 the estate was forfeited due to his bankruptcy,² with ownership passing to the Williams family. Following the death in 1716 of Frances Lloyd (nee Williams), daughter of Sir Robert Williams, the Penrhyn Estate was divided into two moieties; one part passing to the Warburton family and the other to the Yonge family. In 1771, following the death of his father-in-law, General Hugh Warburton, the Warburton moiety passed to Richard Pennant, who had married Anne Susannah Warburton in 1765, when he was 26 years of age. From 1768 the Yonge moiety, formerly the Cochwillan Estate, was leased by Richard's father, John Pennant, and upon his death in 1781 Richard took over the lease. In 1785 he purchased the lands from the Yonge family, thus bringing the estate back under single ownership.

John Pennant was an extremely wealthy merchant of Liverpool and Hanover Square, London; his fortune largely having been amassed from his family's sugar plantations in Jamaica, slavery, and investment in the salt industry.³ Richard had been brought up to run these enterprises which meant that when he inherited this fortune he was ideally placed to develop his new estate, having not only the financial means but also experience gained from managing his various business and shipping interests, and as a Member of Parliament: for Petersfield at the general election of 1761; for one of the two Liverpool seats in a by-election in 1768; and again for Liverpool in the general elections of 1774 and 1784. In 1783 he was made Baron Penrhyn of Penrhyn, County Louth (an Irish peerage, which allowed him to remain as a Member of the House of Commons).

It is believed that he was born in Jamaica, although he never visited there as an adult.⁴ Nevertheless he maintained a keen interest in his sugar plantations, which were worked by slaves and run by local

² E.H. Douglas Pennant, *The Welsh Families of Penrhyn* (Gwasg Ffroncon, 1985).

³ Dr Marian Gwyn, www.spanglefish.com.

⁴ Discussion with E.H. Douglas Pennant, 26th September 2017.

managers. While he was happy to employ slave labour he also possessed what Jean Lindsay describes as '*a belief in the progress of mankind*'.⁵ The slaves had to be valued and humanely treated, and as a demonstration of this he gave instructions to his Manager in Jamaica for some of the slaves to be apprenticed to various trades. In some ways this seems contradictory to his stance toward the abolition of slavery, being one of only two Members of the House of Commons to speak against it. He also became chairman of the Committee of West India Merchants.⁶ His continued support for slavery was due to the Jamaican plantations still being the major source of his enormous wealth, although this was something he hoped to rectify by increasing the income from his estate at Llandegai. In spite of his opposition, the abolition of slavery in Britain came about in 1807, which was a year before his death.

In contrast to the previous hereditary owners of the Penrhyn Estate Richard Pennant was English. Furthermore, in addition to having enormous wealth he was well educated and brought up in a business environment. By instinct he was a merchant, and although he became a member of the minor aristocracy he was not *of* the aristocracy and did not think like a traditional aristocrat. Like so many of his contemporaries he was an innovator and improver and also possessed huge energy, drive, and vision, and he applied these abilities to the development of his newly acquired Estate in north Wales. First, he formulated a three-point plan: to maximise the mineral wealth that lay beneath his lands; to radically improve transport facilities; and to improve agricultural land and increase food output. This was a major project as since the Estate had been divided generally it had been neglected, fallen into a very poor state, and was severely under-developed. To a large extent his ability to carry out the plan was due not only to his immense wealth, but also that he owned much of the land around his Estate at Llandegai and was therefore able to implement the work without undue hindrance. Being a Member of Parliament, he also had an extensive network of contacts and acquaintances that he could call upon for support.

Having formulated his objectives he needed to find people who could carry them through to fruition and in this respect was fortunate in that he appears to have possessed the ability to recognise and harness talent in others. Initially he placed his trust in two men in particular: Benjamin Wyatt II, who he appointed as his Agent, and William Williams who acted as his Slate Reeve at the quarry. Wyatt was charged with developing the infrastructure, such as the roads, wharfage, and tramways that were necessary for transporting slate from the quarry; for bringing about land reforms in order to improve agricultural output; and for re-forestation large parts of the Estate by planting woodlands. By Wyatt's own estimation by 1800 the number of trees planted was over 600,000,⁷ which included making additional plantations '*around the bath house mole*'.⁸

With the first of these objectives in mind he quickly recognised the vast potential of his newly acquired slate quarry, which in many ways he could equate to his sugar plantations in Jamaica. In Jamaica the raw material was sugar, and in Llandegai it was slate. In both cases the problem was one of extraction and distribution. These problems had been overcome in Jamaica at a time when living in the colonies

⁵ Jean Lindsay, 'The Pennants and Jamaica', *Caernarvonshire Historical Society Transactions*, 43 (1982), pp.60-62.

⁶⁶ www.spanglefish.com

⁷ Peter Ellis Jones, 'The Wyatts of Lime Grove, Llandygai', *Caernarvonshire Historical Society Transactions*, 42 (1981), p. 87.

⁸ BU/Penrhyn ms 2941, 'Planting at Penrhyn '97'.

meant that people had very limited access to any form of infrastructure unless they provided it for themselves, and as a consequence of this the plantation owners and their managers had learned to adopt and adapt whatever was available. Pennant now applied this experience as he set about overcoming the problems in Llandegai. He saw the lack of roads and adequate wharfage not as insuperable barriers to development but as obstacles to be overcome. One of the first tasks that he undertook was to improve the output from the slate quarry at what was known as Cae Braich-y-Cefn in Bethesda (better known as the Penrhyn Quarry).

The Cae Braich-y-Cefn quarry had been in existence from as early as 1413, since when it had been worked by small groups of men who had taken out leases from the Estate, many of these leases having been jointly awarded by his father, John Pennant, and General Warburton.⁹ However, this method of working was deemed too casual and inefficient, so in 1782 Richard decided to buy out the leases and take the quarry under his own management. It has been said that this was '*a decision of supreme importance both to the community and to his successors*'; and that '*He was a pioneer, if not the pioneer of an industry*', as at this time there was no precedent to show him how to proceed.¹⁰ While this may be true, much of the credit should also go to the managers he employed to carry out the work; in particular during the early years his long-serving Slate Reeve, William Williams of Llandegai. The reforms that Williams introduced allowed what essentially had been an embryonic slate quarrying industry to be transformed to such a degree that what once had been no more than a part-time or seasonal occupation for a handful of men soon became a major enterprise and world leader in its field. In large part Pennant's decision to take over the Cae Braich-y-Cefn quarry was made as a result of the competition it was facing from other quarries in the county, such as the Dinorwic Quarry in Llanberis and the Cilgwyn Quarry in Nantlle.¹¹

One of the key elements in producing slate at an economic cost was transporting it from the quarry to the customer, and historically this had involved transporting it by road to the sea-board at Aber Ogwen: at the time this being no more than an inlet and having few wharfage facilities. As output grew so the limitations of this method of transportation became more apparent. For example, during periods of inclement weather such roads as existed were often impassable to horse-drawn sledges and carts, and packhorses and donkeys could carry on average no more than 64 slates in their panniers, and there was a high percentage of breakage due to the uneven surface over which the slates travelled. The onset of the Napoleonic wars had seen the introduction in 1784 of a horse tax and in 1797 this was extended to include working horses. Furthermore, the increase in the number of pack animals employed also resulted in a corresponding increase in the cost of animal feed. In addition, the number and size of the ships that could be accommodated at Aber Ogwen was limited. The horse tax was in addition to the slate tax that had been introduced in 1794 to pay for the Navy during the Napoleonic Wars, and the rate of taxation was progressively increased between then and its abolition in 1831.

The response to these challenges was immediate. Between 1785 and 1788 Benjamin Wyatt built a quarry link road known as 'The Old Road' and this allowed for increasing volumes of slate to be transported by 2-wheeled carts. In 1791-1792 a road was built to run all the way from the port to Nant

⁹ As an example, see BU/Penrhyn ms 1978, a lease awarded to Richard Herbert on 3rd September 1768.

¹⁰ (Author unknown), Photochrom Co. Ltd, *Slate: The Penrhyn Quarry* (London, c.1925?), p. 1.

¹¹ J.I.C. Boyd, *Narrow Gauge Railways in North Caernarvonshire, Vol.II, The Penrhyn Quarry Railways* (Usk, 1985), p. 5.

Ffrancon, thus improving access to the minerals and stone deposits at the head of the valley. It was shortly after this that Richard Pennant came into contact with a consortium of entrepreneurs from Liverpool which included among its number a man named Samuel Worthington, and it was he who very quickly came to play a major role in the industrial development of the area. The primary interest of the entrepreneurs was the exploitation of the Estate's mineral wealth and in particular the distribution and sale of slates from the quarry: something that continued until 1829 when Worthington retired.

In 1797 the road was further extended all the way to Capel Curig, and in 1802 the Capel Curig Turnpike Trust built another road running parallel to this, on the east side of the Ogwen Valley (today's A5 trunk road). The improvements to the roads meant a significant reduction in the number of pack animals employed, with a consequent reduction in the amount of fodder required. It also helped to reduce the number of slates damaged prior to their arrival at the quayside. However welcome these improvements were they were not in themselves sufficient to meet the need for handling the ever-increasing output from the quarry which, under the supervision of William Williams, continued to expand.

The improvement to the roads did not take place in isolation, and in 1786 improvements to the wharfage facilities were begun. The inadequacies of the facility at Aber Ogwen meant that it could not be further developed so plans were made to develop the alternative site at Aber Cegin. As a first step Richard Pennant leased the foreshore at the mouth of the River Cegin from the Bishop of Bangor, John Warren of Pen-y-Bryn,¹² and this enabled him to build a new quay that by 1790 was of sufficient size to accommodate ships of up to 300 tons. During the next few years, under the supervision of Benjamin Wyatt, these facilities were further enhanced and what was by now known as Port Penrhyn was soon capable of handling 50 vessels at a time, and the annual tonnage shipped increased accordingly. Even the early development made an immediate impact with the annual tonnage rising from 1,800 in 1780 to 12,000 in 1792.¹³ Subsequent further improvements were later made, with the mole being extended in 1830 and a new dock and second quay being added in 1855. On 1st November 1802 the land was purchased from the new Bishop, William Cleaver, who had been installed on 5th April 1800 following the death of John Warren.

The expansion of the quarry and the improvements to the quay meant that there was an even greater need for improving the transportation of slates between them; not only to reduce the reliance on ever more costly horse drawn carts, but also to reduce the losses incurred due to breakages. Two options were considered, a canal and a tramway. In many ways a canal seemed the ideal solution as they had by then become established as a reliable means by which to transport large and heavy loads at a low unit cost. In 1799 a feasibility study was carried out by Thomas Dadford, a mutual friend of Richard Pennant and the Quarry Engineer, James Greenfield. It was estimated that the canal would cost £3059-3-9 plus the cost of the machinery for four incline planes, an additional £546-0-0. This could be reduced by £205-3-9 if the bridges were paved as fords, resulting in a total cost of £3400-0-0. The canal was to be 12 feet wide at the top, 6 feet wide at the base, and 4 feet deep. The boats were to be 20 feet long by 3 feet wide and 3 feet deep. They would each carry 3 tons with one horse being

¹² BU/Penrhyn mss PP811-815.

¹³ *Ibid*, p. 6.

capable of pulling 10 of them at any one time.¹⁴ However, it was found that the number of inclines needed to overcome the 546 feet of gradient between the two termini made the project unviable.¹⁵

Dadford therefore made a second survey, based on a horse-drawn tramway (railway) linking up with the existing tramway to Penlan Mill (see below). His estimate of the cost for this work amounted to a total of £8328-5-0.¹⁶ Although more than twice the estimated cost of the canal the advantages were deemed to significantly outweigh the disadvantages, and the decision was made that work on the horse-drawn tramway should proceed. This decision was made, in part, based on the socio-economic conditions prevailing at that time; such as the high level of unemployment in the area, the itinerant nature of quarrymen, their relatively low wages, and their prominence during the recent corn riots.¹⁷ (Idle hands do the devil's work!). Dadford's tramway was not the only proposal put forward, an earlier proposal having been submitted in July 1793 by William Jessop of Holyhead, his cost estimate being considerably cheaper at £5000.¹⁸

The final design for the tramway and management of the construction work was carried out by Benjamin Wyatt, who in 1798 had constructed a similar tramway for Samuel Worthington and his associates, running from the newly constructed flint mill at Nant Gwreiddiog (later known as Penlan Mill), to the port. This had been the first above-ground tramway (known locally as the 'Iron Road') to be built in north-west Wales, and to extend this to the quarry appeared to be the obvious solution. Work on the new Quarry tramway began on 2nd September 1800 and was completed by the opening date on 25th June 1801, with the official opening being on 1st July. (Wyatt's own description of the tramway design is included at Appendix II.) The final amount paid out for the construction of the tramway was £6977-2-11, which was significantly less than Dadford's estimate, but far more than Jessop's.¹⁹ In September 1801 a calculation was made which purported to show that based on a daily shipment of 72 tons of slate from the quarry to the port, using a tramway there would be a saving of £3369-12-0 per annum compared with the use of horse-drawn carts.²⁰

Whereas James Boyd conjectures that originally the Penlan tramway/railway extended from Port Penrhyn to the mill at Llandegai, pre-dated the Quarry Railway by three years, and was only later extended to the Quarry in 1801, David Gwyn does not agree. Instead he believes that the Penlan line was merely an off-shoot from the Quarry Railway.²¹ At present there is no available evidence to confirm either theory, although there is a belief that prior to publishing his book on the Penrhyn Quarry Railways²² Boyd had obtained supporting documents that no longer are publicly available. Irrespective of this it seems unlikely that the mill would have opened without an adequate transportation system being in place, and in this scenario, it is likely that the problems encountered with the working of this system are what prompted Wyatt to adopt a new design and introduce the iron-railed edge railway to which Gwyn refers.

¹⁴ BU/Penrhyn Map 202.

¹⁵ BU/Penrhyn Map 202, 'Leveling for Canal 1799 with Estimate'.

¹⁶ Boyd, Op cit, p.15.

¹⁷ Ibid, p.14.

¹⁸ BU/PFA/12/14.

¹⁹ Gwynedd/XM3156/9, 'Payments made during Construction of the Railroad from Quarry'.

²⁰ BU/PFA/12/11.

²¹ Private correspondence 20th November 2017.

²² J.I.C.Boyd, Op cit.

Although it underwent a number of modifications the quarry tramway continued in use until October 1879 when it was replaced by a steam driven railway that ran alongside the River Cegin, and this continued to operate until its closure in 1962. Two of the major changes that took place during the intervening years were the opening of the Chester & Holyhead Railway in 1848, and the opening of the port siding in 1852. In addition, a private siding was also built at Penlan mill, although this did not form part of the quarry network.

The agricultural improvements were in the main brought about by Benjamin Wyatt, who had gained a good deal of experience in farm management while employed by Thomas Lawley on his large estate in Staffordshire. Applying this knowledge, he introduced large folds for the sheep, not only to provide winter shelter but also where fodder could be brought to them. The dung from the folds was taken to provide fertiliser and thus improve the quality of the land. His extensive afforestation programme not only improved shelter but also provided a valuable supply of timber. He encouraged the Estate's tenants to drain their lands and clear them of stones; to divert mountain streams for irrigation; and to grow new crops such as Scotch cabbage and turnips. He also encouraged them to fence their land and improve breeding habits. As a means toward achieving these aims he supported the enclosure of mountain land in order that these improvements could be introduced. As many of the tenants did not have the money to carry out these reforms he financed them from the Estate's funds, reclaiming the money in the form of increased rents.²³

As a result of the re-structuring of the Quarry, improvements to the infrastructure and agricultural reform, new industries were created, and land usage and productivity increased to a level never previously contemplated. These in turn transformed the lives of the local people who now had reliable employment, better living conditions, and a more secure source of food. To some extent they also benefited from the philanthropy of the Estate which provided, in part at least, new buildings in which to carry out acts of worship and, later on, schools. In many instances the Estate also provided new and better homes for its workers, resulting in improved health and well-being. However, even though generally life for many improved people were still reliant on the Estate for their existence and the improvements did not come without cost. For example, men were now expected to regularly report for work rather than on an ad hoc basis as defined by the seasons, and malcontents and malingerers were dismissed. People who previously had relied on access to common grazing land soon found that this was no longer available to them due to land enclosure; although they could rent the much-improved ley land for grazing their animals.

1.2. The arrival of the Entrepreneurs

While the quarry was to form the major part of the Penrhyn Estate's activities it was not the only industry with which it was involved. The opening of the road to Nant Ffrancon had enabled mineral deposits found there to be more fully exploited, and from 1794 a consortium of Liverpool merchants undertook to develop them. The solicitor acting for these merchants, Michael Humble (a financier), Samuel Holland (a mining engineer), and Nicholas Hurry (a ship owner), was Archibald Keightley (pronounced 'Cately'); and it was through his good offices that a man named Samuel Worthington became acquainted with them. It was this acquaintanceship that perhaps more than any other was to

²³ Peter Ellis Jones, Op cit, pp.87-88.

have such a profound influence on the industrial developments that took place in Llandegai over the next three decades.

In 1796 the arrangement between the Penrhyn Estate and the Liverpool merchants was formalised, and a lease was signed accordingly.²⁴ The extent to which they were involved in mineral extraction can be gleaned by the terms of the lease, which refers to 'all the property known as Blaen y Nant', and 'All such copper, lead, tin, calk, callomine, or any other mines, ores, minerals, stone, marble, clays and useful Earths...' In that same year they took over the transportation, sales and distribution of the slate output from the quarry, employing Samuel Worthington as their site manager and agent. By 1797 he had become a partner and was to be involved in all of their activities in relation to the Penrhyn Estate. The partnerships' activities were to expand further, and they became involved in the production of lime, ground flint, ochre, and hone stones; also, the manufacture of wooden-framed writing slates. These were not the only enterprises in which the merchants were involved as they had other quarrying and mining interests in North Wales and elsewhere. However, in terms of Penlan Mill and the associated industrial development of Llandegai it was Samuel Worthington who was at the forefront.

From what we know of Samuel Worthington it would seem that he was born in Middlewich, Cheshire, and was christened at the Parish church of St. Michael, Middlewich, on 17th September 1760. He was the third of six children, and shortly after his birth the family moved to Church Lawton where his three younger siblings were born. At some stage Samuel received training in the silk weaving trade and by 1782 had opened a shop in Further Northgate Street, Chester.²⁵ He continued to trade there until 1791 when his business was eclipsed by a rival store, 'Browns of Chester'. In 1783 Worthington had married Alice Keightley, sister of the above-mentioned solicitor, Archibald Keightley Jnr.²⁶ This link was to prove highly beneficial to Worthington as the two men were to be close business associates for many years, and it was Keightley who introduced him into Richard Pennant's circle.

On 29th October 1793 an advertisement appeared in the London Gazette, page 967, which stated:

'The partnership carried on in Liverpool in the County of Lancashire under the name and stile and firm of James Charnley and Company, as dealers, in Bangor Slate, and Casting Slate Manufacturers, was, on the 19th Day of this instant October, dissolved by mutual consent. The Debts due from the said Concern will be paid by applying to the Factory, in Westmoreland Street, Liverpool aforesaid; and all Persons indebted to the said partnership are requested to pay the same there Dated October 22, 1793.'

The signatories to the advertisement were James Charnley, William Rogers, Benjamin Wyatt, and William Williams: the latter two being employees of Richard Pennant.

On 18th November 1793 the following advertisement appeared in 'Billinge's General Advertiser', a Liverpool newspaper.

'BANGOR SLATE YARD AND CASTING SLATE MANUFACTORY.

All persons having any demand against the late firm of James Charnley & Co. are forthwith requested to deliver the same to the casting slate manufactory, on Westmoreland Street, in order that the same*

²⁴ The 1796 mineral rights agreement was retrospectively formalised in a lease dated 25th March 1801 (BU/Penrhyn ms2033).

²⁵ CRO, Miss Estelle Dyke, Chester Archaeological Society Vol XXXVII, pt. II, 1949.

²⁶ CRO, Knutsford Marriage Register 1783, No.70.

may be adjusted and discharged. All persons indebted to the said late firm of James Charnley & Co. are requested to pay the same immediately, to prevent further application to them for that purpose. The slate yard and manufactory will in future be carried on at the same slate yard, on the New Dock Pier, and manufactory at Westmoreland Street, under the firm Rogers and Keightley & Co. Applications for roofing and manufactured slates must be made at the casting slate manufacturers, and for country orders, address Messrs Rogers, Keightley and Co, Liverpool.'

(* Casting slates are in fact writing slates, made for use in businesses and schools.)

A similar notice appeared in Billinge's on Monday 2nd December 1793. While in this case Rogers and Keightley were acting for Charnley & Co. they also had an interest in importing slates from Bangor into Liverpool in their own right, as evidenced by a number of entries in Billinge's:

22nd July 1793 'On "William and Mary", Captain Jones, 15000 slates for Rogers.'

24th January 1794 'On the "John and Mary Owen", 60 bundles of writing slates to Liverpool, together with 6000 roofing slates, and other sundries.'

16th May 1796 'On "Tartar" Captain Jones, from Port Penrhyn, 24 tons slates, 24 boxes framed slates, and sundries for W. Rogers.'

On 4th July 1796 'On "Jane and Ellen", Captain Roberts, 13 tons yellow oker, 20 tons slates, Rogers & Co.'

William Rogers, as referred to above, was an established solicitor in Liverpool, who by 1789 was in partnership with Archibald Keightley.²⁷ The partnership continued until 9th March 1802, by which time Keightley had his own practice at School Lane, Liverpool.²⁸ From these entries it can be seen that the connection between Keightley and the Penrhyn slate industry had already been established by the time of his brother in laws' [Worthingtons] financial difficulties.

1796 was to be a watershed year for Samuel Worthington; he was appointed as site manager and agent for the Humble, Holland and Hurry partnership, and from 19th April of that year it would appear that most of the exports of ochre, roofing slates and writing slates from Port Penrhyn were addressed to him in Liverpool. This was probably through Keightley's connection with the Liverpool merchants, or possibly through his acquaintanceship with the Penrhyn Agent, Benjamin Wyatt. The outcome was that shortly after this date Worthington moved to North Wales; initially to a house called Ty Newydd (today a Bail Hostel), but eventually, at All Saints 1798, taking up residence in his newly built house, Llwynon (today known as the Old Vicarage), where he remained until his departure in 1829 (Fig.1.2.1).²⁹

In January 1806 Richard Pennant agreed to Worthington's request for the house to be extended and an amount of £250 toward the cost; an amount of £50 per month to be deducted from Worthington's account over the period May to September of that year.³⁰ In return the annual rental on the property increased from £48 to £60, and it remained at this level until Worthington's departure in 1829. The enlargement comprised a two-storey bay to the rear of the property (Fig.1.2.2), with two small rooms being added to the ground floor, and a toilet and two small rooms to the 1st floor (Figs.1.2.3 & 1.2.4).

²⁷ *London Gazette* 9th February 1789 and 13th April 1800.

²⁸ Correspondence with Eric Foulkes. .

²⁹ Llwynon has had a number of spellings, but they all refer to the same property.

³⁰ Bangor/PFA/12/11.

When in 1836 the house was advertised the accommodation was described as comprising a drawing room, dining room, breakfast room, study, kitchen, pantry, and butler's pantry on the ground floor (possibly the 1806 extension); with four spacious bedrooms and servant's apartments to the first floor; three excellent cellars underneath; a coach house and four-stalled stable attached.³¹

In 1796, it appears that Worthington also became a partner in the recently opened Herculaneum Pottery at Toxteth in Liverpool, although there is some difference of opinion about this. The pottery originally had been opened in about 1793-4 by Richard Abbey who took into partnership a Scotsman named Graham, and it is they who in 1796 sold it to Worthington, Humble and Holland.³² While the record shows Worthington as being the proprietor³³ it is unlikely that he would have had sufficient capital to undertake such a venture on his own, and that he would have needed the backing of his brother-in-law and/or the three merchants. This, however, would have been usual practice at that time and would not have affected his claim to proprietorship. However, in his memoirs Samuel Holland (the younger) states that Samuel Worthington was engaged as the manager of the pottery, while at the same time being the site manager and agent for the partners in Llandegai. In spite of this apparent contradiction it is more than likely that Worthington was the proprietor, as it was around this time that he and the merchants had become partners.

This view is reinforced by the fact that at each Annual General Meeting of the proprietors from 1807 to 1812, it was resolved that he should continue as an honorary Committee member and be '*thanked for his services*'.³⁴ From the outset he retained an active involvement with the pottery and this continued until 1806, when he decided that due to the varied and divergent activities in which the partners were engaged, it would be better to convert the pottery from a private partnership to a company with share capital. At the Annual General Meeting on 24th November of that year the value of the company was converted in the form of 50 shares of £500 each, with each of the new proprietors having a certificate for each share they held. Samuel Holland retained one share and Michael Humble, Archibald Keightley and Samuel Worthington four each. Keightley was retained as the company solicitor.³⁵

After this time Worthington's involvement with the Pottery gradually diminished, although he remained as an honorary Committee member until 1812. From the Minute Book there is no evidence of him attending any of the meetings during this period,³⁶ his time and energies being fully directed to his various interests in North Wales. After 1812 there is no record of him being involved with the pottery at all, other than as a supplier of ground flint. On 14th April 1817 a special meeting of the Committee was convened, with Samuel Worthington present, to investigate deficiencies in the weight of flint shipped from Port Penrhyn: these having been measured by the pottery manager, Mr Smith. The outcome of the meeting was that the balance of Worthington's account was reduced by four percent.³⁷ Although it could appear that Worthington was short-shipping to the Pottery, possibly this discrepancy may have been due to the non-standardisation of weights, which did not come about until

³¹ *North Wales Chronicle*, 10th May 1836.

³² *British Porcelain, Pottery and Ceramics Trade Marks*, Herculaneum Pottery.
<http://www.the.potteries.org/mark/h/Herculaneum.html>

³³ *Gore's General Advertiser*, 15th December 1796.

³⁴ Peter Hyland, *The Herculaneum Pottery, Liverpool's Forgotten Glory* (Liverpool, 2005), p. 96.

³⁵ *Ibid*, p. 94.

³⁶ *Ibid*, pp. 14-17.

³⁷ *Herculaneum Pottery Minute Book*, Resolutions, p. 105, Resolution 147. (LRO/380MD47)

1st January 1826, following the relevant Act of 1824 (5 Geo IV chap 74). Prior to this Act, measurements were to some extent still determined locally. In his book *'Walks Through Wales'* published in 1819 Evans wrote about the subject at some length, giving many examples of how in Wales weights and measures varied not only in comparison with England, but also between Welsh counties.³⁸

One consequence of this was that at a subsequent meeting of the Committee on 1st September 1817, it was resolved that Mr Smith and the chairman should jointly procure estimates for the expense of a steam engine, with a view to bringing the grinding of flint in-house.³⁹ On 7th October the Committee agreed to put forward to the proprietors a proposal for the purchase of their own steam engine for the purpose of grinding flint, and this was agreed by the proprietors at the Annual General Meeting on 25th November.⁴⁰ The Committee met again on 2nd December to discuss a letter dated 28th November from Mr Worthington and at that meeting resolved that he should be invited to attend a meeting, or send a representative, to verify the weight of the cargoes received at Toxteth. They also agreed that the company would continue to take shipments of flint from the mill at Llandegai for the next eight months, until such time as the new steam engine was installed. In other words, they gave him notice to quit.⁴¹

It is not known whether there was any direct correlation with the dispute, but it would seem that during this period Samuel Worthington was suffering from some form of prolonged illness. In a letter to the solicitor O.A. Poole dated 23rd January 1817, regarding the arrangement of an annuity on behalf of Miss Ann Lough of Penrhyn Castle in favour of her sister, Margaret, he stated that *'I have been very unwell and confined to the house for some time'*.⁴²

The new engine was installed by August 1818⁴³ and Worthington's involvement with the pottery ceased; apart that is from a resolution being passed on 1st September 1818 which indemnified him against any claim from the Overseers of the Poor of Toxteth Park, on behalf of the Poor employed in the Herculaneum works;⁴⁴ arising from a Bond entered into on 9th April 1798. No further entries for Samuel Worthington are shown in the Minute Book, although his son Archibald appears among the list of those present at the Annual General Meeting held on 26th November 1821, by which time he had acquired his father's shares.⁴⁵

Important as the Pottery was to Samuel Worthington it formed but a minor part of his enterprises, although initially the need to provide it with ground flint had been the sole reason for the building of the mill at Penlan, Llandegai. By 1800 Worthington and his partners had for several years been involved in mineral exploration and extraction within the Nant Ffrancon area, as well as being engaged in shipping cargoes of slate on behalf of the Penrhyn Estate. They did not have an exclusive contract for shipping the slates but carried what cargoes were available to them. However, because of their existing trade in clay and flint between the South Coast and Liverpool they were able to undercut their

³⁸ T. Evans, *Walks Through Wales* (2nd Edition), (London, 1819), pp.72-73.

³⁹ *Herculaneum Pottery Minute Book*, Op cit, p. 108, Resolution 152.

⁴⁰ *Ibid*, pp. 109 and 111, Resolutions 154 and 156.

⁴¹ *Ibid*, pp. 112-113, Resolution 157.

⁴² Gwynedd X/Poole/6353.

⁴³ *Herculaneum Pottery Minute Book*, Op cit, pp. 118-119, Resolution 167.

⁴⁴ *Ibid*, p. 119, Resolution 168.

⁴⁵ *Ibid*, P. 152, Resolution 217.

rivals over these routes, and on 1st August 1801, they were granted an exclusive lease for the carriage of slates.⁴⁶

The partnership continued until around 1811, after which time dealings with the Penrhyn Estate were exclusively in the hands of Samuel Worthington and his sons. In 1810 the firm of Holland and Humble had gone into bankruptcy, and Hurry had already left the partnership. In terms of their activities at Llandegai perhaps the most important factor was their acquisition on 24th March 1800, of a 21-year lease on the Penrhyn Mills, as two of these, Felin Isaf and Nant Gwreiddiog (later known as Penlan Mill), formed an integral part of their industrial activities in the area, as well as being closely linked to the Herculaneum Pottery. Penlan Mill was to be of particular importance as it was the only flint mill to be built in North Wales, and not only did it supply ground flint for the pottery but, following its later conversion, also became a major corn mill.

An indication of just how involved Samuel Worthington became with the Penrhyn Estate, in addition to the Slate Quarry, can be gleaned from the rent rolls. In addition to the mills at Felin Hen, Felin Isaf, Felin Uchaf and Nant Gwreiddiog, at various times he also held the tenancies of numerous other properties that included Cilgeraint; part of the Demesne; Glanlligwy (Glan Llugwy); the Hone Quarry; (unspecified) properties in Llandegai; Lime Kiln & House (Llandegai); a lime kiln in Llanllechid; Llwynon; the Ochre Works; the Paint Mill & Gardens at Llwynon; Pentwmpath; the Port Office; Port Penrhyn Yard & Storehouse; the Port Smithy; the Slate Manufactory; Talybraich; Ty Newydd; Tyn y Clwt Incline House; and Aber Cegin Storehouse. The locations of the major properties with which he was associated are shown in Figures 1.2.5 & 1.2.6.

When Samuel Worthington retired in 1829 the majority of the properties reverted in-house to the Penrhyn Estate, and others were rented to an assortment of tenants. In part his retirement was brought about by his deteriorating relationship with the new owner of the Estate, George Hay Dawkins-Pennant. During the formative years of his relationship with the Estate Samuel Worthington appears to have had an amicable relationship with Richard Pennant, and when he died in 1808 this relationship continued with Richard's widow, Lady Anne. However, under the terms of Richard's will the Estate passed to a second cousin, George Hay Dawkins (who adopted the name Dawkins-Pennant, and sometime later was to build Penrhyn Castle). Upon assuming control of the Estate Hay Dawkins came to the conclusion that the terms of the original leases held by Worthington & Co were unduly generous, and therefore as each renewal became due he took the opportunity to reduce their profitability. Eventually Worthington decided that having made his money, and having interests elsewhere, he would retire. As a result, many of the enterprises in which he had been engaged ceased, particularly those that had been related to the Pottery.

In addition to managing his concerns relating to the Penrhyn Estate, in 1812 he was also appointed by Henry Majendie,⁴⁷ the Bishop of Bangor, to act as his agent for collecting royalties from the Macclesfield Copper Company in respect of copper ore raised from the Old Mine on the Great Orme in Llandudno.⁴⁸ In 1824 Worthington & Co took over the running of the mine, having been granted a

⁴⁶ BU/PP2054.

⁴⁷ Henry William Majendie DD (1754-1830), Bishop of Chester and Bangor. *Oxford Dictionary of National Biography*.

⁴⁸ The company was incorporated on 19th August 1774 and dissolved on 1st November 1833. The Minute Book is held in the University of Manchester Library, Ref. GB 133 Eng MS 1344.

lease covering 700 acres.⁴⁹ His appointment to this role may not have been as surprising as at first it might appear. Having earlier been thwarted by the Duke of Bridgewater in its attempt to build a canal linking its Macclesfield smelter to the River Mersey, in 1767 the Macclesfield Copper Company built a new smelter at Toxteth near Liverpool. When this site was forced to close due to legal reasons it was taken over by the Herculaneum Pottery Company. However, when it was proposed that kilns be built on the site for calcifying the raw flint the Herculaneum Company met the same objections that the Macclesfield Company had encountered, and indirectly this led to Penlan Mill being built. It is likely that during this process Samuel Worthington would have become acquainted with members of the Macclesfield Board and a relationship forged.⁵⁰



Fig.1.2.1 (left): Front elevation of Llwynon.⁵¹ (2005)



Fig.1.2.2 (right): The 1806 extension to the rear of Llwynon.⁵² (2005)

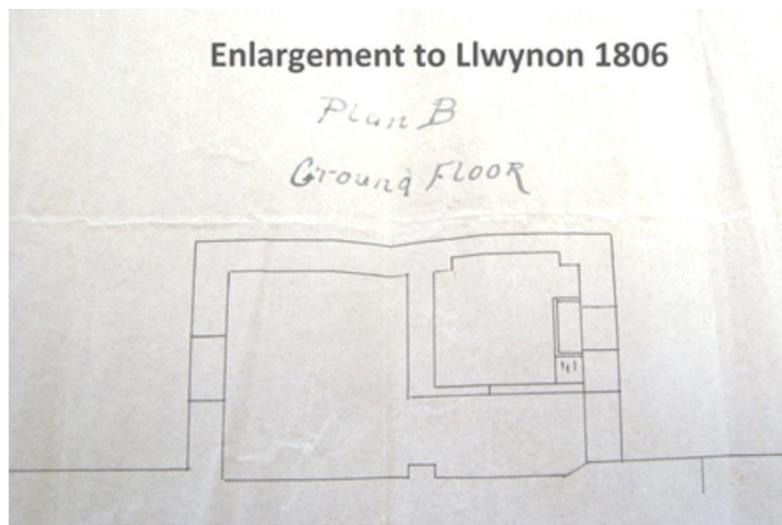


Fig.1.2.3: Extension to the ground floor, 1806. It is likely that this was the butler's/housekeepers room and pantry.⁵³

⁴⁹ C.J. Williams, 'The Llandudno Copper Mines', *Caernarvonshire Historical Society Transactions*, 33 (1972), p.20.

⁵⁰ Jisc Archives Hub.

⁵¹ By kind permission of Mrs B. Hughes and family.

⁵² Ibid.

⁵³ BU/PFA/6/32

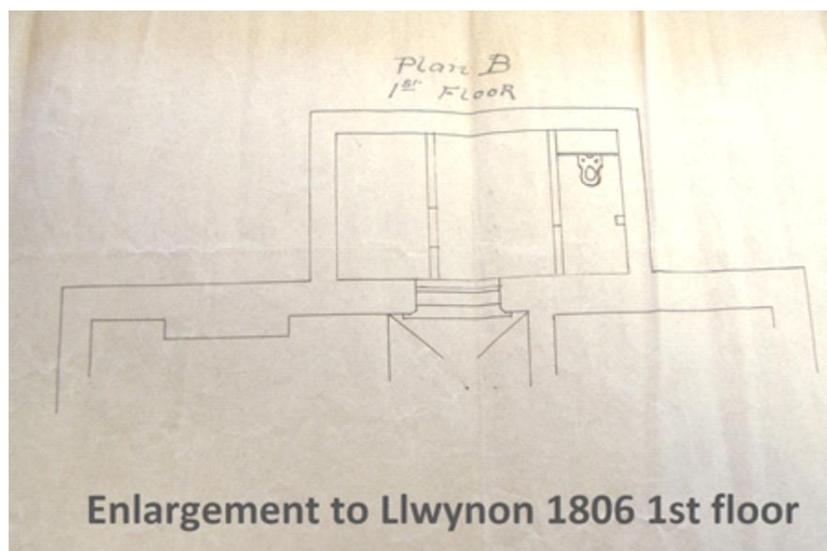


Fig.1.2.4: Extension to the 1st floor, 1806.⁵⁴

The arrival in Llandegai of Samuel Worthington and his associates had to some extent coincided with the introduction of the Wyatt family into the affairs of Richard Pennant. In 1776 Pennant had commissioned the architect James Wyatt to make additions to his country house, Winnington Hall in Cheshire. Five years later, in 1781, he employed James's brother Samuel, also an architect of note, to rebuild the medieval house at Penrhyn. It is likely Samuel had come to his attention not only through his brother, but also as a result of commissions he had recently completed at Baron Hill on Anglesey and the new library at Bangor Cathedral.⁵⁵ It was while executing this commission that Samuel came to recognise the merits of slate as a building material, particularly for roofing. Being an influential figure among eighteenth century architects he soon popularised the use of slate within the building industry, and thereby created a high demand. As a result of this he maintained large stocks of timber and slate from Penrhyn at his building yard in Berwick Street, London; both for his own use and to supply other architects and builders.⁵⁶

In addition to being an architect Samuel also had a very strong interest in science and engineering, and this brought him into contact with a wide circle of likeminded people, such as Matthew Boulton, James Watt, Thomas Williams, Sir John Call the military engineer, Josiah Wedgwood and Joseph Priestly.⁵⁷ He was also closely associated with Thomas William Coke of Holkham Hall in Norfolk (1st Earl of Leicester of Holkham) who had a very keen interest in agricultural improvement, and commissioned Samuel to carry out major developments on his estate, mainly concerned with the agricultural buildings. Richard Pennant was also acquainted with many of these people and joined with a number of them for the opening of the Albion steam flour mill in London during March 1786.⁵⁸

It was in that same year, 1786, that Richard Pennant appointed Samuel's brother, Benjamin Wyatt II, to the position of Agent and to manage his estate at Penrhyn. Prior to this appointment, Benjamin had

⁵⁴ Ibid.

⁵⁵ John Martin Robinson, 'Samuel Wyatt, Architect' (Thesis, Oriel College, Oxford, 1974). (Bodleian Library, Oxford).

⁵⁶ Ibid, p.36.

⁵⁷ Ibid, p. 40.

⁵⁸ Ibid, p.137.

primarily been engaged as Samuel's draughtsman, as well as being involved in the Wyatt family's farming, building, and timber businesses. He also had gained experience in farm management while working for Thomas Lawley and this background made him ideally suited to the task of carrying out Richard Pennant's development plan. In addition to the tasks previously mentioned he also was responsible for building cottages for the slate workers, model farms, poultry yards, and a dairy; as well as constructing the marine bath house on the Menai Strait. By contrast his own house, Lime Grove, was built by his brother Samuel.

It was the improvements arising from the implementation of the plan that initially attracted the Liverpool consortium to the area, and to a large extent it was Worthington's working relationship with Wyatt that enabled the potential of the Penrhyn Estate to be maximised. This, however, was not necessarily without moments of disagreement, as evidenced by a letter Wyatt wrote to Richard Pennant on 31st January 1802, in which he says:

'Mr Worthington has been here all the week. He was rather turbulent at first but finding everything settled and determined he gave way and we parted quite friendly. I went with him to Ogwen Bank and fixed the size of the tablets.

Since the snow left us we have made good use of the Rail Road – the first fortnight of this month was entirely lost and I believe we have shipped in the last fortnight upward of 800 tons, but I am to have the Account in the morning'.⁵⁹

Generally, however, Worthington's relationship with the Estate appears to have been cordial and this was to benefit him further. For example, in 1805 Richard Pennant wrote to him suggesting that he should make slate casks in which to convey rum and sugar: another outlet for the slate workshops at Coed y Parc. The proposal did not come to fruition as Worthington replied that such casks would not be sufficiently secure, would be far more expensive than wood, and would be extremely heavy to handle.⁶⁰ In 1807 Pennant agreed to him building cottages at Cilgeraint near the slate mill at Coed y Parc, as well as a straw barn and warehouse at Port Penrhyn.⁶¹

In 1802 the long serving Slate Reeve, William Williams, retired, and day to day management of the quarry was handled by Wyatt's son in law, James Greenfield. It was he who initiated the system of gallery working and, within ten years, increased annual output from the quarry to around 40,000 tons. As Worthington and his partners were paid by the load to ship the slates they were major beneficiaries of this increased output.⁶² It is perhaps worth noting that at the time of Worthingtons' arrival in Llandegai the actual village was very small and consisted of no more than eight or nine houses. Consequently, the impact of the changes that were taking place would have been significant.⁶³

From various contemporary accounts furnished by the travel writers of the period it would seem that Samuel Worthington was generally held in high esteem. For example, Edmund Hyde Hall wrote *'The spirited improvements made by this gentleman within the parish in draining, fencing, and introducing a great breadth of green crops have produced and are producing the best effects.'*⁶⁴ Richard Fenton called upon him on 4th September 1813, and his diary entry for that day states *'Called on Mr*

⁵⁹ BU/PFA/12/2.

⁶⁰ BU/PFA/12/11. Letter dated 4th March 1805, from Samuel Worthington to Richard Pennant.

⁶¹ BU/PFA/12/11. Memorandum dated 5th October 1807.

⁶² John Martin Robinson, *Op cit*, p. 95.

⁶³ E. Hyde Hall, *A Description of Caernarvonshire (1809-1811)* (Caernarvon, 1952), p. 107.

⁶⁴ *Ibid*.

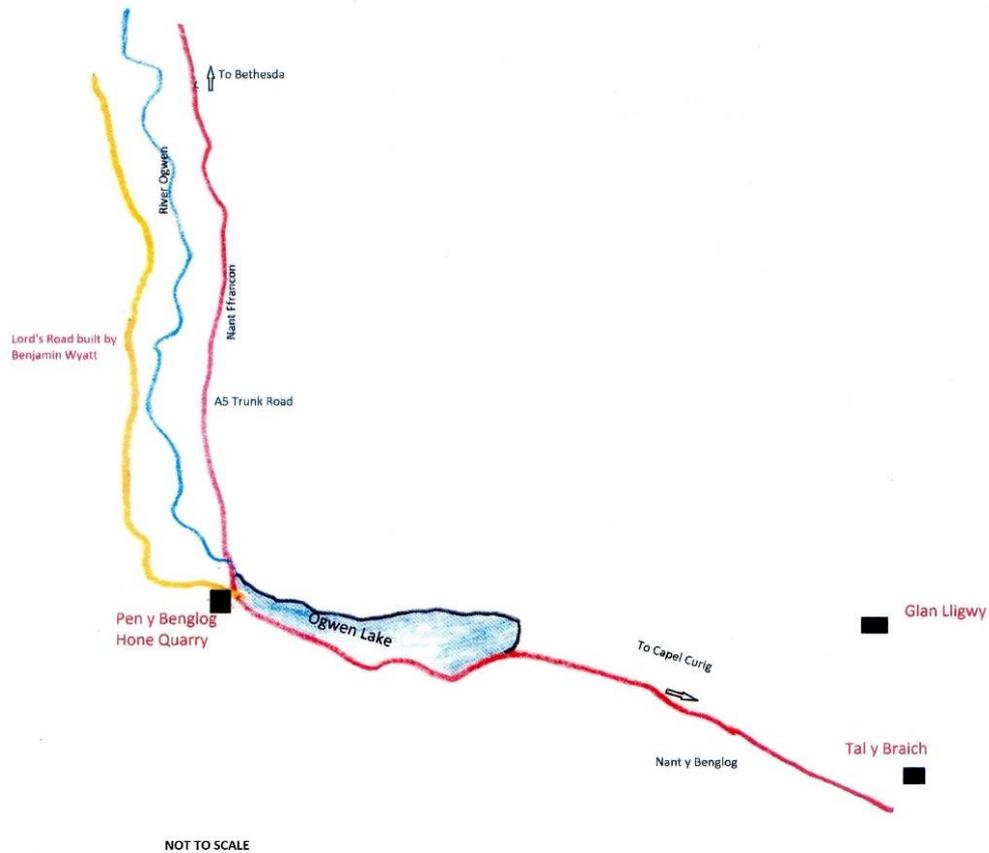


Fig.1.2.6: Marked in red, the major properties associated with Samuel Worthington, located south of Bethesda.

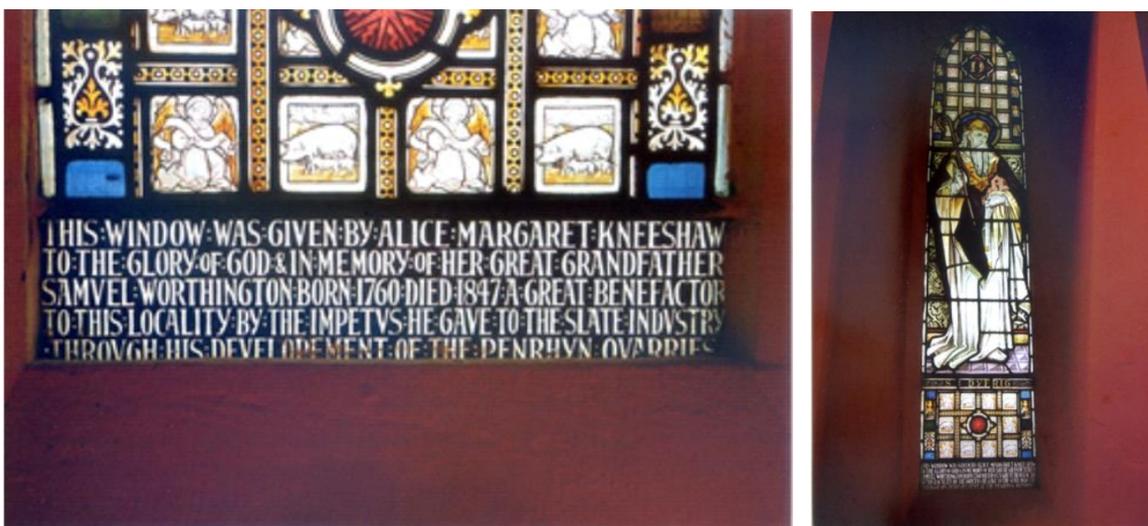


Fig.1.2.7 (left): The inscription on the Worthington Memorial window. (2008)

Fig.1.2.8 (right): The Worthington Memorial window in St Gwynin's Church.

While the departure of Samuel Worthington & Co did not mean an end to many of the activities in which they had been engaged, future leaseholders would not have either the same relationship with the Penrhyn Estate, or the same dynamic influence on the local community.

1.3. Networking

As already stated, initially the rise in the fortunes of Samuel Worthington was to a large degree due to the circle of acquaintances he accrued through the offices of his brother in law, Archibald Keightley. This form of what is now termed 'networking' was very much in evidence at the time, and indeed remains so today (although the term 'nepotism' may have been more appropriate in many cases). For example, Benjamin Wyatt II obtained his position through his brother Samuel; James Greenfield received his appointment through his father in law, Benjamin Wyatt; and in 1818 James Wyatt succeeded his father as Agent to the Penrhyn Estate. This is not to say that these individuals were not very worthy candidates for their positions, or that they would not have achieved them on their own merits: certainly, they each made a success of their appointment. What having the right contacts did provide was that essential ingredient for success, opportunity. On the whole they were not great inventors or discoverers in their own right, but instead had the ability to see advantage in adopting the new technologies and methods of the time; adapting them to suit local needs. While Benjamin Wyatt may have claimed to have invented the horse-drawn tramway emanating from Port Penrhyn, such tramways had been in use elsewhere for some time; for example, at Cheddleton Mill since 1777. Whereas originally the tramways used wooden wheels, by 1776 these had been replaced by iron wheels; and in 1789 William Jessup designed the first wagons with flanged wheels. He first approached Richard Pennant with a tramway using such a design in 1793.⁶⁷

The activities of Benjamin Wyatt II were not confined to his duties with the running of the Penrhyn Estate. In 1796 he acted as agent for Richard Pennant during the unsuccessful Parliamentary campaign. He was a trustee of the Capel Curig Turnpike Trust, holding the positions of clerk and treasurer from its inception until his death. He served as a Land Surveyor and Valuer for neighbouring landowners, and as a Commissioner under the Act of Parliament that empowered W.A. Madocks to build the embankment across the Glaslyn Estuary and reclaim Traeth Mawr.⁶⁸ He also served as a Justice of the Peace, often being at odds with his fellow magistrates over the treatment of quarrymen following the food riots in 1801.

James Wyatt managed both the Estate and the Quarry, and yet found time to also perform civic duties. He was appointed at age 21 as Inspector of roads managed by the Capel Curig Turnpike Trust, as well as its successor. Like his father he served as a Justice of the Peace, as well as being Deputy Lieutenant of the County. From 1850 to 1859 he was a member of the Bangor Local Board Health, active in the promotion of health, sanitation and water supply; and in addition, he was a member of the Board of Guardians of the Bangor and Beaumaris Poor Law Union.

James's son in law, Hugh Beaver Roberts had a successful law practice in Bangor, but also was involved in various slate quarrying ventures and narrow-gauge railways. Through these activities he became involved in a number of other enterprises, each of which enhanced his network of business and social contacts. He too was a Justice of the Peace; Deputy Lieutenant of Merionethshire; and a member of

⁶⁷ BU/PFA/12/14

⁶⁸ Peter Ellis Jones, *Op cit*, pp.81-116.

the Bangor Board of Health. In 1868 he also acted as agent for the Hon. George Sholto Douglas Pennant during the parliamentary election campaign.

This pattern of relationships continued, not only within the Wyatt family but throughout society. While no doubt the performance of civic duties was to some extent motivated by altruism, the contacts made and the influence it provided can not be over-stated. Having fore-knowledge of, as well as control over, local events provided enormous opportunities for financial enhancement; particularly when this was coupled with access to both land and capital.

To some extent Samuel Worthington also exerted power and authority in his own right. In a short space of time he accrued the tenancies of numerous properties belonging to the Penrhyn Estate, each of which was complementary to the other. The tramways controlled the movement of flint and other products from the Penlan and Trefelin sites, as well as slate from the Quarry and minerals from Nant Ffrancon and beyond: these in turn being complemented by his various holdings at Port Penrhyn. The landholdings he held in the Demesne at Glanlligwy and elsewhere allowed him to grow hay and feed for his many horses, straw for his livestock, and packing material for the slates. The flint mill supplied his pottery in Liverpool, and his tenancy of two lime kilns enabled him to produce not only mortar for building development but also fertiliser. Together these came to form what could be termed a 'virtuous cycle' of activity (Fig.1.3 1).

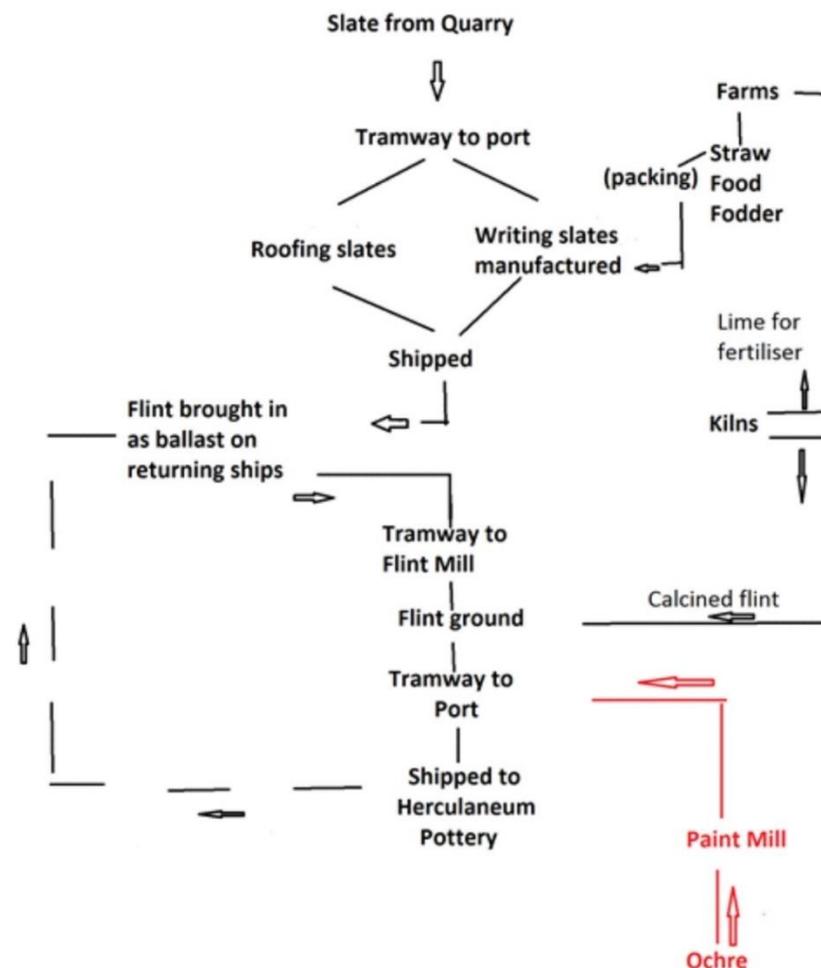


Fig.1.3.1 The 'Virtuous Cycle' of Worthington's activities.

Many of the crops he grew were sold both locally and further afield, and on occasion he acted as a banker. All of these activities helped him to form a network of acquaintances that increased both his fields of influence and also his prosperity. A simple representation of the relationships as they affected Samuel Worthington during his time at Penlan is shown in Fig.1.3.2.

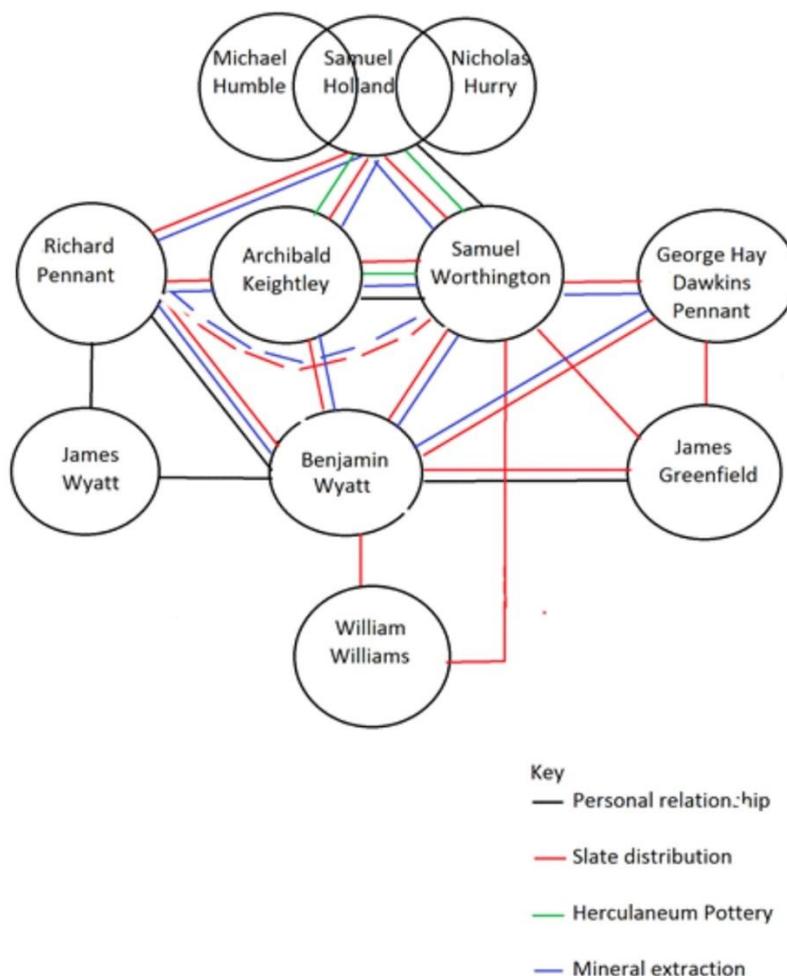


Fig.1.3.2 Relationships between Worthington & Co. and the Penrhyn Estate 1796-1829.

This diagram also reflects the inter-relationships between what Palmer, Nevell and Sissons refer to as ‘Lords’, ‘Freeholders’, and ‘Tenants’;⁶⁹ or what Gwyn and Palmer refer to as ‘Patrician’, ‘Middling Sort’, ‘Plebeian’, and a fourth group that they refer to as the ‘Citizen’ or ‘Burgher’ class, and which represents what they call ‘landless capital’.⁷⁰ In this scenario Richard Pennant quite clearly represents the Lord/Patrician, Wyatt the Freeholder/Middling Sort, and Williams and Worthington the Tenants/Plebeians; although it is reasonable to say that certainly by the time he retired Worthington had become one of the Middling Sort. The Liverpool merchants, Humble, Holland and Hurry could be said to represent the Burgher class, not being landowners but possessing capital.

⁶⁹ Marilyn Palmer, Michael Nevell & Mark Sissons, *Industrial Archaeological Handbook* (York, 2012), p.13.

⁷⁰ David Gwyn and Marilyn Palmer (eds), ‘The Landscape Archaeology of the Vale of Ffestiniog’, *Industrial Archaeology Review*, Vol.XXVII, May 2005.

2. Penlan Mill

History

Unlike many other flint mills outside the main pottery producing areas such as Stoke-on-Trent, Penlan Mill was purpose-built from the outset, only later being converted to a corn mill. This contrasts with other similar buildings such as at Cheddleton Mill in Staffordshire, and Higher Washford Mill at Congleton. At Cheddleton there are two separate mills on the site, the North and the South. It is believed that originally the South Mill was a corn mill and converted for flint production, whereas the North Mill was custom built to grind flint.⁷¹ Higher Washford Mill began life as a corn mill, was first converted to a silk mill, and in the late eighteenth century converted to a flint mill: later being extended in the early and mid-nineteenth century.⁷²

Based on recently released documents it would seem that Penlan Mill first came into use in 1798. Construction work began in around October 1796 and was finally completed in January 1799; although it would appear that flint production could have started in around May 1798. The total cost for building the mill was £4751-19-6 1/2, although there is nothing to indicate whether this cost included the laying of the tramway from the mill to the port.⁷³ What is notable is that at that time it was the only brick-built industrial building on the Penrhyn Estate. The only other brick buildings were the re-constructed Penrhyn manor house built by Samuel Wyatt in 1781, and the recently constructed Penrhyn Bath House built by Benjamin Wyatt. Possibly Wyatt's own house, Lime Grove, may also have been constructed in brick but as the only available illustration shows the exterior as being rendered it is not possible to say.

The primary contractor appears to have been a Mr Henry Gardner, who was paid a total of £1017-1-4 3/4, which included £162-17-0 subsistence for his men. This would tend to imply that they were not local tradesmen, and that they had been brought in for their expertise. Substantial unspecified payments were also made to Willis Earle (£457-7-8); William Williams (£173-1-1); Samuel Lavisley (£151-3-0); John Montgomery (£136-19-8); James Defford (£126-15-1); Joseph Wilsby (£105-7-6); and Thomas Bromfield (£94-17-2).⁷⁴ In addition, a total of £1759-8-8 was paid to Messrs Chifney and Worthington, in respect of payments made to local tradesmen. Of this £848-1-10 (48% of the total), was paid to labourers, who were employed on digging the leat tunnel, moving ground, cutting the water course, cutting the foundations, plus additional general site work. By far the largest portion of this was £366-6-7 for digging the tunnel (21% of the total). This more than anything illustrates what a major civil undertaking was involved, not so much in the construction of the mill itself, but in the supporting infrastructure. The fact that Samuel Worthington and his partners paid rental for the mill, and that it remained the property of the Penrhyn Estate after Worthington's departure, confirms that the building costs were borne by Richard Pennant, with the Estate recouping the cost over subsequent years.

The inclusion of Barker Chifney was important as he had previous experience of the pottery industry, having acted as the local manager for Lord Sefton in establishing a pottery works at Toxteth. He also

⁷¹ Robert Copeland, *A short history of pottery raw materials and the Cheddleton Flint Mill*, (Hanley, 1972).

⁷² www.britishlistedbuildings.co.uk/101330335-flint-moll-central-part-of-higher-washford-mill-congleton .

⁷³ BU/PFA/12/11.

⁷⁴ Ibid.

had formed a partnership with Josiah Spode and Thomas Wolfe for the extraction and shipping of china clay; the partnership being known as Chifney, Spode & Co. The partnership was dissolved by mutual consent on 7th January 1804.⁷⁵ Archibald Keightly was involved as the lawyer for some of these transactions and it is likely that it was through this relationship Chifney became acquainted with Messrs Humble, Hurry, Holland and Worthington.⁷⁶

Analysis of the payments made by Chifney and Worthington to the different trades working at the Penlan Mill site shows the following:

	£
Millwrights	142-16-6
Masons	112-19-1
Sawyers	26-15-11 ½
Bricklayers	42-2-2
Joiners	4-14-8
Smith	57-0-2 ½
Freight / cartage	172-13-6
Grouter	5-7-6
Glazier	7-19-5
Lime Burner	5-9-8
Total	577-18-8

This is in addition to the £848-1-10 paid to the Labourers. An additional sum of £329-2-4 was paid in respect of miscellaneous items such as stones, bricks, cooperage, ale for the workmen, etc., with a further sum of £4-5-10 being paid in Custom House charges.

The 1798 date is borne out by a number of other sources. For example, the lease dated 24th March 1800 between Richard Pennant (Baron Penrhyn of Louth), and Michael Humble, Samuel Holland, Nicholas Hurry and Samuel Worthington, refers to *'All that Mills for the grinding of Flints lately erected on the Farm or Tenement called Nant Gwreiddiog in the Parish of Llandegai in the County of Carnarvon'*. The Indenture also gave them the rights to a number of other mills and properties including the remaining land at the Nant Gwreiddiog holding, which at that time comprised ten separate fields totalling 24 acres; adjacent to which were Melin Isaf (later to be known as the Estate Yard or Trefelin) and the Miller's House (see Fig.7.1.1). The lease also included the Ochre Works, and the newly constructed quay at what became known as Port Penrhyn. In addition, Samuel Worthington was permitted to take Marl Clay for the making of bricks; Clods and Sands; and to make and burn Bricksand Lime. The rental for the flint mill was to be £400 per annum, for the corn mills £250, for the Ochre Works £40 and for the wharf £30; a total of £720 per annum. Although the lease does not make specific mention of the tramway, from 1821 to 1830 it was shown in the rent rolls as a separate item. The lease was to be for twenty-one years, renewable after seven and fourteen years.⁷⁷ The significant level of rental for the flint mill in relation to the other Penrhyn mills reinforces not only its relative importance and the level of income it was expected to produce, but also perhaps reflects the building costs that needed to be recouped. As it transpired the Estate received a handsome return on its capital over the initial twenty-one-year term of the lease, with rental of £8400 being received against an outlay of £4752; the initial cost being recouped in just less than 12 years.

⁷⁵ London Gazette Issue 15665.

⁷⁶ Eric Foulkes, Op cit.

⁷⁷ Gwynedd XM/1959/1.

Further evidence comes from shipping records for 1798, which show that cargoes of slate and ground flint were landed in Liverpool for Mr Worthington on 28th May (33 punches), 20th August (16 tons) and 31st December (60 tons).⁷⁸ The Llandegai Tithe Rentals would also tend to support the 1798 date. For example, the Rental for 1795/96 show William Williams Jnr. as the tenant of the Penrhyn Mills (see Section 7) and the House at Melin Ucha, with the Slate Manufactory being let to Samuel Worthington & Co.⁷⁹ Similarly the Tithe Rental for 1797 also shows William Williams Jnr. as the tenant at the same two properties, although there is a note to say that his tenancy was 'to Michaelmas'. Samuel Worthington & Co. took over the tenancy of the Penrhyn Mills later that year, retained tenancy of the Slate Manufactory, and obtained tenancy of the Ochre Works (the first time this appears in the rent roll).⁸⁰ The Tithe Rental for 1798 and 1799 show Penrhyn Mills and the Ochre Works let to Samuel Worthington & Co and Melin Hen to David Roberts;⁸¹ although there is no mention of a flint mill in any of these records. During these two years the tenant of the Slate Manufactory was Benjamin Wyatt, but whether this was in conjunction with Worthington & Co. is not clear. Certainly it was back in Worthington's hands by 1802⁸² and he remained as tenant until 1828. Worthington & Co. had already been active in the affairs of the Penrhyn Estate for some years prior to 1798, having been granted mineral exploration and development rights, as well as the right to distribute the slates produced at Cae Braich y Cafn (the Penrhyn Quarry), and these mineral rights were retrospectively formalised in 1801.⁸³

A further point for consideration is that the Llandegai Tramway was not constructed until 1798,⁸⁴ which otherwise would have necessitated using pack horses for transporting the processed flint from the mill to the port; although as the dressed slates from Penrhyn Quarry were still transported in this way until the Penrhyn Railroad was constructed in 1801, perhaps this would not necessarily have been an inhibiting factor.⁸⁵ In addition Samuel Worthington took up residence in his newly built house, Llwynon, in that same year, the house being built adjacent to the flint mill. Finally, the rent books for this period show that the annual rental payable for the Penrhyn Mills was £150-0-0, whereas from 1800 the rental on the flint mill alone was £400.⁸⁶

While the evidence above confirms the 1798 date there is further perhaps contradictory evidence which suggests that in fact it could have been a couple of years earlier. For example, in the Estate Rent Roll for 1796/97 there is a margin note stating that '*Cartage of stone to Flint Mill is to be left in Cope's hand as some slate portage due*'.⁸⁷ However, rather than indicating that the mill was in use at that time it more likely confirms that it was under construction, which again would support the 1798 date quoted above. In 1866 Hugh Derfel Hughes wrote that the mill had been erected in '*about the year*

⁷⁸ GAT/ PRN 6387, shipping records recorded by Eric Foulkes and sourced from *Billinge's Liverpool Advertiser* (shipping column). There had been previous shipments to Mr Worthington in 1797 but these did not include flint. [NOTE: a 'Punch' or 'Puncheon' refers to a large cask of variable capacity, usually between 70 and 120 gallons; or the volume of such a cask used as a liquid measure.]

⁷⁹ BU Penrhyn 2809.

⁸⁰ BU Penrhyn PFA/4/53.

⁸¹ BU Penrhyn PFA/4/54. (for 1798) and PFA/4/55 (for 1799)

⁸² BU Penrhyn Add. 2946, p. 25, item 44.

⁸³ BU Penrhyn PP2033, Indenture dated 25th March 1801.

⁸⁴ J. I. C. Boyd, Op cit, p.9.

⁸⁵ Ibid, p. 10.

⁸⁶ Gwynedd XM/1959/1

⁸⁷ BU/Penrhyn/Rental 1796/97 (Uncat) p. 25, Items 6 & 7.

1795', and that it had been erected to grind flint stone for Mr Worthington.⁸⁸ In the issue dated 15th December 1796, *Gore's General Advertiser* carried the announcement that '*On Saturday last the NEW POTTERY (formerly the Copper Works) near this town [Liverpool] was opened*', and that the proprietor was Mr [Samuel] Worthington. The pottery referred to was the Herculaneum Pottery in Toxteth, of which Samuel Worthington was to remain the proprietor until 1806. However, while Worthington & Co acquired the pottery at the end of 1796, originally it had been opened by Messrs Abbey and Graham in 1793-4, and during their tenure the necessary raw materials, including flint, would have been sourced or purchased locally; as indeed was the case for all potteries at that time. From the foregoing it would appear evident that the link between the mill and the pottery came about as a direct result of the acquisition of the pottery, the mill being built to utilise what was in effect a by-product of the slate trade, i.e. the flint used as ballast for the returning slate-carrying ships.

Further evidence comes from the travel writer John Evans, who visited the mill between 1798 and 1800 and was sufficiently impressed to publish a detailed description of its workings, although he does not provide any guidance as to when it was built. However, the fact that it merited such attention would indicate that it was something new and unique.⁸⁹ Writing in 1806 local antiquarian William Williams of Llandegai described the River Ogwen and its environs, which at that time '*had on it present two corn mills, two fulling mills, and lately a flint and oil mills which have been erected on it*'. He goes on to say that '*there is never a lack of water in it [the river], so that machines for any purpose might be made moveable by it for the year round*'.⁹⁰ This was to be an important factor in the siting of the mill.

An alternative suggestion has been offered, which is that Penlan Mill was not a 'new build' but a conversion of one of two old fulling mills located at Llandegai, this being the building marked 'Drumbo' at Nant Gwreiddiog, as shown on the Penrhyn Estate map of 1768 (see Fig.7.1.1); with the water supply to the mill being via a long leat. While certainly an alternative, it is unlikely. First, 'Drumbo' does not refer to a mill, either in Welsh or English. Second, while as evidenced by William Williams there were two fulling mills on the River Ogwen, neither was in the village of Llandegai. Melin Isa (in Trefelin Yard) was in Llandegai, but as we know from the Lease of 24th March 1800 it was a grist mill, albeit there had been a recent addition in the form of '*a mill used for the grinding of colours*'.

Furthermore, if the existing mill (the 'Drumbo') had been fed by a long leat, why does this not appear on any of the Estate maps? George Leigh's 1768 map of the Penrhyn Estate shows both the 'Drumbo' at Nant Gwreiddiog and the mill at Melin Isaf, but no evidence of a leat. Although not inconceivable that it could have been omitted, it is highly unlikely that such a major feature would not have been shown. Finally, if the mill being converted was the 'upper' mill (the felin ucha), why were the two mills still referred to separately in the 1800 Lease agreement: i.e. Melin Ucha and Penrhyn flint mill?

Perhaps the most salient point is the way in which the new mill was constructed. Unlike all of the other mills on the Penrhyn Estate, which were built of stone, apart from the foundations the new mill was built entirely in brick. As it was the first and only flint mill to be built in north-west Wales, it is likely that the expertise would have had to have been imported; probably from Cheshire where Samuel

⁸⁸ H. D. Hughes, *Antiquities of Llandegai and Llanllechid* (Caernarvon, 1883).

⁸⁹ J. Evans, *Op cit*, p.453.

⁹⁰ William Williams, 'A Survey of the Ancient and Present State of the County of Caernarvon', (Trans by E.G. Jones, *Caernarvonshire Historical Society Transactions*, 36, (1975), p. 217.

Worthington originated, or from Liverpool. He had been resident in Church Lawton from 1763 to 1795 and would have been aware of the flint mill there, possibly having had some interest in it. This view is perhaps supported by a letter dated Easter Eve 1899 from J. Williams of Penlan, Llandegai, who was writing to Henry Lewis of Belmont, Bangor. In the letter he writes that he understood that Samuel Worthington had '*erected the mill at Penlan and constructed the tunnel which still conveys the water to the mill*'; also, that '*he made the incline railroad from the tramway to the new mill*'.⁹¹

While alternative theories merit scrutiny, the evidence that the mill was a new build and that it came into operation in 1798 is incontrovertible. Quite apart from the evidence now provided by the recently released documents held in the Bangor Archive, the additional documents quoted above also confirm this. The only real disparity is the record of Hugh Derfel Hughes who quotes the date of around 1795, although his was not a contemporary record.

Between 1800 and 1821 all four of the mills, Penlan, Felin Isa, Felin Ucha and Felin Hen, remained under the tenancy of Samuel Worthington. On 8th January 1821 the new owner of the Penrhyn Estate, George Hay Dawkins-Pennant, wrote to Worthington saying that as the twenty-one-year lease on the mills was due to end in March he was taking the opportunity to increase the rent on all of the various holdings held by him, with the exception of the flint mill which he was reducing. Worthington had offered to renew the leases of all the properties on the same terms as before, with the exception of the flint mill for which he had asked a reduction of £230 per annum '*owing to it having from circumstances decreased in value*'.⁹² This had arisen as a result of his dispute in 1817 with the Committee of the Herculaneum Pottery, as referred to in Section 1.2.

Dawkins-Pennant agreed that the request for a reduction in the rent for the flint mill was reasonable '*on account of the decreased sales of the flint*' but felt that he was justified in increasing other rents, which had greatly increased in value over the past twenty-one years. He did, however, recognise that the properties were closely inter-connected and therefore he could not expect as much income as he would from different tenants. To offset the reduction of the mill rent he wanted a reduction in the rate per ton for shipping slate from the Quarry. He thought a reduction of 8d per ton was a reasonable figure, but he was only asking for 3d. He also thought that the rent for Llwynon and its grounds was grossly undercharged, but as Mr Worthington had laid out his own money there he would not exact any increase. He went on to say that the rent on the buildings in the lower yard (independent of the Paint Mill), the improved Slate Factory, and the Yard at the Port, would be increasing. From March 1821 the new rents would be:

Paint Mill, buildings and gardens	£200-0-0
Wharf at Port Penrhyn	£50-0-0
Slate Manufactory	£25-0-0
Flint Mill, Railroad and Land	£200-0-0
Llwynon	£60-0-0
Ochre Works	£40-0-0

He further stated that if the value of the flint should ever exceed 200 tons a year (100 to 150 tons being the quantity now sold) then a royalty per ton should be paid. The same condition applied to the ochre output. He closed his letter by saying '*I beg to add that I shall have great satisfaction in hearing*

⁹¹ Gwynedd X/ Friars Addn/40; Gwynedd XM/3156/8.

⁹² BU Penrhyn PFA/12/5.

by letter that you agree to continue as my tenant on the above terms, which as they are not proposed hastily or without much consideration, I shall not be disposed to alter'. This was to be the first of several disagreements between the two men, Dawkins-Pennant believing that Worthington & Co had been over-generously treated by his predecessor, Richard Pennant. From this point on relationships deteriorated.

It would appear that Worthington had responded to the above letter on 12th January, as on 15th January Dawkins-Pennant wrote again to say that although he [Worthington] may have suffered some inconvenience as a consequence of works going on in the lower yard, he must have been aware that it was unavoidable. It had been his intention to pass on the increased rent on the yard only, being satisfied that independent of the warehouse it was well worth the addition, even in its original state. He went on to say that as the warehouse had been Worthington's for some time he would withdraw the proposed increase altogether. Furthermore, that he had not been aware that a shed had been taken down in the lower yard, although if any inconvenience had been caused it was Worthington's own fault. He also reiterated that the *'trifling increase'* in rent for the Paint Mill and premises was perfectly reasonable, as was the reduction of 3d per ton in the carriage of the slates. He felt that anyone else in his position would, at the end of a twenty-one-year lease, behave in the same way.⁹³

Worthington replied the following day, referring to his earlier letter of 12th January. He said that the shed that had been pulled down was a saw pit he earlier had built for the slate factory, but as subsequently the saw mill had been erected at the Paint Mill the shed had been converted into a storehouse. Also, that although the additional rent for the Slate Manufactory was *'trifling'* in amount, it represented a considerable advance on the present rent. He believed that a charge of 10/- per ton on all flint sales above 200 tons a year was a very ample increase in rent for the flint mill, but accepted that a charge of 10/- per ton for the quantity of ochre produced between 60-100 tons, rising to 15/- per ton for any amount above this, was agreeable. He said that he had hoped for no more than a 2d reduction in the rate per ton off the carriage of slates, but as he did not wish to give *'any more trouble on this occasion'* he would agree to pay the increased rent for the Paint Mill and Slate Manufactory; and to the reduction of 3d per ton off the carriage.⁹⁴ The reply from Dawkins-Pennant was penned at the foot of this letter, as an endorsement. He confirmed that any increase in rent would not take place until 12th May, provided all rentals due to 25th March (the end of the lease) had been paid. He apologised for pulling down the building over the saw pit, that he had not known was a storehouse. Their bargaining was for now over and Worthington remained as the tenant of the flint mill at a reduced rent of £200 per annum until 1829, when the mill was returned to the Estate.

During the intervening years the relationship between the two parties considerably deteriorated, to such a degree that on 3rd November 1828 Worthington wrote to Dawkins-Pennant saying that in view of the worsening situation they (Worthington & Co) would be writing to Mr Wyatt to give notice of their intention to quit in May of the following year. On 10th February 1829 an agreement was signed between Messrs Samuel, Archibald, and William Worthington on the one part and Dawkins-Pennant on the other, to the effect that upon dissolution of the original lease Worthington & Co were to be compensated for the machinery and kilns at the Ochre Works; the machinery at the paint mill, sawing mill and hone stone mill (all situated at Melin Isa); the dressing and framing tables and workmen's

⁹³ BU Penrhyn PFA/12/5.

⁹⁴ *Ibid.*

tools at the Slate Manufactory, together with the stocks of timber suitable for framing writing slates and making packing cases. Also, the weighing machine and crane at Port Penrhyn, together with the hoisting tackle in the warehouse and the iron railway branching off 'the Spooner machine' to and through the same yard; and the iron book case grates and desks in the port office.

The valuation was made by Mr William Baxter and amounted to £102-9-0. In addition, Mr Baxter estimated the value of the wagons, sledges, etc, for the quarry railway at £838-5-4. Finally, Worthington & Co were to sell to the Estate any straw and hay suitable for the storing of slates; to provide Dawkins-Pennant with a true list of their customers, credits allowed, etc, for roofing slates and writing slates; and the details of the manufacturing and sale of ochre and hone stones sold by them.⁹⁵

Some indication of the flint output (in tons) from the mill during these years can be gleaned from the surviving shipping records for the period 12th May 1826 to 12th May 1827⁹⁶, viz:

1826	May	4	8 $\frac{3}{4}$
	June	27	18 $\frac{3}{4}$
	July	6	14 $\frac{1}{2}$
	August	20	15 $\frac{1}{2}$
	September	33	14 $\frac{1}{2}$
	October	9	0 $\frac{3}{4}$
1827	April	62	16
	May	3	9 $\frac{3}{4}$
		<hr/>	<hr/>
		169	18 $\frac{1}{2}$
1827	September	27	12
	November	22	5 $\frac{1}{2}$
	December	14	7 $\frac{1}{4}$
		<hr/>	<hr/>
		64	4 $\frac{3}{4}$

It is worth noting that such a level of output had continued several years after the ending of Samuel Worthington's formal relationship with the Herculaneum Pottery. Whether he continued to supply the pottery on an ad hoc basis, or whether he had found another market for the ground flint, is not known. Certainly, flint production ceased when he left Llandegai.

While the Penrhyn Estate rent rolls throughout this period refer to 'Worthington & Co', this was not a registered company. Until 1811 the term denoted Samuel Worthington and his Liverpool partners, and from then on to Worthington and two of his sons, Archibald and William.

On 11th May 1823 Mr Baxter, the Penrhyn Estate's Works Manager, wrote to Dawkins-Pennant saying that he had forwarded to Mr Wyatt (the Agent) a copy of a letter from Mr Jackson of Liverpool regarding the possible conversion of Penlan Mill from a flint mill to a corn mill.⁹⁷ Apparently, the plan attached to the letter showed the construction of two additional floors to the present building, as well as details of the proposed machinery layout (sadly there is no copy of the plan available). Mr Baxter said that he was happy with the proposals, but not with Mr Jackson's cost estimates: '£3260 to

⁹⁵ Gwynedd XM/1959/3 'Articles of Agreement Indented' dated 10th February 1929.

⁹⁶ BU/Penrhyn/ms1976, Account of Flint brought down from 12th May 1826 to 12th May 1827, signed by Robert Spooner 23rd January 1828.

⁹⁷ BU Penrhyn PFA/12/17.

complete the machinery not including the expense of the addition to the height of the Building'. He thought this too high a price and that by using the Estates' own labour all of the necessary work could be completed for no more than £2215. Interestingly his estimate included *'the repairs and alterations to the water wheels'* (plural), which would tend to confirm that there had been two wheels present from the outset. (This is discussed later.) When the conversion actually took place is not clear. The rental remained unaltered for the following six years until Worthington & Co relinquished their tenancy; flint continued to be shipped; and there is no mention of any change to the mill's lease to indicate a change of use. However, it had been converted by 1835 when a new tenant took over, no doubt by that time the conversion having been forced upon the Estate due to its inability to attract a new tenant until this had been carried out.

Following the expiry of the 1800 lease with Worthington & Co the rent roll entries refer variously to the 'Flint Mill, Rail Road and Land', the 'Corn Mill', the 'Corn Mill & Land', 'Penrhyn Mill', and 'Penrhyn Corn Mill'. Nonetheless it would seem that between 1821 and 1829 Worthington & Co continued to rent the flint mill at a reduced annual rental of £200, and from 1830 to 1835 it remained 'In Hand' to the Estate. During this period the Poor Rate levied against the mill was £1-8-0, with an additional rate of £1-0-0 being levied against Llwyn Onn.⁹⁸ Meanwhile, from 1821, two of the three old mills collectively known as 'the Penrhyn Mills' (Melin Uchaf and Melin Hen), were taken over by Griffith Thomas at an annual rental of £120.⁹⁹ Melin Isaf had by now become a paint, hone, and saw mill and thus remained part of the Penlan Mill operation.

In May of the following year, 1822, the annual rental on the Penrhyn Mills was reduced to £100 'in consideration of the tenant doing repairs'.¹⁰⁰ In 1835 Griffith Thomas also took over the by now converted flint mill, with the total annual rental for all three mills being £350 (although he actually appears to have paid £373).¹⁰¹ Felin Isaf had by this stage been taken over by the Estate's Works Department under the management of Mr Baxter. Two years later the rental was reduced by £50 per annum, but with an additional £6 per annum being added 'for cottage'; the annual amount payable now being £329. In 1842 there was a further adjustment to reflect the mills now being let separately, with the rental for what was now known as Penrhyn Mill being £279 and for the old mills £60; the cottage being part of the new letting of Lon Isa.¹⁰² In November 1843 the annual rental was further reduced to £200 'the Old mill included with the new being further reduction of 60£ a year'. This remained unaltered until May 1851 when it was reduced to £180 'due to tenant having failed'.¹⁰³

While Griffith Thomas was the tenant throughout this period, from the 1841 Census it would appear that the actual milling was carried out by Thomas Prichard, a 35-year-old miller who lived at the site with his wife Catherine and their two small children.¹⁰⁴ Also living there was Richard Hughes, a 30 year-old carrier, together with his wife and 18 month old son. Thomas Prichard and his family were still living there ten years later, their address now being shown as Tyn y Felin.¹⁰⁵ By 1861 the miller was listed as 28-year-old David Roberts who, together with his wife Margaret and their two infant sons,

⁹⁸ BU/Penrhyn/ADD2835, James Wyatt's accounts for 1835-1842.

⁹⁹ BU Penrhyn Add 2957 'Rental 1821'.

¹⁰⁰ BU Penrhyn Add 2959 'Rental 1822'.

¹⁰¹ BU Penrhyn Add 2973 'Rental 1836'.

¹⁰² BU Penrhyn Add 2980 'Rental 1842'.

¹⁰³ BU Penrhyn 17 (Un-cat) 'Rental 1851'.

¹⁰⁴ 1841 Census, Llandegai. PRO/H0107/1396.

¹⁰⁵ 1851 Census, Llandegai. PRO/H0107/2518.

lived in Penrhyn Mill Cottage (shown as Trefelin).¹⁰⁶ Another miller is also listed in the same census, 24 year old William Owens who was a lodger with John Hughes and family in Bryndwmchwel. By 1871 Margaret Roberts had died and David continued to live in Penrhyn Mill Cottage with his two sons.¹⁰⁷ By 1881 the only Llandegai millers listed in the census were 25 year old Thomas Cragg who lived in No.1 Trefelin with his father John, a sawyer; and Richard Evans age 57, a corn miller living in Mill House together with his daughter and son-in-law.¹⁰⁸ In 1891 the family was shown as living at No. 8 Trefelin, with Mr Evans' son-in-law William Griffith Williams now listed as a hone cutter, whereas previously he had been a stonemason.¹⁰⁹ Richard Evans was no longer listed in 1901 (by when he would have been 79); although 50 year old William G. Williams, his wife Jane, and their 14 month old daughter Elizabeth Ann were still living at No. 8 Trefelin. His occupation was now listed as a stone cutter.¹¹⁰

It would appear that at some time during Griffith Thomas's tenancy a stable was built adjacent to the mill. The precise date is not known although it would appear to have been some time after the mill. There is no mention of the stable in the original March 1800 lease agreement for the Penrhyn Mills, between Richard Pennant and the Liverpool merchants, whereas it is shown on the 1841 Llandegai Tithe Map, sheet 4.¹¹¹ However, it does not appear on the plan showing the alternative routes for the Chester & Holyhead Railway, that was draughted a short time later. The first time that it is documented is in the December 1852 lease agreement with Roger Evans. Based on the available information it would appear that it most likely was erected somewhere between 1835, when Penlan Mill was converted from a flint mill to a corn mill, and 1840-41 when it first appears on the Tithe map. The fact that the stable was constructed in stone rather than brick would also tend to confirm that it post-dates the construction of the mill itself.

In May of 1851 the tenancy of Penrhyn (Penlan) Mill was taken over by Thomas Evans of Maes y Coed, Caerwys, and Roger Evans of Menai Bridge (the Evans Brothers),¹¹² and the rental of Felin Hen passed to John Rogers.¹¹³ The Evans brothers remained as tenants at Penrhyn mill until 1859 when Thomas Evans died and Roger Evans became the sole tenant. It was during the Evans Brothers tenancy that two important changes took place, as evidenced by the relevant lease documents. The first is dated 27th February 1852 (effective from 12th May 1851), and is for the '*Lease of a Messuage Mill and plots of land and premises situate at Llandegai in the County of Carnarvon*' at an annual rental of £180. It goes on to say that the lessees '*And also shall and will at their own costs and charges in all things form and construct and completely finish in a substantial and workmanlike manner and with good and sufficient materials a branch railway and siding commencing at the said Mill to communicate and to form a junction with the Chester and Holyhead Railway*'.¹¹⁴

The work was to be carried out under the direction and superintendence of Mr Hedworth Lee, the Engineer for the railway company, and to his complete satisfaction. In connection with this work the lessees were also to '*erect and complete within the Mill a partition and contain this alteration*', as well

¹⁰⁶ 1861 Census, Llandegai. PRO/RG9/4352.

¹⁰⁷ 1871 Census, Llandegai. PRO/RG10/5730.

¹⁰⁸ 1881 Census, Llandegai. PRO/RG11/5577.

¹⁰⁹ 1891 Census, Llandegai. PRO/RG12/4669.

¹¹⁰ 1901 Census, Llandegai. PRO/RG13/5284.

¹¹¹ Gwynedd Archive.

¹¹² BU Carter Vincent mss 2278, draft lease of 27th February 1852.

¹¹³ BU Penrhyn 17 (Un-cat) 'Rental 1851'.

¹¹⁴ BU Carter Vincent mss 2278.

as to 'take down and remove the Barley Millstones which were to be replaced with French Wheat Mill Stones of the best quality'. In recognition of this work being carried out the lessees were 'to retain and reimburse themselves towards the costs thereof out of the yearly rent first accruing' to the sum of £250.

A separate lease dated 28th December 1859 between Edward Gordon Douglas Pennant, the new owner of the Penrhyn Estate, and Roger Evans of Menai Bridge, refers to 'All that messuage or tenement with the corn mill, 2 warehouses, offices and buildings connected therewith called the Penrhyn Corn Mill', ¹¹⁵ as well 'those two several fields or parcels of land, one situate between the road leading to the Mill and Penlan House and the other between the same road and the Chester and Holyhead Railway, comprising 10 acres or thereabouts'. In addition, the lease included the yards, stables, granaries, offices, outbuildings, etc, and it ran for a term of seven years with an annual rental of £280, an increase of £100 due to the new buildings, with Mr Evans being bound to maintain the railway siding in good order.

Within the document was a reference to 'the provisions of a lease which is surrendered on the granting hereof erected and completed to the satisfaction of the Lessor a warehouse abutting upon the said Corn Mill'; the cost of erecting the warehouse being £100. It would appear that at this time an amount of refurbishment needed to take place, as the lease states 'The Lessor to provide all timber, iron and other materials necessary for repair of the water wheels attached to the mill, the driving wheels thereon, and the main and pin wheels'.¹¹⁶ From this it would appear that the warehouse had been erected sometime during 1852, or shortly thereafter, and was formally incorporated into a new lease in 1859.

Roger Evans retained the tenancy until 1868 when it was transferred to a Roger Evans of Fron Goch, Pentir, and William Evans of Menai Bridge. At the time they took over the annual rental was reduced to £260 as the 10 acres of land no longer formed part of the messuage. It is not clear whether the change of name signified the introduction of a son into the business, whether Roger Evans had ceased to be involved with the mill and the tenancy had passed to other members of the family, or whether he had moved to Pentir. The only note on the rent roll was for 1868 when an entry was made 'Land added 20-0-0 (late R. Evans)'.¹¹⁷ R & W Evans remained at the mill until August 1878 when they sought to have the lease assigned to the Bangor corn merchants Thomas and Henry Lewis, this being for the remaining term of 21 years. T. Lewis & Son formally became the tenants on 12th November 1878, by which time Roger Evans was residing at Craig Owen, Llandisilio, and William Evans at Greenfields near Denbigh, It appears that they had become insolvent, their lease being relinquished 'pursuant to an Order of the High Court of Chancery dated the thirtieth day of July 1879'.¹¹⁸ The re-assignment of the lease was certainly under discussion in June of 1878, with Lord Penrhyns' Agent, W.E. Sackville West, already being in correspondence with Lewis & Son.¹¹⁹ Throughout the tenure of Lewis & Son the annual rental remained unaltered at £280.

¹¹⁵ BU Carter Vincent mss 2280.

¹¹⁶ Ibid

¹¹⁷ BU Penrhyn Add 2877 'Rental 1868'.

¹¹⁸ BU Penrhyn PFA2/59 Lease dated 10th December 1883.

¹¹⁹ BU Penrhyn PFA/2/54.

In December 1883 a new lease was signed between the Trustees of the Penrhyn Estate and Lewis & Co. One of the clauses within the lease was that on or before 12th November 1884 the tenants were to expend the sum of £3000 on such new machinery as was appropriate for a corn mill. Attached to the lease was a schedule listing all of the mills' contents, as well as a clause stipulating that the lessor and lessee were to jointly share the cost of carrying out all repairs and maintenance to the leat tunnel. On the back of the document there was an endorsement dated 24th July 1885, confirming that permission had been granted for the erection of an extension to the mill, together with an adjacent stone shed: both in the upper yard (see Section 3.1.5).

On 25th September 1891 a further attachment was added, to the effect that Thomas Lewis & Co had been given permission to erect a hay house at the mill and that the cost incurred, £66, would be subject to proportionate compensation should they leave the site within the next 30 years. The endorsement was signed by Sackville West (the Agent for Penrhyn Estate) and witnessed by Griffith Roberts of 95 High Street, Bangor.¹²⁰ Lewis & Co remained at the mill until 31st December 1901 when the lease was surrendered.¹²¹ At that time a number of men were employed there including the chief miller John Hughes, who previously had worked at Coed Hywel Mill in Caerhun. There were four teams of horses and wagons, that were used to deliver the (mainly white) flour to local shops, and as far afield as Betws y Coed, Conwy and Penmaenmawr.

Because there was a general problem with milling British wheat, it tending to be soft and damp and therefore requiring drying before it could be ground, much of the grain tended to be imported from Canada and Australia. However, this was not without its own problems, as although the imported grain was drier, it tended to be harder and more difficult to grind. The imported grain was transported to the mill by rail, being unloaded at the Penlan Siding. When the mill closed, John Hughes rented Cochwillan Mill from the Penrhyn Estate and continued to work there until it too closed, in 1955.¹²²

Following the departure of Lewis & Co in January 1902, for several years there is no record of a tenant at the site. However, shortly after their departure there was a proposal to install electric turbines and dynamos at the mill, to provide lighting and power at Penrhyn Castle and to the Estate Works in Trefelin Yard;¹²³ although this did not come to fruition as it was around this time that a public electricity supply was provided for Bangor, Llandegai Village and Pentir.¹²⁴ However, a turbine was installed at the saw mill in Trefelin Yard.

In October 1912 a study was undertaken to assess the mineral deposits at nearby Rhos Uchaf, with a view to developing an iron mine. The assessment was made on behalf of the Silurian Iron Ore Company Ltd, and the report included Penlan Mill which at that time was still fully functional.¹²⁵ The mill was included in the report for three reasons: the two water wheels producing 96-98 horse power, sufficient for crushing ore; it having access to the private railway siding at Penlan; and the water wheels having sufficient power to generate sufficient electricity for drilling and lighting underground works. On 19th August 1913 a lease was taken out by Silurian, that included the mill, sheds, stable, and

¹²⁰ BU Penrhyn PFA/2/59.

¹²¹ BU Penrhyn PFA/2/59.

¹²² A.R. Jones, 'Melin Cochwillan a'r Melinydd Olaf', *Melin*, 2 (1986), pp.5-8.

¹²³ BU/Penrhyn 192 (un-dated)

¹²⁴ Gwynedd XB14/1 Minutes of the meeting of Ogwen RDC, p.75, 29th November 1895.

¹²⁵ Gwynedd XM9801/2.

the waterways across the site; also, the private railway siding at Penlan, wharf facilities at Port Penrhyn, access to the port via the Penrhyn Quarry Railway, and mineral rights to the area adjacent to the mill over an area of 392 acres 1 rod and 26 perches. The lease was for the standard Penrhyn term of 21 years, renewable at years seven and fourteen.¹²⁶

In 1920, following the end of the First World War, the company ceased operations and the seven-year lease option was not renewed. However, on 24th March 1924 a Take Note was issued by Lord Penrhyn to Evan John Morris of Llwyn Celyn, Tal-y-Bont, retrospectively leasing the mine for a period of two years from 12th November 1923.¹²⁷ The terms of the lease were in line with those pertaining to the Silurian Iron Ore Co, the exceptions being that there was no mention of the port facilities or a junction with the Penrhyn Quarry Railway. (All shipments were made via the Penlan siding and therefore the Estate's shipping facilities were not required.) A report dated 24th February 1924 had noted that in order for the mill to be of benefit to the mining enterprise it would need, among other requirements, a new trough (launder) above the water wheels to regulate the amount of water from the leat, and a three-phase copper wire line to be run from the mill to the mine: a distance of approximately half a mile.¹²⁸ Although there was an option to retain the mineral rights for a period of forty-two years, there is no evidence of the Take Note being renewed after the two years had elapsed, and the mill again became unoccupied. A detailed history of the mine is contained in Section 6.4.

In the Ogwen Rural District Council Special Draft (Apport) Valuation List for 1929-32 the mill is not listed, although the report does include the saw mill at Trefelin Yard and the railway siding. Between 1937 and 1939 the ground floor area in the upper yard extension was used as a garage/workshop that Robert Jones, a van driver/mechanic for the Penrhyn Estate, used for servicing his vehicle. The workshop at that time was described as being two storeys high with two large doors to the front and two raised platforms on the ground floor. The rest of the building was used for storing timber, and although the mill was still intact no milling took place. At this time horses were still being used for hauling timber from the saw mill in the bottom yard at Trefelin.¹²⁹ Timber and planks continued to be stored at the mill during the 1940s and 50s,¹³⁰ and during World War II Penlan siding was used for shipping pit props and other materials.¹³¹

During the post-war period a lorry and tractor were garaged in the workshop. The lorry was driven by Jack Smith who lived in a cottage near Hendre Farm (Tan-y-Lon), and the tractor was driven by a man named 'Ben'.¹³² In 1955 the Trefelin Yard was sold to Caernarfon County Council who used the site as a depot for their Highways Department, and it remained in use as such until 1990 when it was sold to Celtest Ltd. The Penlan Mill site, including the leat and surrounding woodland, remained under the ownership of the Penrhyn Estate. Because of safety concerns, and its proximity to the mainline

¹²⁶ BU ms 22870

¹²⁷ A private copy of the lease is held by Mr Morris's grand-daughter, Miss Moira Muir.

¹²⁸ 'The Particulars of Penrhyn Iron Mine', a privately held document (as above) dated 23rd February 1924.

¹²⁹ Dr D.A. Jones during a telephone conversation on 18th August 2010, and at a meeting on site at Penlan on 9th April 2012.

¹³⁰ Mr L. Foulkes, meeting on 5th April 2010.

¹³¹ Dr D.A. Jones, Op cit.

¹³² Mrs G. Roberts, meeting on 30th November 2010.

railway, the actual mill structure was demolished in around 1955,¹³³ leaving only the inner and outer walls of the water wheel pit and the west embankment wall remaining. Possibly the high level of Death Duties being levied against the Penrhyn Estate at that time may have influenced the decision. As it was unlikely to attract a new tenant the mill was no longer an asset but a liability and therefore warranted disposal. For almost the next fifty years the site was used as an informal dumping ground or 'tip', soon becoming buried beneath waste and completely overgrown.

In 2004 the site, together with the surrounding woodland, was sold by the Penrhyn Estate to the owners of the adjacent Penlan Mill Cottage, Peter and Gill Bullen. In September 2007 they in turn sold all three properties, the mill, the cottage and the woodland, to Celtest Ltd, owners of the adjoining former Felin Isaf site in the lower yard. The site was neither scheduled or listed and at the time of the sale outline planning permission had been granted by Gwynedd County Council for garages to be built on the mill site, and this was renewed in 2012. In June 2008 the cottage was again sold, the new owner being Mr E. Goulden.¹³⁴ The mill site and adjacent lands remain the property of Celtest Ltd.

Further evidence to support the succession of tenants at Penlan Mill comes from various contemporary trade directories. For example, Slater's Directory of 1868 lists Roger Evans & Son at Penrhyn Mill;¹³⁵ and in 1883 Slater's shows that Thomas Lewis was the miller at Penrhyn, Llandegai, and Aber mills; as well as at the City Steam Mills in Dean Street, Bangor.¹³⁶ It also lists him as a corn and flour merchant in Dean Street, Bangor.¹³⁷ In 1874, prior to taking over the tenancy at Penlan, Lewis Thomas was listed in Worrall's Directory of North Wales as a miller in Aber, Bethesda, and the City Steam Mills in Bangor.¹³⁸ Slater's 1895 Directory has two entries for him, one under the heading 'Llandegai – Private Residents' as 'Lewis Thomas, corn miller, Penlan Mills; office Bangor',¹³⁹ and the other under the heading 'Trades' as 'Lewis Thomas, Penrhyn Mills, 239 High Street, Bangor; and Penlan Mills, Llandegai'.¹⁴⁰ As always there is an anomaly, and in 1890 this is provided by Sutton's Directory which shows Thomas Lewis & Co. as Corn Millers and Merchants at the City Steam Mills, Bangor; Tea Dealers & General Grocers in Bangor, Carnarvon, Pwllheli, Holyhead, Amlwch, Llangefni, Llanerchymedd, Pentraeth, Bethel, Penmaenmawr, and Bodedern: no mention of Penlan.¹⁴¹

There are also a number of anomalies between the Directories and the Estate records. For example, Slater's entry for 1844 lists William Thomas as the miller at Penrhyn,¹⁴² and at the Bishop's Mill. The rent book for that year shows Griffith Thomas. The same entries appear in 1850,¹⁴³ and 1853,¹⁴⁴ even

¹³³ Mr L. Foulkes, Op cit. The mill was still standing in 1954 when Mr Foulkes left Llandegai to complete his National Service but had been demolished by the time of his return two years later. The 1955 date also corresponds with the date upon which the lower yard at Trefelin was sold to Caernarvon County Council.

¹³⁴ As per Mr Gary Jones, Director of Celtest Ltd, 19th March 2012.

⁷⁹ 'Slater's Directory – Western, 1868', (Manchester & London, 1868), p. 18.

¹³⁶ 'Slater's Directory – North Wales, Cheshire, and Shropshire with Liverpool 1883', (Manchester, 1883), p. 26.

¹³⁷ Ibid, p. 24.

¹³⁸ 'Worrall's Directory of North Wales', (Oldham, 1874), p. 196.

¹³⁹ 'Slater's Directory of North & Mid Wales 1895' (Manchester, 1895), p. 85.

¹⁴⁰ Ibid, p. 668.

¹⁴¹ 'Sutton's Directory of North Wales', (Manchester, 1890), p. 32.

¹⁴² 'Slater's Directory of Liverpool and its Environs', (Manchester, 1844), p. 10.

¹⁴³ 'Slater's (Late Pigot & Co.) Royal National and Commercial Directory and Topography', (Manchester & London, 1850), p. 12.

¹⁴⁴ 'Slater's (Late Pigot & Co.) Royal National and Commercial Directory and Topography', (Manchester & London, 1853), p. 12.

though Griffith Thomas had left the site in 1851. However, it seems likely that William was the son of Griffith Thomas, as the rent book entries for 1842 and 1843 show the tenants as 'Griffith Thomas & Son'. Similarly, the 1856 entry shows Evans Bros as the millers at Penrhyn Mill, and Roger Evans as the miller at Llandegai. William Thomas is still shown at the Bishop's Mill, which is in line with the rent book.¹⁴⁵ The same entries appear in 1859.¹⁴⁶ In the case of Roger Evans, he was one of the 'Evans Bros' shown in the rent book, and later took over sole tenancy. What is not clear is which mill was referred to as 'Penrhyn' and which was referred to as Llandegai. What seems likely is that possibly the entries in Slater's Directory refer to Evans Bros being the holders of the Penrhyn lease, with Roger Evans actually being situated in the Llandegai mill.

¹⁴⁵ BU/Penrhyn/Add 2866, 'Rental 1857', p. 115. Also 'Slater's Directory of North Wales 1856, p. 15.

¹⁴⁶ 'Slater's (Late Pigot & Co.) Royal National and Commercial Directory and Topography 1958-0', (London, 1859), p. 15.

3. Location and Description

3.1. Location and overview of the site

The Penlan mill site is located in the village of Llandegai to the south of Bangor, standing between the old Shrewsbury to Holyhead coach road and the River Ogwen, adjacent to the railway embankment of the North Wales Coast Line railway and east end of the Llandegai tunnel.¹⁴⁷ There is no vehicular access as the site is privately owned. However, it can easily be approached on foot via the Wales Coast Path: either from the lane known as Trefelin,¹⁴⁸ or by following the public footpath that runs from opposite the former smithy on the old coach road (sign-posted 'Rugby Club'). The path runs between what currently is Ashbrook Plant Hire Ltd¹⁴⁹ (formerly known as The Carters Yard or Timber Yard), and the main line railway.¹⁵⁰ From the corner of Ashbrook's yard the site is approached via an un-surfaced drive that is approximately 85m long and 6m wide, sloping down toward Penlan Mill Cottage and the upper yard. Originally the lower part of the drive formed a section of the the incline for the tramway that linked the mill with Port Penrhyn.¹⁵¹ When the Shrewsbury to Holyhead road (the former A5 trunk road) was built by Thomas Telford it bisected the tramway, and a bridge was constructed over it, forming a tunnel. The end of the tunnel is still visible beneath the bridge that sits above the embankment of the main-line railway, adjacent to the driveway to Pentwmpath and The Old Vicarage (formerly Samuel Worthington's residence, Llwyn Onn). The upper entrance to the tunnel was located between what are now the gardens of Haulfre and Tanygraig, where the turntable for the tramway was located at the start of the incline. Some evidence of the tramway bed remains and can still be seen running to the rear of the garden at Tanygraig (although more specifically this relates to the tramway extension from Llandegai to the Quarry).

Penlan Mill Cottage is on the right-hand side of the driveway, and adjacent are three stone-built sheds. On the garden wall of the cottage there is a slate plaque bearing the legend 'Alf's Patch' (Fig.3.1.1).¹⁵² The open area in front of the sheds was known as the Upper Yard (not to be confused with the Timber Yard which also was often referred to by the same name), and it is here that in 1885 Lewis & Son built an extension to the mill (see Section 3.1.5). Originally the yard had a cobbled surface, although following work carried out by the water authority there is no evidence of this today (Fig.3.1.2). Adjacent to the sheds, at the east end, there is a gate leading into a grassed area that is part of the private garden belonging to the cottage. Until the 1980s a two-roomed 'privy' or 'Ty Bach' stood in the corner of the garden, although it has since been demolished (Fig.3.1.3).¹⁵³

At one time Penlan Mill Cottage comprised two separate dwellings. The first time it appears in the record is in the 1861 census when the tenant was a 28-year-old miller named David Roberts. Since passing into private ownership the cottage has undergone a number of extensions and improvements,

¹⁴⁷ SH 6000 7070.

¹⁴⁸ SH 6020 7088.

¹⁴⁹ Over recent years the company name has changed. Originally known as Blake & Arnold Ltd it subsequently was re-badged as Hewdens Plant Hire Ltd.

¹⁵⁰ SH 6075 7065.

¹⁵¹ J. I. C. Boyd, *Op cit*, P. 9.

¹⁵² The plaque is in memory of Alfred Burrows, the late father of Mrs Gillian Bullen. Mr & Mrs Bullen were the owners of the cottage until 2007

¹⁵³ BU Penrhyn PFA/2/59, Lease dated 10th December 1883.

although one interesting feature has been retained, namely the support arms of a wall-mounted writing table, that is situated beneath the western-most bedroom window (Fig.3.1.4). It is not known whether this was positioned there simply to benefit from the light, or whether to provide a view into any of the carts or wagons that either passed beneath the window or were in the railway siding. If this was the case, it would have provided an ideal vantage point for a tallyman to observe traffic passing to and from the mill.

Opposite the cottage there is a galvanized metal gate that leads on to railway property. Originally there was a much larger gate here, leading to what was a private railway siding, situated adjacent to the mainline railway (see Section 5.4). Just beyond the gate, opposite the cottage, the pathway continues down another much steeper incline that was part of the original 'Occupation' Road. Approximately two-thirds of the way down the incline, to the right-hand side, there is a cast-iron pipe protruding from the stone wall. It emerges from approximately half-way up the wall and extends vertically into the ground (Fig.3.1.5). Allegedly the pipe was used for conveying water from the mill site to the cottages in Trefelin and only became redundant after mains water and sewage pipes were installed in around 1974.¹⁵⁴ Some remains of the pipe were uncovered beneath the road surface in January 2016, during work on a new drainage system (see Section 4).

The wall at this point contains what appears to be a large stone arch, now filled in. Whether the arch was incorporated as a means of strengthening the wall or whether it provided access to an inner chamber is not known. However, from its position on the slope it is thought unlikely that it is the latter, rather that it was inserted to strengthen what is a high, load-bearing, wall. Just before the arch, to the west side, there is a broken section of pipe protruding from the wall, with what remains of the bottom coupling directly beneath, buried in the ground. There is nothing to indicate the purpose of this second pipe.

At the foot of the slope, to the left, there is some protruding brickwork still standing, that are the remains of the support walls for the bridge that gave access between the mill and the former mainline railway siding. Immediately beyond this section of wall there is an underpass leading to Trefelin Cottages, the first part of the road being un-surfaced. Prior to the construction of the Chester & Holyhead Railway the lane formed part of the original 'Occupation' Road. Beyond the underpass the dressed limestone wall of the railway viaduct continues. It is capped with sandstone, which probably was imported from Cheshire. This is a reasonable assumption as there is very little naturally occurring sandstone in north-west Wales; although during the construction of the Chester & Holyhead Railway large quantities of the stone were quarried near Chester, and this would have been transported to Llandegai by train as work on the railway progressed. The remains of the mill face the underpass. Prior to its demolition in 1955 there had been a bridge connecting the mill with the private railway siding, that was located alongside the adjacent main-line railway. According to anecdotal reports clearance beneath the bridge had been extremely limited, with horses having to have their collars turned sideways to facilitate passage. Colloquially it was referred to as 'the tunnel'.¹⁵⁵ What remains of Penlan

¹⁵⁴ Gwynedd XC2/3/205, 'Plans and Sections of Intended Sewers and Rising Main, Drg. No. 2, Sheet A' dated 30th August 1973. The plans, reference no. 03/9/2A, were drawn up for Ogwen Rural District Council by A. H. S. Waters and Partners, Consulting Civil Engineers, Birmingham.

¹⁵⁵ Mrs Gladys Roberts, Op cit.

Mill lies to the right of the path, although it is now difficult to see as it is again heavily overgrown, in spite of having been cleared on two separate occasions during the course of excavation.

Some of the important features pertaining to the Mill are its siting, location, and power output. In common with many other mills, Mosty Lea being an example, it is sited against a hillside, being what Mike Davies-Shiel refers to as a 'bank mill'.¹⁵⁶ This facilitated the loading of raw materials directly to the upper floor, thus minimising handling. Its location provided easy access to both the Port tramway and, perhaps of more significance post its conversion to a corn mill, ease of access to both the Shrewsbury to Holyhead Road and the Chester to Holyhead Road. It was linked to both of these by the newly constructed 'Occupation' Road which was uncovered during excavation of the site.

By comparison with other contemporary flint mills Penlan was extremely powerful, its two 20 feet diameter water wheels, both overshot and working in tandem, producing an estimated 96-98 hp,¹⁵⁷ and this was one of the features that later on made it attractive to the Silurian Iron Ore Company which leased it during the First World War period.¹⁵⁸ By comparison Mosty Lea Mill had a single 20 feet diameter undershot wheel; Higher Washford Mill a single 18 feet breastfed wheel; and the mills at Cheddleton where the the North Mill has a single low-breast wheel 22 feet in diameter, and the South Mill has a similar wheel with a 20 feet 5 inch diameter wheel. Because of its great power Penlan Mill was able to operate more than grinding pan at a time and was also capable of crushing iron ore, although there is no firm evidence to confirm that this actually took place on the site.



Fig.3.1.1: Penlan Mill Cottage with plaque (2010)

¹⁵⁶ Mike Shiel-Davies, *Watermills of Cumbria*, (Nelson, 1978), p.62.

¹⁵⁷ Gwynedd/XM9801/2.

¹⁵⁸ BU/Penrhyn ms22870.



Fig.3.1.2 (left): Penlan Mill Cottage and cobbled yard.¹⁵⁹ (1980)

Fig.3.1.3 (right): Remains of the 'Ty Bach' at Penlan Mill Cottage. (2006)



Fig.3.1.4 (left): Writing table support arms. It is believed that this is an original feature dating from the 19th century.¹⁶⁰ (2010)

Fig.3.1.5 (right): The water pipe to Trefelin and stone arch inset into wall. (2004)

3.2. Description of the Mill complex

From the historical record we know that what we refer to as the mill complex comprised a number of different elements, and that it was constructed in five phases. Phase 1 was the original flint mill with its associated waterways, tramway, and access road; Phase 2 was the conversion to a corn mill; Phase 3 was the construction of the stable; Phase 4 was the construction of the warehouse and railway siding; and Phase 5 the extensions to the Upper Yard. Very little physical evidence of these still exist, having been either demolished or buried. What does remain comprises parts of the original mill building and warehouse extension, which form one contiguous structure; some elements of the waterways; some of the footings to the stable; plus some elements of the tramway and part of the access road. What follows is a description of the various elements, how they might have worked, and

¹⁵⁹ Courtesy of the RCAHMMW.

¹⁶⁰ By kind permission of Mr Eric Goulden..

the evidence today. These include the flint and corn mills, the stable, the warehouse extension and its link to the railway siding, and the extensions to the Upper Yard. The waterways are discussed in Section 4, and the tramway, access roads, and railway siding are discussed in Section 5.

Where it is thought to be beneficial the one metre square alpha-numeric grid reference allocated during excavation of the site has been included in the description, these correlating with the relevant site plans (see Appendix I). The grid is designated alphabetically west-east and numerically south-north. For ease of reference and orientation the embankment wall abutting the upper yard is designated the west wall; the side nearest the railway line (the warehouse extension or 'outer mill') the north wall; the stable side the east wall; and that adjacent to the water wheel pit the south wall. The original working part of the mill (the 'inner mill') lies between the warehouse extension and the water wheel pit. The remains of 'Occupation' Road lie adjacent to the east wall of the stable.

The construction phases are represented by the following schematic, which is not to scale, and the detailed description of the site follows these phases.

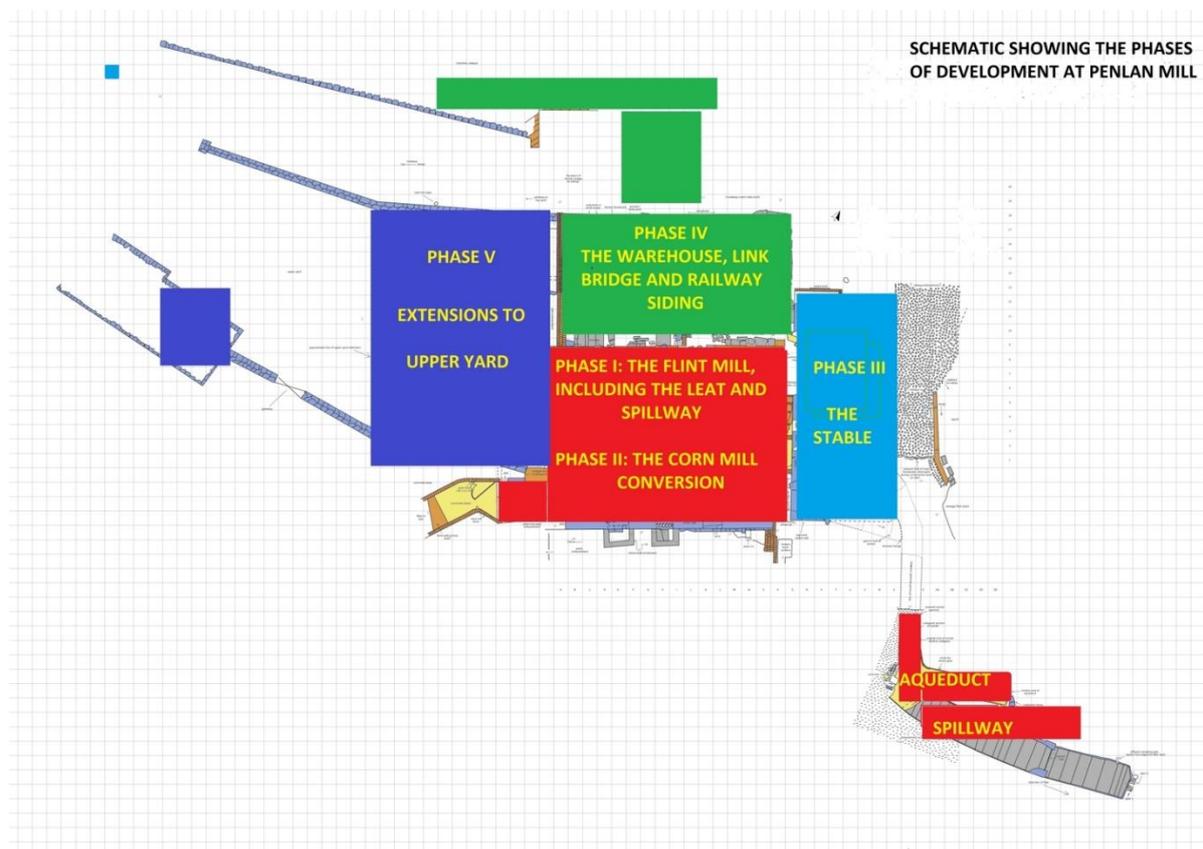


Fig.3.2.1: The phases of development at Penlan Mill

3.3. The Flint Mill (Phase I)

This is by far the most important area, being the original mill building and the primary working area. Internally it measures 16.4 metres east to west and 8.6 metres north to south. In the main the walls are constructed in brick on a stone base, are 85cm wide, and laid as English Garden Bond, typically with three rows of stretchers between single rows of headers. This is in contrast with other local farm and industrial buildings which were built entirely of stone. However, it is in accord with similar mills in

England, for example the ground storey of Higher Washford Mill is constructed in dressed coursed pink sandstone with English garden bond brickwork to the first and second floors and a Welsh slate roof. Similarly, Mosty Lea Mill near Oulton in Staffordshire and both mills at Cheddleton.

The north, east and south walls of the flint mill are constructed in this way, the only variation being the west (embankment) wall. The style of brickwork is the same throughout the rest of the site, including the warehouse extension and the support wall for the bridge that connected it to the railway siding.¹⁶¹ Where the later brickwork does differ, for example in the warehouse extension, is that whereas the main fabric of the building is constructed using red brick, the newer work is formed from bricks of a somewhat lighter colour (Figs.3.3.1 & 3.3.2).

Sample measurements of bricks were taken from throughout the site and these produced a range of results, which indicates that the bricks were made prior to standardisation. Also, that they were produced following the introduction of the Brick Tax; which was first introduced in 1784 during the reign of King George III, to help pay for the wars in the American colonies. In order to mitigate the effects of the tax, which was levied at the rate of 4s per thousand, manufacturers began to increase the size of their bricks, up to a maximum of 280mm x 125mm x 80mm (11 inches x 5 inches x 3 ½ inches).¹⁶² The government's response was first to introduce a maximum volume of 2500 cubic centimetres per brick (150 cubic inches), and then in 1794, 1797, and 1805 to progressively increase the rate of taxation: peaking at a maximum of 5s 10d per thousand. The tax was not abolished until 1850, by which time it was considered to have become detrimental to industrial development.



Fig.3.3.1 (left): The darker brick of the original walls from c.1798, as represented in the east (end) wall of the water wheel pit. (2011)

Fig.3.3.2 (right): The slightly lighter brick from Phase 4, the 1852 support wall for the bridge connecting the warehouse extension and railway siding. (2015)

Within the main structure of the mill the most common dimensions were as follows:

- 220mm x 100mm x 80mm
- 225mm x 110mm x 80mm
- 230mm x 110mm x 75mm
- 230mm x 110mm x 80mm
- 235mm x 100mm x 90mm

¹⁶¹ http://en.wikipedia.org/wiki/Brickwork#Brick_dimensions.

¹⁶² http://en.wikipedia.org/wiki/Brick_tax

The bricks forming the outer edges of the small building adjacent to the stable (Q-T, 13-14) were as follows:

225mm x 110mm x 70mm
 230mm x 110mm x 70mm
 240mm x 100mm x 70mm
 240mm x 110mm x 70mm

whereas those forming the support wall for the bridge from the railway siding (Fig.3.6.20) were:

230mm x 115mm x 75mm
 230mm x 115mm x 80mm
 235mm x 115mm x 70mm

None of the bricks examined were 'frogged', i.e. indented to one face, with the exception of those found in P6, the area above the exit of the vitreous pipe running beneath the 'oven' area; indicating that these were laid at a later date. In contrast to those shown above, the 'frogged' bricks were of uniform size, measuring 235mm x 110mm x 75mm. By contrast the size of a standard brick in the United Kingdom today is 215mm x 102.5mm x 65mm.¹⁶³ There are no markings on any of the bricks to indicate either the manufacturer or where they were made, although we do know that there was an exchange of building materials between Benjamin Wyatt at Penrhyn and his brother Samuel at Holkham Hall in Norfolk.¹⁶⁴ Otherwise the only indication we have is an entry dated 30th December 1797 in the Account headed 'Payments for Messrs Chifney & Worthington on Acct of the Flint Mill', which shows a payment to David Lloyd for 4600 bricks at a cost of £7-11-6.¹⁶⁵ There is also an entry dated 7th February 1798 in the Account headed 'Expenses for Building Flint Mill', that shows a payment to 'Lloyd for Bricks, £7-10-0.' There are numerous other entries in both of these accounts showing costs for the freight and unloading of bricks, but none of them give any indication as to where the bricks were sourced. In total it would appear that something in the order of 184,000 bricks were used in the construction of the mill, plus an unquantified amount of stone.¹⁶⁶

Notwithstanding the above, there is also the possibility that the bricks were sourced locally. For example, in the Estate's Rent roll for 1773, there is an entry under 'Miscellaneous Receipts (General Account)' that reads '*Rec'd of Mr Richard Silvester for the Clay of one hundred and twenty thousand bricks made by him on Mr. Hughes' tenement in Llanllechid at 6d/1000 according to agreement. £3-0-0.*'¹⁶⁷ There are other references too, for example an entry for 30th June 1783, '*Paid for unloading coals from the Flatt to the Brick Bank £1-3-4*', and another one dated 19th August 1783, '*Paid Henry William Morgan for nine tons of coal to burn Brick at Aber Ogwen at 16/- per ton £7-4-0*'. There is a further entry dated 27th August 1783 '*Paid Thomas Dickenson and his workmen a subsist from time to time while making bricks at Aber Ogwen £21-5-4*'.¹⁶⁸ As this is indicative that bricks were being made

¹⁶³ <http://en.wikipedia.org/wiki/Brick>

¹⁶⁴ PRN 6387, Op cit

¹⁶⁵ BU/PFA/12/11.

¹⁶⁶ Ibid.

¹⁶⁷ BU/Penrhyn/1721.

¹⁶⁸ BU/Bangor ms19063/Penrhyn 1971.

locally, it is reasonable to assume that the bricks used for the construction of the mill could have been sourced close by.

The West Wall

The west wall of the flint mill (A1-8) stands against the embankment to the Upper Yard and is largely intact; certainly up to second floor level (approximately 6.5m). It is constructed from a combination of materials. The face immediately abutting the earth embankment is constructed from stone, whereas the abutting revetment (A1-6) is constructed from a combination of brick and stone (Fig.3.3.3). The revetment stands approximately 2.65m high and projects approximately 70cm from the main wall. Above the corner section in A7 there appears to be the opening to a chute, this probably having been the method by which the raw flint was introduced into the mill. The top surface of the revetment is mainly capped with brick, although some sections of it are capped with slate; particularly the return section that abuts the south wall in A-C1 (Figs.3.3.4 & 3.3.5). More or less centrally in the revetment there are two irregular holes, and at this point the wall appears to be hollow. However, there is no evidence in the form of an inlet or outlet to support this.

There are three brick columns abutting the wall, one in each of the corners (A1 and A8) and one in A2. The columns in A1 and A8 appear to act as buttresses, whereas the column in A2 supports the outlet from a small chute that carries water from the head race. The top surface of the two southerly columns, those in A1 & A2, are capped with slate. The wall between these two columns is constructed in rough stone, as is the return leg of the revetment to the section of the south wall in A-C1 (Fig.3.3.6). The column in A1 stands 2.1m in height and measures 35cm by 37cm. The adjacent pillar in A2 stands 1.76m high and measures 47cm deep by 35cm wide, with the aperture above, the water chute, being slate lined.



Fig.3.3.3: The west wall of the flint mill (A1-8). The revetment is to the centre in A1-6, with A7 stepped back to the right. The brick column in A8 is shown to the right-hand side, abutting the north wall. The second brick column supporting the water chute is shown to the left in A2, and the holes are in the centre, half way up the wall. (2005)



Fig.3.3.4 (left): The top surface of the revetment to the west wall. Although still under excavation, the top of the two brick columns in A1 and A2 can be seen in the bottom-left corner. (2005)

Fig.3.3.5 (right): The top surfaces of the revetments. Brick to the west wall and slate to the south wall. (2005)

The column in A8 is slightly different in that it is formed in two contiguous and equal parts and stands on what effectively is a stone plinth. The plinth, which continues along the base of the remaining section of the north wall, is 40 cm high. The half of the column nearest to the embankment stands 1.9m tall above the plinth, whereas the other half stands 1.75m above the plinth. Each half measures 50cm wide (an overall width of one metre) by 37cm deep. At the base of the revetment in A3-5 there is a brick arch, which is in line with the sunken area of slate floor that runs west-east through the centre of the flint mill (Fig.3.3.7). This is discussed later.



Fig.3.3.6 (left): The brick columns in A1 and A2 and the revetment to the south wall in A-C1. In both cases the wall is built from rough stone. (2005)

Fig.3.3.7 (right): The brick arch at the base of the revetment in A3-5. (2010)

The South Wall

A large part of the south wall, which is also the inner wall to the water wheel pit, is still standing, the average height being approximately 5.5m. The entire wall is constructed in red brick, with the section in A-C1 having a revetment constructed from rough stone. In C1/D1 there is the start of a stone wall that from C3 curves in a north-easterly arc and ends in E4. The only section of the original wall remaining completely intact is where it abuts the brick wall in C1, and at this point it is 2.1m high. The rest of the wall has been partially demolished, but what remains of it tapers down to a height of 35cm; although this is by no means indicative of its original height. The width throughout is 60cm.

In D1 part of the inside face of the wall sits above the fly-wheel pit, and at this point it is recessed. Initially it was thought that this was a doorway (Fig.3.3.8) although based on the depth of the pit it soon became apparent that this was not the case. A more likely option is that it was hollowed to allow more room for the pit wheel. The fact that the wall sits upon the large slab on which the axle mounting was based and not alongside it suggests that the wall was a later addition; which again would tend to support the supposition that the recess was to accommodate the pit wheel. The wall may have been built on top of the slab in order to provide a degree of stability. From the remaining footings there is evidence that there was a similar structure adjacent to the second wheel pit (Fig.3.3.9). The likelihood is that they were built as retaining walls, as a means of keeping raw materials away from the adjacent machinery. The fact that they are built of stone rather than brick reinforces the suggestion that possibly they may have been a later addition.

In E-F0 and K-L0 there are large archways, each measuring 1.38m wide by 1.2m high at the apex (Fig.3.3.10). The axles from the water wheels passed through these before connecting to the pit wheel (so called because of its location; it can also be known as the 'cog' wheel). Only the wheel pit in front of the western-most wheel has been excavated (D-F1), although the second pit (J-M1) appears to provide a mirror image. When the students from Bangor University were on site in 1980 the axle through E-F0 was still in-situ (Fig.3.3.11), although what remains of it today lies in the water wheel pit, half buried beneath debris (Fig.3.3.12). It is believed that the mounting that originally supported the axle may have been taken for its scrap metal value.



Fig.3.3.8: The recess to the inner face of the retaining wall, sitting above the wheel pit. The axle mounting slab is to the right and the archway through to the water wheel pit to the left. (2009)

Further along the south wall there is a metal mounting inset at G0, and adjacent to this, in H0, there is a bricked-in doorway (Fig.3.3.13). The doorway is also visible from inside the water wheel pit. In J0 there is what appears to be the offcut end of a metal beam set into the wall approximately 30cm above ground level (Fig.3.3.14). This in turn is located beneath a rectangular aperture in the brickwork approximately 1.25m above, that appears to have housed a large beam. Above the aperture the brickwork to the upper half of the wall is stepped back and appears to be narrower than that at the base (Fig.3.3.10), and this continues to the end of the wall in O0. The aperture is also in line with the main entrance to the flint mill, which is in the north wall.



Fig.3.3.9 (left): The remains of the retaining wall footings in L-N 1-4. (2009)

Fig. 3.3.10 (right): The south wall, showing the openings for the axle housings. (2012)



Fig. 3.3.11 (left): The opening in E-F0 with axle still in place.¹⁶⁹ (1980)

Fig.3.3.12 (right): The remains of the axle lying in the water-wheel pit. (2015)

Much of the rest of the wall, particularly the upper part, shows evidence of where beams may have been inserted, or where there may have been alteration. The possible implications of these are discussed later as part of the site interpretation. The remains of one of the beams, which measured

¹⁶⁹ Courtesy of the RCAHMMW.

4.82m x 35.5cm x 25.4cm, was found during excavation, but unfortunately it rapidly rotted away before it could be properly documented.



Fig.3.3.13 (left): The metal housing and bricked-in doorway: G0-H0. (2009)

Fig.3.3.14 (centre): The end of the metal beam in J0 (2009)

Fig.3.3.15 (right): The bricked-in doorway in N/O0. (2011)

The East Wall

The east wall of the flint mill begins in P1 and continues to P8, where it abuts with the north wall. There is virtually nothing left of the wall above ground level. In the corner of P1 there is evidence that at one time there may have been some form of arched feature, possibly either a window or even a doorway (Fig.3.3.16).



Fig.3.3.16 (left): The arched section of wall in P1. (2015)

Fig.3.3.17 (right): The piece of curved stone found in O2. (2006)

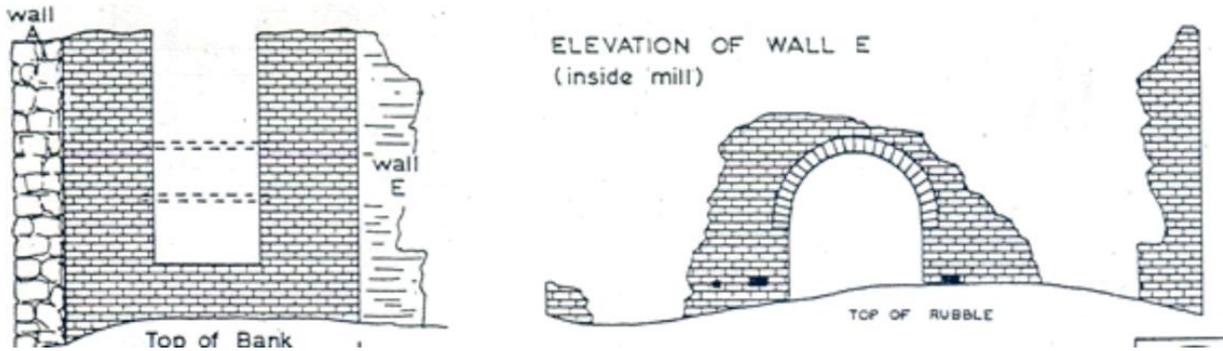


Fig.3.3.19: (Left) Elevation of the east wall of the water-wheel pit (Wall A), facing west.
 (Right) Elevation of east wall (E), facing east.¹⁷⁰ (1980)



Fig.3.3.18 (left): The junction of the east and north walls in P8: east wall to right of the picture. (2009)



Fig.3.3.20 (right): The remains of the archway P2-6, viewed from inside the mill (facing east). (2004)



Fig.3.3.21 (left): The remains of the archway in April 2006, viewed from inside the mill. Note the deterioration in less than 2 years.



Fig.3.3.22 (right): The left front face of the archway. (2006)

¹⁷⁰PRN 6387, F.M. Llewellyn, Survey of Penlan Mill and Kilns at Port Penrhyn. (1980)..

The exact nature of this feature is difficult to ascertain. The position of the remaining arch suggests a window, whereas the straight edge of the wall below suggests a door: possibly a door with transom above. Either way, the joins in the brickwork would tend to suggest that this section of wall was a modification, possibly even a later addition. During excavation a shaped piece of stone was found in O2 that possibly could have fitted into the arched section above the vertical edge (Fig.3.3.17). Also found was a piece of curved wood with a bevel edge to one side, possibly a window frame (see Section 8, Finds, Item 10/01/005).

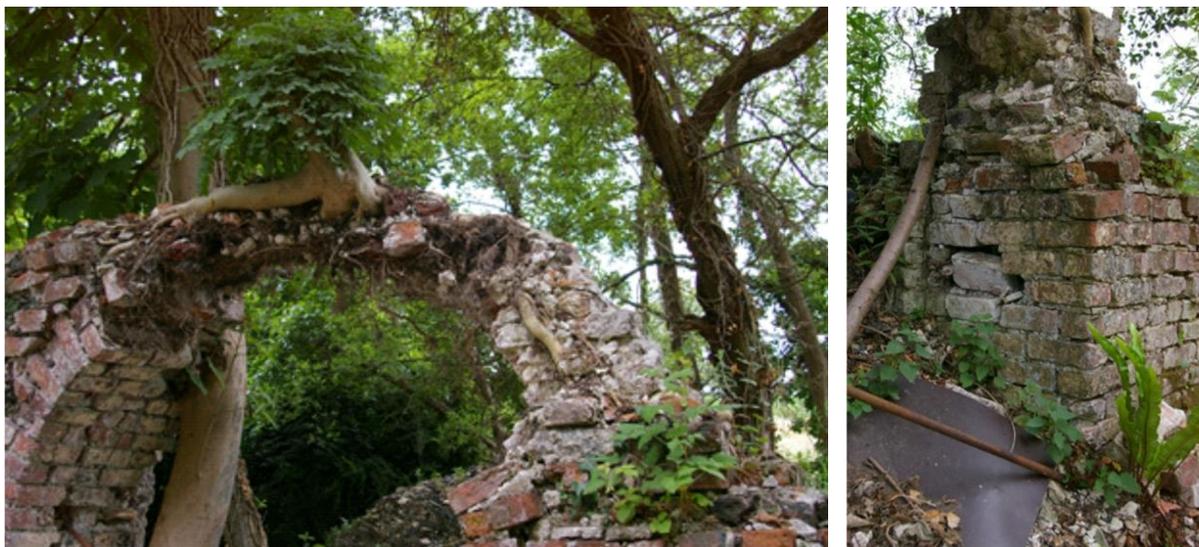


Fig.3.3.23 (left): The top of the archway with tree roots embedded. (2006)

Fig.3.3.24 (right): The right front face of the archway. (2006)



Fig.3.3.25 (left): The position of the archway (left) in relation to the main body of the mill. (2006)

Fig.3.3.26 (right): Side view of the archway from the south with oven in the background. (2006)

The remainder of the east wall has been demolished apart from a small section of standing brickwork in P8, where it forms the corner with the north wall (Fig.3.3.18). At this point the wall is a maximum of approximately 60cm high by 80cm long.



Fig.3.3.27 (left): East side of the oven. The logs are lying in the stable area, from where they were cut. (2006)

Fig.3.3.28 (right): Side view of the archway from the north, with oven in the background. (2006)

While this is the only part of the east wall that remains today, until early 2009 there was a large arched structure in P2-6, approximately 2.4m tall by 2.25m wide. Immediately abutting this, to the rear, there was a further structure located in the space between the east wall of the mill and the west wall of the stable. It appears to have been built of brick, was rectangular in shape, and had an entrance to the south side; presumably through which fuel would have been loaded. The roof appeared to be rounded, although it was not possible to ascertain this due to building rubble deposited there during demolition. From what scant information is available it would seem to have been some form of oven. Unfortunately, both structures were demolished before they could be recorded and therefore the only remaining record is from the drawing made by Mrs Llewellyn's team of students in 1980 (Fig.3.3.19), and photographs that were taken prior to excavation. The illustrations are included to provide a permanent record of these features (Figs.3.3.20 to 3.3.28).

By the time excavation work resumed in October 2009 all that remained of the archway and oven was the base on which they had stood (Fig.3.3.29). The possible purpose of these structures is discussed later.

Immediately adjacent to the site of the archway, in P7-8, the wall is stepped downwards. In front of this section there is a narrow ledge two bricks wide that continues to the junction with the north wall, where it then narrows to one brick wide to the junction with the east wall of the outer mill (Fig.3.3.30). Beneath the junction of these two walls, in P9, there is a vitreous clay trap that is embedded into the ground (Fig.3.3.31). This in turn is in line with another pipe that emanates from beneath the base of the oven, and from their position it would seem that originally a length of pipe ran between them, parallel to the mill wall. The pipe originates in O1, turns through ninety degrees beneath P1, and continues to where it emerges in P6. At this point it is encased in concrete above which there is a course of bricks, that do not appear to have been cemented together. The layer is one brick wide and three bricks high, and these are the only bricks found on the site that are 'frogged'. Behind them there is another layer of concrete that stands level with the top of the bricks and extends to the brick base

of the oven. The entire structure stands between the east wall of the mill and the west wall of the stable. The ledge that runs in front of P7-8 begins at this point, being only one brick wide (Fig.3.3.32).



Fig.3.3.29 (left): The location of the archway and oven in P & Q 3-7. The archway stood upon the brick wall adjacent to the slate floor, and the oven upon the raised brickwork in the centre. (2009)

Fig.3.3.30 (right): The break in the east wall and the brick ledge. (2010)



Fig.3.3.31 (left): Location of the clay trap adjacent to the east wall of the mill. (2011)

Fig.3.3.32 (right): The pipe emerging from beneath the oven in P6. The east wall of the mill is to the right, and the west wall of the stable to the left. (2010)

The North Wall

Much of the north wall has been demolished, the only sections remaining standing being in A-C9 and L-P9. It is a maximum of 60cm high in P9, gradually reducing to 8mm in L9. The main entrance to the inner mill (the original flint mill) is between I9 and L9, where there is a break in the wall. Immediately in front of this, from I-J8/9 and K-L8/9, there are two abutting slate blocks that together form the threshold. There are rectangular post holders at the outer end of each of the slabs (I8 and L8) that would have housed the door frame, and there is a drop-bolt holder at the inner edge of the slab in J9, where the two slabs join. The post holder in L8 still has its metal frame, whereas the frame for the one in I8 is missing (Figs.3.3.33 to 3.3.35).

The base of the brick wall then continues from E9 to I9, and in D9 there is the threshold for a pedestrian doorway. Unlike the threshold to the main entrance which is fashioned from carefully dressed and fitted slabs, the pedestrian threshold comprises a number of irregularly shaped pieces of slate. Possibly at one time they may have been more closely fitted together, but from the available evidence this perhaps is unlikely (Fig.3.3.36).



Fig.3.3.33 (left): The remaining section of the north wall in L-P9, with the post holder in L8. (2009)



Fig.3.3.34 (right): The metal post holder in L8. (2006)



Fig.3.3.35 (left): The threshold slate in I-J8. The edge of the post holder is shown left of picture, and the drop-bolt holder is to the right, adjacent to the spade handle. (2006)



Fig.3.3.36 (right): Threshold to pedestrian doorway in D9. (2010)

From A-C9 much of the wall is still standing. As already has been described, immediately adjacent to the south side of the wall in A8 there is a brick column, and running from this, parallel to the base of the wall, there is a stone plinth. Also, to the south face in B9, approximately half way up from the base, there is an opening measuring 16cm square. This continues through the wall to the north face, and

probably was cut into the brickwork to facilitate a line shaft (Fig.3.3.37); possibly indicating that there was a powered hoist from the ground floor of the warehouse extension to the chute above. There are also a series of niches in the north face which were to house support beams for the upper floors (Fig.3.3.38).



Fig.3.3.37 (left): The south face of the north wall in B-C9. (2015)



Fig.3.3.38 (right): The north face of the wall in A-B9.
Hole for line shaft in centre, notches for floor joists above. (2015)

The Floor Area

The entire floor to the flint mill is constructed from slate blocks. Generally, these are laid facing longitudinally north to south, the principal exception being the area immediately in front of the main doorway that lies in J-L8 (Fig.3.3.26); these being of a higher quality and longitudinally laid east to west. The only other exception is in the extreme top corner of A7 at the junction of the west and north walls, where they are laid diagonally at an angle of approximately 45 degrees. There does not appear to be any practical significance to this other than it being a convenient way to finish off an awkward space. Immediately adjacent to the west wall revetment the floor slopes slightly downward, toward the wall, forming a shallow gully.

Although throughout the floor generally is well laid there are a number of disturbed areas, notably the central section from C5 to F5. The slates in this area are depressed inwards (downwards), as though the ground beneath has subsided. The depressed area of floor is in line with the arch that lies

at the base of the stone revetment stonework to the west wall (Figs.3.3.7 & 3.3.39). One possible explanation for this area of floor having collapsed is that there was a cellar beneath it. The existence of a cellar is suggested by one of the items listed in an inventory attached to the 1883 lease document, which refers to '1 shaft in cellar floor 10' x 2 inches square'. While this hints at the possibility of a cellar, there is no specific evidence in terms of a recognizable entrance to support this theory.



Fig.3.3.39 (left): The depressed section of slate floor in C5-F5, facing east. (2010)

Fig.3.3.40 (right): The south wall revetment with the opening to the chamber in C1. The start of the retaining wall is to the left and the slate slab to the right. (2010)



Fig.3.3.41 (left): The outline of the opening to the chamber can be seen adjacent to the foot of the ladder. The retaining wall is to the left of picture, south wall revetment to the right. (2005)

Fig.3.3.42 (right): The slate slab in A-B1&2. The nut is shown at the left and the two holes to the right. (2005)

In C1, at the junction of the south wall revetment and the stone retaining wall, there is an irregular shaped hole in the floor where the slate has collapsed and beneath this in B-C 1 & 2 there is a small chamber. There does not appear to be a formal entrance to the chamber, the hole only becoming evident when during the course of excavation loose debris began to pour into it. Because of the amount of debris that has fallen into the chamber it is not possible to see what the floor surface looks like, or whether there is a tunnel running from it beneath ground level. There is what possibly could

be a narrow drain feeding from the north east corner of the chamber, although this is by no means certain.

The opening to the chamber is too small to enter, but from what can be seen three of the walls appear to be stone and the north wall earth, possibly backfill. Perhaps what is most important is that the chamber stands immediately adjacent to the depressed section of slate floor in C5 to F5. The position of the opening to the chamber is shown in Fig.3.3.40, where it is marked by a piece of timber. During excavation it was possible to insert a length of wire 46cm long between the slates in this area of the floor. There is no apparent relationship between the large slate slab lying adjacent to the opening in A-B 1&2, which appears to have been deposited there during the demolition of the building. The slab was rust-stained and there was a hexagonal metal nut attached to the top surface towards the left (east) end, and two round holes at the opposite end. The front edge appears to have been slightly chamfered, although it is not clear why (Fig.3.3.42).

It was debated whether to enlarge the size of the opening in order to verify the dimensions of the chamber, but the decision was made to leave the floor area intact as the slates are held in place by compression, and to remove them would in all likelihood have caused a large area to collapse, thus further reducing the integrity of the site.

As previously described, adjacent to the chamber entrance there is a retaining wall (see the description of the south wall), which in turn is adjacent to the first of the two wheel pits. The pit is 3m in length and it was excavated to a depth of 1.5m below ground level. Based on this it would seem safe to assume that the pit wheel would have had a diameter of approximately the same size, i.e. three metres (Fig.3.3.43).



Fig.3.3.43 (left): The (pit)wheel pit in D-F1. (2009)

Fig.3.3.44 (right): The axle mounting slab in D-G2, viewed from the front (north edge). The four bolt holes are visible to the upper surface, with the head of one of the bolts still showing at bottom right. (2005)

Immediately in front of the wheel pit there is a large slate mounting slab (D-G2) on which originally the axle housing was seated. The location of the four holding bolts can still be clearly seen on the upper surface (Fig.3.3.44). The slab had been badly damaged, probably during the removal of the

mounting plate, but has now been restored to its original position. The inner edge, facing the wheel pit, has been chamfered to accommodate part of the axle mounting (Fig.3.3.45). During excavation one pair of the bolts that originally anchored the axle housing was found to be in-situ to the underside of the slab, together with their spacing bar (Fig.3.3.46). A second pair was found lying in the spoil beneath it (Fig.3.3.47).



Fig.3.3.45 (left): The chamfered edge to the rear of the slate mounting slab.
The bricks on top of the slab are not related. (2009)

Fig.3.3.46 (right): The retaining bolts in situ to underside of the slab. (2009)



Fig.3.3.47 (left): Retaining bolts and spacing bar found beneath the slab. (2009)

Fig.3.3.48 (right): The limestone blocks with metal cups located in C5 (right) and F5 (left). (2010)

Running west to east, more or less across the centre of the mill, there are four small limestone bases located in C5, F5, I5, and L5, and these appear to be for housing vertical support columns. There is a fifth base in H7, which is located adjacent to a small flywheel pit that abuts the north wall. The bases in C5 and F5 on average measure 78cm square overall, with a 23cm square metal cup in the centre (Fig.3.3.48). The bases in I5 and L5 do not have a metal cup but instead have a 34cm square recess approximately 4cm deep; although it is likely that originally cups were inserted (Fig.3.3.49). The base in G/H7 is the same except that it has a 25cm diameter by 4cm deep round hole in the centre (Fig.3.3.50).



Fig.3.3.49 (left): The limestone block in I5. (2006)

Fig.3.3.50 (right): The limestone block in G/H7. The north wall is top of picture and the small wheel pit to the left, beneath ladder. (2006)

Running north to south, in line with the metal mounting that is inset to the south wall at G0, there are two very large limestone blocks; one in F-G3 and the other in F-G6. The block in F-G3 is 1.6m long by 55cm wide and 64cm thick. The one in F-G6 is 1.52m long by 65cm wide and 64cm thick, and they both stand 10cm above floor level (Fig.3.3.51). At each end of the blocks there is a single retaining bolt, these being approximately 1m apart. Inside these there are two square holes approximately 55cm apart, probably for holding support legs of some kind (Fig.3.3.52). Longitudinally the blocks are orientated east-west, with a small pit at each corner of the front (north) face. These appear to be service pits designed to provide access to the underside of the blocks and the securing bolts inset into them. There are four pits in total, marked AP1-AP4 on the site plan, where AP1 is to the north east, AP2 to the north west, AP3 to the south west, and AP4 to the south east (Figs.3.3.53 & 3.3.54). While all four pits serve the same function, they are not uniform in size.

AP1 measures 62cm across the back edge and 52cm at the front. The left (east) side measures 68cm and the right side 74cm. It is 84cm deep and the base is slate (Fig.3.3.55).

AP2 measures 50cm across the back edge and 56cm at the front. The left side measures 70cm and the right side 74cm. It is 84cm deep and the base is a combination of stone and slate (Fig.3.3.56).

AP3 measures 46cm across both the back and front edges and 67cm to both sides. It is 80cm deep and the base is part slate and part soil (Fig.3.3.57).

AP4 measures 55cm across both the back and front edges and 68cm to both sides. It is 76cm deep and the base is mainly soil (Fig.3.3.58).

There is another block in H2, running in line with the slate mounting slab. It is 1.45m long by 76cm wide by 60cm thick, with a retaining bolt in each corner. It is orientated north-south, and again there is an adjacent pit (AP6). (Figs.3.3.59 & 3.3.60) Whether this is an access pit or a small fly wheel pit is not clear, although as there is no obvious access to the underside of the stone block the latter is the more likely.

The fourth block is in J3. It has an irregular shape and at its maximum measures 80cm by 60cm by 55cm thick. It has a single bolt inserted in the centre, and one access pit (AP5). (Figs.3.3.61 & 3.3.62)



Fig.3.3.51 (left): The two limestone blocks are marked by the horizontal ranging poles, and the access pits by the vertical poles. (2011)

Fig.3.3.52 (right): The limestone block in F-G3. (2005)



Fig.3.3.53 (left): The location of the limestone blocks, facing west. The slate mounting slab and retaining wall are to the left, with the brick column and water chute showing to the top left. (2011)

Fig.3.3.54 (right): The limestone block in F-G3 with its two access pits, AP3 to the right and AP4 to the left. (2011)



Fig.3.3.55 (left): Access pit AP1. (2011)

Fig.3.3.56 (right): Access pit AP2 (2011)



Fig.3.3.57 (left): Access Pit AP3 (2011)

Fig.3.3.58 (right): Access Pit AP4 (2011) The small tunnel at the rear of each of the pits allows access to the mounting bolts located in the stone block above.



Fig.3.3.59 (left): The limestone block in H2. (2005)

Fig.3.3.60 (right): The Pit AP6 in I2. (2009)



Fig.3.3.61 (left): The limestone blocks in (from L-R) J3, H2 and F-G3, together with their respective access pits (AP5, AP6 and AP4). The metal beam is inset to the south wall at J0 (top left of picture); the metal housing is at G0; and the slate mounting bed is to the right. (2011)

Fig.3.3.62 (right): Access pit AP5, located in I3. (2011)

Directly in line with the blocks in F-G3 and F-G6 and the metal housing inset at G0 there is a small fly wheel pit, immediately adjacent to the north wall of the mill in F-H8 (Fig.3.3.63).



Fig.3.3.63 (left): The flywheel pit in F-H8 in course of excavation. The small limestone block in H7 is shown at bottom left adjacent to the tree stump, and the north wall is to the right. (2005)

Fig.3.3.64 (right): The slate cover in N&O 1&2. The Metal strip stands proud, top left of the hole. (2009)

In the extreme south east corner of the mill in N&O 1&2 there are four large slate slabs that together form a cover. There is a square hole located centrally between them, and a flat metal bar protruding upwards from the surface (Fig.3.3.64). Beneath the slabs there was found to be a pit measuring some 1.8m east- west by 1.0m north-south. When first uncovered it was backfilled with soil and rubble (Fig.3.3.65), but after excavation it was found to be approximately 90cm deep and have a central row of bricks some 23cm wide running along its length. As this is only three bricks deep and not supported underneath, evidently it is not designed to be load bearing; perhaps other than to support the slate cover. In addition, there is a slate slab, laid flat and running at an angle from the south west corner of the pit towards the row of bricks; and beneath the slab there is a further row of bricks. These do not appear to support the slab as there is a gap between them. There is a second, much shorter, slate slab that occupies the other half of the pit, to the north side (Fig.3.3.66). The sides of the pit are lined with brick.

In the east wall of the pit, facing the end of the slab, there is the opening to an exit channel 40cm wide which feeds into a pipe beneath the base of the wall in O1. After approximately 1.0m the pipe turns through ninety degrees to the north and continues beneath the concrete base of the hearth area to a point where it exits into the space between the east wall of the mill and the stable (Figs.3.3.67, 3.3.68 & 3.3.32). The possible purpose of this pit is discussed later.



Fig.3.3.65 (left): The pit in N&O 1&2 after the cover was removed, but prior to excavation. (2011)

Fig.3.3.66 (right): The inside of the pit facing east with the row of bricks running through the centre, and the slate slabs to each side. The mouth of the exit channel is at the top of picture, adjacent to the rear pole. (2011)



Fig.3.3.67 (left): The opening to the exit channel with horizontal pole inserted to full length. (2011)

Fig.3.3.68 (right): The horizontal poles show the direction of the water flow from the pit to the exit pipe in P6. (2011)

The Water Wheel Pit

Essentially this forms part of the inner (flint) mill and stands adjacent to the south wall. It is enclosed on all four sides, with all walls being largely intact. Originally it housed two large water wheels set in tandem. Water from the leat was delivered to the head race at the west end of the pit, was then delivered to the water wheels via a wooden launder (Fig.3.3.69). While in 1980 the launder was virtually intact today very little of it remains. The small section that does remain has collapsed inside the pit, together with what little remains of the water wheel (Fig.3.3.70). To the inside north wall of the pit the locating holes for the cross beams that supported the launder are still visible (Fig.3.3.71). There are four of them, the most easterly marking the extent of the launder and the point at which water would have dropped to the second wheel. From the fragment remaining embedded in the wall

the beams would have been approximately 40cm square. The quality of the brickwork inside the pit is poorer towards the east end, perhaps indicating that this section was added at some later date (this is discussed later in the report). A window opening is set in the east end wall.



Fig.3.3.69: The south outer wall of the water wheel pit as it appeared in 1980, with original wooden launder above.¹⁷¹



Fig.3.3.70 (left): The inner west wall of the water wheel pit and remains of the launder. (2011)

Fig.3.3.71 (right): The remains of a support beam in the north face of the inner wall of the water wheel pit. (2006)

¹⁷¹ Courtesy of the RCAHMW. The photograph was taken by Mrs Llewellyn's students during their drawing exercise.

As already stated, water flowed into the launder via the headrace, located above the west wall of the water wheel pit. Originally the headrace would have had a wooden base, although there is no evidence of this today: only soil and rubble remaining. However, 4.5m from its junction with the water wheel pit the surface changes and there is a raised concrete step some 50cm deep, which would have accelerated the flow of water on to the launder (Fig.3.3.72). As beyond this point the channel has been completely backfilled with building waste it is not possible to see how far this surface extends, although it is reasonable to assume that it goes as far as the first of the two walls that have been erected to block off the flow of water to the mill, at which point the headrace is 2.34m wide. At the front edge of the concrete step it is 2.69m wide, and at the edge immediately above the water wheel pit it is 2.48m wide.

The brickwork that forms the inner wall of the headrace appears to have been raised in three distinct stages. The section nearest the water wheel pit (the east end) appears to have been built first. It is 4.15m long, runs to the front of the concrete step, and forms part of the original south wall of the mill. The second section is 2.19m long and runs from the front edge of the concrete step to the point where the race bends towards the leat. In both cases the change in brickwork is defined by a straight edge. This section of wall appears to have formed part of the 1885 extension in the upper yard. At the end of this section of wall the headrace turns roughly west-south-west as it joins the leat proper, and at this point there is what appears to be a post hole; probably the location of a sluice gate.

The third section runs from this point into the main leat channel, and it is constructed in a more modern hard red brick. Just beyond the turn the leat is divided by two retaining walls that have been constructed to cut off the flow of water to the mill. The first of these is built in the same hard red brick as the side wall in section three, and it is likely that it was built in around 1955 when the mill building was demolished. The second wall has been built using modern breeze blocks and was constructed in around 2008 or early 2009. Subsequently the area between the two walls has been completely backfilled with building waste. While no longer visible, the bottom surface of the leat between these two walls comprises quality timbers closely joined together and caulked (Fig.3.3.73).



Fig.3.3.72: The concrete step in the headrace and the location of the post hole. The joins between the three sections of brickwork are clearly visible. (2011)

Adjacent to the concrete step there is an opening set flush into the wall measuring 25.5cm wide by 30.5cm tall. This is the entrance to a chute through which water passed to the inner mill, where it exited above the column that stands adjacent to the west wall revetment in A2. The flow of water was controlled by means of a small sluice, although there is nothing of this remaining apart from some markings on the brick wall. Both sides of the chute are brick and both the base and top surfaces are slate. The top piece of slate is in effect a lintel and is considerably wider than the aperture, measuring 95cm long by 7.5cm in depth. The slate base is 4cm in depth. A pole was inserted inside the channel which extended for a distance of 2.68m before encountering a solid wall, at which point presumably it turned through 90 degrees before dropping to the mouth of the chute inside the mill.

Immediately in front of the concrete step there is an arched section of brickwork that is located at ground level. It seems unlikely that there would have been an opening at this point as the area behind the wall is solid ground. Coupled with this, the arch is located at the junction of what appears to be old and newer brickwork. The old brickwork marks the west end of the inner mill, whereas the new marks where the extension in the upper yard once stood (Fig.3.3.74).



Fig.3.3.73 (left): The base of the leat above the head race, between the two retaining walls. (2009)

Fig.3.3.74 (right): The chute entrance and arch in the headrace wall, adjacent to the join between old and new brickwork. (2011)

The inner north and east walls of the water wheel pit are constructed in brick on a stone base,¹⁷² whereas the west wall is constructed from heavy rough stone, as shown in Fig.3.3.70 above. It is this wall that carried the main weight of the water as it passed to the launder. Externally the south wall is more decorative and mainly constructed from dressed limestone blocks on a stone base, although there is some brickwork to the inside face, possibly inserted during repair. The wall has three symmetrical arches, albeit the easternmost (arch 1) is larger. The central arch (arch 2) appears to be purely decorative as unlike the other two it did not house any working machinery; whereas the axle mounting slabs for the water wheels were housed in arches 1 and 3. While the dressed stone face continues for almost the full length of the water wheel pit there are two exceptions. At the western end where it abuts the earth embankment it is constructed from rough stone; and at the eastern end

¹⁷² As with the rest of the building, the bricks are laid as a form of English Garden Bond.

it finishes just short of the end of the pit, giving way to brick that in turn is slightly stepped back from the stonework (Figs.3.3.75 & 3.3.76).



Fig.3.3.75 (left): The contrasting stonework in the outer wall of the water wheel pit, with the rough stonework visible adjacent to the embankment. (2009)

Fig.3.3.76 (right): The outer wall of the water wheel pit, showing the stepped-back brickwork at the east end. (2006)

Abutting the outer (south) wall of the water wheel pit, immediately in front of arches 2 and 3 (left and centre), there are small stone-built pits. There is no corresponding feature in front of arch 1 (the most easterly), which instead is open at the base and has a gap beneath its axle mounting slab (Fig.3.3.77).

The pit in front of arch 2 (Fig.3.3.78) is not totally symmetrical. Internally it measures 1.12m at the rear (immediately adjacent to the wall), and 1.18m at the front. The west side wall measures 86cm and the east wall 82cm. The maximum external dimensions are 1.9m at the rear and 2.02m at the front, while on average the walls are 38cm wide. The pit had been backfilled with waste material and contained several pieces of honeycomb tile from a drying floor, fragments of ribbed jam/marmalade jars, and miscellaneous pieces of broken bottles, wood and metal (all listed in Section 8, Finds).

After removal of the waste material the pit was found to be approximately 56cm deep at the front and 94cm (to the cill height) at the rear. It has a mainly slate floor covering the entire area, apart from a strip 20cm wide along the eastern edge. The slate floor comprises two large slabs, the first (the westerly) lying flat and running north-south the full width of the pit. The second sits at a slight angle, possibly having subsided. The cill above the pit, inside the arch, is a flat stone slab with a row of ten bricks laid lengthways across the full width, starting 18 cm from the front edge. The bricks are tapered and slope downwards towards the inside of the water wheel pit. They are held in place by a metal strip 3cm wide and 5cm deep. At the front edge they stand 9.5cm above the slab and at the rear 5cm, flush with the metal retaining strip.

Immediately beneath the cill the gap between the pit and the water wheel pit has been bricked up forming a seal between the two. There is nothing to indicate the reason for this as at this point there was no machinery inside the wheel pit, and there are no fittings to the inside of the arches' stonework.

The pit in front of arch 3, (Fig.3.3.79) stands adjacent to the earth embankment to the west of the mill and is of similar shape to that in front of arch 2. Internally it measures 1.3m east-west and 1.15m north-south, and the average width of the walls is 36cm. It is approximately 70cm deep at the front

and 86cm (to the cill height) at the rear. The base comprises two large stones that form a ledge 1m x 0.4m, and the remainder is soil and waste material.

Again, as with arch 2, the pit was backfilled with waste material, among which were found a large number of pottery fragments, including two intact bases from W. P. Hartley jam jars. (Fragments of these had been found liberally scattered across the entire mill site but until now had not been identifiable.) There were also a number of pieces of rusted iron. As with the pit in front of arch 2 the wall beneath the cill has been bricked in, although there is a gap beneath the stone base through to the water wheel pit. This is not visible inside the pit but is clearly visible from inside the water wheel pit.

There is nothing directly linking pits 2 and 3, and there is only rough ground between them (Fig.3.3.80). When and why they were built is not clear, especially as they do not appear to have a defined inlet or outlet. Nor is it clear whether they were bricked in from the outset or whether this work was undertaken at some later date. The fact that they are not uniform in size and are relatively crudely constructed by comparison with the rest of the building possibly indicates that they were a later addition, perhaps in response to a newly apparent need. One possible explanation is that they were built to stop material from the adjoining embankment passing through into the water wheel pit, although this is highly unlikely as the same result would have been achieved simply by bricking in the wall beneath the cills, which they did anyway. Similarly, having noted during excavation work that water from the embankment seeps quite freely into them, they could have been built to stop the unwanted inflow of water into the water wheel pit. Once more this seems unlikely as again bricking in the base of the wall would prevent this from happening; unless the pits were built first, were found to be inadequate, and therefore the bricking in took place later. The position of the pits, outside the mill and in line with the water wheel axles, precludes them having any processing function.



Fig.3.3.77 (left): The area in front of Arch 1, without a pit. (2011)

Fig.3.3.78 (right): The pit in front of Arch 2. (2011)

There is no pit in front of arch 1 and, unlike with the other two arches, the area beneath the axle mounting slab has not been bricked in. Why this should be so is not at all clear, although one possible explanation is that as this arch is lower down the slope than the other two, the ingress of unwanted

material into the water wheel pit was not a problem, i.e. the base beneath the arch is higher than the surrounding ground.



Fig.3.3.79 (left): The pit in front of Arch 3. (2011)

Fig.3.3.80 (right): First view of the pits in front of Arches 2 & 3 before they were excavated. (2011)

The Roof

None of the roof has survived and the only evidence we have comes from the lithographic print, shown below in Fig.3.3.97, in which it is shown running east-west, with twin gables facing south and possibly a chimney against the east wall; although the accuracy of this print cannot be relied upon. The only reliable data is that from the number of broken slates found on the site it is safe to assume that the roof was slated, and this is borne out by an entry dated 2nd May 1798 in the Account headed 'Expenses for Building Flint Mill', that states 'Settled with Lord Penrhyn for Slates used at the Flint Mill £38-12-0'.¹⁷³ A small piece of rounded slate ridging tile was also found (see under 'Items found on site' item 11/007/001), although it cannot be assumed that it actually came from the mill itself. The use of slate would also have been consistent with contemporary mills such as those at Cheddleton and Higher Washford. Based on the evidence furnished by (Finds) Item 06/06/007, which is a line shaft mounting still affixed to timber, it would appear that the roof trusses measured 85mm deep x 70mm wide.

The Waterways

Whereas most water mills are located adjacent to a river or canal, or have a dam feeding them, the main water supply to Penlan Mill was conveyed overland for approximately 600 metres via a purpose-built leat, the middle section passing through a brick-built tunnel, and with the flow of water from the River Ogwen being controlled by means of a sluice gate. A full and detailed description of the leat is contained in Section 4.1. At various times there were up to seven additional water channels passing through the site, two of them above ground and five below. These are described in Sections 4.2 to 4.8.

¹⁷³ BU/PFA/12/11.

Interpreting the Site

In order to attempt any form of interpretation of the site it is necessary to understand what features should be looked for, and this in turn requires a basic understanding of what processes were carried on there. It also is important to understand the site within context, as it existed not in isolation, but as part of a broader industrial complex. Unfortunately, it has not been possible to find any pictorial evidence of how the mill may originally have looked, the only exception being a c.1840 lithographic print of Penrhyn Castle, that appears to show Penlan Mill and Felin Isa in the foreground: possibly also the chimneys of Llwyn Onn.¹⁷⁴ However, as with all such prints of that time they were often prone to artistic licence rather than objectivity, and thus cannot be entirely relied upon.

There is also very little remaining in the way of material evidence, and what does remain reflects not so much the building as it was during its original incarnation as a flint mill, but as it was after its conversion to a corn mill and the subsequent extensions and alterations, for example the addition of the warehouse in 1852, its linking to the mainline siding, and the building of the upper yard extension and shed in 1885. Notwithstanding the lack of material evidence, there is a reasonably large amount of documentary evidence still surviving, and by using these two sources together it is possible to compile a description of how the mill may have looked, and how it operated.

By the time Penlan Mill was built there was already a grist mill known as Melin Isa (the lower mill) in the area below which historically had been used for grinding corn for the Penrhyn Estate. In 1798, when the new flint mill was built on the hillside above, Melin Isa was leased to Samuel Worthington and his partners. The lease stipulated that the old part of the mill containing *'one pair of wheat stones in good and sufficient order and repair'* must continue to grind corn for Lord Penrhyn, but that the remaining part of the old mill could be used by Worthington and his partners for their own manufactory, and that the newly added part of the mill at Melin Isa could be used for *'the grinding and making of colours'*.¹⁷⁵ In addition the lease granted the partners the rights to the Ochre Works at Coed y Parc, Bethesda, together with its associated kiln, sheds, pits, etc. One other crucial element was that the lease gave the partners the right of access to the new wharf and buildings erected on the tenement known as Penrhyn Arms, latterly known as Port Penrhyn.

Although primarily the partners were engaged in the shipping and distribution of slates from the Penrhyn Quarry in Bethesda, recently Worthington had also opened a pottery at Toxteth in Liverpool (the Herculaneum Pottery), and for this he needed a ready supply of materials, and a reliable means of shipping them there. These included not only flint but also colours and paints for decorating the finer items that he was producing. Because of this the lease on the Port had an additional relevance for him.

The development of these sites at Llandegai elicited a good deal of interest by contemporary travel writers. The Rev. Bingley wrote of the *'two mills belonging to Mr. Worthington and Co. of Liverpool. One of these is for the purpose of grinding materials for an earthenware factory at Liverpool. The other is an oil and paint mill: oil colours are here prepared, from the mineral, entirely to their finished state, and are shipped for Liverpool, at Port Penrhyn'*.¹⁷⁶ Richard Fenton described how *'This Mr.*

¹⁷⁴ Gwynedd/XP, *'Penrhyn Castle from Penlan'*, (Newman & Barclay, Watling Street, London, c.1840).

¹⁷⁵ Gwynedd XM/1959/1, Lease document dated 24th March 1800.

¹⁷⁶ Rev. W. Bingley, *North Wales Delineated from Two Excursions* (London, 1814), p. 104.

Worthington, nearer Llandegai, has a beautiful house overhanging the River, and carries on a Flint grinding Work, for the Potteries, on a great scale. The flints he imports from Southampton, or other ports nearer to the Downey Countries'. He goes on to say that Mr. Worthington 'being concerned in the Herculaneum pottery at Liverpool, he carries on here an extensive work subservient to it, viz., a mill for reducing flint, first burnt with an impalpable powder, to make China'.¹⁷⁷

Writing in around 1798 John Evans described the '*curious mill, to grind pestrosilex, or chert, quartz, and flints, for the use of porcelain and delph ware potteries*', and went on to describe in great detail the dimensions and workings of the mill, and how in addition '*an ore of Manganese is also here prepared for the purposes of bleaching; and an ore of zinc, as a substitute for white lead, in pigments*'. According to Evans '*The chert and quartz are obtained from the base of Carnedd Llewelyn, in the parish of Llan Llechid; and the flints are brought, as ballast, in the ships that convey the slates from this county to Ireland*'.¹⁷⁸ When Edmund Hyde Hall visited Mr. Worthington he too described '*a mill for reducing flint, first burnt with an impalpable powder, to make China*', and how '*The Mill for this purpose, in all its branches, is a curious piece of Machinery*'. He also mentions Melin Isa, stating that '*what most provoked my admiration was the mill for sawing Boards, which is so simple as immediately to be comprehended by any person without much knowledge of mechanism*'; how two men carry out the work, whereas ordinarily thirty-six men would have been required; and that '*By the wheel that sets this machine in motion several other mills are moved, such as those for grinding various paints, bruising Linseed for Oil, &c*'.¹⁷⁹ In an earlier reference Hyde Hall also stated that '*at Llwynon, the residence of Samuel Worthington, Esqr, stands a powerful mill for grinding flint and soap stones, which are brought from the coasts of Kent and Cornwall and reduced here to an impalpable powder, and then conveyed to the pottery at Liverpool*'.¹⁸⁰

In summary, from the above accounts we know that by 1798 there was a flint mill at the Llandegai site, the purpose of which was to grind previously calcined flint to a fine powder, that was then shipped to the pottery in Liverpool. We also know that the flint was shipped in to the site, most probably as ballast aboard ships on their return from delivering slates to other parts of England and Ireland. Furthermore, we know that pigments and paints for the pottery were produced at Melin Isa and also shipped to Liverpool. These were produced from locally sourced minerals, including ochre for which Samuel Worthington also had the mineral concession. This was of particular importance at that time as supplies from France, the traditional source, had been suspended due to the ongoing hostilities during the Napoleonic Wars.

While these early travel writers praise the enterprise of Worthington and marvel at the flint mill, with the exception of John Evans¹⁸¹ they do not attempt to describe how the mill worked, or where the various activities took place. Evans's description of the overall process is both comprehensive and illustrative, even though today some of his terminology is difficult to fully understand. However, it should be noted that he was a layman describing a technical process which at the time could have been described as 'hi-tech'.

¹⁷⁷ Richard Fenton, Op cit, p.239, p. 245.

¹⁷⁸ J. Evans, Op cit, pp. 453-454.

¹⁷⁹ E. Hyde Hall, Op cit, pp.245-246.

¹⁸⁰ Ibid, p. 107. .

¹⁸¹ J. Evans, Op cit, pp. 453-454.

'The machinery is well contrived, and consists of two overshot wheels about twenty feet in diameter, having trundles on the beams, sixteen do; which working within the mill, impart power to another large horizontal trundle-wheel, lifting several upright levers, that again operate on others, on two floors above. Circular vessels are paved at the bottom with gritstone, on each of these is a centre with several elbows, between which are placed large flat stones, moved rapidly round by the communicated motion. The chert and flints are previously roasted in kilns nearly similar to those used for the calcination of lime. The materials so prepared are put into the molindary vessels, with a portion of water, and ground into an impalpable powder. The mass in a fluid state is let out into diverse reservoirs, where after undergoing various decantations, is carried to a drying stove, and then packed in casks, and shipped to different parts of the kingdom.'*

* The dictionary definition of the word trundle is (i) to rotate or spin, (ii) a small wheel or roller.¹⁸² Within the context of Evans' narrative it would appear to be used to mean the former. No definition for the word 'molindary' has been found, and his use of the word 'impalpable' seems to be out of context.

The process described by Evans has changed little since that time and can still be seen in operation at historical sites such as Cheddleton and Etruria. However, in the case of Penlan Mill what neither he nor any of his contemporaries describe is, for example, where the kiln for calcining the flint was located; precisely where it was dried, Evans merely saying that it was carried to a drying stove; or how it was transported. For a better understanding of these activities, and their relevance to Penlan Mill, it is perhaps worth looking at how in general a flint mill works.

How Flint Mills Work

Flint mills developed in order to provide a raw material for the production of fine pottery, being used to improve both the whitening and strengthening qualities. Before the flint can be mixed with the other materials it has first to be rendered to a fine particulate, which is where the milling or grinding process comes in. As flint is a naturally hard material, before it can be ground generally it has first to be calcined (burnt) in order to make it easier to crush. This is done in a brick-lined kiln that is filled with alternate layers of flint and coal slack, usually in the proportion of about one ton of slack to twenty tons of flints.¹⁸³ The mixture is then fired from the base of the kiln and allowed to burn naturally (Fig.3.3.81 & 3.3.82). Usually the calcined flint is then crushed, typically in some form of stamp mill or, more recently, a granulator, before passing to the grinding pan. Not all flint mills have a kiln but instead rely on the flint being reduced by crushing alone.

The grinding pan consists of a circular wooden or metal structure, typically around three feet high. Inside this outer surface, that is known as 'staffing', there is a continuous band of iron called a 'slug iron'; designed to ensure that the runner stones do not fall against the staffing, and that the sweep arms are kept at their correct distances. The base or floor of the pan is paved with a level layer of chert stones known as 'pavers', that typically are between nine and fourteen inches thick: the equivalent of the lower mill stone in a corn mill. They are grouted in with broken pieces of flint, and then sealed with clay to ensure that water does not percolate through (Figs.3.3.83 & 3.3.84).

¹⁸² Collins English Dictionary: 21st Century Edition, p. 1639.

¹⁸³ Robert Copeland, Op cit, p.15.



Fig.3.3.81 (left): The flint kiln at Cheddleton Mill (2005)¹⁸⁴

Fig.3.3.82 (right): Draw vent for the flint kiln at Cheddleton Mill. (2005)

In the centre of the pan there is a vertical shaft to which are attached either three or four metal paddles or 'sweep arms', that usually are made of cast iron. To each of these arms there is attached a number of heavy wooden hanging arms that are designed to protect the sweep arms from abrasion. Typically, these hanging arms are made of oak and are fitted with metal toe plates for protection against wear. They also have slots that enable them to be adjusted up or down. The shaft is driven from beneath the pan by a large horizontally mounted cog wheel that is known as a 'wallower', and this in turn is driven by a vertically mounted pit wheel that is driven by the main shaft from the water wheel (Fig.3.3.85). Typically, the shaft extends vertically above the grinding pan in order to provide power for additional ancillary machinery, such as pumps or hoists. The sweep arms can run freely on the shaft, where they are tightened by a brake strap or drum. The brake drum is designed to provide a slip mechanism in case a paver stone becomes jammed and causes damage. The speed of the drive shaft will depend on the diameter of the pan, and typically this will be between 12-18 revolutions per minute.

As the central shaft is rotated by the power source, in the case of Penlan Mill the water wheel, so the paddles rotate heavy runner stones that then grind the crushed flint to a fine powder. Usually the runner stones are a form of chert which, being softer than the pavers, wear more quickly. During the grinding process the flint is mixed with water in order to minimise the amount of dust produced. Prior to Benson's patents of 1726 and 1732 the flint was ground dry, resulting in silicosis and a reduction in the working life expectancy of the operative to around two years: the result being that it became virtually impossible to find people willing to perform this task.¹⁸⁵

When the flint has been sufficiently ground a wooden bung is removed from a hole in the side of the grinding pan allowing the solution to be run off via a chute into a wash tank below. Alternatively, it can be pumped from the pan into the tank. This is a circular vat with a central shaft that has fixed wooden gates with long handles, and these are rotated by hand. Once in the wash tub additional water is added and the solution then vigorously agitated to ensure that the ground flint is fully suspended in the water. This has the effect of grading the flint, with any that has been insufficiently ground dropping

¹⁸⁴ Figs.3.3.81 & 3.3.82 By kind permission of Mr Ted Royle MBE, Trustee at Cheddleton Mill.

¹⁸⁵ Robert Copeland, *Op cit*, p. 6.

to the bottom of the tank and any that has been ground too finely floating on the top: the intermediate material being that required.

In the side of the wash tank there are a series of vertical holes in each of which is a wooden plug through which the water is drawn off from the top downwards, (hence the name 'plug-plank'). The top layer of very fine flint is run off into a drainage channel and the intermediate layer is run into a settling tank or 'ark'. The remaining layer of heavy coarse material is pumped from the wash tank back into a grinding pan where it is mixed with fresh material for re-grinding. The material in the ark is allowed to settle before the plugs in the side of the ark are removed and any remaining water drained off. The material is then pumped into a drying (slip) kiln where it is heated via a form of hypocaust. When sufficiently dried it is packed into tubs or blocks ready for shipment.



Fig.3.3.83 (left): A typical grinding pan showing the drive shaft, sweep arms, and hanging arms. The brake drum is also visible on the shaft.¹⁸⁶ (2011)

Fig.3.3.84 (right): A runner stone inside the grinding pan. The weight of the runner stone can vary between 1-30cwt (2011)



Fig.3.3.85 (left): The first floor at Cheddleton Mill. The grinding pan is to the right and the wash tub to the left. The beam engine and pump are in the background. (2011)

Fig.3.3.86 (right): Cheddleton Mill. The ground solution passing via a chute from the wash tub (top of picture), into the settling ark below. (2011)

¹⁸⁶ Figs.3.3.83 to 3.3.91 By kind permission of Mr Ted Royle, Op cit.



Fig.3.3.87 (left): A typical 'plugplank'.

Fig.3.3.88 (right): The slip kiln at Cheddleton Mill where the material from both of the mills is channelled for drying.



Fig.3.3.89 (left): The tiled base of the slip kiln.

Fig.3.3.90 (right): A slip kiln oven.

Not all flint mills used a slip kiln but instead allowed the ground flint to dry naturally in a sunpan, or be shipped in a semi-liquid form. The disadvantage of allowing it to dry naturally is that the rate at which it dried was entirely dependent on the weather. When sunpans were used about four inches of the washed flint was drawn off at a time and allowed to dry through evaporation. As each layer dried so another was added, up to a maximum of approximately eighteen inches. The semi-dry material was then cut up into conveniently sized cakes, which both aided the drying process and made the material easier to handle. Figure 3.3.91 provides an overview of the entire process, and Figure 3.3.92 illustrates the main components and gearing.

From the above it is evident that the features that would need to be present at or near the site are:

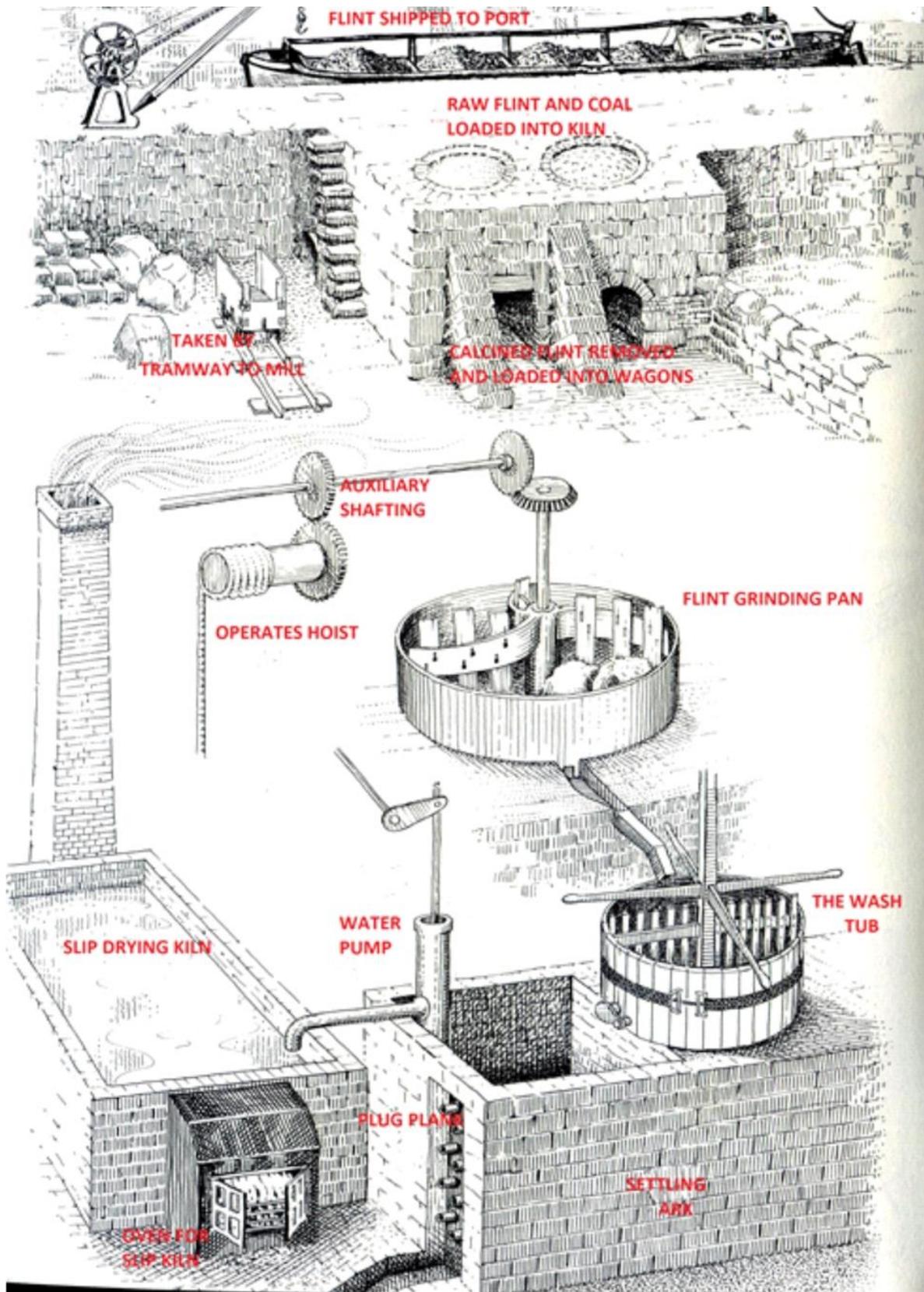


Fig.3.3.91): The flint grinding process.¹⁸⁷

¹⁸⁷ Figs.3.3.91 & 3.3.92 Based on original drawings by Robert Copeland and reproduced by kind permission of Mr C.J. Copeland.

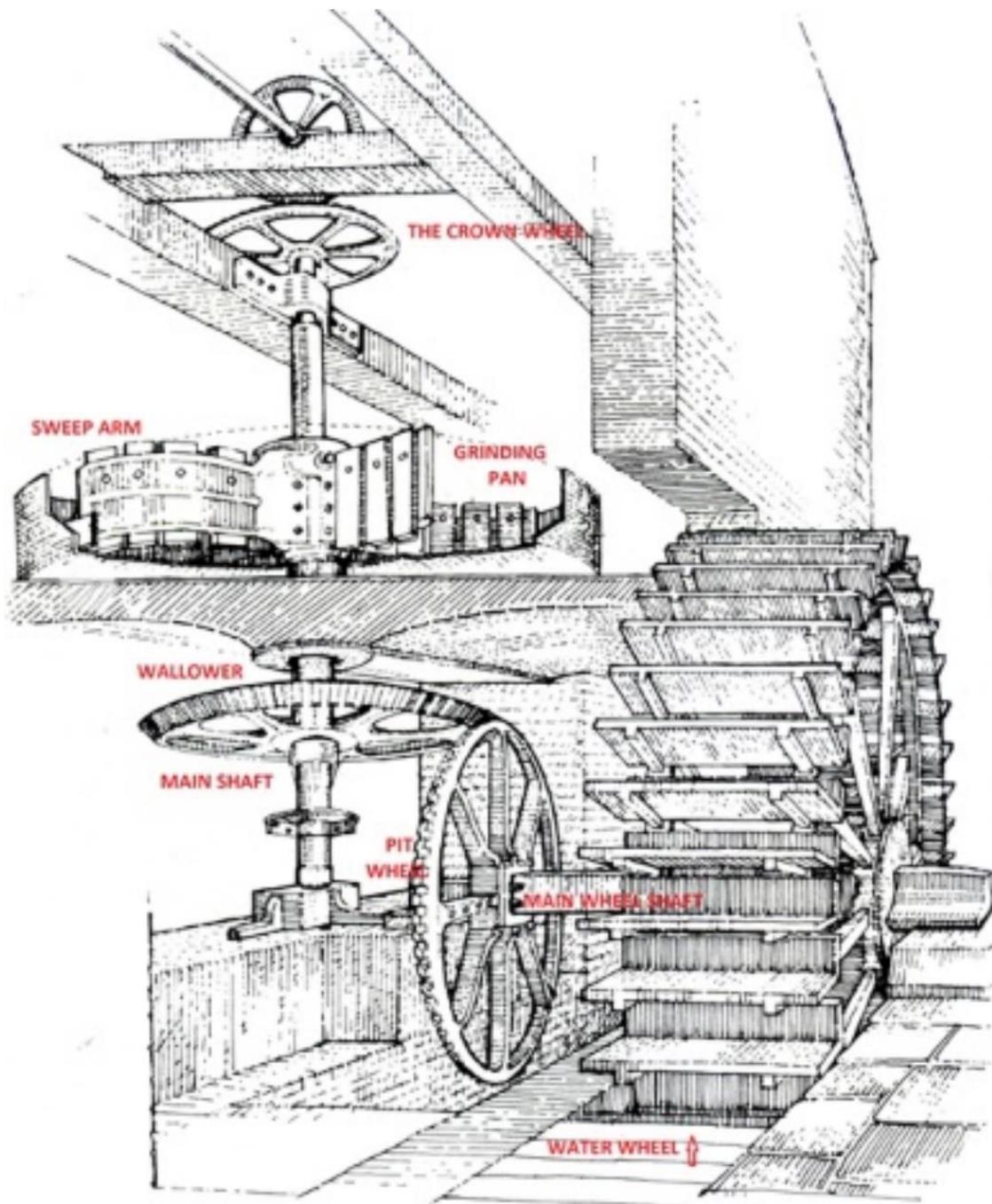


Fig.3.3.92: Typical gearing at a flintmill.

- a source for the raw flint and chert stone
- a means for transporting them
- a means for calcining the flint
- a power supply for operating the machinery
- a crushing facility
- a grinding facility
- a suitable source of water, both for driving the water wheels and washing the raw material
- a means of drying the ground material
- a means of transporting the ground flint to the customer

The evidence at Penlan Mill

From the documentary evidence we know that the flint was brought as ballast for the slate ships returning from Ireland and parts of southern England, and the chert stone was obtained from the base of the nearby Carnedd Llewelyn.

How it was transported

As has already been mentioned, one of the key requirements for the successful operation of the mill was an adequate means of transportation. Initially the materials would have been transported either using a horse-drawn cart or, more likely at that time, pack-horses. The actual date cannot be verified but it is believed that by 1798 a horse-drawn tramway had been built to link the mill with Port Penrhyn: this being the first such over-ground tramway in northwest Wales. Although there is little reason to dispute this date it is worth noting that there is no reference to either the tramway or a kiln in the original lease document of 20th March 1800; or in the accounts itemising the construction work carried out when the mill was built. This perhaps adds weight to Gwyn's contention that the tramway did not come into existence until two or three years later, following construction of the Penrhyn Quarry railway.

The Llandegai section of the tramway remained in use until 1829 when Samuel Worthington relinquished his holdings with the Penrhyn Estate and ceased his activities at the mill; the annual rental from 1821 having been £200.¹⁸⁸ This was a considerable sum for those times and is perhaps indicative of its importance to the operation of the Llandegai mills. From 1829 it remained 'In hand' to the Penrhyn Estate for the next two years, at which time it was removed.¹⁸⁹ The tramway was constructed by Benjamin Wyatt who in 1803 made an entry in the Capel Curig Hotel's Visitors Book in which he described its technical attributes and claimed to be the 'inventor'.¹⁹⁰ In 1804 he also published the same data in *'The Caledonian Mercury'*.¹⁹¹ A copy of the entry is reproduced as Appendix II.

Boyd describes the tramway as being about a mile in length and running from Port Penrhyn to Llandegai, more or less along the route of the present A5 trunk road (Fig.3.3.92). The two gradients, from the Cegin valley to Llandegai and from Llandegai to the mill site, were accommodated by means of balanced inclines, with the drums being mounted vertically as opposed to the more usual horizontal plane.¹⁹² One drawback to this form of mounting was the undue amount of wear on the bottom bearing: a problem that became so acute that by 1824 remedial action was required.

When the Shrewsbury to Holyhead turnpike road was built through Llandegai the road surface was raised and a tunnel constructed beneath it, in order to accommodate the tramway as it branched down to the mill. One end of the tunnel is still evident today, sitting above the north end of the mainline railway cutting, and adjacent to the driveway to Llwynon (Figs.3.3.93 & 3.3.94). Although much of the land has subsequently been taken by the railway cutting, it is thought that the line of the incline from the turnpike tunnel to the mill ran through what was then the garden of Llwynon, and in

¹⁸⁸ BU/Penrhyn Add. mss 2956-2958, 2960-2969.

¹⁸⁹ James I. C. Boyd, Op cit, p. 22.

¹⁹⁰ Gwynedd XM/5171/1.

¹⁹¹ *The Caledonian Mercury*, 31st December 1804, Issue 12998.

¹⁹² James I. C. Boyd, Op cit, pp. 9-11.

front of what is now the mill cottage, to the chute above the west wall. Apart from the tunnel some additional evidence of the tramway still exists. For example, the bed is evident in the garden to the rear of Tanygraig in Llandegai; and the winding house cottages at the Marchogian incline, that runs parallel to the A5 trunk road into Bangor, opposite the Crematorium. Originally Incline Cottage had been two separate buildings with the tramway passing between them, but subsequently they have been converted to a single private dwelling today known as Incline Cottage (Fig.3.3.95). The route taken by the tramway is shown at Fig.3.3.96.



Fig.3.3.93 (left): The tunnel entrance beneath the road at Llandegai. (2006)

Fig.3.3.94 (right): Inside the tunnel, which is now bricked-up at one end. (2006)

The line of the section of stone wall that surrounds the Penrhyn demesne between Llandegai and the former nursery at what is now the Glantraeth housing estate, appears to some extent to have been dictated by the route of the tramway. The tramway was in existence prior to the wall being built and was not removed until after work on the wall had been completed; this probably explaining why it deviates away from the main road prior to the approach to the Marchogian incline. The alternative to this deviation would have meant the tramway being inside the walls of the Demesne; something that obviously would not have been desirable.



Fig.3.3.95: Incline Cottage at Marchogian (2015)

However desirable it may have been there is no evidence that the tramway extended from Penlan Mill to the other mills in the lower yard at Melin Isa. However, during the course of excavation at the mill site the bed of a cobbled road was uncovered, suggesting that the movement of materials between the two mills was effected by road rather than rail. The road was subsequently identified as being what had become known as 'Occupation' Road (see Section 5.2).

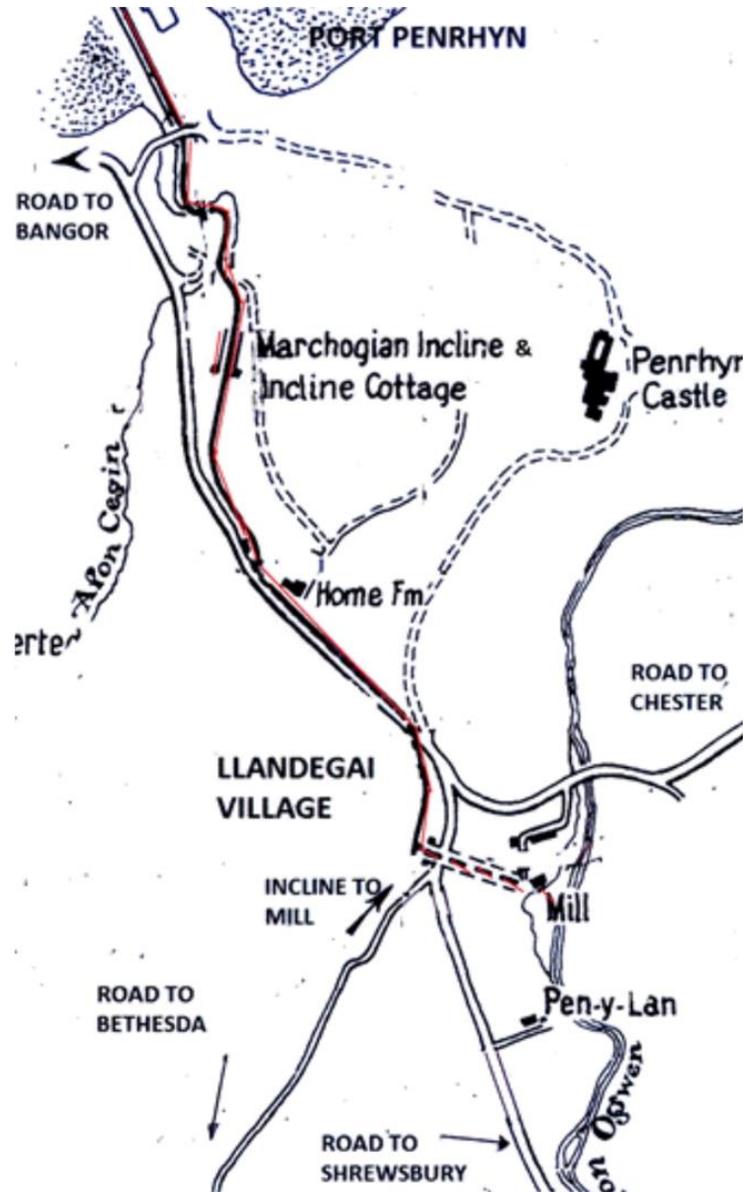


Fig.3.3.96: Route of the 1798 Tramway from Port Penrhyn to Penlan Mill.¹⁹³

How the mill may have worked and where the ancillary processes were carried out is more problematic. From both the layout of the remaining floor space and the documentary record we know that the original mill building was rectangular in shape and measured some 16.4 metres east to west and 8.6 metres north to south. The original height of the building is not known, and there is a certain amount of conflicting information. As flint mills to a large extent tend to work by gravity, as do corn mills, the building needs to be of an adequate height: typically, three storeys. The highest remaining

¹⁹³ Based on J.I.C. Boyd, Op cit, p.11.

wall, the west wall, is approximately 6.5 metres in height, or approximately 21 feet, which takes it to the ground level of the upper yard. This does not include any part of the building that may have stood above that, such as the loading area afforded by the small chute located above and to the west of A7.

In John Evans' account published in 1812 it would seem that already it was three storeys high, as he describes how the machinery lifted '*several upright levers, that again operate on others, on two floors above*'. This would have been in accord with the layout for other flint mills, where typically the ground floor housed the gear room, the first floor the grinding pans, and the second floor (often in the roof space), the lateral shafting for driving ancillary machinery. However, in 1823 a Mr Jackson of Liverpool presented Hay-Dawkins with a plan involving the addition of two further floors in order to convert it to a corn mill. This would have resulted in a building five storeys high although there is insufficient physical evidence to suggest that this work was carried out.

The 1883 lease agreement with Thomas Lewis & Co. enumerates the various items of machinery taken over at that time, which included a number of upright shafts the longest of which was 25ft, or approximately 7.7 metres. We do not know whether this ran through the height of the building, or whether it may have been connected to some of the other shafts that were listed in the same document: there is nothing to indicate whether and how these items fitted together. In the 1885 endorsement to this lease there is mention of the extension that was to be erected in the upper yard, contiguous with the existing building. From anecdotal information we know that this extension was two storeys high, although there is nothing to indicate whether this fed directly into the existing building or whether it was simply an adjunct.

Again anecdotally, prior to it being demolished the overall mill building was described by one person as being '*extremely large*', whereas another describes it as being three stories high; although one has to temper this with the fact that such memories are some sixty years old, and that to a younger person three stories would have appeared extremely large. In addition, the majority of local corn mills, including Cochwillan Mill and Felin Isaf Glan Conwy, are only three stories high, as is Cheddleton Flint Mill (from the settling arks to the top grinding floor).¹⁹⁴ Overall, based on the above information, it is reasonable to conclude that even though the original mill had been converted from a flint mill to a corn mill, the overall working height level remained at three storeys.¹⁹⁵

There is a query with regard to the original longitudinal dimension of the mill. From examination of the remaining brickwork to the inner side of the south wall, and inside the water wheel pit, it appears as though it had been extended eastward. The wall from grids 'J' to 'O' is stepped back and somewhat narrower than for the remainder of its length; and in grids 'H' and 'O', there are bricked-in doorways through to the water wheel pit. Furthermore, the outer (south) wall of the water wheel pit appears to have been extended or modified, the easterly of the three stone arches being considerably larger than the other two. Significantly these features incorporate the length of wall occupied by the second (eastern) water wheel and its associated machinery. Notwithstanding, there is nothing particular in the surface layout of the slate floor to indicate that any alteration has taken place, and the floor area in front of both of the drive shaft apertures in the south wall (E-F0 and K-L0) are a mirror image to each other (see Plan 2). Furthermore, from the documentary record we know that from the outset

¹⁹⁴ Email from Helen Outram, Cheddleton Trustee, 5th December 2013. According to another trustee, Ted Royle MBE, the main working area is two storeys.

¹⁹⁵ This has been confirmed by Mr Glyn Williams of Tyddyn Heilyn Farm.

there have been two water wheels. For example, writing at the beginning of the nineteenth century John Evans describes there being ‘two overshot wheels, about twenty feet in diameter’.¹⁹⁶

All subsequent documents issued by the Penrhyn Estate make reference to there being ‘wheels’, plural. In May 1823, when discussing the possible conversion of the mill, Mr Baxter refers to ‘*the repairs and alterations to the wheels*’. There is nothing to indicate what was meant by the word alterations, although conceivably it could have referred to the enclosure of the water wheel pit. In the lease dated 28th December 1859 between Roger Evans, miller, and Lord Penrhyn the reference is to ‘*the repairs of the water wheels attached to the mill & the driving wheels thereon*’.¹⁹⁷ In the plan attached to the lease of 10th December 1883 between Thomas and Henry Lewis and Lord Penrhyn, the mill is shown as having two wheels in tandem,¹⁹⁸ and in a 1912 report for the Silurian Iron Ore Company the surveying engineer describes the mill as having ‘*two powerful Water Wheels, measuring each 20 feet diameter and 6 feet wide, also both are “over shot” with plenty of water all the year round*’.¹⁹⁹ Finally, as part of his assessment as to the use of the mill as a power source in connection with his iron mining venture, in 1924 E. J. Morris wrote ‘*a water power of about 100 H.P. is available at this old mills, - two water wheels 20’ x 6’ is already there*’.²⁰⁰ Whereas the physical evidence is both inconclusive and contradictory the documentary evidence is not; the exception being that somewhat frustratingly the c.1840 lithographic print only clearly shows one wheel, although the second wheel may be obscured by the trees (Fig.3.3.97).



Fig.3.3.97: The picture depicts Penrhyn Castle in the background, viewed from Penlan. The building to the left in the foreground appears to be Penlan Mill as there is a water wheel shown to the south side, whereas the river is behind it. Based on its relative location, possibly the building to the right depicts Felin Isaf. (c.1840s)²⁰¹

¹⁹⁶ J. Evans, Op cit, pp. 453-454.

¹⁹⁷ BU/ CV mss 2280.

¹⁹⁸ BU Penrhyn ms PFA/2/29 (1883) Lease on Penlan Mill

¹⁹⁹ Gwynedd XM9801/2, ‘The Penrhyn Iron Mine – Near Bangor, North Wales’, 12th October 1912.

²⁰⁰ E. J. Morris, ‘The Particulars of Penrhyn Iron Mine’, dated 23rd February 1924. Papers privately held by, Miss Moira Muir, Op cit.

²⁰¹ (Gwynedd) ‘Penrhyn Castle from Penlan’, engraved by Newman & Barclay, Watling Street, London.

A possible explanation for the apparently differing evidence would be if an extension had been undertaken somewhere between 1798 and c.1810; possibly after Samuel Worthington had found that having only one water wheel provided insufficient power to run the various pieces of machinery they required, and one theory that has been put forward is that in around 1802 it was realised that an additional wheel was required to drive plant for crushing the calcined ore. However, to date there is no documentary evidence to support this theory. Furthermore, as the mill had been built by men well versed in the construction and operation of flint mills, it seems unlikely that so shortly after its completion they would need to re-design it. While the water wheels at both of the Cheddleton mills are very similar to those at Penlan; that at the North mill being 22 feet in diameter and 5 feet 9 ½ inches wide, and that at the South mill being 20 feet in diameter and 5 feet 5 inches wide; it is worth remembering that these mills were built at different times and for different purposes. Furthermore, neither mill is used for crushing the raw flint. Therefore, the question still remains as to why the south walls at Penlan Mill should display the signs of extension.

The answer to this question remains unknown and the physical evidence is contradictory. Based on the floor surface it would appear that the mill has not been extended longitudinally since its original construction, although the brickwork of the west inner wall would seem to suggest otherwise. Possibly the bricked-in doorways originally were to provide maintenance access to the water wheels from inside the mill, and this requirement subsequently became redundant. This in turn may have been due to the later enclosure of the water wheel pit, as we have no way of knowing whether it was enclosed from the outset, or whether its dressed stone south wall was a later addition. This would only make sense if the second wheel was added post the opening of the mill, as in that situation, with two wheels in tandem, it would have been necessary to extend the launder to feed the second wheel, and possibly at the same time keep the water within a confined area; although it is certainly feasible to run wheels in tandem without the mill race being enclosed, as evidenced at Felin Isaf, Glan Conwy. However, again from the documentary evidence, it would seem that there have been two wheels from the outset. The lithographic print seems to offer some indication, as in this the water wheel is clearly visible and not contained within a pit. However, the same caveat regarding its accuracy applies, particularly as the print post-dates the mills' conversion.

A further possibility is that the construction of the stone outer wall to the water wheel pit was for aesthetic purposes; the mill being of particular interest to visitors, coupled with a desire on the part of either Samuel Worthington or Richard Pennant to present it in the best possible light. A contemporary account published in 1814 by the Rev. W. Bingley states that: '*The walks that have been formed near these buildings [Penlan Mill and Melin Isa] are somewhat interesting; and the planting of the adjacent grounds with trees and shrubs will, in the course of a few years, render this, much more pleasing than it is at present*'.²⁰² According to the Estate's accounts the cost of carrying out the planting and fencing of this area amounted to £60-14-0.²⁰³ This planting was very much in evidence until 2010, providing a pleasant woodland walk from the mill to the mouth of the leat tunnel (see Section 4.1).

If the dressed stone facing wall of the water wheel pit had been constructed later, it could explain why the east end of the water wheel pit is not flush with the main building, although again this is not at all conclusive. As can be seen from Fig.3.3.76 there are no variations in the stonework other than the

²⁰² Rev. W. Bingley, Op cit, p.104.

²⁰³ BU/PFA/12/11.

height of Arch 1, and all three arches are symmetrical. There is disturbance to the stonework adjacent to Arch 1, although this is thought to have been caused by the roots of the trees that had grown on top of the wall: these subsequently being removed in 2005. The earlier use of cement rather than lime mortar to repair the stonework had caused additional disturbance.

A further possibility is that while there may always have been two wheels, initially the second may have been somewhat smaller and being replaced when the mill was converted to facilitate the grinding of corn. Certainly this is feasible, but perhaps unlikely since the amount of power required to grind corn is somewhat less than that required to both crush and grind flint. More likely is that two wheels would be necessary if flint was to be both crushed and ground at the same time. Certainly, such a view could be supported by Hugh Derfel Hughes' account of how *'the thunder of these heavy stones was heard for miles, and the earth would shake'*.²⁰⁴ Furthermore, at the outset John Evans describes the mill as having two wheels both being twenty feet in diameter.

The Water Wheels

Nothing remains of the water wheels apart from two short lengths of octagonal shaft 43cm (1ft 5 inches) in diameter, and part of a central hub; both in very poor condition and obscured beneath undergrowth and rubble in the water wheel pit. From contemporary descriptions we know that originally there were two wheels in tandem, both overshot, 20 feet (6.096m) in diameter and 6 feet (1.8288m) wide. In 1980 Mrs Llewellyn and her group of students recorded that there was part of a surviving wheel measuring 20ft 6in (6.26m) in diameter by 5ft 4 1/2in (1.64m) wide; the second wheel having disappeared by this time, although according to contemporary observation it had been in place at the time the mill was demolished c.1955. Her report at the time included detailed drawings of the wheel which she describes as being of unusual design with *'a metal rim and ten wooden spokes set into a massive hub. The hub is unusual in that there was no provision for the easy removal of the spokes; the sockets were closed at the back and, though the two faces of the hub were separate at the upper level (diagram C) no junction could be seen on the inner rim (diagram D),'* (Fig.3.3.98).

Mrs Llewellyn went on to say that the wooden shaft for the wheel was also still in situ, and probably was a replacement as it was laminated, with the thickness being made up by a number of sections pinned with leather caulking on to an octagonal baulk of timber, this in turn having been created by pinning a section. While originally the shaft would have connected with a fly-wheel, nothing of that wheel remained. At the time that her survey was carried out there was no evidence of a second fly-wheel pit, although subsequent clearance of the site has revealed that one did exist; it having been buried beneath a large amount of heavy rubble.²⁰⁵

As already stated, much of the wooden launder that distributed water across the wheels was still in place at the time of the 1980 survey, even though the east end had collapsed into the water wheel pit. Today nothing remains apart from a few lengths of timber lying against the west wall of the pit (Figs.3.3.69 & 3.3.70).

While the documentary record refers throughout to both of the water wheels as being 'overshot' this may not be entirely accurate. Having two overshot wheels in tandem would tend to be inefficient as

²⁰⁴ H. D. Hughes, Op cit, p.131.

²⁰⁵ F. Llewellyn, 'Penlan Mill, Tal-y-Bont and Kilns' (undated), (Bangor).

the tail-water from the first wheel would be in opposition to the water flow of the second, thus causing a 'drag' effect (Fig.3.3.99). A more efficient option would be that if the first wheel (the westerly) was a true overshot wheel, and the second was a backshot wheel (also known as a pitch-back wheel). With an overshot wheel the water from the head race is deposited on the top of the wheel, slightly beyond the axle, thus moving the wheel in a clockwise direction. With a pitchback wheel the water is still deposited on top of the wheel, but slightly in front of the axle and thus moving the wheel in an anti-clockwise direction. The result is that instead of the tail-flow from wheel one impeding wheel two it would assist it by providing additional thrust applied to the bottom of the wheel (Fig.3.3.100). The third option, and undoubtedly the most efficient, is that both wheels were pitchback, and thus both wheels would rotate in an anti-clockwise direction, with the tail-water from the first wheel adding impetus rather than impedance to the second.

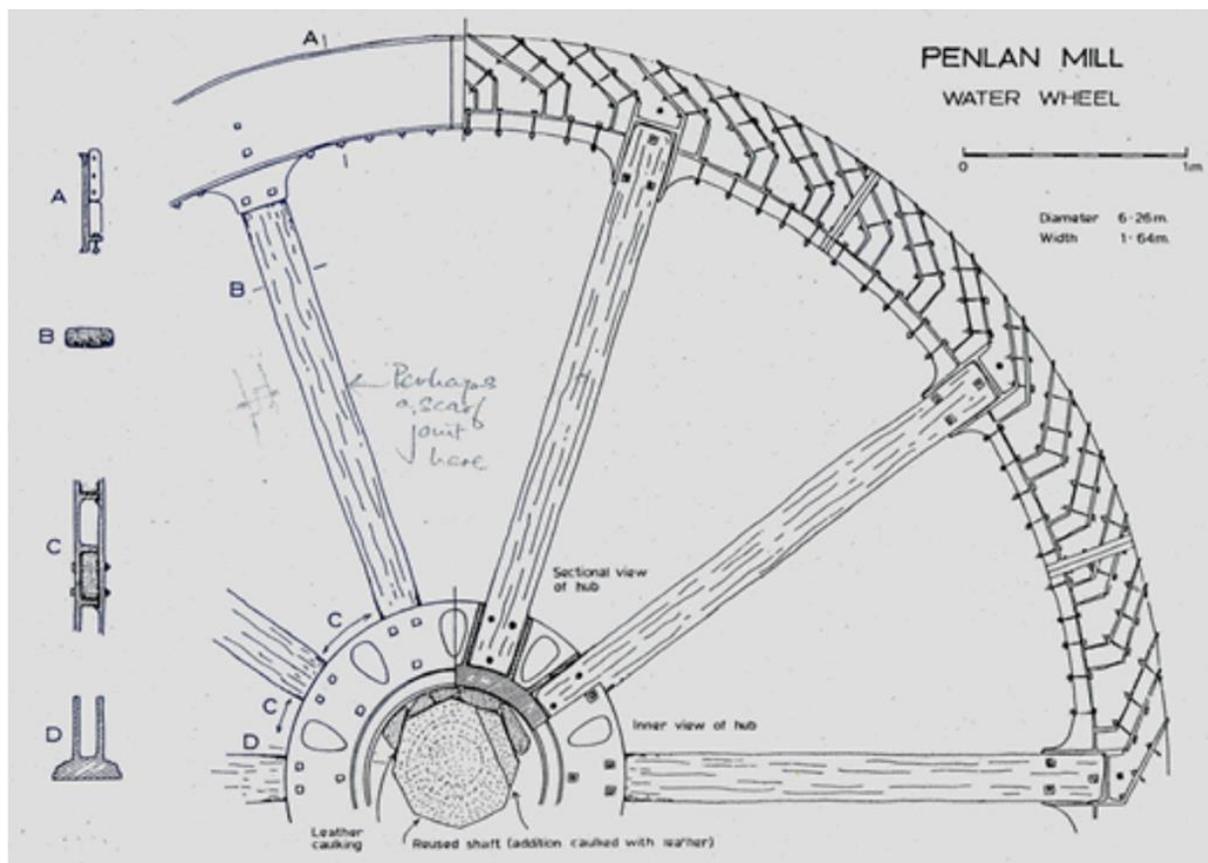


Fig.3.3.98: The water wheel at Penlan Mill as recorded in 1980.²⁰⁶

In all three cases the striking face of the wheel could comprise buckets, blades, or paddles, all of which would serve to capture the water required to provide the energy for driving the wheel. As a result, the weight of the water captured on the 'loaded' side of the wheel is heavier than on the opposite 'empty' side, and this determines the direction of rotation. From the 1980 sketches made by Mrs Llewellyn it would seem that in the case of Penlan Mill the water was captured in buckets, this being consistent with the optimum design for a pitch-back wheel.

While overshot wheels of both types require more engineering than undershot or breast-fed wheels, they have the added advantage that they do not require a rapid water flow. They also are more

²⁰⁶ F. Llewellyn, PRN 6387, Op cit.

efficient in that they can utilise all of the available water flow for power. Pitch-back wheels have an additional advantage in that they can continue to function until the height of the water in the wheel pit rises above the axle; something a straightforward overshot wheel cannot do, as in this situation it would either stall or be destroyed.²⁰⁷

Based on the above, and because it would seem that generally the mill was engineered to a high standard, it is most likely that option three would have been the preferred choice, and that both wheels would have been pitch-back. By adopting this arrangement efficiency would have been in the region of 90%, which no doubt contributed to Penlan Mill being so powerful; various contemporary records estimating its power potential at 96-100hp. With option two, the overshot and pitchback wheels working together, efficiency would still have been around 70%, but could not have operated if and when the water level in the water wheel pit started to rise.²⁰⁸ By contrast both the North and South mills at Cheddleton are low-breast fed.

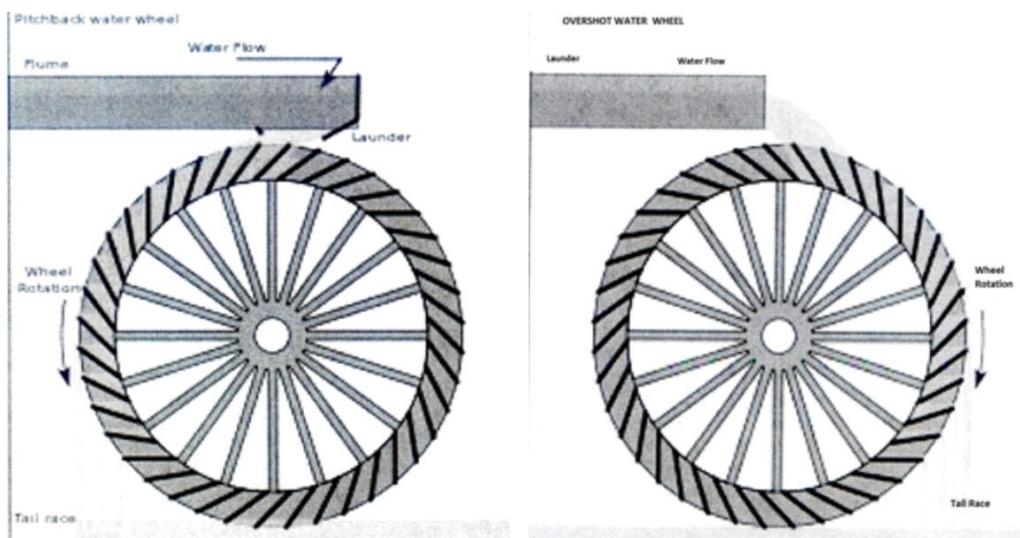


Fig.3.3.99 (left): A pitchback wheel.²⁰⁹

In Fig.3.3.99 the water flow is from left to right, as at Penlan Mill.

Fig.3.3.100 (right): An overshot wheel.

The water was directed on to the wheels by means of 'paddles' set at the headrace and operated from inside the mill, although there is no evidence from the surviving masonry precisely where these may have been located. However, as it would have been necessary to divide the flow of water prior to it having reached the first wheel, the 'paddle' or sluice would have needed to be situated at the start of the launder, with the control lever being located inside the mill building at the extreme west corner. A good example of such an arrangement can be seen at Felin Isaf in Glan Conwy. This site comprises three separate buildings: a clover mill, a corn mill, and an oats drying kiln. Here the two mills are driven by individual wheels that are in tandem and share a common mill race and launder. In this instance the first wheel is over-shot and drives the clover mill, whereas the second is pitch-back and drives the corn mill.

²⁰⁷ http://en.wikipedia.org/wiki/Water_wheel#Undershot_wheel,

²⁰⁸ Ibid, p.14.

²⁰⁹ Figs.3.3.100 & 3.3.101, Ibid.

To operate the first wheel a shutter in the launder is depressed by means of a series of inter-connected rods that are operated via a long wooden lever inside the mill building. The degree to which the shutter is held open is controlled by a simple peg board, the peg holding the lever in place at the desired point, as shown below (Fig.3.3.101). As the shutter is depressed the water drops through the resulting aperture and on to a chute, from which it then drops onto the water wheel (Figs.3.3.102 to 3.3.104). The water is guided to the aperture by means of a wooden board sitting adjacent to it in the launder. When power is no longer required the aperture in the launder is closed simply by moving the lever in the opposite direction. To operate the second wheel the shutter to the first wheel is closed and the water passes over it to a similar arrangement at the far end of the launder (Fig.3.3.105).



Fig.3.3.101: The control lever inside the mill, held in place by the peg board. The lever is connected to a shaft that goes through the wall and connects with the shutter control mechanism.²¹⁰

In the case of Felin Isaf the two mills are never in operation at the same time, in which case the flow of water across the launder is relatively simple. Whether the wheels at Penlan Mill would both have been simultaneously in operation is not known, although perhaps unlikely; in which case the arrangement described above would have been perfectly adequate. If they had operated simultaneously the same method would have applied, with the supply of water to each wheel being controlled by means of a strategically placed board laid longitudinally in the launder. We have no evidence either way.

As illustrated in Fig.3.3.104, with the shutter depressed water falls onto the chute beneath the launder, where it passes onto the wheel. The control levers for the second wheel are visible top right. The control levers for the second wheel (Fig.3.3.105) are operated from inside the mill.

²¹⁰ Figs.3.3.102 to 3.3.106 By kind permission of Mr David Manton, Felin Isaf Mill, Glan Conwy.



Fig.3.3.102 (left): The control levers operating the shutter in the floor of the laundry.
In this illustration the shutter is depressed to the open position.

Fig.3.3.103 (right): Reverse view of the control levers with the open shutter in the foreground.
The laundry is visible in the background.



Fig.3.3.104 (left)

Fig.3.3.105 (right)

Where was the flint burnt?

There has been some debate about where the flint was burnt, and there is no conclusive evidence either way. When Brigadier Trevor and Mrs Llewellyn corresponded on this issue during 1980 and 1981, they appear to have concluded that it actually took place in the kilns located on the quay at Port Penrhyn.²¹¹ In part this seems to have been predicated upon an understanding that the lease between Samuel Worthington and the Penrhyn Estate included a clause to the effect that there should be no fires at the mill because of the risk of fire at the lower mill (Melin Isa) where timber was sawn, and where linseed oil and paints were produced. While in many ways this would make sense, possibly it is

²¹¹ RCAHMW, Letter headed 'Port Penrhyn Flint', from Brigadier Trevor to Mrs. Llewellyn dated 8.4.80. (un-referenced).

a misinterpretation of the original document, which on page 3 reads [that the lessees] *'shall not at any time during the continuance of the said term hereby granted push, plow, or burn any of the said Lands or Grounds hereby demised nor get thereon or therefrom any Turfs for firing, nor dig, plow, break up or convert into Tillage any of the Meadows or usual mowing grounds hereby demised'*.²¹² In other words, this is a general condition that applies to *all* of the properties covered by the lease, and relates to general land husbandry.

What may have clouded the issue somewhat is the series of advertisements that appeared in Gore's General Advertiser between 27th March and 8th May 1800, relating to the Herculaneum Pottery site at Toxteth. The initial advertisement, on 27th March, was placed by Samuel Worthington & Co and was for *'A person well acquainted with the management of Smelting Copper and Lead ore, and erecting buildings for the purpose'* etc. This also appeared in the editions dated 24th April and 8th May. However, in the edition dated 24th April an additional notice was published that read:

'We whose names hereinafter named, Owners and Occupiers of Land and premises within Toxteth Park, do not know that there is now any Copper Works within Toxteth Park, but know that there was for some time past a copper Works within Toxteth Park, and was some years past since given up, and the Smelting of Ore removed from out of Toxteth Park, and some part of the buildings with additional erections thereto, were converted into a Pottery called and stiled [sic] by the name of The Herculaneum Pottery, and was, and now is, carried on by the said Samuel Worthington and Co.

'Whereas by the said late Copper Works, when carried on, great damages were done to the Land and Premises, and also to the Corn, Grass, Vegetables, Plants and fences, by the pernicious smoke arising therefrom, which were a grievous nuisance, and carried great and heavy losses to the owners and occupiers of the Land and Premises, by making them of much less value, and also bad for health, and made life very uncomfortable.

'Therefore this is to give notice to the said Samuel Worthington and Co., and to all other persons or person whatsoever, to caution them, that they do not at any time or times thereafter, carry on the business of Smelting Copper, or Lead Ore, or any other ore, in any business whatsoever, or any part, within Toxteth Park aforesaid, that may be a nuisance, as to spoil or damage the lands or premises therein belonging to any of us, or to the the Corn, Grass, Vegetables, or any other thing growing therein belonging to any of us, by lessening the value of the Lands, or making life uncomfortable, which, if done, we fear that we, or some of us will be obliged and feel it necessary to have the trouble to bring actions against them, for to remove and take away such nuisance, and to recover the loss or damage suffered thereby, of which they have this notice, this fifth day of April 1800'.²¹³

The notice was signed by John Webster, William Lafell, John Bisham, Henry Healy, John Bellis, John Miller, John and James Parr, John Litherland, and Joseph Sefton.

From the above it would appear that whereas Samuel Worthington & Co. were hoping to carry out some form of ore reduction at the Toxteth site (possibly of flint and the ores for producing colours), the owners of the adjoining properties were warning them against it because of the potential harm to property, as previously experienced. Almost certainly this prevented such activities taking place at

²¹² Gwynedd XM/1959/1, Indenture dated 24th March 1800, sheet 3.

²¹³ *Gore's General Advertiser*, 24th April 1800.

Toxteth for at least the next eighteen years and, to some extent, ensured that the processing at Llandegai continued.²¹⁴

A further point to consider is, if there were no fires how did they manage to dry the flint solution once it had been washed? Furthermore, as the flint mill was situated at least 140 yards from Melin Isa, surely this was a more than adequate distance to safeguard against fire?

These arguments do not in themselves, however, provide sufficient evidence upon which to make any sort of judgement, and there are other factors that need to be considered. For example, Brigadier Trevor postulates that as the reduction of lime and flint is by a very similar process; that as lime kilns and flint kilns are virtually indistinguishable; and that in both processes a large amount of coal is required; it would be far more economical to land the material at the port and burn it there before transporting it to the mill. Similarly, that in the same way it would also have been economical to transport the quartz and other ores for colours to the port for burning, before transporting the residue back to the mill.

The Brigadier goes on to say that either the ground flint was shipped out in semi-liquid form (in which case no heat would be required), although there is no contemporary evidence to support this; alternatively, that it was shipped out as a dry powder, in which case hearths would have been required at the mill to facilitate the drying process: again, with the attendant risk of fire. This in fact appears to have been the chosen method, as described in the contemporary account furnished by the travel writer John Evans, who describes how *'The mass in a fluid state is let out into divers reservoirs, where, after undergoing various decantations, is carried to a drying stove, and then packed in casks, and shipped to different parts of the country'*.²¹⁵ However, the type and size of stove required to dry ground flint is not on the same scale as that required for calcining it, and there is no reason to suppose that these operations would have been undertaken at the same location.

Whilst logically the kilns at Port Penrhyn provide a strong candidate for the site where the flint was burnt, we do not actually know when these were built. Under the heading 'Disbursements' in the Penrhyn Estate account book for 1753, Item 43, there is an entry *'Pd Ed. Lloyd for carrying 3 tons of stones from Liverpool for Penrhyn Kiln.'* This in itself is not a substantial quantity of stone,²¹⁶ but unfortunately there are no further entries to elaborate on this.

In 1778 there were further entries which show that for the period May to July payments were made for a new lime kiln, as follows:²¹⁷

11.5.1778	Pd for the carriage of two boat loads of building stone for the new lime kiln.	£1-13-0
22.5.1778	Pd for the Masons for making the new Lime Kiln.	£3-11-4
23.5.1778	Pd Wm Price for teamwork in drawing materials for repairs at the mills and The Lime Kiln.	£3-1-6
29.6.1778	Pd Wm Rathbone for Boat Load of building hones for finishing the new Lime Kiln.	£1-3-0
3.7.1778	Pd Hugh John Thomas for lime for the new Lime Kiln.	£0-15-0
3.7.1778	Pd M Hughes for 820 bricks for lining the new Lime Kiln.	£0-16-4

²¹⁴ *Herculaneum Pottery Minutes Book*, Resolutions 157, 158, 159 and 167 refer. (LRO/380MD47).

²¹⁵ J. Evans, *Op cit*, p.454.

²¹⁶ BU/Penrhyn/1674, Rental May 1757, Disbursements 1753.

²¹⁷ BU/Penrhyn/1730.

While these latter entries indicate that a new lime kiln was built during that period, it would seem the level of expenditure was too low in comparison to the size of the very substantial kilns at Port Penrhyn. Possibly a smaller kiln was erected, either at the Port or elsewhere.

One suggestion put forward is that the kilns at Port Penrhyn were built due to the need for lime mortar during the construction of Penrhyn Castle, and that Samuel Worthington had merely made use of them. Although construction of the present-day castle did not commence until around 1821 Richard Pennant, the first Lord Penrhyn, had embarked on a series of improvements to his estate shortly after he inherited it in 1771, and this would have necessitated a ready supply of lime both for building and for agricultural use. In 1781 Samuel Wyatt had constructed an earlier version of the castle on Pennant's behalf, shortly after he had inherited the Estate. When the travel writer Nicholas Owen visited the area in 1791 he described how '*Penrhyn glitters in its yellow glory, beautifully contrasted with the pure white of the interspersed [lime-washed] cottages of the plain*'.²¹⁸ Similarly John Evans, who in 1798 also extolled the new works and in particular the newly constructed principal entrance to the park, that was built in around 1785. He described it as being '*by a grand gateway, in the manner of a Roman triumphal arch*'.²¹⁹ If at least one of the two kilns on the Port Penrhyn site had been constructed for this purpose then it is certainly feasible that the flint was burnt there.

Other dates compliment this in that work on the original (Wyatt) castle had been completed by the time Worthington & Co. took over the port site, and shipments to Herculaneum were coming to an end by the time work began on the new castle. Furthermore, the port provided the necessary access to the means of transportation, both for the raw material coming in (stone and coal) and the processed material going out. The only element of doubt is that there is no reference to the port kilns in the lease document of 24th March 1800, and neither do they appear on the 1803 Estate map: a serious omission for such a major structure. The first time that they are specifically mentioned is in a plan attached to the Order dated 27th March 1821 relating to the closure of the Holyhead to Shrewsbury road, which at that time ran through the Penrhyn Demesne prior to it being enclosed by the newly built wall. The Order stated that the existing road was to be replaced with a new one running from the Penrhyn Arms to Port Penrhyn and the '*new lime kilns*', over the new bridge constructed by George Hay Dawkins-Pennant.²²⁰ The Order was confirmed at the Caernarfon Quarter Sessions on 4th May 1821. However, the reference in the closure Order to '*the new lime kilns*' is not necessarily literal, as the term 'new' is often applied to something that has superseded an existing place or structure and is therefore a relative term. This is borne out by Estate papers relating to the new lime kiln at Port Penrhyn, that refer to a date of 1791, but not carried out until 1821.²²¹

Whereas the 24th March 1800 lease does refer to '*all that new made Wharf or Quay with the Sheds*' there is no specific reference to the kilns; but there is with respect to the kiln at the Ochre Works. Furthermore, there is no mention by any of the contemporary travel writers of a kiln being located at the port, even by John Evans who took a keen interest in industrial processes and described them in great detail. In describing the workings of the mill Evans does state that '*The chert and flints are*

²¹⁸ N. Owen, *Caernarvonshire, a sketch of its history* (London, 1792), P. 30.

²¹⁹ J. Evans, *Op cit*, p.452.

²²⁰ Gwynedd X/Plans RD/39.

²²¹ BU/Penrhyn/1043-44.

previously roasted in kilns nearly similar to those, used for the calcination of lime, although he does not specifically mention where this took place.²²²

Notwithstanding the above, possibly there are positive indicators in the Estate rental records. In 1789 under Llandegai rentals there is an entry for a house at the lime kiln let to a Robert Owen for 10s per annum, and from 1795 to 1811 there are entries for a Lime Kiln and House let to Evan Jones for £11-0-0 per annum. From 1814 it was let to Samuel Worthington & Co for a rental of £20-0-0 per annum. Prior to 1795 the property had been listed in the rent rolls as 'Grinding Stone Mill' and had been let to Richard Thomas at a rental of 2/- per annum: the large increase in rent perhaps being indicative that a major change had taken place.²²³

By contrast, during the same period (1789 to 1794) the lime kiln at Aberogwen was let to the Rev. M. Williams for a rental of £2-10-0 per annum, and from 1814 to 1820 the lime kiln in Llanllechid was let to Worthington & Co for a rental of £2-2-0 per annum; the kiln subsequently being taken 'In Hand' by the Estate from 1821.²²⁴ The scale of variation in rental, almost ten-fold, indicates a vast difference in size between the three kilns. What none of these preclude is the possibility that as demand increased, a smaller kiln was superseded by a newer and larger one. Therefore, the kiln could have been on the same site as the original, or adjacent to it.

Alternatively, the flint could have been burnt at a location close to the mill. Although there is no physical evidence to support this it would have been perfectly feasible as the site underwent a number of changes following Worthington's departure. Furthermore, the size of such a flint kiln can be relatively small, as is evidenced by those at Cheddleton (see Figs.3.3.81 & 3.3.82); and certainly, a dedicated kiln would not have needed to be on the massive scale of the Port Penrhyn kilns. In addition, we know that during this time it was common for many corn mills to have a kiln attached, as can be seen from the Estate records, viz:

1769	Repairs to stable and build a new kiln (Penrhyn Mills)	£7-18-4
1771	Tiles for the kiln (Penrhyn Mills)	£1-17-6
	Freight for the above	£0-6-0
8.10.1776	Repairs to kiln at Melin Ucha	£0-17-10 ½
1772	Rebuilding the grates at Melin Hen and setting them up	£0-13-1
26.8.1777	Repairing the wall of Melin Hen kiln	£0-5-0
30.9.1777	Slating Melin Hen kiln	£1-2-4
20.9.1781	2500 bricks for repairing Melin Hen kiln	£2-18-9

(The references for the above are contained in Section 7.4)

Perhaps the best guide comes from recently catalogued documents held in the Bangor University Archive which show that one of the very first tasks carried out in 1796, during construction of the mill at Penlan, was the building of a kiln. There is an entry in the Estate's accounts, dated 24th December 1796, 'Masons building Kiln £3-2-0'.²²⁵ At first site this appears to be a somewhat small sum for building a kiln, although it does refer only to labour and not materials, and a kiln dedicated for burning flint would not have needed to be very large. However, what this does compliment is the fact that during

²²² J.Evans, Op cit, p. 454.

²²³ BU/Penrhyn/Add/2806, 'No.5 Rental 1794'.

²²⁴ BU/Penrhyn/rent rolls.

²²⁵ BU/PFA/12/11.

an archaeological survey carried out in the 1960s of the land now occupied by the Llandegai Industrial Estate, pieces of unburnt flint were found lying alongside what had been the bed of the original 1798 tramway. Therefore, as flint does not naturally occur in north-west Wales it is reasonable to summarize that it had been dislodged from a wagon while en route to the flint mill. Overall, taking into account the above, and bearing in mind the huge size and likely construction date of the kilns at Port Penrhyn, it would be reasonable to assume that the flint was calcined on site at Penlan. There is no supporting material evidence to support this although given the amount of disturbance that has taken place at the site post Worthington's departure this is not at all surprising.

If the flint *was* burnt near the mill site the most likely location would have been to the north-west of the mill building, possibly even in the location now occupied by Penlan Mill Cottage. This would have been in close proximity to the tramway and also would have facilitated loading of the flint into the first floor of the mill via the chute set above the west wall. Alternatively, it could have been slightly further to the north in the area currently occupied by the main-line railway. One argument against this would have been its proximity to Mr. Worthington's house at LlwynOn, although this would not necessarily have been a prohibiting factor.

A further possibility is that the kiln was located to the east side of the mill; particularly as at that time the stable had not yet been built and, during excavation, red brick dust was found beneath the ground in that location (see Figs.5.6.1 to 5.6.3). This, however, is highly unlikely as this area lays down-slope to the mill, is further away from the loading chute, and closer to the timber mill (although the timber mill did not exist in 1800 when the original lease was taken out). The leat lies to the south, and in addition we know from the Rev. Bingley's journal (quoted above) that this area recently had been planted.²²⁶

We do know that at various times Samuel Worthington rented two other kilns: one listed as 'Lime Kiln & House'²²⁷, and the other 'Lime Kiln (Llanllechid)'²²⁸, although we do not know precisely where these were located. Furthermore, the period during which he rented them, 1814-1820 and 1816-1820 respectively, was in the latter years of flint production at Llandegai and would not have facilitated flint burning during what would have been the mill's most productive years. In addition, it is unlikely that either of these kilns, or indeed the kiln at the ochre works, would have had adequate transport links to or from the mill site.

There is, however, one further point to be considered. The original lease of 24th March 1800 between Richard Pennant and the Liverpool partners refers to '*all those works called the Ochre Works, situate on the Farm or Tenement called Coed y Parc in the said Parish of Llandegai together with the privilege of working and getting all the ochre which may be had or found on the said Tenement and the Mill Kiln, sheds, pits, House, Garden and Lands now or heretofore held or occupied herewith*' (it then goes on to list the Wharf and Quay). What this actually means is open to interpretation, particularly as there is little punctuation. Does it refer to the mill kiln at the Ochre Works, or does it refer to buildings elsewhere? As the section preceding this refers to '*all that said Farm or Tenement called Nant Gwreiddiog*', etc, it would seem that it refers to a kiln at the Ochre Works.

²²⁶ Rev. W. Bingley, Op cit, p.104.

²²⁷ BU/Penrhyn Add 2813, 2815-16, 2818-20, 2954.

²²⁸ BU/Penrhyn Add 2815, 2817-2820, 2954.

Port Penrhyn remains a strong contender, even though the construction of the new kilns was not directly related to the development of the Penlan Mill site, but rather for the purpose of producing lime for the Estate's new building programme, as well as to support the improved agricultural methods introduced by Richard Pennant and Benjamin Wyatt. Also, this location would ideally have suited Worthington & Co. as not only did they hold the lease on the port but also had an office there. In addition, their transport link to and from the mill and the slate quarry passed close by. Being astute business men, they also would have seen the opportunity afforded by having easy access to the raw materials required for their newly acquired pottery, as well as the means of processing them without incurring the disfavour of their neighbours at the Toxteth site in Liverpool.



Fig.3.3.106 (left): The kilns at Port Penrhyn. (2010)

Fig.3.3.107 (right): The kilns at Port Penrhyn, showing the draw vent and different strata of stonework. (2010)



Fig.3.3.108: The interior of one of the kilns. (2010)

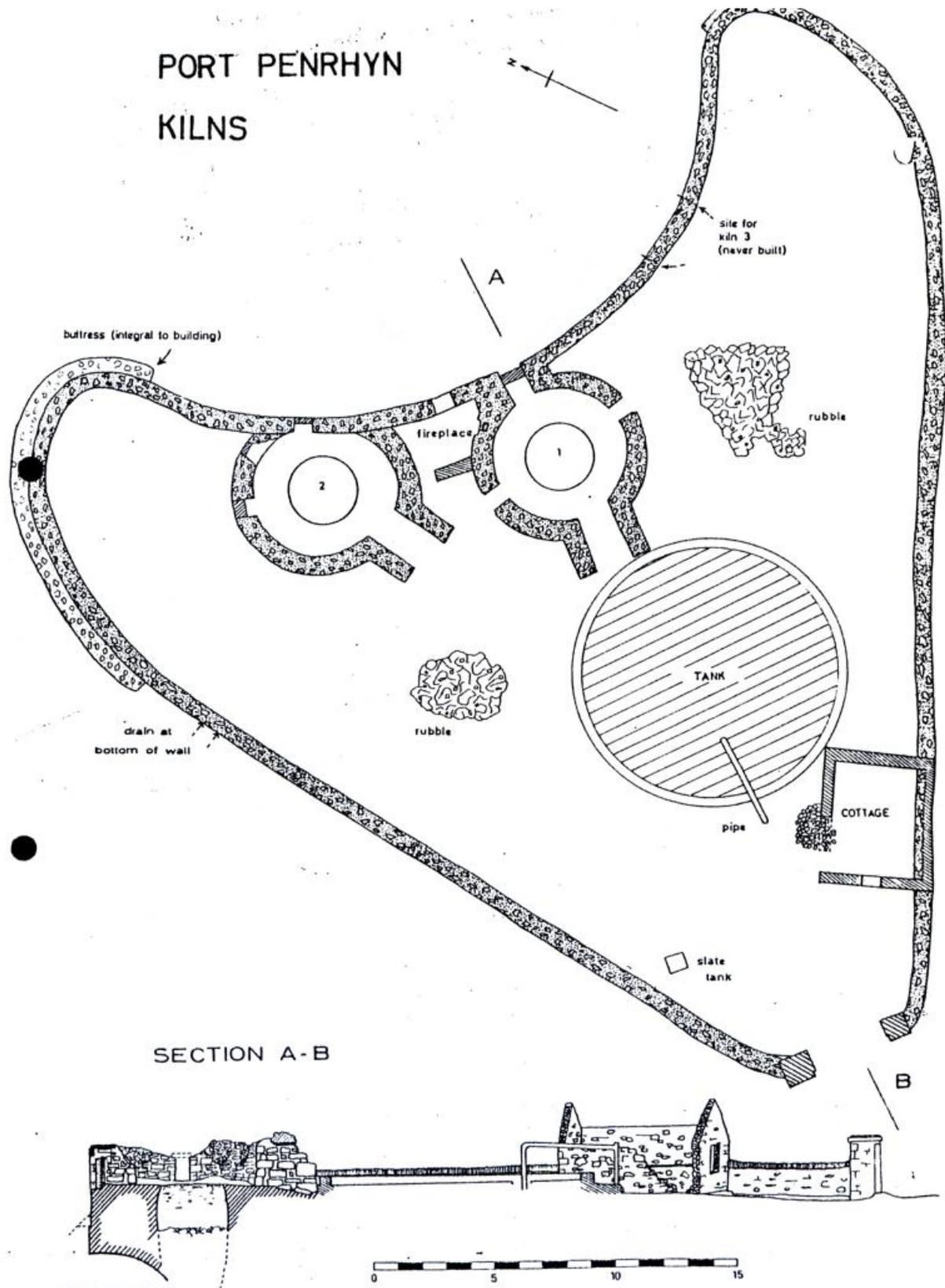


Fig.3.3.109: Plan of the Port Penrhyn kilns. (1980)²²⁹

²²⁹ Figs.3.3.110 & 3.3.111, F. Llewellyn, PRN 6387, Op cit.

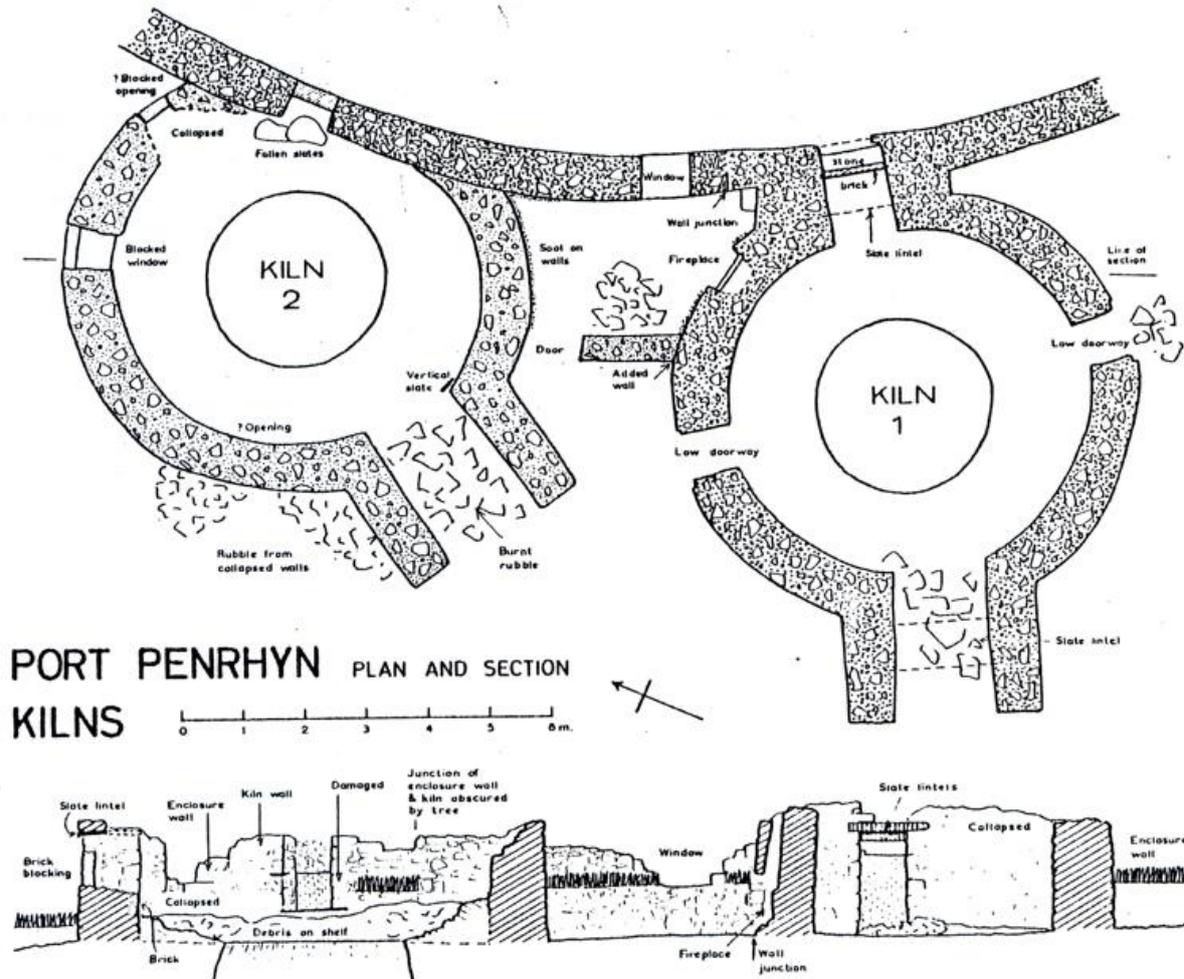


Fig.3.3.110: Plan and section of the Port Penrhyn kilns. (1980)

Nonetheless, based on all of the above, in particular the newly released accounts, it would appear that the most likely location for burning the flint would have been at the mill site; particularly as it was in the nature of Samuel Worthington to control all aspects of his enterprises, and there is no reason to suppose that this would not equally have applied to the calcining of the flint. Furthermore, some of the arguments put forward in favour of the Port would equally apply to Penlan: the transport link via the tramway, etc.

In 1980 the Port Penrhyn kilns were recorded by Mrs Llewelyn and her students from Bangor University, and for completeness their drawings are included above (Figs.3.3.109 & 3.3.110). As can be seen from their illustrations the kilns at Port Penrhyn were far larger than those at Cheddleton Mill, possibly illustrating that the kilns at Port Penrhyn were multi-functional, whereas those at Cheddleton (Figs.3.3.81 & 3.3.82) were built purely to meet the requirements of the flint mill.

Where was the flint crushed?

The first question to answer is whether it *was* crushed, as once flint has been reduced to a calcined form there is not necessarily a requirement for it to be crushed prior to grinding. Traditionally throughout much of Staffordshire, and certainly at Cheddleton Mill, it has been common practice merely to break up the calcined flint pebbles using a sledge hammer, although at some sites a jaw-

crusher was used for this purpose.²³⁰ If in the case of Penlan Mill additional crushing was required there is nothing to suggest that the flint was crushed anywhere other than on site; whether this be either manually or mechanically. If mechanically, then certainly we know that from the outset there was sufficient power available as there were two large wheels, which an engineer's report from 1912 estimated could '*produce a power of from 96 to 98 horse power, which means a power for crushing the ore*'.²³¹ Hyde Hall also described it as being '*a powerful mill*'²³², and as already mentioned Hugh Derfel recounted how when the mill was in operation '*the earth would shake*': perhaps indicative of an activity more violent than just the grinding process.

Irrespective of their application, with most types of water mill the fundamental engineering does not alter. The power is generated by the water wheels and transmitted via a series of cogs and shafts from the fly wheel to the operating head; the major difference being whether this performs a rotating/grinding motion (as in a corn mill or flint mill), a hammering motion (as with a crushing mill or fulling mill), or a sawing motion. In the case of Penlan Mill there was sufficient power available to facilitate at least two of these activities, crushing and grinding, although nothing remains in the material record to indicate whether any form of mechanical crushing took place on the site.

Where was it dried?

In order to answer the question of where the ground flint was dried we first have to decide whether it *was* dried. From the description by John Evans it would seem that the answer to this is 'yes', and therefore the question is where on the site did this take place? One theory that has been put forward is that wet 'blounts' of ground flint were transported to an area of Llwynon Garden where they were cut and rolled into flat cakes, perhaps three inches thick, and then put into wooden moulds where they were allowed to dry naturally in the sun (in a sun-pan): alternatively in a drying shed.²³³ It would have been from here that the dried material was shipped to Port Penrhyn via a siding to the tramway.

It has been suggested that the location of the drying area was at the corner of the field that sits opposite the house named 'Haulfre' (the former vicarage), immediately alongside the old turnpike road (former A5), at the junction with the Bangor to Conwy Road (A551).²³⁴ Today the area is thickly wooded, and there are no visible remains (Fig.3.3.111). An examination of the area was also made using a metal detector, but this did not produce any results. However, there is documentary evidence of a structure having been located here before and during Worthington's tenure. It appears on the 1791 plan attached to the Order that allowed the closure of the highway that ran through the Penrhyn Demesne from Llandegai village to the Taverna Gate near Port Penrhyn.²³⁵ It is also shown on the map of the Penrhyn Demesne dated 1804;²³⁶ Telford's plan of c.1820 that was drawn to show the proposed new route of the Conwy road around Tal-y-Bont;²³⁷ on the Plan of Deed dated 27th March 1821

²³⁰ Correspondence with Ted Royle, Op cit, 31.3.2015.

²³¹ Gwynedd XM9801/2, The Penrhyn Iron Mine – Near Bangor, North Wales', 12th October 1912.

²³² E. Hyde Hall, Op cit, p.107.

²³³ While Cheddleton Mill currently has a slip kiln this was not built until 1890. Prior to that the ground flint was shipped out in 'slop' form in two mobile arks. (Email from Ted Royle, 11th November 2015)

²³⁴ SH 598709.

²³⁵ BU/Penrhyn/mss1044.

²³⁶ Gwynedd XM/Maps/437/8.

²³⁷ BU/Penrhyn ms 183.

regarding the closure of the main road to Bangor;²³⁸ and on the 1828 map of Penrhyn Park drawn up for Hay Dawkins-Pennant.²³⁹ However, by the time the new Llandegai Tithe Map was produced in 1841 it no longer appeared.²⁴⁰

Though there may be some merit to the theory it contradicts Evans' contemporary description of the process, in which he describes how the material was '*carried to a drying stove, and then packed in casks, and shipped*'.²⁴¹ Furthermore, it does not explain how the material was dried during wet periods, as relying on natural ventilation, even under cover, would make it virtually impossible to control the timetable to which any such business must run. It would also introduce additional handling time and therefore costs, something that someone as astute as Worthington would have been anxious to avoid. The fact that it existed as early as 1791 suggests that perhaps it is more likely that the structure shown on the various plans would have been some form of dwelling, sited as it was at the junction of two major highways. Alternatively, a stable or hay shed, as this would have been the ideal location for such a building. The fact that by 1841 it no longer appeared on any maps would add weight to this latter argument, as by then the flint mill was no longer in operation and the section of tramway to the mill had been removed.

A further indication that this was not a drying area is the lack of evidence produced by the recently completed full geophysical survey of the field (carried out as part of the local authority planning process), which revealed no trace of a tramway or any other structure. What the survey's 2016 follow-up excavation trenches did confirm is that the field was once the site of a Roman settlement: probably an extension to that found nearby at Bryn Cegin.

From the documentary evidence there is little doubt that the flint was shipped out in dry form, and that the drying process did take place on site at Penlan, in which case, where? From contemporary examples, such as Cheddleton Mill, we know that a 'slip' or drying kiln does not need to be large. All that is required is a flat paved bed suspended above a heat source, located close to the settling ark(s). If it was located outside the building it would need to be protected by a roof (Figs. 3.3.89 & 3.3.90). Typically, this would have been located in or adjacent to the actual mill so as to facilitate the transfer of material directly from the settling arks. The ground flint in semi-liquid form would then have been placed on to the bed and allowed to dry as heat was applied to the under-side, the water being dissipated through evaporation. If the slip kiln was located outside the building it would also have needed a chimney to take away the smoke from the oven.

One option to consider is whether this process was in any way connected with the archway and adjacent oven located in between the east wall of the mill and the west wall of the stable (Q4). This is certainly a possibility as it is unlikely that the stable had been built by this stage (something that is discussed later). The oven would have provided the necessary heat source, and it is situated immediately adjacent to the possible site of the settling arks. However, if this was the case then one would expect to see physical evidence of such a structure, and none has been found; although once

²³⁸ Gwynedd X/Plans/RD/39.

²³⁹ BU/Penrhyn ms 26 (Un-Cat).

²⁴⁰ Gwynedd Archive, Llandegai Tithe Map (1841), Sheet 4.

²⁴¹ J. Evans, Op cit, p.454.

again it should be stressed that there has been extensive disturbance and damage to this part of the site, not least when the stable was built and the ground was covered over during its construction.

Before any judgement can be made as to the relevance of these features to the drying process, there are a number of points to consider. First, the archway occupied the full depth of the east wall but did not extend beyond the building line in either direction, to the east or west. Second, as can be seen from the photographs (Figs.3.3.22 & 3.3.23), there was no evidence of it having been subjected to heat and the brickwork is un-marked. Third, while the oven sat directly behind the arch, there is no apparent opening connecting the two, the only visible aperture being to the south side of the oven. Finally, the profile of the arch appears to compliment the remaining section of arched wall in P1 (Fig.3.3.16). These anomalies in the relationship between the archway and the oven raise a number of questions, such as why was the archway built; why was the oven built; why are they positioned adjacent to each other; and were they built at the same time?

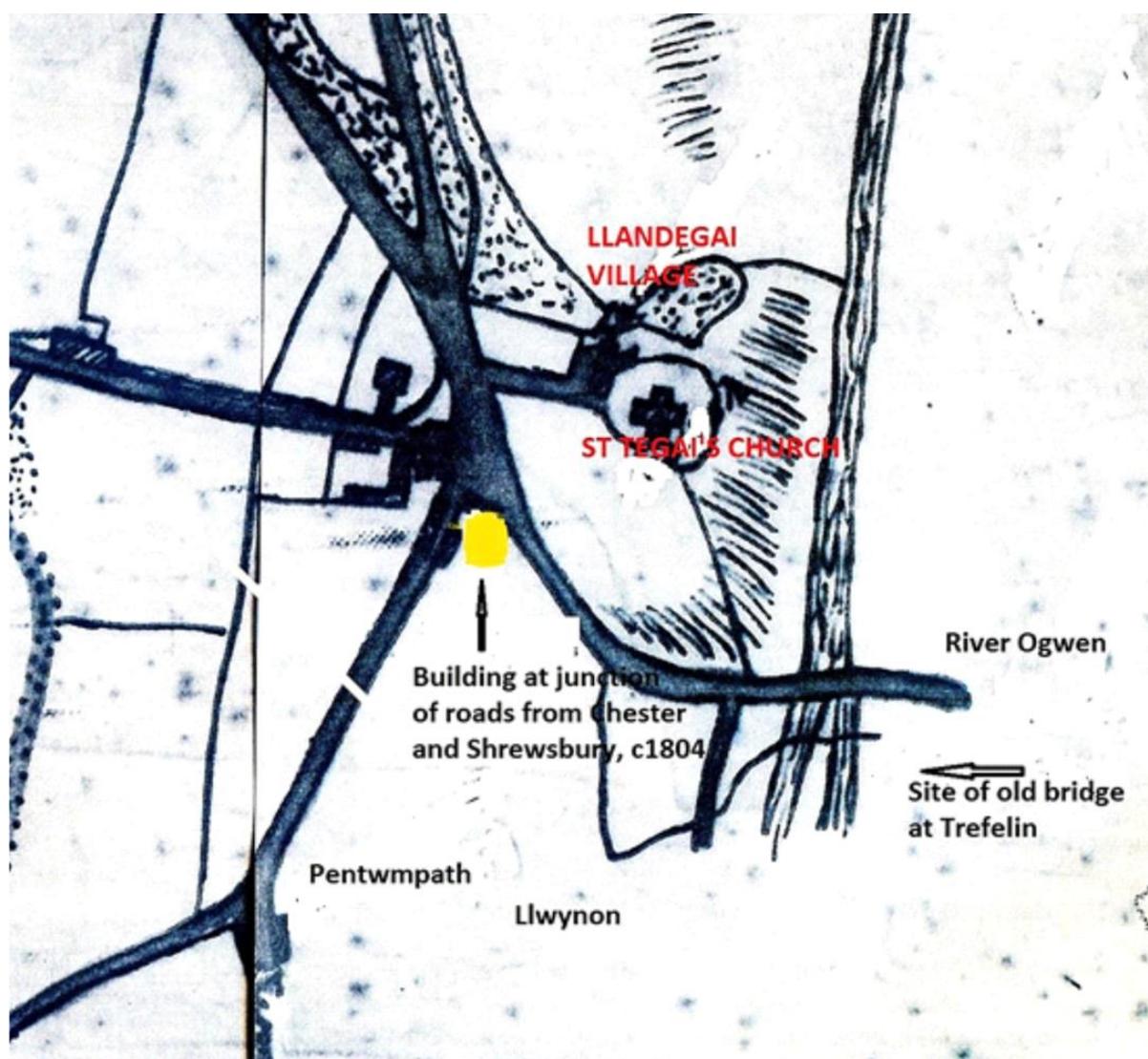


Fig.3.3.111: The shed located at the junction of the Chester and Shrewsbury roads in 1804, prior to the Penrhyn demesne being enclosed.²⁴²

²⁴² Based on Gwynedd/XM/Maps/437/8, Map of the Manor and Demesne Lands of Penrhyn Mawr, 1804.

From the evidence above, it is reasonable to say that there was no direct link between the archway and the oven other than their proximity to each other. The archway formed part of the main east wall of the mill and the oven was an adjunct. Furthermore, the base of the oven sat outside the mill building, in the space between the mill and the stable. Whether or not there was more than one archway in the east wall is impossible to say as there is insufficient remaining material evidence. Because of the query regarding the profile of the arched section of wall in P1 certainly it is a possibility. However, if this was the case, why? There are two possibilities: either it was for decoration or for light, although certainly not for structural reasons. If it was for decoration, then why? The mill was erected solely as an industrial building and did not have any sort of dual purpose. Furthermore, why was it on the east wall that was only visible from one side? Materials were delivered to the mill from the west side, Mr Worthington's house at Llwynon was on the north side, and the path to the leat tunnel was on the south side. The east side faced the river and Felin Isaf, both of which lay down-slope.

If the purpose of the archway(s) was to provide light, why use such an elaborate method for doing so? In an industrial building of this sort surely regular-shaped square or rectangular windows would have been more appropriate? Furthermore, from the brief opportunity that was afforded to examine the archway prior to its demolition, there was no evidence of window frames or glazing bars having been affixed to it. A small piece of what appears to be a window frame was found but it is likely that this came from the smaller arch in P1.

One other possibility is that there were one or more arched doorways in the east wall, even though there were already two doorways in the adjoining north wall, one for pedestrians and the other for carts. This raises the question of why would it be necessary or desirable to provide access to the mill from the east side as the ground below it sloped away from the building? The only possible reason for this would be if the slip kilns were located on this side of the building. However, if it was a doorway then again, why was it so elaborate? The simple answer to this is that based on all of the foregoing it is not really possible to say with any certainty why the archway was constructed, although it would seem that the only practical reason would be as a doorway.

The location of the oven is equally puzzling, particularly as it has been built in front of the archway, that to a large degree it obscures. The fact that it does obscure it would seem to indicate that the oven was built sometime later than the flint mill, possibly at the same time that it was converted to a grist mill in around 1835. Alternatively, it could have been built at the same time as the stable, which possibly was some time later. Assuming that it was built sometime after the flint mill, it would have been too late to be part of the flint-drying process. Also, it possibly is too small and in the wrong place to have been connected with drying grain for the grist mill (see Section 3.4).

If there was a slip kiln (and Evans refers to '*divers reservoirs*'), the most likely location would have been adjacent to either the north or east wall. Even though the north wall contains two doorways (one for carts and the other pedestrians), as the slip kiln does not necessarily occupy a large area possibly there would still have been sufficient space between them. Coupled with this is the fact that at this stage the warehouse extension had not yet been built. It could not have been located on the west or south side of the mill, these being the embankment wall and water wheel pit respectively. The east wall is certainly a possibility as there was no other building close by, and the area in N&O 1&2 perhaps may have been the site of a settling ark (Figs.3.3.64 to 3.3.67). As can be seen from the site plans, a drainage pipe runs from this pit to a point where it crosses with an underground drainage

channel in R4/5 (see Section 5.6). Whether this underground channel originally extended as far as the east wall is not clear, as today it abuts the base of stable wall (the stable having been added later).

One advantage of having a slip kiln adjacent to the east wall would be its proximity to a settling ark, hence less distance to pump the slop material between the two. The fact that the ground to this side of the mill slopes downward would be a further advantage as it would facilitate the flow of material. To have a slip kiln located further away from the mill, whether to the east or the north, would have created handling problems; particularly as the slop from the settling ark usually is pumped directly into the kiln.

Another possibility is that the slip kiln was located inside the building and on the ground floor. Certainly, this would have been an ideal position because of its proximity to the settling ark and the main entrance to the mill, and being close to the exit doors would have reduced the amount of handling of the finished product. The only potential problem with this is that the ground floor would have housed the gear room.

Based on the evidence currently available it would appear that the most likely position for the slip kiln(s) would have been outside the mill building, located adjacent to the east wall near the south east corner. The fact that there may have been one or more doorways adjacent would only have been a bonus. The location of the oven in front of the archway is an irrelevance as undoubtedly it was built far later.

Items found on site

Among the large number of items that were found during the course of excavation only a small number were identifiable as possibly having come from the original flint mill. These comprise:

- A large metal 'key' or spanner, possibly for operating the sluices that controlled the water to the leat and/or head race; or for the heavy-duty nuts securing the machinery. It has been removed to Cochwillan Mill for exhibition and safe keeping. (10/16/001)
- Some lengths of heavy-duty chain. (05/08/001) (09/12/001) (GRP31/001) While these are listed as possibly being attributable to Phase 1 of the development, according to James Boyd wrought iron chains were generally not used in North Wales until much later, possibly after 1840.²⁴³
- The hook from a lifting hoist. (10/046/001)
- Part of a hoist assembly. (GRP31/006)
- A large doorstay with a round head at one end and hook at the other. (GRP29/001)
- Pieces of wire rope of various thickness. (10/04/001-002) (10/MISC/007) (GRP11/003) (GRP35/010)
- Parts from line shaft mountings. (06/06/007) (06/10/001) (09/10/001)
- A small length of rounded slate ridge tile. (11/007/001)
- A number of metal wedges, as used for packing and adjusting wheel shafts. (06/20/007) (09/14/010) (09/15/003) (09/15/011) (M/MISC/013)
- Three of these were found in the cog wheel pit at E1.
- Numerous very large bolts, plus iron nails of various descriptions were also found.

²⁴³ J.I.C. Boyd, *Op cit*, p.26.

All of the above items are detailed in Section 8, 'Finds', categorised by material type.

Conclusion

Having determined what activities would have taken place, and based on both the documentary and material evidence that is available, it is likely that the processing that took place at or in connection with Penlan Mill during Phase 1 of its existence, 1798-1829, was as follows.

From the documentary evidence it would seem that having been shipped as ballast for the returning slate ships the raw flint was transported to the mill via the horse-drawn tramway, following which it was calcined in a kiln located on the site at Penlan. It was then unloaded into the mill building through the chute that sits above the west wall (in A7), and then raised by a hoist into the grinding pans. We do not know exactly how many pans there were but possibly four. Based on the comparative size of the water wheels with those at Cheddleton, each of which produced approximately the same horse power as those at Penlan, more likely it was two. There is no evidence to indicate whether or not the flint was mechanically crushed before being put into the grinding pan, although the likelihood is that it was not. In all probability, where flint nodules needed to be reduced this was done using a sledge hammer, as was common practice at that time.

From the position of the four small limestone blocks that are aligned west to east across the ground floor of the building (in row 'C') it would seem that they were to locate columns that gave additional support to the floors above, this being necessary due to the weight of the grinding pans when they were in operation

The hoist would have been powered by a horizontal shaft that was connected by means of a vertically-mounted cog which meshed with a horizontally-mounted crown wheel. The crown wheel was connected to a large vertical shaft that passed through the grinding pan and all the way down to a large mounting block on the ground floor, where it would have rested on an end-plate known as a toe step. This in turn was fixed to a very large mounting block. Attached to the shaft was a large horizontally-mounted cog known as the wallower, which in turn was connected to the vertically-mounted pit wheel that was driven by the axle from one of the water wheels. If the machinery was not in use the wallower would have been disengaged from the drive shaft by means of a spline in the toe plate.

Although several items were found on site that indicate that a line shaft with attendant belt-driven pulley wheels were in use, it is thought that these would have been installed at some later date, possibly during or after the conversion to a grist mill in around 1835. Prior to this possibly the gearing requirements would have been simpler, and the use of inter-connected cog wheels would have been sufficient to drive the machinery.

Nothing remains of the machinery, but it is likely that the toe step(s) were mounted on the large limestone blocks located in F-G3 and F-G6, facing the opening in the south wall to the water wheel pit. The fact that there are two blocks could indicate that there were two drive shafts, both driven by the same water wheel; alternatively, that there was only one vertical shaft directly connected to the water wheel, but with a second shaft being driven by means of additional horizontal shafting and gears. Either of these scenarios would have enabled two grinding pans to be driven by a single water

wheel. As a caveat to this, at Cheddleton only one pan is driven by a wheel of very similar size and with the same estimated power output, i.e. 48hp.

The water required for the grinding pans would have entered the mill via the chute in the west wall (A2), before it was pumped up to the second floor. As the openings from the chute is 1.76m above ground level, and as the grinding pans were approximately 5-6m above ground level, then it is likely that the water had first to be stored in some sort of reservoir. Either this could have been a wooden tub located on the ground floor, or possibly it could have been the otherwise unexplained underground chamber that lies in close proximity to the chute (B-C 1&2). This latter option could make sense as there is the suggestion of a drainage channel emanating from the north-east corner of the chamber, and this is in line with the drainage pipe from the pit in the south-east corner of the mill (P2). Without taking up the floor it is impossible to say.

Once the flint had been sufficiently ground the plug in the side of the pan would have been removed and the material, in semi-liquid form, run off into the wash tub situated on the floor below. The large amount of additional water that would have been required in the wash tub either could have been pumped from the reservoir or fed directly from the chute adjacent to the west wall. Having been suitably agitated in the wash tub the resulting material would have been run off into a settling ark, where it naturally separated into the three different grades: coarse, intermediate and fine. The plugs in the side of the ark would then have been progressively removed allowing the fine top layer to drain away and the intermediate layer to be pumped out onto the drying kiln floor. The heavy coarse grains remaining in the settling ark would have been pumped back up to the grinding pan where they would have been mixed with a fresh batch of un-ground flint ready for the process to be repeated.

The material in the 'slip' or drying kiln would then have been heated until all of the unwanted moisture had been removed, and the dry flint packed into casks for shipment to the pottery in Liverpool, the return journey to the port being via the horse-drawn tramway. A schematic diagram illustrating the grinding process is shown below (Fig.3.3.112).

One question that it is not answered is why there is no evidence of at least one large mounting block for a toe step in front of the second wheel pit. There is no evidence in the floor surface of one having been located there, or of one being subsequently removed. The questions that then arise are (a) what was the purpose of the second water wheel, particularly as it was of equal size to the first, and (b) how was the power from this second wheel transmitted?

If we accept there have been two water wheels from the outset, and the documentary evidence seems overwhelmingly to confirm that this was the case, then it is possible that either the second wheel was not needed for grinding the flint; or if it was, then the power train was connected by some alternative method.

If the second wheel was not needed for grinding flint, then what else was it for? The colours were ground in the paint mill at Felin Isaf, and the timber saw mill was located there too. Possibly it provided a back-up in the event of the first wheel being out of commission, although it is highly improbable that such contingencies were catered for, particularly in view of the cost involved. Alternatively, it may have been used to drive some form of mechanical crusher, although the use of such a device has to some extent already been discounted. The third option is that it was used for grinding flint, but with the power being transferred by means of cogs attached to the metal housing set into the south wall

(G0). If this was the case, then the toe step for the vertical drive shaft could have been mounted on the large stone block in H2. There is also an access pit (AP5) adjacent to the remains of a stone block in J3, which would tend to indicate that machinery was mounted on this also. There is a further possibility, which is that the mounting block was made of wood rather than stone, in which case there would not necessarily be any remaining evidence.

Although none of the above scenarios offer any conclusive evidence it is likely that the second wheel could have been used in the same way as the first, i.e. for grinding flint, but with the power being delivered through an alternative gearing arrangement.

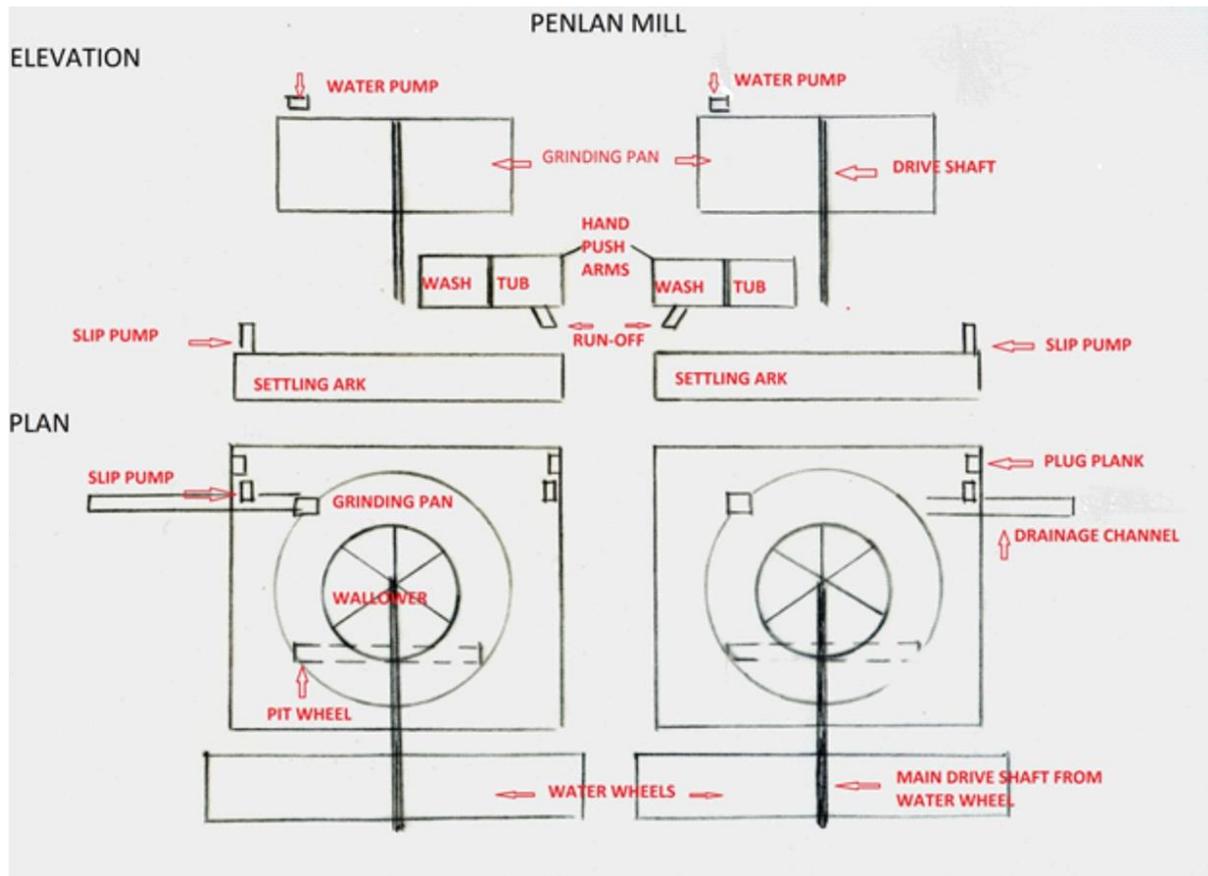


Fig.3.3.112: Schematic of the flint grinding process.²⁴⁴

3.4. Conversion to a corn mill (Phase 2)

From the documentary record we know that sometime after the departure from Llandegai of Samuel Worthington and his sons the flint mill became redundant and remained 'In Hand' to the Penrhyn Estate until November 1835, when it was taken over as a corn mill by Griffith Thomas. We also know that in the intervening period the building had been converted to meet its new purpose. Some idea of what this entailed can be gleaned from Mr Baxter's letter of 11th May 1823 to George Hay Dawkins-Pennant (see Section 2.1), in which he mentions the need for new machinery and to increase the height of the building, possibly by two additional floors. While the need to instal new machinery is self-evident the need to increase the height of the building is not, as both flint mills and corn mills

²⁴⁴ Based on a sketch produced by Mr Ted Royle, Op cit.

work in a very similar way. Furthermore, there is no conclusive evidence that the building has been extended upwards and it is probably safe to assume that the main structure of the building remained essentially unaltered. As a rider to this, possibly the roof space was increased to facilitate storage of the grain as it arrived at the site.

How Corn Mills Work

Water-powered corn mills have been in existence for over 2000 years and throughout time the basic principles of milling have remained largely unaltered.²⁴⁵ Typically the grain is first dried and then cleaned by means of a brushing machine before being fed between a pair of horizontal millstones. These always work in pairs with the lower, the bedstone, being static, and the upper, or runner stone, rotating above it. The milling faces on both stones are 'dressed' or shaped in order to facilitate the movement of the grain toward the periphery. The grain is fed from a hopper that sits above the stones, with the grain entering between them through a central hole or 'eye' in the runner stone. The ground grain spills out from the edges of the stones and is collected in a surrounding wooden case (sometimes known as a 'vat' or 'tun'), from where it falls via a chute into a meal bin or 'ark' on the ground floor below: in some mills straight into sacks. Often it will pass through a series of sieves on the way, depending on the fineness required. As with a flint mill, there is a requirement for the means of importing the raw material, in this case the grain; for storing it, if necessary; and for removing the finished product from the mill and transporting it.

In the case of both flint mills and corn mills the process is essentially gravity fed, with the prepared material being ground on the first floor of the mill, and then descending via chutes to the next stage of processing. There is an exception to this in the case of corn mills where the brushing process is often carried out on the ground floor. Usually the material that is to be ground is lifted to the upper storey by means of a hoist; although where the mill is built into a slope it can be introduced directly to the top floor of the building. Likewise, they share a common requirement for power, whether provided by wind, water, steam or electricity. The power is transmitted throughout the building via a system of drive wheels and gears or cogs; these being connected by means of line shafts that can be in either the vertical or horizontal plane. Power is applied to any particular shaft by means of cogs and/or belts, which are attached via pulleys.

In the case of water-driven corn mills the typical arrangement that developed in the seventeenth century was based on the three-floor plan. Grain was stored on the upper floor, the cleaning, milling and dressing was carried out on the middle floor, with bagging taking place on the ground floor. Because of the weight of the stones and the pressure they exerted the load was distributed by means of a stout wooden frame known as a Hurst, which generally extended between the ground and first floors.²⁴⁶ One fundamental difference between a grist mill and a flint mill is that before milling can take place the grain needs to be dried, to which end a drying floor would need to be installed (see below).

In terms of Penlan Mill, during its early period as a corn mill, 1836-59, the corn would have been brought to the mill by horse and cart, the tramway by then having been dismantled. After being dried, typically on the first floor, above the kiln, it would have descended via a chute to the ground floor,

²⁴⁵ Martin Watts, *The Archaeology of Mills & Milling*, (Stroud, 2002), p. 47.

²⁴⁶ *Ibid*, p.141.

where it was gathered in sacks. These would then have been hoisted back up to the milling floor where the grain was placed into the hopper(s), before being fed to the millstones. The milled corn would then have descended, by gravity, through a series of sieves (depending on the quality required) before being deposited into sacks or a meal bin on the floor below. The flour (or meal if animal feed) would then either have been lifted via a powered hoist back up to the top floor ready for onward distribution; alternatively shipped out through the main doors on the ground floor.

From 1852 onwards, after the warehouse and link to the railway siding had been completed, it is likely that some of the initial working practices would have changed. Either the grain could have continued to be brought into the mill still using the original chute, or via the newly built chute in the warehouse extension (A13-17). As imported grain from the Dominions became more popular it would have been brought in by rail, transferring from the private Penlan siding into the mill via the recently constructed bridgeway that connected it to the mill. The ground grain/meal would then have been hoisted back up to the top floor from where it was sent for delivery using a horse-drawn cart.

It is likely that the construction of an extension in the upper yard in 1885 would also have affected the method of working, in that to some degree it may have restricted access to the chutes. Unfortunately, as much of the milling process was carried out on the upper floors, which were removed during the course of demolition, there is nothing left to mark exactly where the machinery was located. Only one clue remains, which is a hole through the dividing wall between the mill and warehouse, of sufficient size to accommodate a horizontal line shaft, possibly for operating a hoist (B9). From its position relative to the floor joists it would appear that the shaft ran at or near ceiling height (Fig.3.3.37).

Based on the above the features that needed to be present at Penlan were:

- A means for transporting the grain
- A drying kiln
- A means for lifting the grain between floors
- A milling facility

The evidence at Penlan Mill

We know that originally Penlan Mill was built to grind flint, only being converted to a corn mill in the early to mid-1830s. As generally most types of mill operate in the same way, the main part of the conversion would have been to remove the flint grinding pans and replace them with millstones; also, to alter the gearing. It is not thought that the building was fundamentally altered during this period, with the overall dimensions remaining the same and the number of water wheels remaining at two. Little is left in the material record, although some small pieces of equipment were found during excavation of the site, and these are listed below.

- Numerous fragments of leather drive belts. (09/15/005-007), (09/15/033) (10/13/004)
- A large belt-shifting tool used for engaging/dis-engaging belts across pulleys. (11/049/001) (It has been removed to Cochwillan Mill for exhibition and safe-keeping)
- The hub of a pulley wheel with some of the arms attached. (06/10/003) (10/67/013)
- Several pieces from the outer edge of pulley wheels. (06/10/004) (09/10/007) (10/66/001)
- A length of round metal shafting with the hub and part of the arms of a pulley wheel attached. (09/10/010)

- A 'worm' for moving grain. It is 2.25m long with a 9.5cm diameter wooden shaft, has 19 metal blades set 12cm apart, and a metal cap at one end of the shaft. It has been removed to Cochwillan Mill for exhibition and safe keeping. (05/18/001)
- A number of small buckets from a grain elevator, with one end rounded. (GRP9/012) GRP29/006) (GRP34/004)
- A small bucket from a grain elevator, with both ends square. (GRP9/001)
- Several pieces of honeycomb tile from a grain drying floor. (11/57/022) (11/61/001) (11/62/001) (11/62/002) (GRP7/003)
- Some fragments of different sized meshes from sieving devices. (06/06/001) (06/06/002) (GRP9/007) (M/MISC/011)

Fortunately, there are also documentary records from 1883 that provide further information, such as the number and size of various driving shafts, the type of millstones that were fitted, etc.²⁴⁷ These comprised:

2	Water wheels 20' diameter x 6' breast
2	Pit wheels
2	Crowns
2	Upright shafts
2	Spur wheel ten nuts
4	Pairs of French stones
4	Pairs of Anglesey stones
2	Old wire + 1 silk dressing machines
2	Upright shafts, 1 off 25' x 2 ¼ inches square, and 1 off 13' x 2 inch square
8	Stone spindles complete
1	Top layering shaft about 18' long x 2 inches square with mitre wheels and 4 pulleys
1	Cross shaft in upper loft 8' long x 2 inches square
30 ft	Worm to shift grain
20 ft	Worm to shift flour
1	Elevator
2	Hoists with gearing
1	Shaft in cellar floor 10' x 2 inches square
1	Barley wire dressing machine

Where was the grain dried?

Typically, the grain is dried on a purpose-built drying floor which is supported by pillars, and which is heated by a kiln or oven located immediately beneath it. Generally, the kilns are fairly large structures and together with the drying floor form what essentially is a form of hypocaust (Figs.3.4.1 & 3.4.2). The pillars can be brick, slate, or even metal. Typically, the drying floor comprises a large number of flat tiles that have a honeycomb surface to the underside, and a pattern of very small round holes on the top surface (Fig.3.4.3). The tiles are supported on a metal frame, with the heated air being circulated to the underside. As the type of kiln required for heating a grain-drying floor is fundamentally different to that used for calcining flint, a completely new kiln would have been required.

Generally, the drying floor is usually located on the first floor of the building, with the oven or hearth on the ground floor. First the grain is spread over the surface of the floor, usually several inches deep,

²⁴⁷ BU/PFA/2/59 Lease of 10th December 1883.

and every hour it is moved around the floor with a shovel to ensure an even distribution of heat. Typically, the drying process is completed in twelve hours, after which time the grain is ready for milling.

A number of drying tiles were found on site at Penlan and these have been identified as type 9D/8+7A=106 that were manufactured in Buckley, Flintshire. To date the only other site locally where this type of tile has been found is Cochwillan Mill at Tal y Bont, which is less than half a mile from Penlan.²⁴⁸ Both mills were owned by the Penrhyn Estate and are from roughly the same era.



Fig.3.4.1 (left): The oat drying kiln at Felin Isaf, Glan Conwy, with the oven to the front side and the drying floor directly above. (2015)²⁴⁹

Fig.3.4.2 (right): Part of the drying floor at Felin Isaf, Glan Conwy, showing the brick support columns and metal frame. (2015)

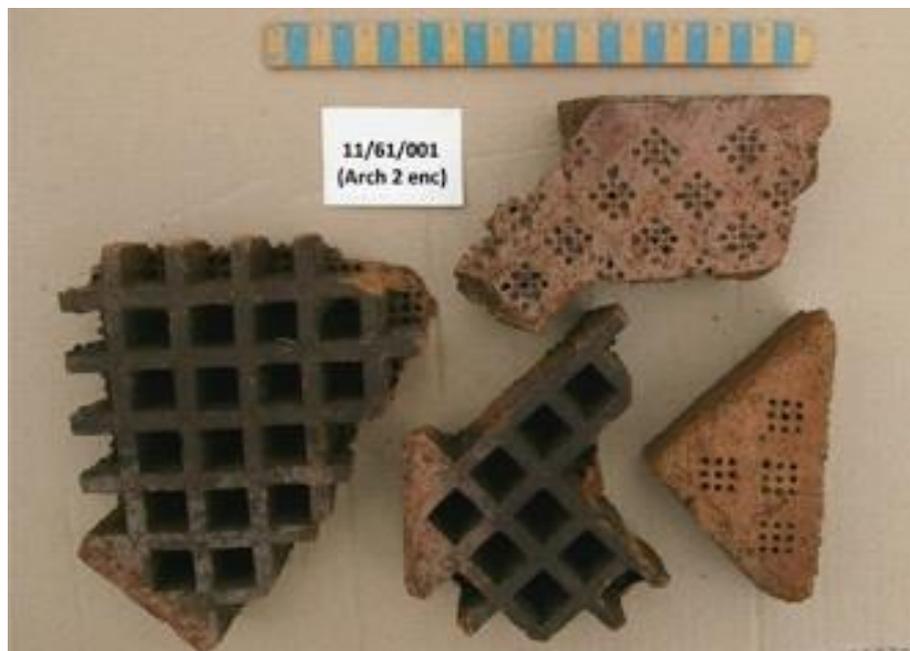


Fig.3.4.3: Pieces of tile from the drying floor at Penlan Mill. The honeycomb underside of the tiles shows evidence of heat having been applied.

²⁴⁸ Correspondence with Peter Crew dated 25th November 2015.

²⁴⁹ Figs.3.4.1 & 3.4.2 By kind permission of Mr David Manton, Felin Isaf Mill, Glan Conwy.

As drying the grain is the first part of the milling process it seems likely that the kiln would have been located near the point at which the grain first enters the mill. In the case of Penlan Mill this would either have been the chute above the west wall, or the main doorway in the north wall. While there is nothing to suggest that Penlan was in any way different from the norm there is no evidence, material or documentary, to indicate where the kiln and drying floor may have been located; although we know from the presence of the floor tiles that the grain was dried on site.

The absence of the actual drying floor is to be expected as it would have been removed during demolition of the site. Nonetheless it would be reasonable to assume that there should be some evidence of where the hypocaust's support columns may have been, irrespective of the material from which they were constructed, and there is none. Similarly, it would be reasonable to suppose that there should be some evidence of where the kiln and oven stood. Together they would have formed a large and heavy structure that was subjected to heat, and presumably some marks would have been left on the surface of the floor. Again, none were found.

The most likely answer for this lack of evidence within the main building is that the drying process was carried out elsewhere. Certainly, it is not unprecedented for the drying kiln to be located outside the main building, some local examples being Felin Isaf Mill in Glan Conwy; Melin Tyddyn Du and Melin Tan y Bwlch, both in Maentwrog. This practice seems to have been widespread as there are examples as far apart as Melin Bompren near Cardiff and Preston Watermill at East Linton, East Lothian. In the case of nearby Cochwillan Mill the drying kiln is located in a separate building that abutts the main mill. Internally it measures 17 feet in length and 14 feet in width. Like the kiln at Felin Isaf it is funnel-shaped with the drying floor above, and has a hearth that runs through the centre, open at both ends. In both mills, there is a walkway around all four sides. Because of the warmth and privacy they provided, the kilns were often a popular rendezvous for courting couples!

Assuming that the kiln was outside the main body of the mill, then the question that arises is where it was located; particularly as there is no stand-alone structure shown on any of the site plans or listed in the documentation. Initially it had been thought that the oven attached to the east wall may have formed part of the drying process but its proximity to the stable and (possible) arched doorway would seem to preclude this; particularly as a working kiln would have been required from inception and throughout the corn mill's working life. Furthermore, the stable was built at approximately the same time as the mill conversion took place.

A more practicable location would have been to the north side as there was adequate space in that area. Also, it was close to the west wall which, as it was a 'bank mill', would have facilitated easy handling of the grain. When the warehouse extension was built (Phase 4, Section 3.6) the kiln could have been incorporated within it: its proximity to the newly created chute and railway siding being positive advantages. The 1852 lease agreement between the Penrhyn Estate and the Evans Brothers perhaps may add some credence to this, as apart from the lessees building the branch railway and siding, it also states that they were to '*complete within the mill a partition*'; perhaps indicating that this was to encase the kiln and protect the remaining storage area. A further possibility is that the kiln was located in the upper yard, above the west wall, as this too would have provided easy access to the loading chute. However, this is unlikely as there is no mention in any of the documentation regarding its relocation when the later extensions were built.

Where was the grain milled?

When in 1980 Mrs Llewellyn and her students carried out their recording exercise they uncovered one of the original millstones, which she describes as being late 19th Century (1871) and originating from Liverpool. It had four balance pockets, which was a system patented by Henry Clarke and William Dunham of 48 Mark Lane, London. In this type of stone weights were installed in the wheels in vertical holes spaced at 90-degree intervals. The height of each stack of weights was adjustable by a screw, by which means the wheel could be made to rotate in balance and without wobble. Typically, the holes were covered by plates showing the patent date of 1859. The partnership dissolved by mutual consent in 1868, although William Dunham continued the business while retaining the partnership's name.²⁵⁰

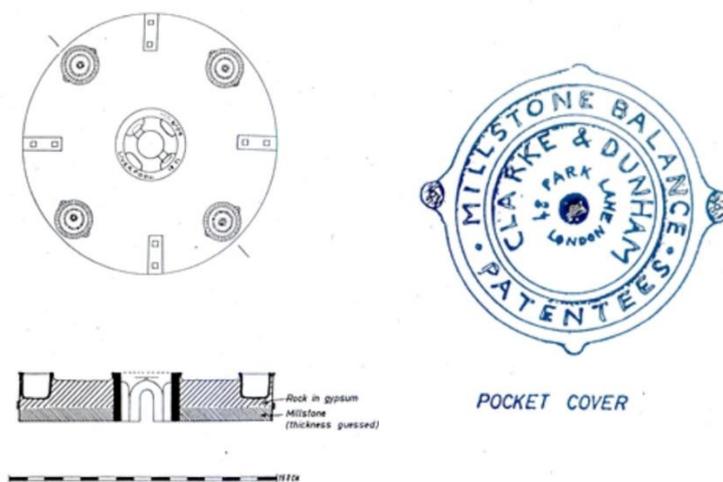


Fig.3.4.4 (left): Plan and elevation of the millstone found at Penlan Mill in 1980.²⁵¹

Fig.3.4.5 (right): The pocket cover.



Fig.3.4.6: The millstone found on site at Penlan Mill in 1980.²⁵²

²⁵⁰ http://www.gracesguide.co.uk/Clarke_and_Dunham

²⁵¹ Figs.3.4.4 & 3.4.5 F. Llewellyn, PRN 6387, Op cit.

²⁵² Courtesy of the RCAHMW.

In 2006 the stone was still on site in the upper yard, covered by undergrowth. It appears that subsequently it may have been removed when the yard was cleared, although alternatively it may still be there but inaccessible due to the extensive shrubbery that has been planted. The drawings of the stone which Mrs Llewelyn completed in 1980 are included above (Figs.3.4.4 & 3.4.5), together with a contemporary photograph (Fig.3.4.6).

From the inventory of 1883 we know that there were 8 pairs of millstones, four French and four Anglesey, although we don't know whether all of them were in use at the same time. Based on the drawings and photograph it is likely that the stone found on site was one of the French stones (also known as 'burrs'). These generally were shipped from the Paris basin in blocks, often as ballast. The blocks were fitted together within wrought iron hoops and backed with Plaster of Paris, the work being carried out by millwrights or specialist makers.²⁵³ The fact that it had balance pockets in the top surface would also indicate that it was a runner stone.

One important feature that is common to most corn mills is the sturdy timber frame that bears the weight of the millstones and, in many cases, encloses some of the gearing. Typically, these are known as Hurst Frames, and they are designed to withstand both the weight and vibration from the mill machinery. These forces are taken down to the ground and into cill beams or metal pads beneath the feet of the corner or bridge posts. In spite of these being such large and sturdy structures no evidence of such a frame was found on the site, the timber either having been salvaged for re-use, or rotted away. Apart from one large beam (05/18/002) that very quickly rotted once exposed to the elements, and some small miscellaneous pieces of timber, no other timbers were found on site.

3.5. The Stable (Phase 3)

What remains of the stable lies to the east side of the mill and at a slightly lower level, reflecting the fact that the site is built on a slope. Like both parts of the mill it is a rectangular structure that externally measures 15.2m north to south and 7.0m east to west. There has been considerable disturbance to the site over the years and there is very little of the original structure remaining. The footings to most of the north and half of the east wall are still in evidence, although there are only two very small sections of standing wall remaining, these being the south west corner and the west wall: this latter being adjacent to the former archway in the inner mill. From these remains it would appear that it was constructed from stone, which is in keeping with other Penrhyn stables in the area but in complete contrast to the mill itself. All of the walls are 60cm in width.

Mid-way along the east wall in W/X4-5 there is what appears to be a doorway, sufficiently wide to provide access for a horse. The opening is 1.4m wide and what remains of the slate threshold is 34cm in width (Fig.3.5.1). This compares with the stable doorway at Glan y Mor Isaf Farm (Glan y Mor) which is 1.05m wide. There are only two small areas of the floor surface still intact; those in the north east and south west corners being brick. The remaining floor area adjacent to the north wall is cobbled which again is in common with other Penrhyn stables; an example being the floor at Glan y Mor which is from the same period (Fig.3.5.2). There is no remaining evidence of either the southern half of the east wall or the south wall.

²⁵³ Martin Watts, *Op cit*, p.143.

Based on data extrapolated from the stable at Glan y Mor it is estimated that it would have stabled a minimum of eight draught horses, each having a stall 1.7m wide by 2.6m deep located along the stable's west wall.²⁵⁴ It is conceivable that up to a further seven horses could have been stabled assuming they were stalled along the east wall, although this is thought to be unlikely.

In the northwest corner at R9 there is a modern manhole that is directly linked to that in the outer mill at B13-14. Again, there has been a good deal of ground disturbance as a result of this being installed, particularly as it links to the nearby sewage filter bed. No doubt it was during this work that the walls and much of the remaining floor were destroyed.

Immediately adjacent to the outside of the north wall in P-T12-13 are the brick footings of a small rectangular structure that measures 3.3m east to west and 1.03m north to south. There is no evidence of an entrance although it could have been at the west end, which has been demolished. Alternatively, or perhaps additionally, there could have been an entrance from inside the stable itself. There is nothing to suggest what this structure may have been, although based on its size and location it is likely to have been a tack or harness room.

The front of the stable, to the east side, opens on to a cobbled surface which during initial excavation was thought to be a yard area, but has now been identified as 'Occupation' Road (see Section 5.2). Today this abuts the modern sewage filter bed which is located on what previously had been the stable's manure pit, dating back as far as 1871 and beyond.²⁵⁵



Fig.3.5.1 (left): The slate threshold in W/X 4 & 5. (2011)

Fig.3.5.2 (right): An example of a typical Penrhyn cobbled stable floor from the mid-1840s.

This particular floor, which is at Glan y Mor Isaf, has been pointed.²⁵⁶ (2015)

When the stable was built is somewhat problematic, although it is unlikely that it was at the same time as the mill (see Section 2). This is based on the location of the underground waterways that run beneath the site, and in particular beneath the 1852 warehouse extension and the stable. This is discussed elsewhere (see Section 5), but in essence they comprise large semi-round brick-built tunnels and smaller slate-built channels, the tunnels running directly beneath the area of the stable floor. It would not have been possible to construct these without first demolishing part of the stable walls, or

²⁵⁴ The stable at Glan y Mor Isaf Farm measures 10.65m long by 5.0m wide, and the doorway is 1.05m wide. The stalls measure 1.7m wide by 2.6m deep.

²⁵⁵ Unreferenced plan of the Penlan Siding boundary produced by the L & NW Railway.

²⁵⁶ By kind permission of Mr David C. Pritchard.

at the very least severely undermining and destabilising them. When the tunnels were constructed is not known either. One of the tunnels forms the tail race from the water wheel pit, which in turn feeds into the spillway. It is connected to another tunnel which carries water from a culvert running parallel to the mainline railway.



Fig.3.5.3: The stable area and cobbled road viewed from the north, with the possible harness room in the foreground. (2012)

The only reference to the construction of a stable is contained in a Memorandum of Agreement that was signed on 12th September 1823, between George Hay Dawkins-Pennant and Samuel Worthington, giving Worthington permission to build a stable on the lower yard at Llwynon '*in the situation shown on the attached plan [of which no copy is available], as agreed upon between Samuel Worthington, James Wyatt, and Mr William Baxter*'. No rent was to be paid for the stable as the the cost involved, £120, was being funded directly by Worthington.²⁵⁷

What was meant by 'the lower yard at Llwynon' is a matter for conjecture. At that time the Chester and Holyhead Railway had not been built, and both the lower yard at Trefelin (Felin Isaf) and Penlan Mill lay below Llwynon: to all intents and purposes it was a single entity. From a plan dated c1844 (Fig.7.1.9) we know that there were stables along the west wall of the Felin Isaf site, and from a plan dated 1918 (Fig.7.1.8) we know that there were also two lots of stables ranged along the north side of the site. Whether either of these was the result of the 1823 agreement, or whether it was the stable at Penlan, we do not know. What is of interest is the location of the stable in relation to the cobbled surface of 'Occupation' Road. This is discussed in Section 5.2.

²⁵⁷ BU/PFA/12/16.

3.6. The warehouse and siding (Phase 4)

Also referred to as the outer mill area, the warehouse extension is rectangular and internally measures 16.4 metres east to west, and 9.1 metres north to south. It lies immediately adjacent to the north side of the inner mill occupying grids A-P 9-18, and together they form a contiguous structure (Fig.3.6.1). From the documentary record we now know that this outer area, together with the mainline railway siding, was added in 1852; approximately fifty-four years after the original flint mill was built. All that remains standing is a part of the west wall, which is constructed from brick and stone, abuts the embankment, and stands immediately below the upper yard.

In front of the brick wall, in B9-12, there is stone revetment that protrudes one metre from the embankment wall (Figs.3.6.2 & 3.6.3). The back surface is thirty centimetres wide, flat, and is constructed from brick covered in mortar. The centre section is approximately forty centimetres wide, slopes downwards, and is constructed from mortar over rough brick and stone (Fig.3.6.4). To the top right-hand side of the revetment there is an aperture 21cm wide and 32cm tall that extends for 20cm into the brick wall (B11). Some small pieces of timber were recovered from here, suggesting that it once housed a floor joist. At the front the average height of this section is 2.15m and at the rear 2.5m, giving some indication of the ceiling height.

Sitting above the wall in A13-17 is what looks to have been a chute, possibly for loading/unloading materials between the upper yard and the first floor of the mill; or between the upper yard and railway wagons brought across from the siding. The wall at this point is three bricks wide (Figs. 3.6.2 & 3.6.5). The side walls of the chute are constructed from dressed stone, with the north side being part of the high outer wall that runs parallel to the inclined track leading up to Penlan Mill Cottage and the upper yard (formerly part of 'Occupation' Road). The south wall of the chute tapers inward with the end furthest from the mill wall being narrower; although as it was not possible to remove the large roots and tree stumps from within this area it has not been possible to fully ascertain accurate dimensions. Projecting at a right angle from this wall, below surface level, is a broken section of vitreous clay pipe that prior to the sewage pipe being installed possibly fed into the cast iron pipe that ran to Trefelin (Figs.3.6.6 and 3.6.7). It is likely that originally the bottom surface of the chute had a sloping wooden base.



Fig.3.6.1 (left): The inner mill is to the left and the outer mill to the right.

The chute is located top right, immediately below the cottage. The stable area is in the foreground. (2011)

Fig.3.6.2 (right): The revetment to the west wall of the outer mill.

The chute is at top right, beneath the foliage. (2010)



Fig.3.6.3 (left): Side view of the stone revetment showing the location of the joists in the central (south) wall (2010)

Fig.3.6.4 (right): Top surface of the stone revetment to the west wall in A9-11. (2010)



Fig.3.6.5 (left): The Chute above the embankment wall in A12-13. The descending pipe feeding into the manhole is encased in concrete. (2010)

Fig.3.6.6 (right): The junction of the iron and clay pipes. (2010)



Fig.3.6.7: The iron pipe feeding from the upper yard to the manhole. At this point the pipe is 1.85m above the base of the chute. The end of the clay pipe is visible to the left. (2010)

The dividing wall in A-09 forms the north wall of the inner mill (the flint mill) and the south wall of the outer mill (the warehouse extension). Only the base level of the east and north walls remains, both constructed from red brick (see Section 3.3 for detail). In the north wall of the outer mill in J-K18 there is a double-width slate threshold that is directly in line with the entrance to the inner mill that lies in I-L8 (Fig.3.6.8). All of the visible brickwork is contiguous and, as with all other parts of the mill, laid as English Garden Bond. Where loose bricks have been found they are flat on both sides. In P18 the external north-east corner of the mill wall is chamfered to 45 degrees, possibly to facilitate passage for horse-drawn wagons between the mill and the railway embankment (Fig.3.6.9). What appears to have been a slate path runs alongside the wall at this point and leads to the rear of the stable (Fig.3.6.10). The south and east walls are 60cm wide while the north wall is 49cm wide for most of its length (from the chamfered corner), but only 23cm wide for the last two metres at its west end (A-B18).

While it has been greatly disturbed by subsequent ground works the internal floor of the outer mill is essentially level and retains some areas of the original slate surface (Figs.3.6.11 to 3.6.13). Within the floor area limestone bases for vertical support columns are still visible in H11, H15, L15 and M15 (Figs.3.6.14 to 3.6.16). The blocks in H11 and H15 are in line with one in H7, and the block in M15 is in line with one in M4: both M4 and H7 being in the inner mill. Because of the amount of disturbance that has taken place it is not possible to ascertain whether these were the only supports within this part of the building, although it is unlikely because of the need to support the weight of the bridge from the railway siding. The likelihood is that there would have been additional column bases, but that they were obliterated during the course of earthworks by the water authority.

From what little evidence is furnished by the remaining floor surface there is no indication that this part of the mill was used for any form of industrial processing, and this is consistent with the fact that it was built as a warehouse to provide additional storage space. However, if this is the case then it counters any argument for the kiln having been located here, although it does not entirely preclude it.



Fig.3.6.8 (left): Slate threshold in J-K18. The drop bolt holder can be seen in the bottom right hand corner of the centre slate (2010)

Fig.3.6.9 (right): Shows the chamfered north-east corner of the outer mill in P18 (2010)



Fig. 3.6.10 (left): shows the slate path running from P18 alongside the east wall, leading to the rear of the stable. The remaining road surface can be seen in the foreground. (2011).

Fig.3.6.11 (right): The remaining floor surface in B-E 10-13. (2010)



Fig.3.6.12 (left): The remaining floor surface in A-E 14-17. (2010)

Fig.3.6.13 (right): The remaining floor surface in O & P 17. (2010)



Fig.3.6.14 (left)

Fig.3.6.15 (right)

In Fig.3.6.14 the poles mark the location of the limestone blocks in (front to rear) H7, H11 & H15. Fig.3.6.15 Shows the limestone blocks in M4 (nearest) and M15. (2011)

One prominent feature is a sizeable hole in H-I9 and H-I 11, lying adjacent to the west side of the south wall (Fig.3.6.17). There is little to suggest why this feature should be present although the fact that a large cast-iron gully trap (Item 11/28/005) and some small pieces of glazed clay pipe were found adjacent to it could indicate a drain of some sort, although there is no obvious sign of either an inlet or outlet channel. Whatever its purpose, the gully trap would not have been installed until much later as the material in which it was coated, Dr. Angus Smith's Solution, was not invented until around 1880. Possibly at some stage it connected with the large underground drainage tunnel which from the excavation work that has taken place appears to run from the vicinity of the south-east corner of the outer mill (see site plan). As this section of the tunnel probably pre-dates the construction of the warehouse this certainly is feasible. If it *was* constructed as a drain the obvious question would be why, as there would not seem to be any particular requirement for such a feature in a storage area where no processing took place. There is also the possibility that it was put in place sometime after the warehouse was erected, although had this been the case then to connect it to the underground tunnel would have been a far more difficult task; particularly bearing in mind the very large stones that line the sides of the hole.



Fig.3.6.16 (left): The limestone blocks in H15 and L15 (nearest). (2011)

Fig.3.6.17 (right): The hole in H9-11, I9-11, viewed facing north. (2011)

Yet another possibility is that it pre-dates the construction of the outer mill and was constructed at the same time as the original building. It is also feasible that it was connected with a hole that was excavated in O12, and that both of the holes linked with the main tunnel. While there was nothing distinctive about the hole in O12 it was found to have evidence of both brick and slate surfaces toward the base, although no evidence of inlet or outlet channels (Figs.3.6.18 & 3.6.19). One possibility is that they were in some way connected to the slip kiln or settling arks. However, from the discussion in Section 3.3 this perhaps is unlikely. The only way to provide a more definitive answer would be to excavate a far larger area, although probably this would be inconclusive bearing in mind the large

amount of disturbance and change that has taken place: it would also further compromise what remains of this part of the mill.



Fig.3.6.18 (left): The hole excavated in O12. (2011)

Fig.3.6.19 (right): The inner surfaces of the hole in O12. Note the layers of slate and brick, perhaps indicative that this may have been the site of a settling ark. (2011)

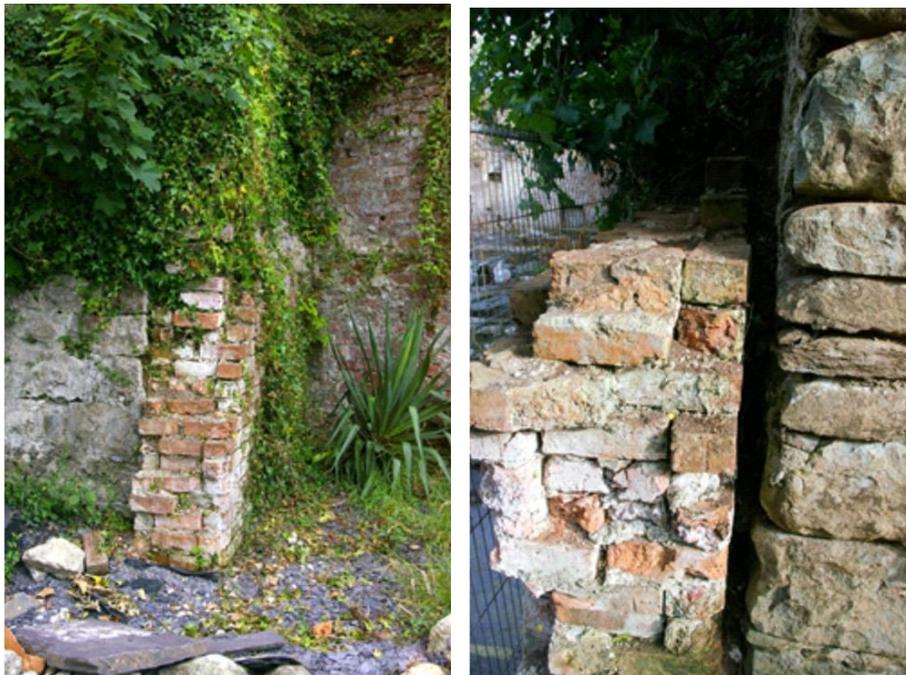


Fig.3.6.20 (left): Remains of the bridge support wall, opposite A17 (2010)

Fig.3.6.21 (right): End view of the bridge support wall in A17. (2010)

A more recent feature is a manhole that has been constructed adjacent to the west wall (B13-14), although this is not part of the mill itself. A cast-iron pipe that emanates from below the upper yard feeds into it; the pipe running across the sloping face of the chute area and descending vertically down the brick facing wall, at this point being encased in concrete (Figs.3.6.5 to 3.6.7). The outlet pipe from the manhole continues beneath the surface of the mill and enters a second manhole in the stable area at R9, before continuing to the sewage filter bed that adjoins the site. No doubt it was during the installation of these pipes that the slate floor surface became so badly disturbed, the east wall broken through, and the cobbled surface in the upper yard virtually destroyed.

Nothing remains of the bridge that linked the mill with the railway siding apart from remnants of a brick support wall that stand to each side of the path leading to the upper yard and cottage (Figs. 3.6.20 & 3.6.21). What perhaps is anomalous is that there is no evidence of any major support structure in this part of the mill capable of supporting the bridge. Furthermore, the north wall of the mill at this point, from A18 to D18, is actually narrower than from G18 to P18. A description of the siding is contained in Section 5.4.

While not visible on the surface there are two further features in this part of the mill. The first is a culvert that runs from the hill above Bryn, in the area of the old Penrhyn Iron Mine (see Section 4.7). The second feature is that there are one or more armoured electrical cables laid in parallel with the culvert. It is likely that the culvert was created during the construction of the Chester & Holyhead Railway, and therefore pre-dates the construction of the warehouse. It also is likely that the cables were laid some considerable time later date, thus adding to the disturbance of the floor surface.

3.7. The Upper Yard Extensions (Phase 5)

Anecdotally the extension was a two-storey building which appears to have measured some 16m across by 7.24m deep that stood immediately abutting the upper storeys of the mill, in the position now occupied by the slabbed area of the yard. There are no remaining signs of the building other than some small sections of wall, although in the 1930s it is reputed to have contained raised loading bays to the ground floor, with storerooms above.²⁵⁸ It also had two sets of large doors.²⁵⁹ As there is no evidence of any remaining stone or brick footings it is possible that it was constructed from corrugated metal sheets.

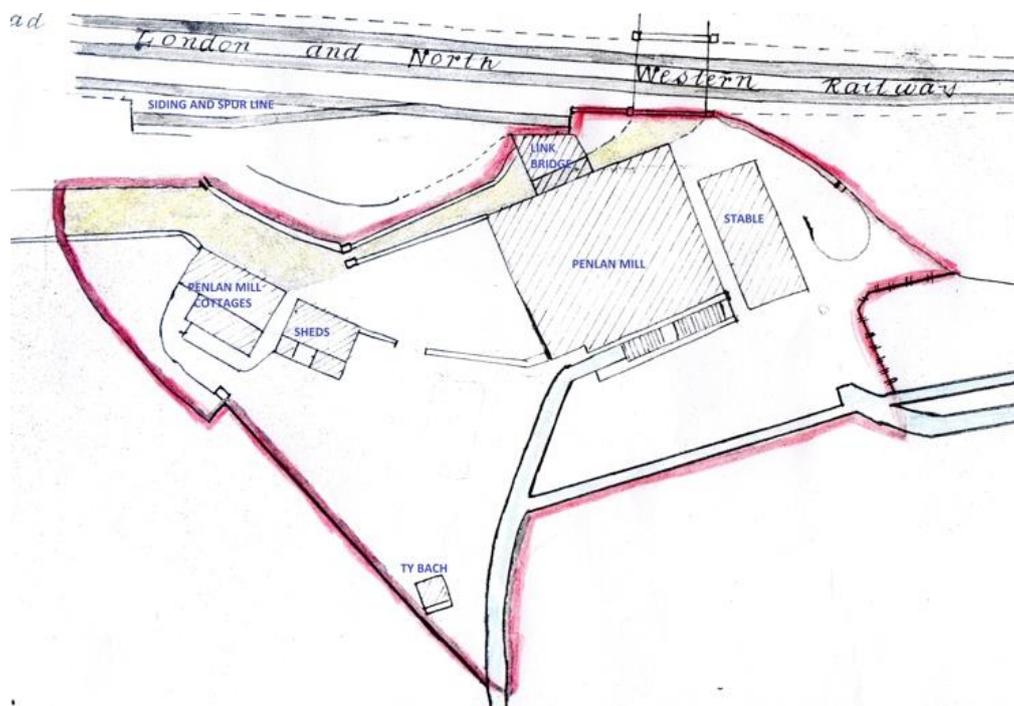


Fig.3.7.1: Area covered by Lease of 10th December 1883.²⁶⁰

²⁵⁸ As described by Dr. Daffydd Alun Jones during a site meeting in April 2012.

²⁵⁹ Ibid, 18th August 2010.

²⁶⁰ BU/PFA/2/59. Lease for Penrhyn Mill dated 10th December 1883, taken out by Lewis & Son.

The extension was added in 1885 by the then tenants, Lewis & Son. At the same time, they also built an additional shed contiguous with the two already in situ to the south side of the yard, and in line with Penlan Mill Cottage. The shed measured some 6.1m wide by 4.57m deep and still exists, being the one furthest from the cottage. It is built of stone with a slate roof and originally had two large doors to the front. These were removed in 2005 when it was converted to a log store. From a further endorsement to the 1885 lease, dated 25th September 1891, we know that permission had been granted for the erection of a hay house, although there is no documentary or material evidence to indicate whether this was in the upper yard area elsewhere.

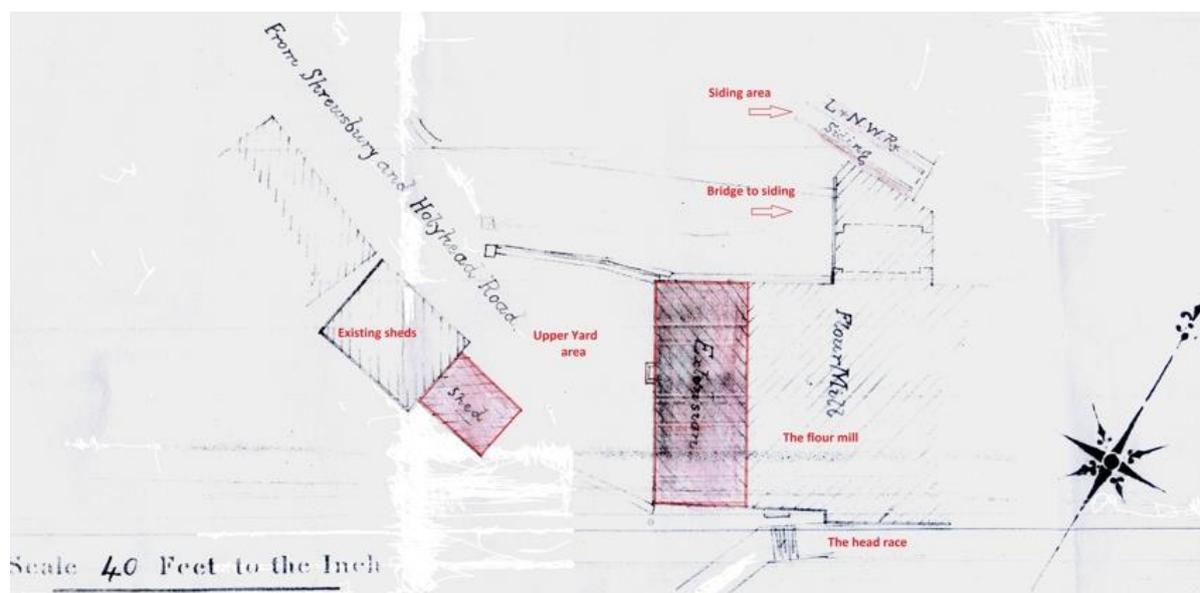


Fig.3.7.2: Plan of new buildings to be constructed at Penlan Mill as per endorsement to the 1883 Lease, dated 24th July 1885.²⁶¹

In 1974 the water authority installed a sewage disposal system for the Llandegai area that involved laying pipes beneath the upper yard, passing in front of the cottage and sheds. During the course of this work virtually all of what hitherto had been a cobbled surface was either covered or removed (Fig.3.1.2).

²⁶¹ BU/PFA/2/59, *Ibid.*

4. The associated waterways, above and below ground

There are a number of water channels running through the site, some of them being above ground and some below. Much of the recording of the waterways was carried out on a 'rescue' basis as they are located on a working industrial site that has undergone considerable change since 2007. In particular this applies to the leat, aqueduct, and culvert.

The most obvious of the waterways is the leat that carried water from the River Ogwen both to Penlan Mill and the mills in the lower yard at Trefelin.

4.1. The Leat

Building work on the leat began in late 1796 and was completed in around September 1797. It was a major undertaking that primarily involved a large number of Labourers, working together with other trades such as Masons, Carpenters, etc. It is not possible to ascertain the precise cost involved although from the information available it is estimated to be in excess of £450.

The leat begins at the River Ogwen, starting from the weir just above 'Shaky Bridge' (Fig.4.1.1).²⁶² In order to help direct the flow of water to the leat entrance, and to protect the structure itself, the back edge of the weir is secured by a series of large slates embedded vertically into the river bed (Fig.4.1.2). From the entrance the leat runs north-north-west for approximately 600 metres and is divided into three roughly equal sections. Two of these run above ground, with the central section running through a tunnel. The tunnel remains as an original feature from the 1797 construction and is still largely intact.

During the construction of the A55 Expressway a large earth embankment was built to level the approaches to the bridge that carries the road across the River Ogwen. Effectively this truncated the leat channel, although a tunnel was embedded into its base to facilitate the drainage of surface water (Fig.4.1.3). Whether it was during the course of this work or some time earlier, the entrance to the leat from the river was sealed off by a brick wall, with the remains of the original sluice gate being left in place immediately behind it (Fig.4.1.4). In September 2013 refurbishment work took place that included re-sealing the base of the brick wall and replacing the original wooden sluice with a metal one (Fig.4.1.5). The work was carried out following heavy erosion to the earth bank above the lower end of Trefelin Yard, immediately in front of the north end of the leat tunnel. This had caused flooding throughout the yard, as well as depositing hundreds of tons of silt into the River Ogwen.

A part of the leat, the approximately 100m section running from the weir at Shaky Bridge to the north side of the A55 Expressway tunnel, has been brought back into use as part of a new hydro-electric scheme. In preparation for this in September 2015 the weir was altered to re-direct the flow of water toward the leat entrance, and at the same time a new channel was created to facilitate a fish run (Fig.4.1.6). On the opposite side of the weir a wooden barrier was erected, secured to the river bed by three metal stumps (Fig.4.1.7). Work on the main scheme commenced in March 2016 and the plant came into service at the beginning of 2017. As part of this scheme the first section of the leat has now been piped with the pipe being buried beneath the ground. The following description is of the leat as it was prior to this work taking place.

²⁶² SH 7000 6015

While there are parts of the leat still intact, in recent years it has been subjected to a good deal of damage, due not only to the highway construction, but also to work carried out in an attempt to reduce the flow of unwanted water to the lower yard at Trefelin. Prior to it being piped underground the leat emerged from beneath the footings of the Expressway as an open channel, passing through pasture before entering the main tunnel (Fig.4.1.8 & 4.1.9): this section of the leat being part of the original 1797 construction. From the visible evidence the sides of the channel are formed by earthen banks and, unlike the later sections, the base of this part of the leat appears to be entirely puddled.

The tunnel is approximately 100m long, brick built and round in shape, but with the floor being slightly flattened (Fig.4.1.10). At the north end of the tunnel, that nearest to the mill, an approximately 30m section of the leat has been completely demolished (Fig.4.1.11) causing the water to flow directly downhill into the River Ogwen, entering the river immediately adjacent to the large industrial shed situated at the south end of the Trefelin site.



Fig.4.1.1 (left): The weir and leat entrance, south of Shaky Bridge. (2010)

Fig.4.1.2 (right): The vertical slates securing the rear edge of the weir. (2015)



Fig.4.1.3 (left): The leat tunnel beneath the A55 Expressway (south side). This section is no longer visible having been piped and buried during the installation of the hydro-electric scheme. (2010)

Fig.4.1.4 (right): The original sluice gate at the start of the leat. The brick wall is behind it. (2010)



Fig.4.1.5 (left): New sluice at start of the leat. (2013) This now forms a part of the new hydro scheme and is no longer visible.

Fig.4.1.6 (right): Alterations to the weir including the creation of a fish run, shown to the right, adjacent to the leat entrance. (2015)



Fig.4.1.7 (left): The new section of the weir at Shaky Bridge. (2016)

Fig.4.1.8 (right): The north end of the leat tunnel as it emerges from beneath the A55 Expressway. (2015)



Fig.4.1.9 (left): Bed of the leat between the A55 and the main brick tunnel (2015)

Fig.4.1.10 (right): Inside wall of the original brick tunnel, unchanged since 1797. (2004)

From this gap the bed of the leat continues for the final 200m to the start of the headrace. This entire section of the leat was intact until the end of 2010 at which time the whole of the lower (east) side wall was demolished to facilitate industrial development (Figs.4.1.12 & 4.1.13). Whereas the ground adjacent to it had previously comprised very pleasant woodland it has now been replaced by a large man-made earth embankment (Figs. 4.1.14 to 4.1.17).

The side walls of the leat were constructed from a combination of stone and slate blocks. The bed comprises a number of different materials which as far as can be ascertained are as follows, with the approximate measurements beginning from the first of the two blocking walls that seal off the end of the leat nearest the head race, i.e. running roughly north to south. As already described in Section 3.1 the bed of the leat between the two walls is constructed from quality timbers closely fitted together to create a seal (Fig.3.3.73).

0-88 metres	Puddled
88 metres	A row of bricks, laid flat
88-103.5 metres	Slate
103.5-106 metres	Cobble stone for half the width (from the outer wall)
106-126.8 metres	Puddled
126.8-131.3 metres	Stone/slate for half the width (from the inner wall) From 128.1-128.6 metres there is a large stone 50cm x 40cm located in front of an aperture in the top edge of the inner wall, although there is no opening behind the aperture.
131.3-157.7 metres	Puddled

From here to the tunnel this section of the leat has been destroyed.



Fig.4.1.11: North end of the tunnel with the demolished section of the leat in the foreground. (2015)



Fig.4.1.12 (left): The remains of the leat with lower (east) wall demolished. (2011)

Fig.4.1.13 (right): Reverse view of the leat with the remains of the demolished sump in the background. (2011)

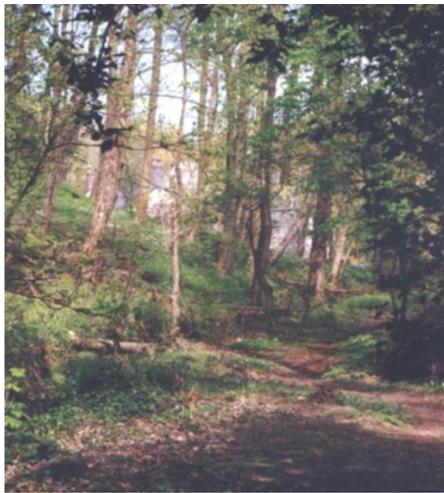


Fig.4.1.14 (left): The original woodland and 'Keeper's Path' alongside the leat. (2006)

Fig.4.1.15 (right): The woodland adjacent to the leat area in 2006, with one of the series of small foot bridges built by Peter Bullen.



Fig.4.1.16 (left): Lower level of the man-made embankment to the south side of Trefelin Yard, replacing the former woodland. (2011)

Fig.4.1.17 (right): The upper level of the man-made embankment, sitting above and behind the lower level. (2011)

Why one section of the leat should have a slate bottom surface is not at all clear, as there are no distinguishing features surrounding it. The slate area exposed is approximately 15.5m long x 3.5m wide, and each slate is an average of 90cm wide: ranging from 80cm to 110cm. The estimated thickness of the slates is 5cm (Fig.4.1.18). Although at this point the exposed width of the slate bed is 3.5m the width between the side walls of the leat is 2.65m, indicating that the base was put in first and the walls built on top of it. After the end of the slate bed, that furthest from the mill, the bottom surface is cobbled for half of its width (Fig.4.1.19), whereas at the near end, immediately adjacent to the slate, there is a row of bricks, laid flat (Fig.4.1.20).

By far the most important function of the leat, and the primary reason for it being built, was to provide the water required to turn the wheels at Penlan Mill. The flow of water to the mill was controlled via a sluice at the north end of the leat, as it entered the start of the head race. There is nothing left of this today, although during excavation two small pieces of cement were found there, which from the indentations in their surface appear to show that they once had held in place wooden strips, or something similar.²⁶³ However, as a good deal of waste material has subsequently been dumped into this part of the leat it is not at all certain how much credence can be placed on this. Also found was a large 'key' or spanner that possibly was used for opening and closing the sluice gates (Fig.4.1.21). This appears under the list of 'Finds' as Item 10/16/001.

At various times the leat was known colloquially as 'The Cut' or 'The Black River' and at one time a young local girl named Lottie Howard drowned in it. Several people have recalled their childhood experiences of how they went swimming in 'The Cut' and how, when the sluices were closed, they used to take salmon and trout that had become trapped in the intervening stretch of water.²⁶⁴ Apparently some of the fish also made their way to the cottages in Trefelin via the large cast-iron pipe that conveyed the water for flushing the toilets. An evacuee who stayed in one of the cottages during WWII describes how the toilet was in an outhouse, with a stream running beneath the plank seat and plenty of fish swimming by!²⁶⁵ The main sluice that allowed water into the leat from the River Ogwen, and the sluices that controlled the flow of water to the spillway, aqueduct or mill, were opened each morning and closed each evening. One of the men responsible for carrying this out was Mr Robert Davies who lived at 15 Llandegai Village. Eventually he became the foreman and moved to Penlan Mill Cottage,²⁶⁶ which his son later purchased from the Penrhyn Estate.

As the various sluices and channels feeding from the leat were demolished before they could properly be recorded, any description of how they operated has largely to be based on photographs and old documents. Nonetheless these do allow for a reasonably accurate interpretation.

Apart from the headrace that carried water to the wheels at Penlan, in 1883 there was only one channel feeding from the leat and this appears to have served three separate functions, each being controlled by use of sluice gates (Fig.4.1.22). Firstly, to carry water to the main wheel that powered the saws, etc, in the main Estate Works in Trefelin (formerly the Felin Isaf corn mill), and secondly, to provide water for the aqueduct that fed the Smithy and Slate Works also located in Trefelin Yard (see

²⁶³ Finds:11/54/001.

²⁶⁴ For example Dr D.A. Jones, L. Foulkes, and Mrs R. A. Thomas.

²⁶⁵ Raymond Millbank, *The Highs and Lows of an Evacuee: North Wales 1939-1945*, (2006), p.29.

²⁶⁶ L. Foulkes, Op cit, 5th April 2010.

Section 4.3). Thirdly, to carry away any overflow or unwanted water taking it directly to the river. Within the report this channel is referred to as the Spillway (see Section 4.2).

Sometime later a second channel was built, the entrance being located closer to the mill and headrace. It would appear that this was introduced to provide the water supply for a turbine that was used to generate electricity for the Estate Works (see Section 4.4). As the turbine pipes do not appear on the 1883 plan but do on a slightly later (undated) plan (Fig.4.4.1), it is reasonable to suppose that this work was carried out at around the turn of the twentieth century.



Fig.4.1.18 (left): Location and extent of the slate bed of the Leat. (2011)

Fig.4.1.19 (right): Cobbled base of the leat bed. (2011)



Fig.4.1.20 (left): The brick edge to the slate section of the leat bed is shown between the poles. (2011)

Fig.4.1.21 (right): The sluice key/spanner ('Finds' Item 10/16/001)

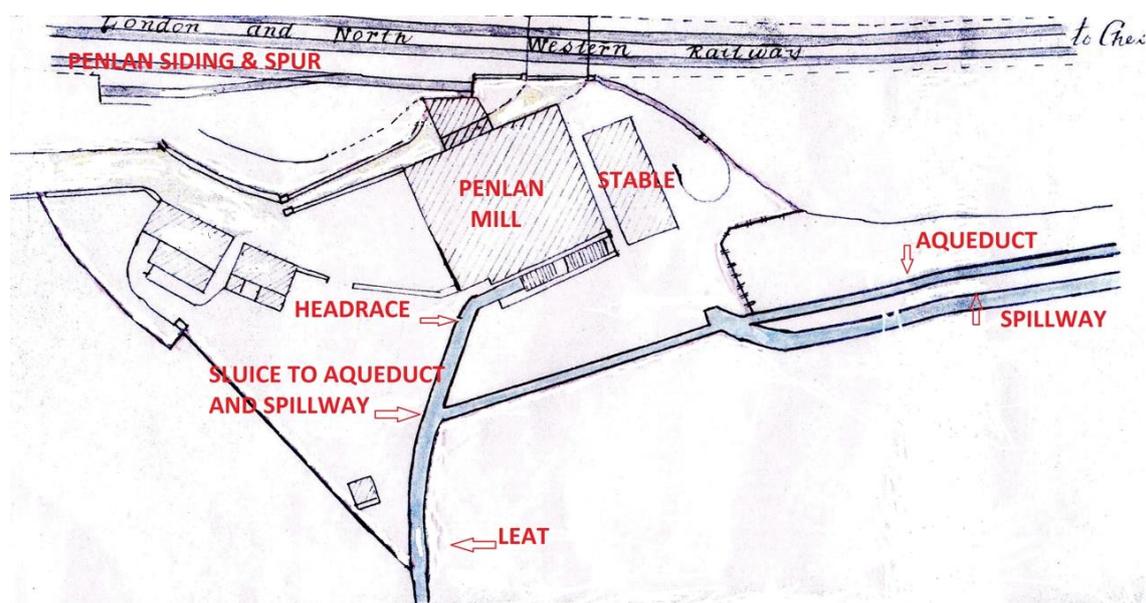


Fig.4.1.22: The water channels feeding from the Leat in 1883.²⁶⁷

4.2. The spillway

As stated above the spillway fulfils three separate functions: to provide water to power the waterwheels in the main Estate Works; to provide a supply of water to the aqueduct; and to carry away any unwanted water from the site, including from the Penlan Mill tailrace. Once Penlan Mill had been demolished and the Estate Works closed the leat was sealed above the headrace, completely cutting off the flow of water beyond this point. After this date any residual water that drained into the leat was channelled directly into the spillway, and from there through pipes beneath Trefelin yard and into the river. Today this remains its sole purpose. Originally water entered the spillway either by means of a sluice located in the side of the leat, or via an adjoining overflow channel (Figs.4.2.1 & 4.2.2). Neither of these features survives following demolition of the leat wall.

Essentially the spillway is one contiguous structure comprising two parts that for ease of understanding are referred to as the upper and lower. The original upper part comprised an open channel that was constructed from stone with the side walls toward the upper end being capped with brick (Figs.4.2.3 & 4.2.4). In 2008 a large concrete pipe was laid within the upper section, the pipe continuing to carry water through to the section below. As a result of this work both the concrete pipe and original stone spillway are now buried beneath the earthworks. At the end of the pipe there is a concrete ledge that causes water to cascade into the lower section of the spillway.

The lower section of the spillway is part of the original c.1797 construction and still remains in use. It is constructed from large slate slabs that form a series of steps, some 27 in total. They are laid laterally across the width of the channel and are of variable size, being 2m wide, between 60-95cm in depth, and 7-9cm thick. At step 18 there is a rendered pillar at each side and between these there is a badly damaged gate or trap, designed to stop large items passing through and blocking the entrance to the piped culvert that carries water beneath the lower yard. The height of the gate is 95cm and it comprises 8 round horizontal metal bars, each 2cm in diameter and 145cm long (Fig.4.2.6).

²⁶⁷ Extracted from BU/PFA/2/59, the lease between Penrhyn Estate and Lewis & Co.

The sides of the spillway are constructed from a number of different materials, for example brick with brick capping; stone base with slate blocks above, capped with flat slates; slate blocks; and slate blocks with some stone. At step 7 (only) the right-hand wall is entirely built in brick. The height of the side walls varies throughout; between a maximum of 1.5m and a minimum of 0.8m on the right-hand side (descending), and 2.1m to 0.8m on the left. The variation in materials would tend to suggest either that the spillway has been altered at various times, or that it was constructed using whatever spare materials were available.

To the left-hand side (descending) between slabs 24 and 25 there is an outlet pipe from the adjacent sewage filter bed, from which daily samples are taken by the water authority (Fig.4.2.7). The end wall is 0.8m high, built of brick, and has two large round pipes inset that together form the culvert that passes beneath Trefelin Yard to the river (Fig.4.2.8). Originally this had been an open channel that has only been culverted in recent times.²⁶⁸ Originally the channel branched with two separate channels leading to the Estate Works. It would also appear that at one time it merged with the original race for Felin Isaf, which originally had received its water directly from the river (Fig.4.4.2).



Fig.4.2.1 (left): The sluice and overflow to the spillway. (2006)



Fig.4.2.2 (right): Rear view of the sluice (right) and overflow (left). (2006)



Fig.4.2.3 (left): Top section of spillway, facing downwards. (2006)



Fig.4.2.4 (right): Top section of the spillway, facing upward. (2006)

²⁶⁸ As this occurred prior to Celtest Ltd purchasing the site it is likely that this was following demolition of the Estate Works buildings by Caernarfonshire County Council, following which water was no longer required for driving machinery.



Fig.4.2.5 (left): The lower section of the spillway showing the exit pipe from beneath the earthworks, the concrete ledge, and the slate steps. (2010),

Fig.4.2.6 (right): The lower end of the spillway from the gate to the culvert pipes. (2010)



Fig.4.2.7 (left): Location of the water sampling point, left of picture. (2010)

Fig.4.2.8 (right): Outlet from the culvert pipes where they join the river. (2010)

4.3. The aqueduct

The purpose of the aqueduct was to provide a supply of water to the Slate Works and Smithy that were located in Trefelin Yard, adjacent to the main Estate Works. It would appear that initially the water came directly from the spillway, at its confluence with the underground tailrace from Penlan Mill (Fig.4.1.22). From the point at which the three channels merged the flow of water into the aqueduct was regulated by a sluice gate (Figs.4.3.1 & 4.3.2). It was an open-topped channel constructed from wood, but as was evident at the time it was recorded on the site plan it had been coated in cement: probably added for reinforcement, protection, sealing, or all three. It was located adjacent to the slated lower section of the spillway, running parallel with and slightly above it (Figs.4.3.3 & 4.3.4). It is not entirely clear whether the aqueduct was part of the original site design or

whether it was a later addition, as there is a possibility that initially the water supply to the lower mills came directly from the leat, with the aqueduct only being built after the opening of the Chester & Holyhead Railway. However, as both the slate works and saw mill formed an early part of Samuel Worthington's operations it is likely that the aqueduct was constructed at the outset and with these in mind.



Fig.4.3.1 (left): The location of the sluice gate at the start of the aqueduct, prior to it being sealed. Remains of timber support post still embedded in the channel. (2010)

Fig.4.3.2 (right): The sealed-off entrance to the newly buried aqueduct, the concrete slab having been inserted into the sluice gate channel. (2010)



Fig.4.3.3 (left): The aqueduct, facing west, prior to it being back-filled. The spillway is to the left. (2010)

Fig.4.3.4 (right): The aqueduct is the concrete structure top left of picture, sitting above the spillway and with the pipe overhanging. (2010)

Until 2010 a short section of the aqueduct channel remained visible, measuring approximately 7m long by 1.75m wide; although it is not known whether this was part of the original construction or had at some stage been modified. However, as part of the improvements to the site drainage system on 26th April of that year this remaining section was buried beneath earthworks; the main length of the aqueduct having previously been removed, probably being redundant once the Slate Works and

Smithy had become demolished. At the same time the three water channels were merged into one (Fig.4.3.5).

As the aqueduct passed beneath the railway viaduct it was supported on sandstone arms protruding from the east side of the third pillar (from the west end) before passing through to the bottom yard at Trefelin (Fig.4.3.6). The top of the support arms stands 190cm above the present ground level and the top surface measures 94cm wide x 72cm deep. They are 62cm thick at their deepest point, which is where they abut the side of the pillar. Generally, it had been assumed that the purpose of the aqueduct was to provide a power source for the saw mill, whereas based on the location of the support arms it would seem that in fact the water passed directly to the Smithy and Slate Works. This is borne out by the c.1906 plan that shows what is described as a 'water trough to slate works' (Fig.4.3.7).



Fig.4.3.5 (left): The junction of the aqueduct and lower section of spillway.
The outlet from the tail-race tunnel joins from the left-hand side. (2010)

Fig.4.3.6 (right): Sandstone aqueduct support arms beneath viaduct arch. (2010)

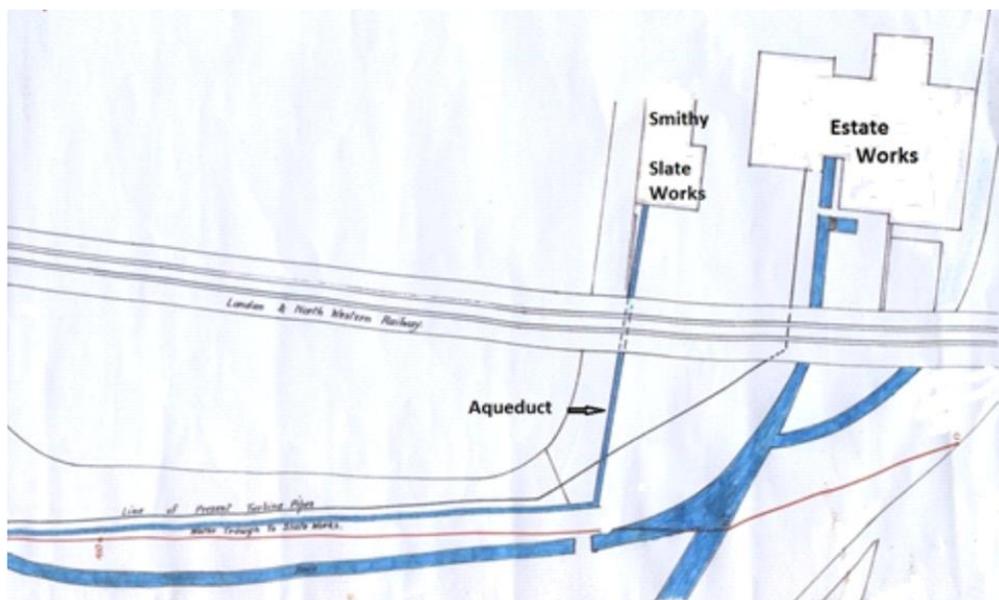


Fig.4.3.7: The route of the aqueduct (water trough) c.1906.²⁶⁹

²⁶⁹ Based on BU/Penrhyn192 (undated)

The underground water courses

While from the description of the leat it is evident that its purpose was to carry water *to* the site, of equal importance was the need to remove water *from* the site. In the main this was achieved by means of the spillway but there are five other channels, all of which lie underground and all of which are connected. The first of these is the tail race.

4.4. The tail race

As water passed over the water wheels it exited from the waterwheel pit via an opening at the base of the (east) end wall. From here it entered a brick-built tunnel that is offset from the outside (south) wall of the mill by approximately 15 degrees (see site plan). It then slopes downward towards the lower yard for a distance of approximately 7 metres, at which point it merges with another longer tunnel of equal shape and proportion that appears to be a main drainage channel (Figs.4.4.1 & 4.4.2). From the section of the tail-race tunnel exposed during excavation it is evident that there is a distinct join in the roof part way along its length, as though it had been constructed in two stages (Fig.4.4.3). Possibly this occurred when the two tunnels were merged, although if that was the case it raises the question of whether they both were built at the same time, or whether one pre-dates the other. Obviously, the mill would have needed a tail-race from its inception, although not necessarily via an underground tunnel. The reason for the main tunnel being built is not readily apparent, although there would seem not to have been a need for it prior to the construction of the mill: it does not appear to serve a stand-alone function.



Fig.4.4.1 (left): Junction of the two tunnels, with the main tunnel in the foreground running north-south, and the tail-race tunnel (top of picture) running east-west. (2011)

Fig.4.4.2 (right): Top view of the junction of the two tunnels with the main tunnel in the foreground. The tail-race tunnel with join showing is at top of picture. (2011)

The only rider to this is that possibly it may have been part of the drainage system from the settling arks, and this is perhaps borne out by the fact that the small underground drain that runs from R4 to T4 feeds into it. If the tail-race was built first and in an open channel the question arises as to why subsequently it was covered and placed inside a tunnel. One possible explanation is that in view of its proximity to 'Occupation Road an open channel could have been prone to blockage, and to enclose it and merge it with the main tunnel would provide an elegant solution to resolving this problem. As the tunnels pre-date the stable a more likely explanation is they were enclosed in order to facilitate its construction, both tunnels passing beneath the stable floor. On this basis in all probability both tunnels

were constructed at the same time, the main tunnel being part of the drainage system for the settling process. This would tie in with the small underground drain that runs from Q4 to T4 and feeds into it (Section 4.6).

During excavation top sections of both tunnels were exposed and this provided an indication of their size and condition. They are built of brick and have a curved roof that appears to have some rendering to the outer surface. There is no evidence of damage to the tail-race tunnel, although there is some slight damage to the main one.



Fig.4.4.3: Top surface of the tail-race tunnel, facing west, with the join showing in the upper surface. (2011)

4.5. The main drainage tunnel

Precisely where this longer tunnel begins has not been determined, as to carry out further excavation would have considerably compromised what remains of the remaining floor surface of the outer mill and therefore the integrity of the site. A contractor was approached with a view to passing a camera along the inside of the tunnel but due to the amount of sludge still remaining on the bottom surface this could not be done. The tunnel appears to emanate from beneath or immediately adjacent to the outer mill (warehouse extension), at a point where the culvert that runs alongside the railway viaduct feeds into it (see Section 4.7). From the point where the two large channels merge, what has now become a single tunnel turns through approximately 25 degrees in the direction of the spillway, passing beneath the unsurfaced road that leads to the upper part of the site and the newly constructed man-made embankment.

As the tunnel emerges from beneath the road the last two metres had previously collapsed into the bed of the channel with the sludge and debris blocking the tunnel entrance by as much as seventy-five percent. This severely impeded the water flow and in large part was a contributing factor to the regular flooding that took place when heavy rain caused a back-up of water in the adjoining culvert. Since 2010 when the blockage was cleared the water flow has considerably improved (Figs.4.5.1 to 4.5.5).



Fig.4.5.1 (left): Blocked entrance to main tunnel, as marked by the rearmost pole. (2010)

Fig.4.5.2 (right): The rearmost pole marks the location of the exit from the main tunnel. (2010)



Fig.4.5.3 (left): Depth of sludge inside the tunnel entrance. (2010)

Fig.4.5.4 (right): Tunnel entrance after most of the sludge removed. The near post marks the original extent of the tunnel prior to the roof collapsing. (2010)

From the mouth of the tunnel, looking south toward the spillway, the exit channel has a brick retaining wall to the left-hand side that originally ran for approximately 2.5 metres before it turned through ninety degrees to the left, when it formed the entrance to the aqueduct (Fig.4.5.6): the aqueduct sluice gate being located at this point (see Figs.4.3.1 & 4.3.2). This section of the retaining wall is approximately 0.6 metres high with the brickwork being in very good condition. The wall to the opposite side of the channel lies against the earth embankment that forms the west side of the site (Fig.4.5.4). Originally the wall to this side of the channel was built of stone but as part of the reconstruction work that took place in 2010 it was lined with concrete (Fig.4.5.7). Following the reconstruction work and the closure of the aqueduct water from the tunnel has fed directly into the spillway and from there to the river.



Fig.4.5.5: The join in the brickwork marks the end wall of the tunnel prior to the roof collapsing.(2010)



Fig.4.5.6 (left): The junction of the main channel and the entrance to the aqueduct. (2010)

Fig.4.5.7 (right): New concrete edge to the exit channel after being lined. (2010)

The width of the tunnel is an average of 1.6 metres and at the point where it merges with the tail-race tunnel it is buried approximately 1.2 metres beneath the present-day surface. The height of the tunnel as it exits from beneath the road is approximately 0.75 metres, whereas its height at the junction with the underground drain (in grid T4) is approximately 1.1 metres, i.e. it appears to reduce in height over its length: possibly this variance being due to a build-up of deposits at the mouth of the tunnel. The thickness of the main tunnel roof is 25cm.

4.6. The underground drain

The third underground channel is a small drain that exits from beneath the area of the former archway in R4 and joins the main drainage tunnel in T4: again, beneath the stable floor. It is 2.7 metres long, has brick edges and a flat slate top, and at the far end has a small square drain hole in the base that drops vertically into the main drainage tunnel. At the point where it exits from beneath the west wall of the stable it is 0.5 metres below the present surface level, sloping down to 0.85 metres as it joins the tunnel: a drop of 35cm over 2.7 metres. It is 42cm wide at the top end decreasing to 32cm at the

lower. The inside of the channel is 13cm wide by 10cm deep and the drainage hole is 13cm square. Something noted during excavation is that at differing levels beneath the surface of the surrounding ground the soil was very red, possibly indicating that originally the drain had fed into a brick-built structure that was part of the settling or drying process. However, despite further investigation nothing specific was found. If it had been part of these processes, then it is likely that originally it was not located underground but was covered over during construction of the stable (see Section 3.3).



Fig.4.6.1 (left): The junction with the main drainage tunnel at T4, with the red brick deposit very much in evidence. (2011)

Fig.4.6.2 (right): View facing east from R4 to T4. Main drainage tunnel marked by poles at top of picture. (2011)



Fig.4.6.3 (left): Reverse view with west wall of stable in the background. Near poles mark the line of the main drainage tunnel.

Fig.4.6.4 (right): The junction with the main tunnel at T4. At this point the depth to the base of the main tunnel is 1.1m. (2011)

There is a fourth underground channel running through the site, and while perhaps this was not directly related to Penlan Mill it may have had some relevance to earlier development at the site, particularly the mills in the bottom yard.

4.7. The Culvert

The culvert appears to emanate from beneath the hill above Bryn, in the area of the former iron mine at Rhos Uchaf (see Section 6.4). It then runs diagonally downhill across the field that lies adjacent to Bangor Rugby Club, scorch marks making the route visible during very dry weather. As it reaches the lower boundary hedge adjacent to the former Shrewsbury to Holyhead coach road it passes into a drain that is located close to the layby. It then passes beneath the road and into Penlan field on the opposite side where there is a second drain, and at this point the water can quite clearly be seen. From here it continues beneath the fields to the large storm drain located at the junction of the footpath that runs alongside the plant hire yard and the driveway to Penlan Mill, and from here it continues beneath the drive, running parallel with the railway. From Penlan Mill Cottage it continues downward to the foot of the slope, to the point where the support wall for the Penlan railway siding once stood, just before the underpass and entrance to Trefelin (Fig.4.7.1). At this point it turns south east, passing beneath the outer mill, before feeding into the main drainage tunnel. The approximate route of the culvert is illustrated in Fig.4.7.7.



Fig.4.7.1 (left): Location of access point to culvert at Penlan Mill. (2010)

Fig.4.7.2 (right): The inside of the culvert at the access point. (2011)

In order to try and prove the course of the culvert a small trench 1.6 metres deep and 1 metre square was dug at the foot of the slope and adjacent to railway embankment, as shown above. At this point the culvert was found to be lined with slate to all four surfaces (Fig.4.7.2).

A second trench 1 metre square and 1.1 metres deep was dug in the floor of the outer mill (grid N16), this location having been chosen because there was a round depression in the floor surface that initially led to the thought that there may have been a well there. There was no further evidence to support this and the hole was found to be backfilled with pieces of sandstone, probably from the construction of the viaduct. A channel was found containing an armoured electric cable and tree roots, but no sign of water. However, as flowing water could be heard close by the trench was back-filled and marked, and another trench opened at right angles to it. This was found to contain the culvert (Figs.4.7.3 & 4.7.4).

To prove that there was a continuous flow of water from Bryn and through the Penlan water courses to the river a dye was inserted into the drain next to the rugby field. It took over an hour for it to pass through but in that time, it was clearly visible as it passed through the system, i.e. the drain in Penlan field, the trenches adjacent to the underpass and in N16, the spillway, and as it exited into the river.

The reason for the waterway to be culverted along this particular route is not at all clear. Emanating as it does from the hill above Bryn, if its purpose was simply to take away unwanted water it could more easily have been routed directly into the leat or river without passing near the mill. Furthermore, the fact that it is routed alongside the railway line and in parallel with it suggests that perhaps it was not culverted until the railway was built, or shortly thereafter. This then begs the question where it did go before, particularly as it pre-dates the construction of the cottages in Trefelin. Also, the fact that it feeds into the main drainage tunnel beneath the mill site reinforces the idea that both channels were constructed prior to the stable and the 1859 warehouse extension. In turn this leads back to the questions of why the main tunnel was built, why is it so large in comparison with the culvert that feeds into it, and what passed through it originally. It is unlikely that we will ever know the answer to these questions.

One possible explanation with regard to the culvert being routed as it is could be that originally it fed directly to Trefelin Yard. Had construction of the railway embankment not caused it to change direction it would have continued to flow directly downhill to the slate works and smithy, thus enhancing both the rate of flow and the reliability of the water supply; something that would have been important in view of the problems associated with the original race at Felin Isaf feeding directly from the river. The loss of this additional flow would have caused disruption to the output of these facilities, and this in turn would have necessitated an alternative source of power: hence the aqueduct.



Fig.4.7.3 (left): Marker showing location of culvert in N16. (2011)

Fig.4.7.4 (right): Dye passing through culvert in N16 (2011)

There is one unanswered question in this scenario: what happened during the period between the embankment and viaduct being built, and the aqueduct being constructed. Presumably the mill would have continued to operate as before since its water supply came from the Penlan leat and would not have been interrupted. The workshop and smithy on the other hand would either have needed an

alternative temporary water supply, or, if the aqueduct already existed, the railway contractor would have had to schedule his work around it. Once the viaduct had been completed and the aqueduct erected beneath it, the water in the culvert would no longer have been required and therefore was fed away from the site via the main tunnel to the spillway. Alternatively, it was still required and therefore re-routed via the tunnel to the head of the aqueduct that was situated just prior to the spillway. This would have been a more elegant solution as it had the advantage of maintaining a supply of water to the workshop and smithy at those times when the saw mill was not working. Such a solution would certainly have appealed to the mind-set of early 19th century industrialists who maximised every natural resource that was available to them. Another possibility for it following the route from Penlan field toward the railway is that originally it did not flow down to Trefelin Yard, but instead continued straight on to Llwynon, providing the water supply. This probably unlikely but we have no evidence either way.



Fig.4.7.5 (left): Channel adjacent to culvert with armoured cable exposed. (2016)

Fig.4.7.6 (right): Inside of the culvert exposed during drainage work, the water flow being from right to left. (2016)

While essentially the report is based on the status of the site at completion of the excavation work, it is perhaps worth noting that as a result of the severe flooding that took place in November 2012 and December 2015, in January 2016 a new drainage system was installed by Celtest Ltd. During the course of this work the access point at the foot of the drive was filled in, a new manhole and drain were installed, and a new pipe was laid to take the water from the manhole to the main underground tunnel, following the line of the existing culvert. Both the manhole and drain are located in the outer mill/warehouse area (Figs.4.7.5 & 4.7.6), although as the new pipe did not extend as far as the tunnel it still has not been possible to ascertain precisely how and where they join.

From this illustration (Fig. 4.7.7) it is evident that had the culverted stream not been diverted during the construction of the Chester & Holyhead Railway line it would have continued in a straight line from the point where it passes beneath the old turnpike road, and on to the lower yard.

While the precise source of the culvert is not known it is likely that it emanates from a water table near the summit of the hill at Bryn. The evidence for this is twofold. First, the 6-inch OS Map dated

1914 shows a well adjacent to Rhos Isaf that is to the west side of the hill; secondly the level of flooding at the Rhos Uchaf (Penrhyn) Iron Mine, that lies to the east side of the hill.

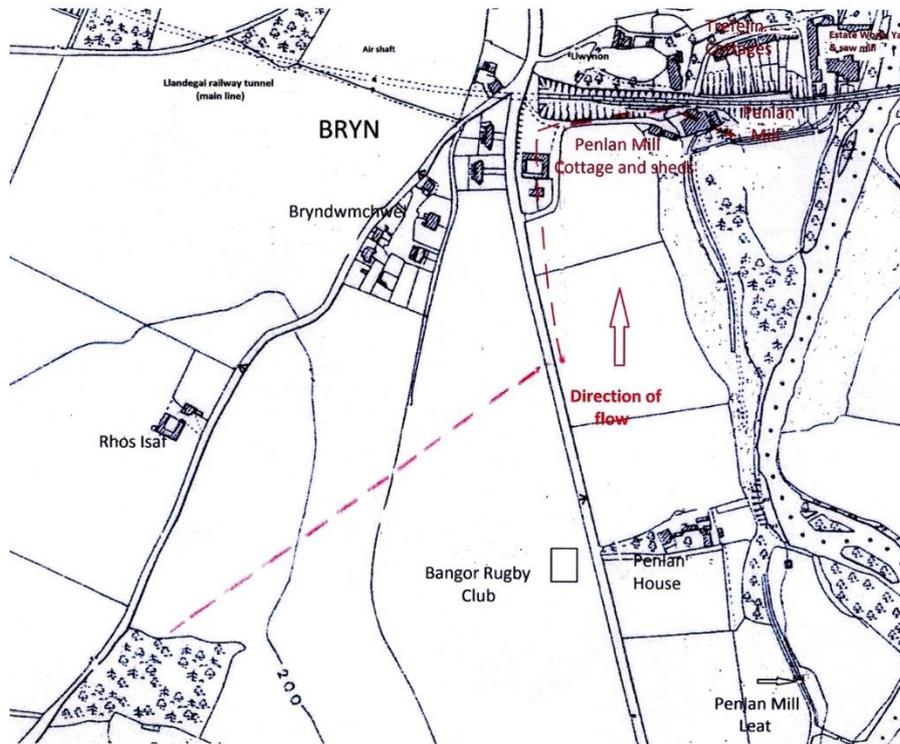


Fig.4.7.7 The approximate route of the culvert from Rhos Uchaf to Penlan Mill.

4.8. The turbine pipeline

In the early part of the twentieth century a turbine was installed in the Estate Works to run the machinery, and at the same time it was proposed that an additional turbine should be installed at Penlan Mill to provide electricity for Penrhyn Castle, but this did not proceed. In order to deliver the water that drove the turbine a new pipeline was installed, running directly from the leat to the Works building. As with the aqueduct much of the physical evidence has been removed, although fortunately there is supporting documentary evidence available. From a contemporary plan (Fig.4.8.1) it would appear that a second sluice was introduced into the lower side of the leat, in between the headrace and spillway sluice.

As water flowed from the leat it first entered a brick-built tank or 'sump', where it passed through a metal filter before entering a large bell-mouthed iron pipe. The flow of water into the sump was controlled by means of a sluice gate (Fig.4.8.2), the gate being located immediately in front of the sump and inset from the wall of the leat. As the entrance to the sluice channel was below the water line it could only be clearly seen after the leat had been drained. This is illustrated by Figs. 4.8.3 & 4.8.4. Fig.4.8.3 merely shows a dip in the leat wall immediately in front of the sump area, whereas Fig.4.8.4 clearly shows the opening. Fig.4.8.5 shows the location of the sump in relation to Penlan Mill.

The sump was built of brick and internally measured 1.85m x 2.2m at the base and was 1.7m deep. There were two large slate slabs laid across the top forming a bridge rather than a cover. Water entered the sump via a narrow channel with the flow being controlled by the sluice gate that was inset against brick columns at the entrance. What little remains of the gate would tend to indicate that it

was made of wood and had side edges 15cm wide (Fig.4.8.6). The filter was made of metal, although it was removed before it could properly be recorded (Fig.4.8.7).

From the sump water passed into the large bell-mouthed pipe that measured 76cm in diameter externally with a 40cm bore. The top edge of the pipe was 63cm below the top edge of the sump wall, which at this point had reduced from 1.7m to 1.4m. The centre of the pipe was offset from the centre of the wall, the distance from the edge of the pipe being 26cm to one side and 83cm to the other (Fig.4.8.8). Originally it had travelled beneath the ground to the lower yard, although today there is a gap half way down the embankment: the lower section having been removed during earthworks in the surrounding area. During the course of the drainage work later carried out by Celtest a new pipe was laid connecting it with the upper section of the spillway; the new section of pipe running underground diagonally across the embankment. The original known path of the pipeline is shown in Figs.4.8.9 & 4.8.10.

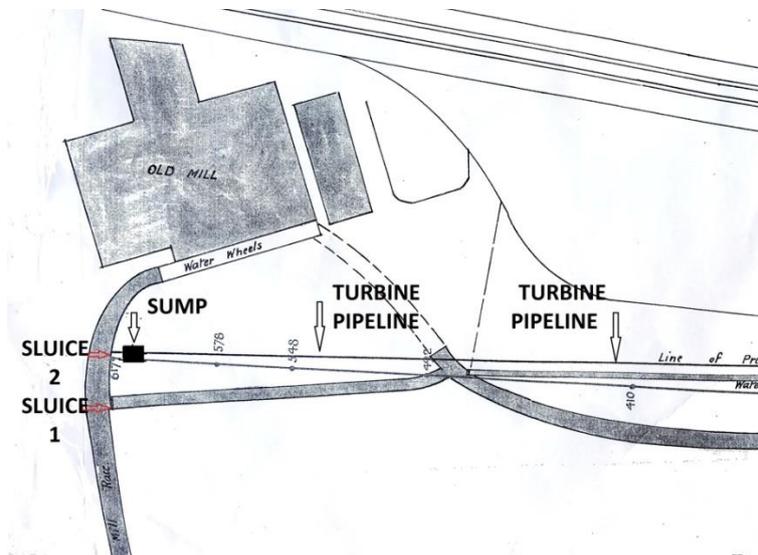


Fig.4.8.1: The route of the turbine pipeline, c.1906.²⁷⁰



Fig.4.8.2: The sluice gate leading to the aqueduct sump. (2006)

²⁷⁰ Based on BU/Penrhyn 192 (part).



Fig.4.8.3 (left): Location of sump for turbine pipeline. (2006)

Fig.4.8.4 (right): Entrance to turbine pipeline sump. (2010)



Fig.4.8.5 (left): Location of the sump prior to demolition, situated at the top of the southerly embankment. Upper yard to the Mill in the background, sluice to spillway channel marked by poles in the foreground. (2010)

Fig.4.8.6 (right): Remains of the original sluice gate. (2010)



Fig.4.8.7 (left): Filter inside turbine pipeline sump. (2006)

Fig.4.8.8 (right): Bell-end of the iron pipe, showing through to the open far end. (2010)



Fig.4.8.9 (left): Route from sump to far end of the original pipe. (2010)



Fig.4.8.10 (right): View from end of the pipe to the spillway culvert. (2010)



Fig.4.8.11: Inside the sump, looking toward the leat. The plastic pipe is a modern feature and not part of the original construction. (2010)



Fig.4.8.12 (left): View of sump after demolition, with iron pipe in background and remains of sluice in foreground. (2011)



Fig.4.8.13 (right): Top view of the demolished sump. (2011)

5. Transport Links

One of the crucial factors in the early development of the industrial complex that comprised Penlan Mill and the Trefelin Yard, and more essentially the Penrhyn Quarry, was the availability of an adequate transportation system. None of the enterprises carried out at these sites would have been as successful as they were without it, as they each involved the movement of large quantities of heavy materials.

The early development of roads between the Penrhyn Quarry and Port Penrhyn, and the building of the tramways between the Port, Penlan Mill and the Quarry, has already been briefly covered in earlier sections, and as several works have previously been published on these topics it is not felt necessary to repeat them further.²⁷¹ All of these developments were undertaken by the Penrhyn Estate and under the guidance of its Agent, Benjamin Wyatt. They were not the only developments to take place and there were a series of improvements to the infrastructure that were made by others, both throughout the county and nationally.

Initial improvements to the roads locally were made by the Penrhyn Estate and this was complimented by the work of the turnpike trusts which developed the road network nationally. Further enhancements were made by Thomas Telford and this marked a period of sustained improvement. Following the end of the First World War the transportation of heavy goods became increasingly mechanised with the roads being improved accordingly. In 1848 the Chester & Holyhead Railway was opened, which in turn enabled the building of the Penlan Siding and mainline links with Port Penrhyn. Subsequent changes included the building of the Penrhyn Quarry Railway in 1876.

5.1. The Turnpike Trusts

By 1798 the two main roads that passed through Llandegai were the Chester to Holyhead Road and the Shrewsbury to Holyhead Road, both of these being turnpike trusts.²⁷²

The Caernarvonshire Turnpike Trust

The Caernarvonshire Turnpike Trust (later known as the Caernarvonshire Old Turnpike Trust) was set up in 1768 when powers were granted to turnpike the road between Tal-y-Cafn and Pwllheli, passing through Conway, Carnarvon, and Bangor. It existed for 114 years during which time its powers were granted and renewed by several Acts of Parliament. Originally the route through what was the then hamlet of Tal-y-Bont crossed the River Ogwen via a wooden bridge near Felin Isaf (in earlier times known as Melin y Bont), that stood in what today is known as Trefelin Yard. From there it continued up the hill (today's Trefelin), via Lon Pistyll, and on to Llandegai Square where the toll gate was located. A small section of the original stone gully at Lon Pistyll is still visible today (Fig.5.1.1).

As the only road bridge across the River Ogwen on the road between Chester and Bangor, Tal-y-Bont Bridge has always played a significant role both locally and nationally. Its importance grew with the

²⁷¹ In particular J.I.C. Boyd, Op cit. Also, Quartermaine, Trinder & Turner, *Thomas Telford's Holyhead Road*, (York, 2003).

²⁷² For a full history of the Trusts refer to R.T. Pritchard, 'The Caernarvonshire Turnpike Trust', *Caernarvonshire Historical Society Transactions*, 17 (1956); and 'The Post Road in Caernarvonshire', *Caernarvonshire Historical Society Transactions*, 13 (1952).

demise of the Aber-Beaumaris crossing, the development of the Caernarvonshire Turnpike Trust, and the building of Telford's new coast road. Over a long period of time maintenance of the bridge had proven to be problematic, the first record of this being an Order issued by the Council of the Marches in Wales in 1602.²⁷³ According to the Order the structure had been in complete decay for two years, many people had been drowned, and the Queen's service for Ireland hindered. People had been unable to complete their journeys and Judges of Assizes and their officers had been endangered *'having no way to avoid the same either at full sea or when there is any land flood in the river'*. The Order rebuked the Justices of the Peace for the County and imposed a special levy of £140, with the Bishop of Bangor, Henry Rowlands, being responsible for its collection.



Fig. 5.1.1.: The original stone gully at Lon Pistyll. (2018)

Throughout the ensuing period the wooden bridge at Tal-y-Bont had required constant repair and consequently, in 1791, a new stone bridge was built 110 yards downstream from the existing timber bridge. It would appear that at least three quotations were submitted for this work; one on 23rd February 1791 by Robert Griffiths of Bangor for a sum of £845-0-0; another on 4th March 1791 by John Edmunds senior; and a third by David Owen and Evan Prichard for a sum of £515-0-0.²⁷⁴ It is not evident to whom the contract was awarded. By 1820 the bridge again needed to be replaced and a number of quotations were submitted, each offering a different design. One of these, for a three-arch bridge, was submitted by a stonemason from Trefriw named Evan Williams; and a further four designs were submitted by William Jones of Tal-y-Bont. There are no details of design No. 1 but design No. 2 was for a 2-arch bridge at a cost of £976-10-7; design No.3 for a bridge with three arches (one main arch and two much smaller arches) at a cost of £1373-4-3; and design No.4 for a bridge with one large

²⁷³ BU/Ms 211 (13th March 1601-1602).

²⁷⁴ Gwynedd/X Plans B/189.

central arch and two small round tunnels inset above the water line, each being 13 feet in diameter: the cost for this option being £1095-15-10.



Fig. 5.1.2 (left): The stone footing beneath Tal-y-Bont Bridge, c.1824. (2004)

Fig. 5.1.3 (right): The present-day bridge, completed in 1881. (2004)

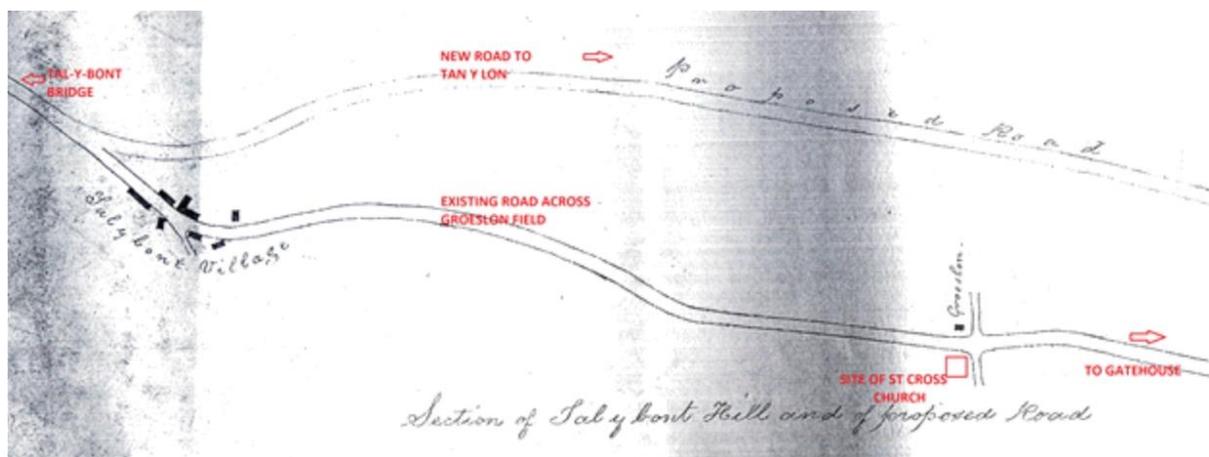


Fig. 5.1.4: Telford's proposed re-routing of the road at Tal-y-Bont, 1822.²⁷⁵



Fig. 5.1.5: Part of the original road at Groeslon field, prior to Telford re-routing it in 1822. (2004)

²⁷⁵ BU/Penrhyn ms 42.

There is no evidence to indicate which of the designs was chosen or who carried out the work, although it would be safe to assume that a stone bridge was built. This assumption is based on an Order dated 2nd August 1824 being issued by the local Justices of the Peace binding the Clerk of the Peace, Richard Anthony Poole, to have the bridge repaired. The monies allocated were for the sum of £260-0-0, the task was to be performed by a Mr William Owen, and the work to be carried out was the insertion of stones into the river bed in order to protect the foundations of the bridge.²⁷⁶ Presumably this solution proved to be adequate as the bedding stones are still in evidence today (Fig.5.1.2), and it was not until 1881 that the bridge was reconstructed in its present form by Owen Morris of Caernarvon (Fig.5.1.3).

Between December 1818 and July 1819 a new section of road leading to the bridge was built at Tal-y-Bont and the joint contractors were Griffith & Co and Richards & Co; the labour being provided by Jacob Defford and William David and the total cost £604-10-4 ½.²⁷⁷ In around 1820 George Hay Dawkins-Pennant, the new owner of the Penrhyn Estate, built a wall to enclose the Demesne, and as a consequence the road was re-routed from the top of Trefelin to follow the present day route to Llandegai. At around the same time the toll gate in Llandegai Square was closed and a new one built at Tan-y-Lon. At the same time the road via Lon Pistyll was closed.

A further consequence of the Demesne's enclosure was that the various roads that hitherto had passed through it were now re-routed outside the wall. This included the main Llandegai to Bangor road that was altered to what essentially is its present-day route. This in turn meant that part of the route of the Penlan Mill and Quarry tramway also had to be altered as it now lay in the path followed by the new section of road. As the tramway was still in use at this time it also meant that the new wall surrounding the Demesne had to follow the route of the tramway as it approached the Marchogion Incline, thus leaving the fields adjoining the Incline Cottages to remain outside Penrhyn Park.

In 1822 Thomas Telford re-routed the road through Tal-y-Bont to avoid what was known as 'Tal-y-Bont Clip', with the new section of road following the line of today's A551 trunk road (Fig.5.1.4). Prior to this the road had passed through Tan-y-Lon and Gatehouse, between Groeslon and St Cross Church, across Groeslon field to the centre of the old part of the village near Ty Mawr and continued on to the new stone bridge (Fig. 5.1.5).

The Capel Curig Trust

Improvements to the road between Capel Curig and Bangor did not come about until the Capel Curig Trust came into being in 1802. Following the inauguration of the Trust work immediately began on building a road to link Capel Curig with the Pentrefoelas and Shrewsbury roads. The posts of Clerk and Treasurer to the Trust were held by Lord Penrhyn's agent, Benjamin Wyatt.²⁷⁸ The Trust road started in Llandegai where it joined the Caernarvonshire Trust road from Conway. It continued along the route of the former A5; more or less parallel with the River Ogwen, past what today is the site of Bangor Rugby Club, along Lon Isa through Tyddyn Iolyn, and on to Halfway Bridge. Instead of crossing the river at this point it continued along the west side of the river to Pont Twr in Bethesda.

²⁷⁶ Ibid.

²⁷⁷ Ibid.

²⁷⁸ M. Hughes, *The Holyhead Road 1810-1842: A Study in Highway Administration* (Thesis, BU, 1963), p.59.

The record shows that in 1806 £8945-6-3 was expended on the Capel Curig stretch of road, against £8038-5-0 in receipts. The costs included the building of 8 bridges, 2 toll houses, 5 toll gates, and 16 miles of entirely new road with fences and drains; plus, the cost of purchasing land, widening, fencing, and repairing. Securities for the work were given by Richard Pennant.²⁷⁹ His first subscription was made in 1804, the sum with interest being £1588. A second subscription of £912 was made on 29th September 1806. In total the capital advanced amounted to £2500, and with interest added by 24th September 1807 it had amounted to £2802-11-5 ½. The annual interest on the loan amounted to £140-2-6.²⁸⁰ The road soon fell into disrepair and in 1815, following reports by two committees, an Act was passed allocating funds for repairs. These were received in 1816 and 1817, following which a considerable amount of work was carried out. This included the stretch between Lon Isa and the River Ogwen, and it was at this time that Halfway Bridge (now known as Pont Pandy) was built.

In 1819 the Trust was replaced by the Shrewsbury-Bangor Ferry Turnpike that came into existence on 1st August of that year. This was a significant development as for the first time a major road building programme was undertaken using Parliamentary money. It was part of a national strategic development plan, designed to provide an enhanced communication link between London and Dublin. The work was entrusted to the leading civil engineer of the day, Thomas Telford, and his hallmark influence is still much in evidence. Shortly after the Trust came into existence two new toll gates were opened, which were in addition to the existing four. One of the new gates was at Lon Isa²⁸¹, and because of the amount of wear caused by the cartage of heavy stone, in 1824 it was fitted with a weighing machine.²⁸² The weighing house remains standing to the present day, but the machinery has been removed.

The development of these two roads and the improved communication they afforded was to be of immense benefit to Samuel Worthington and his associates, not least because of the improved transportation of minerals from their various mines in the area to the mills at the Trefelin Yard. The new roads, together with the building of the tramways and developments at the Port, provided them with quick, safe, and economic transport; allowing them to maximise exploitation of the area's vast mineral wealth.

5.2. 'Occupation' Road

As part of the development in the vicinity of Penlan Mill a new cobbled road was built. While there is no definitive information available it is probable that it was built by Benjamin Wyatt and/or Samuel Worthington. There are a number of reasons for supposing this the first being that prior to the construction of Penlan Mill and Llwyn Onn there was no requirement for a road linking Felin Isaf and the smallholding above at Nant Gwreiddiog. However, once the new mill and Llwyn Onn had been built and Worthington had taken possession of the Felin Isaf site, there was a need for a new road to directly link them. This new road also provided a direct transport link for all three properties with both the Shrewsbury to Holyhead Road and Chester to Holyhead Road. Certainly by around 1840, if not sooner, the new road had become known as 'Occupation' Road.

²⁷⁹ BU/PFA/12/3. 'State of the Capel Curig Road account on 24th June 1806'.

²⁸⁰ Ibid.

²⁸¹ SH 6000 6987.

²⁸² J. Quartermaine, B. Trinder & R. Turner (eds), Op cit p.39.

It is slightly open to interpretation but it would appear that 'Occupation' Road ran from just above Tal-y-Bont Bridge, starting at what is now the main A551 trunk road.²⁸³ It then went down the hill to the entrance of Trefelin Yard (originally Felin Isaf), around the front and side of the Yard, essentially following the same route as the present day road i.e. in front of Trefelin Cottages, beneath what is now the railway under-pass, and on to Penlan Mill. From the Mill it continued up the slope to Penlan Mill Cottage and then followed the inclined driveway to what today is the site of the plant hire company, continuing on to join the old Capel Curig to Bangor turnpike road.²⁸⁴ There was an additional section that ran from slightly further along the turnpike road, from opposite the smithy on the corner of the road up to Bryn and down the drive to Llwyn Onn (today known as the Old Vicarage), Pentwmpath, and Y Stabl.

The first part of the road, the section between Tal-y-Bont Bridge and Trefelin Yard, had originally formed part of the Chester to Holyhead Road prior to the bridge being re-sited and the Penrhyn Demesne enclosed; while a part of the section in front of Penlan Mill Cottage had formed part of the bed for the Penlan tramway (Fig.5.2.1). The road was eventually truncated by the construction of the Chester & Holyhead Railway which caused it to be slightly re-routed in order to accommodate the embankment. In 1853 the eight workmen's cottages in Trefelin were built adjacent to the middle section of the road, between the Yard and the railway under-pass.



Fig. 5.2.1: The route of 'Occupation' Road c.1844.²⁸⁵

²⁸³ SH60157010.

²⁸⁴ Gwynedd X/R/12, Official Maps & Plans, 'Chester & Holyhead Railway, Book of Reference to plan of Line to complete the Communication from Chester to Holyhead', (Deposited with Clerk of the Peace of the County of Carnarvon, 30th November 1844).

²⁸⁵ Ibid.

The remains of the road were first uncovered in August 2010 during excavation of the Penlan Mill site, at which time the area was largely wooded. As this section of the road lies immediately adjacent to the front of the stable wall initially it had been thought that its cobbled surface formed part of the stable yard, and it was only following further excavation work that its true purpose was recognised. The remains of the cobbled surface ran from approximately two-thirds of the way along the stable wall (in excavation grid X1) and terminated at the railway embankment. According to the railway company's plan, it did not extend beyond its present southerly limit: i.e. beyond what is today the sewage filter bed.

The total length of road exposed during excavation was approximately 16 metres, with the distance from the north east corner of the stable wall to the embankment being 4.38 metres. At its widest point, adjacent to the railway embankment, it is approximately 5 metres wide, reducing to approximately 3 metres at the southern end. For most of its length there is a gully running along the eastern edge, this petering out towards the embankment. From the southern end of the road a low brick wall runs northwards alongside the gully for approximately 4.5 metres, and southwards for approximately 2 metres. The southern section is offset at an angle of approximately 10 degrees towards the adjacent filter bed (Figs.5.2.2 to 5.2.4).



Fig. 5.2.2 (left): The remains of 'Occupation' Road, truncated by the Chester & Holyhead Railway. (2011)

Fig.5.2.3 (right): The gully to the eastern edge of 'Occupation' Road. (2011)

(Note that the route ultimately taken by the railway was that shown on the above plan as the upper Limit of Deviation, running between the saw mill in Trefelin Yard (shown as item 4) and Penlan Mill.)

Although an attempt was made to continue excavating the road up as far as Penlan Mill Cottage this was not possible as the area in front of the railway under-pass is in constant use by the residents of Trefelin Cottages as a turning point: Trefelin being a very narrow road with no facility for turning apart from the area adjacent to the mill. One small area was uncovered but it proved to be inconclusive as no further evidence of a proper cobbled surface was found (Fig.5.2.5). Until 1980 there still had been a cobbled area at the top of the slope in front of Penlan Mill Cottage (see Fig.3.1.2), although whether originally this was part of the road is inconclusive as the yard in front of the mill's upper yard extension would also have been cobbled. From anecdotal reports the road was still in use until the 1940s, with

horses hauling timber from the saw mill in Trefelin Yard to the Timber Yard at Bryn.²⁸⁶ There is some slight evidence of the cobbled surface still remaining on the section of road that passes between Pentwmpath and Worthington's former residence at Llwynon.



Fig.5.2.4 (left): The east edge of the road facing south, showing the brick wall and gully.



Fig.5.2.5 (right): The remaining surface of the road as it heads toward the Upper Yard and Penlan Mill Cottage. (2011)

5.3. The Chester & Holyhead Railway

The opening of the Chester & Holyhead Railway in 1848 was to mark the culmination of the new transport systems in the area and made a major impact on the local community; not only after completion, but also during its construction. It was a major engineering feat that brought about lasting changes to the landscape that are still evident today: in particular the construction of track, bridges, tunnels, and embankments. A feature that came to dominate the immediate locality was the construction of towering viaducts across the rivers Ogwen and Cegin; the Llandegai viaduct in particular as it bisected the lower yard at Trefelin, truncated 'Occupation' Road, and separated Penlan Mill from the Estate Works in the lower yard. It is likely that it also altered the course of the aqueduct to the smithy and slate works, also the culvert that runs from the hill above Bryn (see Sections 4.3 and 4.7). The work carried out in the local area was part of Contract No.9 which covered a 6 ½ mile stretch that included the Llandegai, Bangor and Belmont tunnels, as well as the two viaducts.²⁸⁷

Little physical evidence remains of the navvies who built the railway, although one can only imagine the impact the arrival of approximately two thousand workmen and their families had on the local population. Apart from the logistics involved in housing and feeding a workforce that was many times larger than the local population, there were also the social and cultural implications. Married workers were accommodated in temporary double-boarded timber cottages, although there is no trace of these today. Shops were erected to provide food for the families, and on occasions beer was sold; this latter soon bringing the company into conflict with the local innkeepers, who in 1845 petitioned for it

²⁸⁶ Mr Glyn Williams of Tyddyn Heilyn Farm, Op cit.

²⁸⁷ North Wales Chronicle 2 March 1847.

to stop. Many of the single men lived in lodgings, and although generally well behaved there were instances where they absconded without paying their board.²⁸⁸

The railway company also contributed £300 toward the cost of employing a number of scripture readers who travelled up and down the track talking to the men during their meal breaks. Many of the navvies who were monoglot Welsh speakers took the opportunity to learn English, and one lasting legacy from their sojourn in the area was the degree to which many local people became anglicised.

Relations between the Welsh navvies and their English counterparts were mixed, especially as they were paid on piecework and initially the Welsh were not as productive and took some time to come on par.²⁸⁹ In large part this was because the English navvies were already hardened, having worked on contracts elsewhere either building railways or canals. In the early stages of construction there were often violent clashes between the different nationalities, although as time progressed these tended to reduce. One particularly violent incident took place in May 1846 when a group of Welshmen decided to serve a 'Welsh ejection' upon some of their fellow workers: primarily upon some Irish labourers, but also English, and Scottish. The problem started on Penmaen Bach contract No.8 but quickly spread along the coast toward Bangor. A group of 60-70 labourers were forced to flee without having time to gather their possessions and were chased by what grew to be several hundred Welshmen.

At Llandegai the group of rioters divided into two groups: one keeping to the main road into Bangor and other taking the hill path. Those following the main road reached Bangor first, and as they passed the lock-up (where petit sessions were being held) one of the Magistrates, the Rev Mr Vincent, recognised one of them, and believing him to be a ring leader ordered him to be locked up. This inflamed his fellow rioters and they attacked the two constables who were present there, both of whom were injured. The Rev Vincent was also struck and forced to retire inside the building. The Magistrates who were present immediately swore in special constables, including ten or twelve of the Irishmen who had taken refuge there. The Riot Act was read, and the situation became even more inflamed; only cooling down when it was found that the ring leader had escaped over the lock-up wall. He returned to the front of the building and taunted the Magistrates, daring them to re-arrest him.

The following day, a Saturday, such a degree of ill feeling still remained that at 10 o'clock in the morning the Magistrates reported the incident to the commanding officer of the garrison at Chester. He immediately dispatched a Company of the 68th Regiment of Foot under Captain Wynne. They travelled by train to Liverpool and then by chartered steamer to Bangor, where they arrived that evening. The officers were billeted in the Castle Hotel and the men in the public houses. Even though the city was over crowded with a drunken mob of navvies and several disturbances took place, the presence of the troops kept the situation under control. The troops remained in the city for some time following the incident to ensure that it did not re-occur.²⁹⁰

There was a further incident a week later when a group of local men attacked an English railway worker; having previously threatened to cut off the ears of any Englishmen they found, so that they

²⁸⁸ North Wales Chronicle 28 April 1846.

²⁸⁹ P.E. Baugham, *The Chester & Holyhead Railway, Volume One: The Main Line up to 1880* (Newton Abbot, 1972), p.60.

²⁹⁰ North Wales Chronicle 26 May 1846.

might tell them apart from the Welsh. In the ensuing melee the Englishman, James Webb, had his left ear cut in two, was stabbed in the head with a penknife, and received a number of other injuries. Two of the ring leaders were sent to gaol for their part in the incident.²⁹¹

In November 1848 two local men who were working at the cutting at Llandegai fell out over ownership of a shovel, and as a result of the dispute both were dismissed. Shortly afterwards, as he was returning home, one of the men was attacked from behind and received a serious stab wound to his chest. He was taken to the George & Dragon public house (known today as The Slate), where he was attended by the surgeon who managed to revive him. The perpetrator was apprehended and charged, while the man who had been attacked was fined five shillings for being drunk and disorderly on a Sunday!²⁹²

Work on the railway was also extremely dangerous and many navvies were killed or badly injured. For example, in 1846 Robert Roberts and Robert Jones were killed when they fell down No.1 shaft in Bangor tunnel; and 17 year-old Griffith Jones was killed when a loaded wagon ran over him on Conway Marsh.²⁹³ In March 1847, a local carter named Thomas Smith was crushed to death when he fell from his cart while carrying stone between Aber and Tal-y-Bont.²⁹⁴ Earlier that year, in January, several tons of loose earth or rubbish fell upon John Hughes while he was working in No.1 tunnel at Llandegai. He was trapped for an hour before being released, but fortunately was found not to have sustained serious injury.²⁹⁵ This continued to be a problem and in September 1848 Mr George Stephenson, who was addressing the half-yearly meeting of the Chester & Holyhead Railway, advised that '*In the Llandegai tunnel about eighty yards will require lining to be made perfectly safe*'.²⁹⁶

A number of contractual problems arose between the railway contractor and the Penrhyn Estate. These included, for example, the late return to the Estate of land at Llwynon;²⁹⁷ the poor state of the road from Llandegai via Ty Newydd Farm to the Cegin; the non-restoration of the gravel pit at Tai'r Meibion;²⁹⁸ the shoddy workmanship at the Cegin viaduct;²⁹⁹ and agreement on the amount of land taken from the Estate by the railway company.³⁰⁰

Local farm tenants were also affected. For example, Mr Thomas could not communicate between the two parts of his land between Bangor and the Cegin³⁰¹, and Cefn Faes Newydd Farm and Old Cefn-faes Farm were severed in two by the new line and had to be re-fenced and drained³⁰². Consequently, the rent for both farms had to be reduced, causing a reduction in the Penrhyn Estate's income.

In 1852, four years after the opening of the railway, a new private siding was constructed at Penlan: this perhaps offering some further indication of the Estate's willingness to adopt new technology.

²⁹¹ North Wales Chronicle 9 June 1846.

²⁹² North Wales Chronicle 25 November 1848.

²⁹³ North Wales Chronicle 8 September 1846.

²⁹⁴ North Wales Chronicle 23 March 1847.

²⁹⁵ North Wales Chronicle 26 January 1847.

²⁹⁶ North Wales Chronicle 26 September 1848.

²⁹⁷ BU/Penrhyn mss 1800, Folios 73-74 (March 1848).

²⁹⁸ Ibid.

²⁹⁹ BU/Penrhyn mss 1800 Folio 200 (10 April 1848); Folio 417 (23 June 1848).

³⁰⁰ Ibid, Folio 662 (17 November 1848).

³⁰¹ Ibid, Folio 265 (2 May 1848).

³⁰² BU/Penrhyn ms 1741 (29 November 1847).

5.4. The Penlan Siding

The Penlan siding was situated alongside the Chester & Holyhead Railway main line; to the south side and adjacent to the east end of the Llandegai tunnel (Fig.5.4.1). It was always privately owned by the Penrhyn Estate and from the available evidence would appear to have been constructed in around 1852 (see Section 2 for details of the lease between the Estate and the Evans Brothers). The maximum number of wagons that it could hold was ten (Fig.5.4.2),³⁰³ and according to the terms of the Evans Brothers lease it could only be used in conjunction with the mill. It was still in use in 1885 at which time Thomas Lewis & Co were paying an annual rental of £5 for its use, plus a further 5/- for use of the adjacent land and gate.³⁰⁴ However, in May 1902, following Mr Lewis's departure from the Penlan mill, it was taken over by the Estate.³⁰⁵ In the Ogwen Rural District Council Special Draft (Apportionment) Valuation List for 1929-1932 it is listed as Freight-Transport Hereditaments, London Midland & Scottish Railway Co., Penlan (siding).³⁰⁶ On 29th October 1949 a payment of 8/9d (eight shillings and nine pence) was paid to the Railway Executive, being the 'Siding Rent'. This is the only recorded such payment during the period April 1947 – March 1951.³⁰⁷

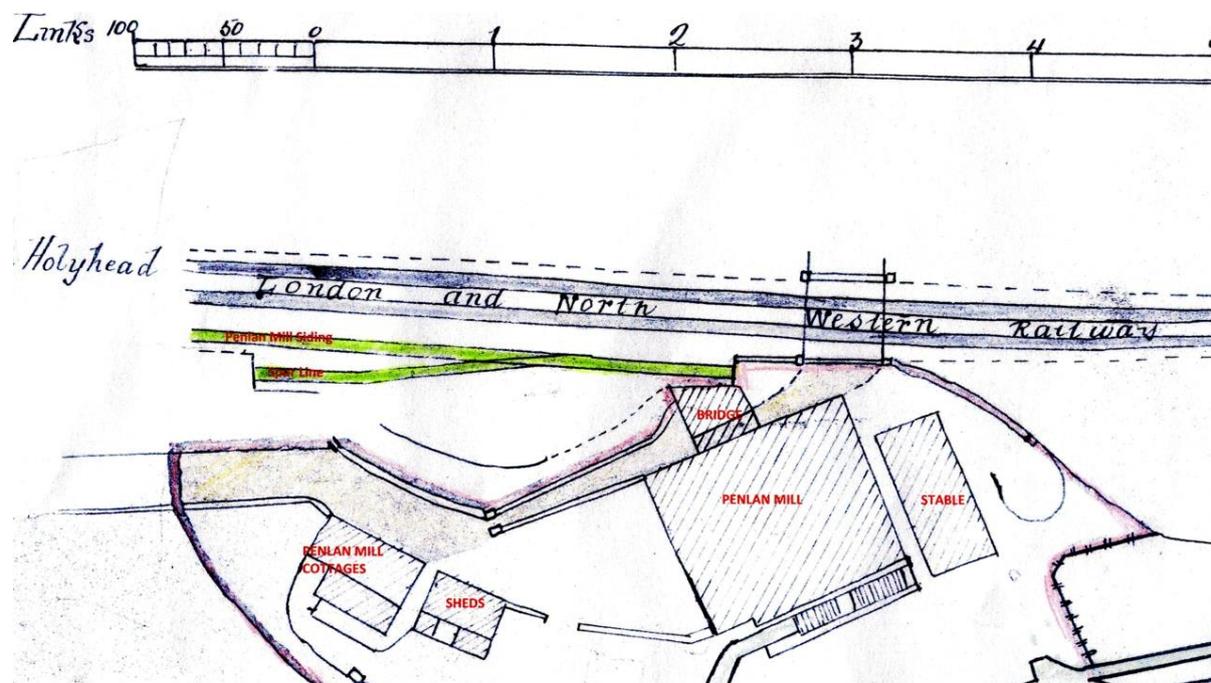


Fig.5.4.1: Plan dated 1883 showing the location of the siding and the bridge connecting it to the mill.³⁰⁸

The siding played an important part in the Llandegai area for almost a hundred years, from the mid-19th century to the mid-20th. It was the existence of the siding that helped maintain and develop the various industries that developed during that period, these including milling, iron ore production, and the shipping of timber products. Initially it was used to bring in grain from England to the mill at Penlan.

³⁰³ J. M. Dunn, *The Chester & Holyhead Railway*, (Oakwood, 1968), Appendix.

³⁰⁴ Notated on an unreferenced plan of the siding dating from 1871.

³⁰⁵ BU/ms29355.

³⁰⁶ Gwynedd/XB.14.98, p.23.

³⁰⁷ BU/un-cat, Penrhyn Estate Saw Mill Account April 1947 – 31st March 1951.

³⁰⁸ BU/Penrhyn 138.

Later, after the mill had ceased to operate, it was used by the Penrhyn Estate to ship in pipes and other materials.

In the early part of the 20th century it was also used for shipping out iron ore, and during World War II for shipping out pit props, fencing posts, and other timber products. It remained in existence until around 1962, at which time the track was removed. It may not have been in active use for some time prior to this, as by 1955 the timber saw mill at Trefelin Yard had closed; many of the Estate's commercial activities had by then ceased; and Penlan mill had been demolished: including the bridge connecting it with the siding. Until the departure of Thomas Lewis & Co from Penlan in 1901 use of the siding was always included in leases pertaining to the mill, with the mill tenant being responsible for its maintenance and safe use.

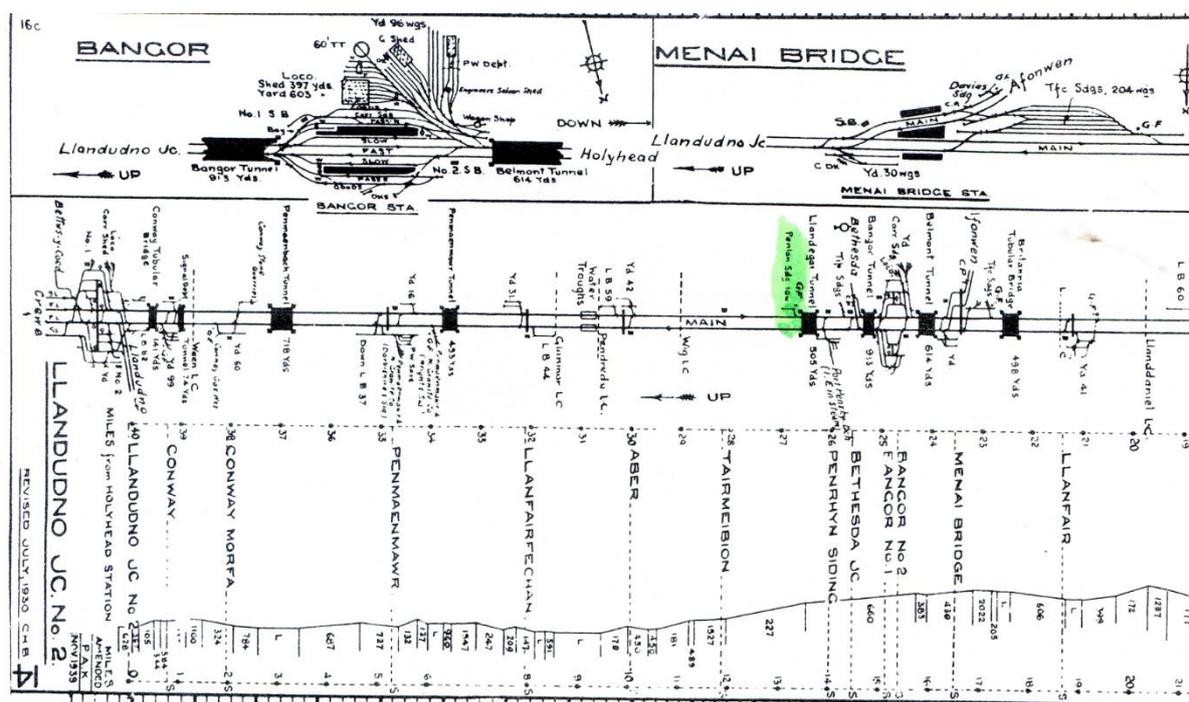


Fig.5.4.2: Railway plan from 1930 showing the siding adjacent to the east end of Llandegai Tunnel. It is marked as having a capacity of 10 wagons.³⁰⁹

The wagons were manoeuvred between the siding and the mill by horses, using the adjacent path. While the siding had the capacity for up to 10 wagons it would seem that there were never more than two or three in use at any one time, and assuming that the wagons were actually taken into the outer mill (warehouse extension) the transfer would have been affected via the bridge. As this was approximately 30 feet wide there would have been more than adequate room to run the wagons across, possibly even for there to be a loop on the bridge, or inside the mill itself. It is not clear how the transition from the siding to the bridge was made as this is not shown on any of the available plans. One possibility is that there could have been a turntable, although again there is no evidence to support this view. Indeed, because of the lack of available evidence we do not even know if the wagons were actually taken into the mill, or whether the transfer of materials took place track-side. Certainly, this is what happened when timber products such as pit props and fence posts were being shipped. However, on balance it seems likely that in the case of grain and iron ore they were taken

³⁰⁹J.M. Dunn, Op cit.

directly into the mill building as handling such commodities trackside would have been extremely difficult. Furthermore, if it was not the intention for goods to be loaded or unloaded directly through the warehouse it is unlikely that the large chute would have been built into the west wall.

The construction of the spur line would have made handling the wagons far simpler. As each wagon was loaded or unloaded it would have been shunted onto the spur, thus freeing space for the next one to enter the mill. It also would have allowed any spare wagons to be temporarily stored. It is not known whether the spur was constructed at the outset or whether it was added at some later date. The first time it became in evidence was in the 1883 lease between the Estate and Lewis & Co.³¹⁰

Because of its location wagons were shunted into the siding from the down-line that ran between Mold and Bangor. Prior to World War II the train ran twice a week, leaving Mold at 8.30am and reaching Caernarfon at midday. On its return trip it stopped at Port Penrhyn at around 3.30pm and arrived back in Mold at 6pm.³¹¹ Presumably during each trip empty wagons were shunted onto the spur, and full ones collected. No doubt it was the extensive shunting involved that contributed to the overall journey time.

It is thought the release levers that managed the siding were controlled by a signal sent from the Penrhyn Siding signal box, which was situated near the west end of Llandegai tunnel. Prior to the signalling system being electrified the levers would have been operated manually. Operation of the levers released the switch points, allowing the wagons to move in and out of the siding as required. As there was not a cross-over from the up-line the wagons would have been backed into the siding.³¹²

³¹⁰ BU/PFA/2/59 Lease of 10th December 1883 for Penlan Mill, between Thomas Lewis & Co and the Penrhyn Estate.

³¹¹ As per Eric Foulkes.

³¹² Mr David Alan Carr, former signalman, and Mr Keith Davies, former signalling engineer. 17th March 2016.

6. The Upper Yard at Bryn

The upper yard at Bryn lies in what formerly was a part of Llwynon fields, adjacent to the former Shrewsbury to Holyhead coach road at Tanybryn. From around 1890 it was initially developed as an annexe to the timber mill at Trefelin, but from the early 20th century soon came to have a greater significance.

6.1. The Timber Yard

Although it is not clear precisely when, at some point the decision was made to store timber that had been sawn in the lower yard at Trefelin at a new timber yard at Penlan, from where after treatment it was shipped. While generally it was known as the Timber Yard at times it was also referred to as the Carters Yard. Initially just stables were erected on the site, together with two new cottages for the carters (Fig.6.1.1). The first record of the new facility was in the 1889 25" OS Map of Caernarvonshire, Sheet V11.13. A 'pickling' tank was added some time later, and again from the OS maps this would appear to be sometime after 1929. The tank was filled with heated creosote into which fence posts, etc, were immersed overnight before being shipped out through the Penlan siding. Much of the timber that was processed at the yard went for pit props, during World War II in particular, although these were not 'pickled' (Fig.6.1.2).

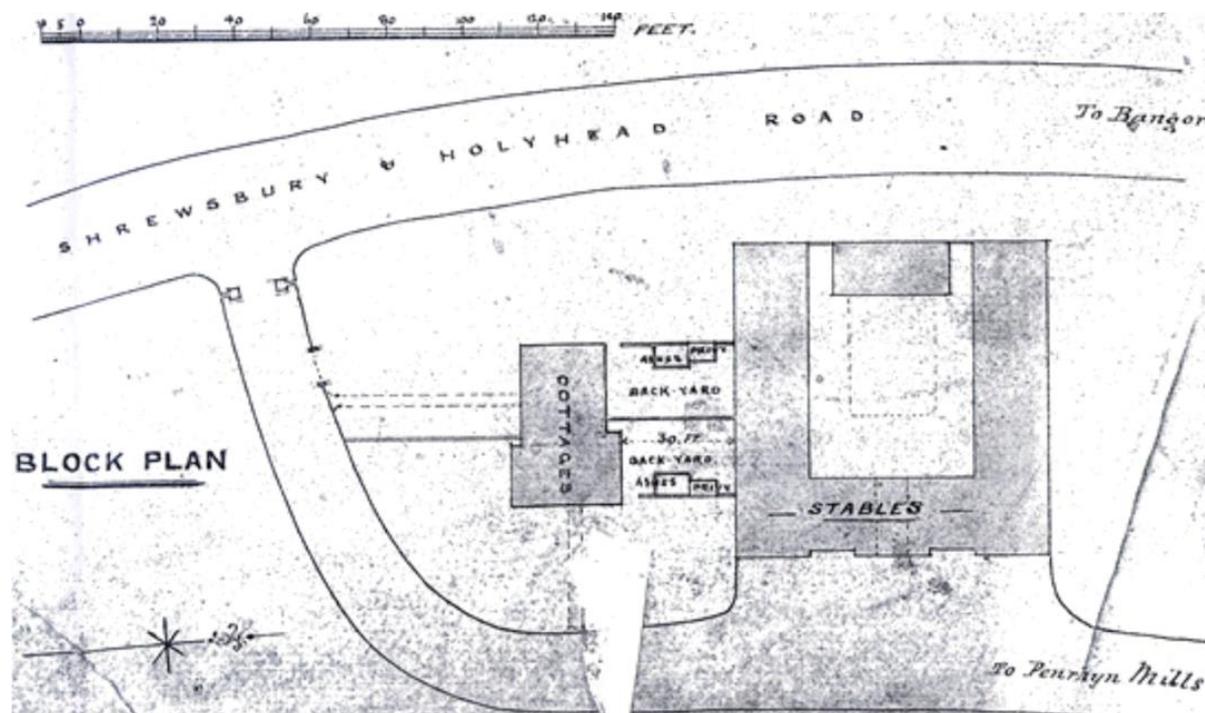


Fig.6.1.1: The Timber Yard c.1890.³¹³

Initially timber was transported between the two sites and to the siding using draught horses, although this task was later undertaken using a motor lorry. It has been said that the bridge between the mill and the railway siding was so low that the horses' collars had to be turned sideways to allow passage.³¹⁴ Locally the gap beneath the bridge was known as 'the tunnel'. Eventually part of the yard

³¹³ BU/140.

³¹⁴ Mr Glyn Williams, Op cit.

was taken over by the Penrhyn Forestry Department with the head forester, Mr Barrie, having an office there. In the 1954-1955 Rate Book the yard was shown to contain the Penrhyn Machinery Depot, the creosoting shed, the old forestry office, and the Garrison Engineer's office.³¹⁵ At one time the keeper of the tank was William Roberts, who lived in Mona Cottage, Llandegai, and was a Deacon of Gatehouse Chapel.³¹⁶

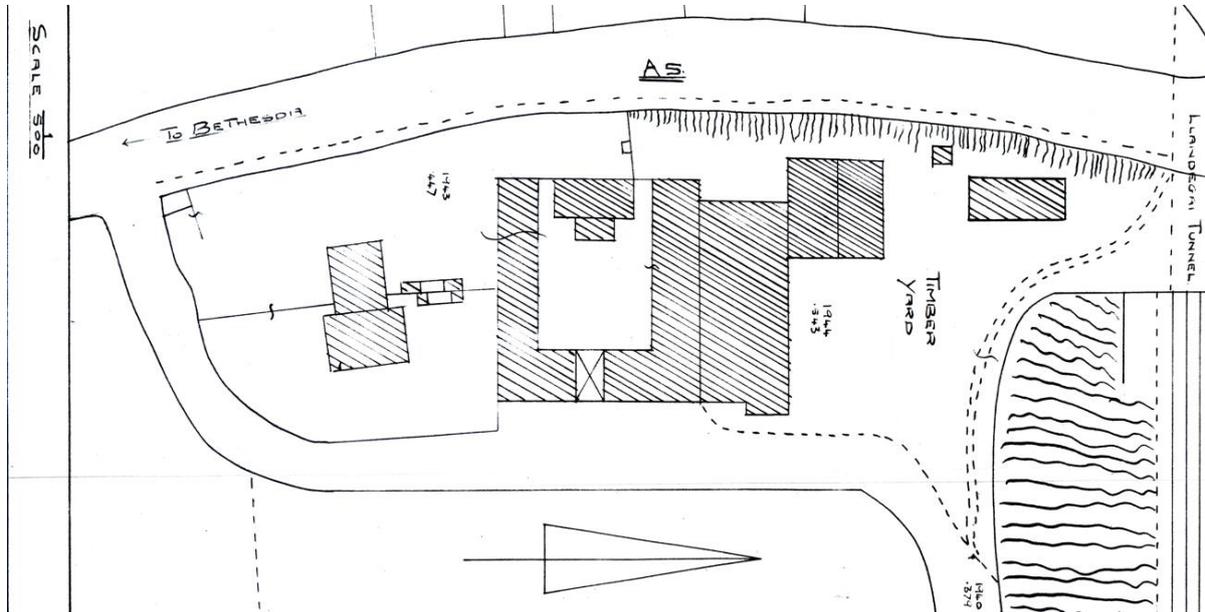


Fig.6.1.2: Plan of Timber Yard c.1951with Penlan Cottages (also known as the Carter's Cottages) to left of site.³¹⁷

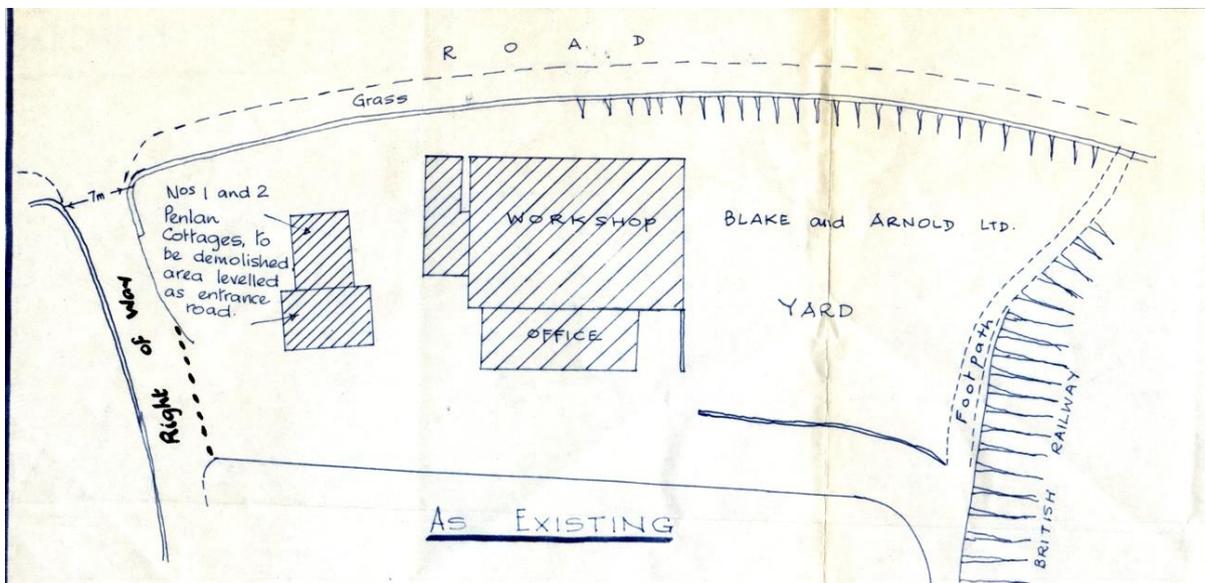


Fig.6.1.3: Plan of the existing yard prior to removal of cottages. (1991)³¹⁸

³¹⁵ Gwynedd/XB.14.113, Ogwen Rural District Council Rate Book 1954-55, p.48, Items 951-954.

³¹⁶ Dr Dafydd Alun Jones, Op cit.

³¹⁷ BU/Penrhyn 131.

³¹⁸ Figs.7.1.3 to 7.1.5 Courtesy of Mr Merfyn Jones, Op cit.

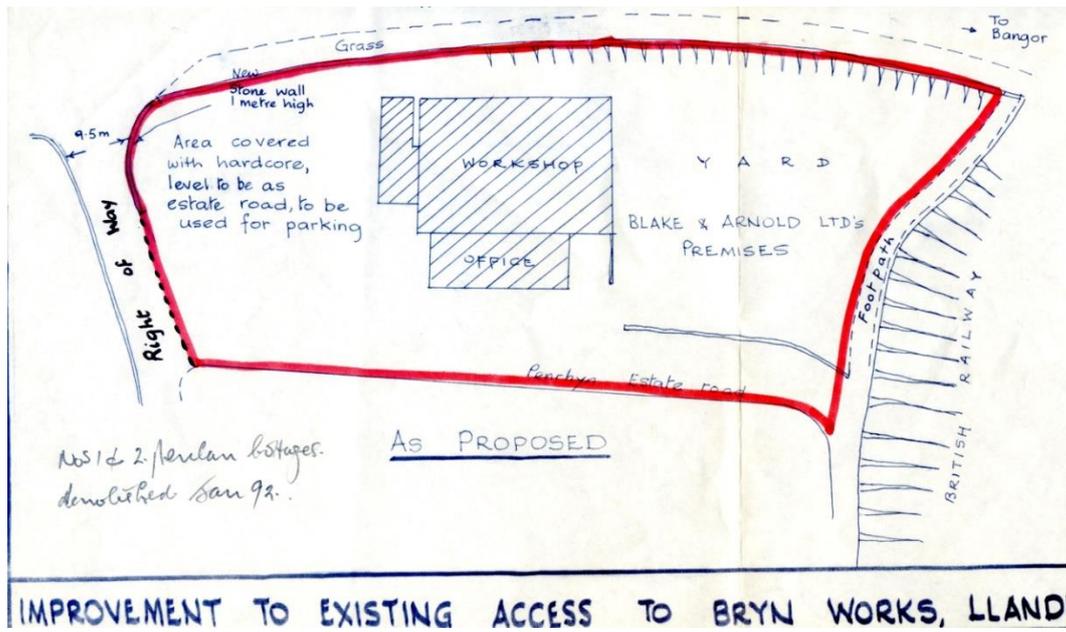


Fig.6.1.4: Proposed plan of the yard after removal of cottages. (1992)

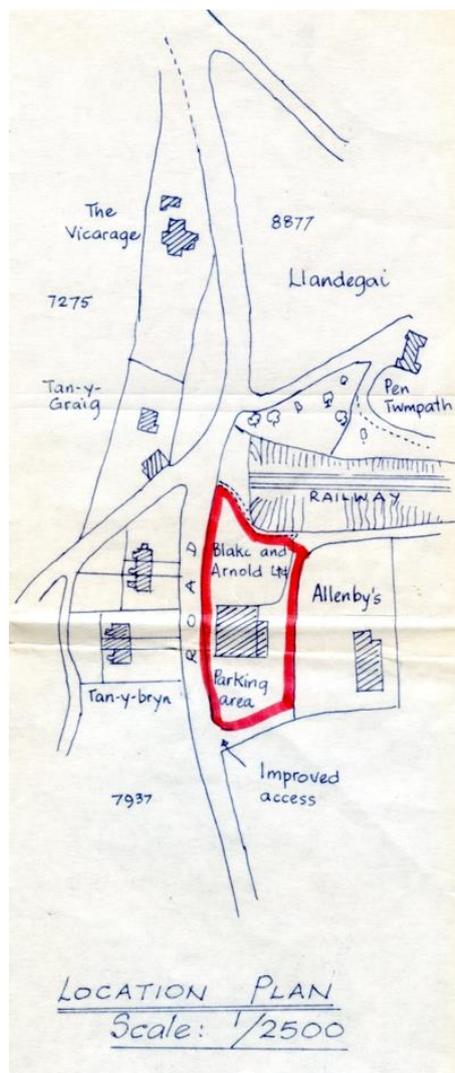


Fig.6.1.5: Overview of the yard showing proposed changes. (1991)

In 1958 the site was sold to Blake & Arnold Ltd, a plant hire company based in Caernarfon. In February of that year they applied to Caernarvonshire County Council for planning permission to develop the site 'To establish the necessary facilities to operate a Civil Engineering Plant Business'; for which final approval was granted on 24th March 1958.³¹⁹ They removed all of the existing buildings, including the creosote tank, erected a new workshop and offices, but retained the two cottages (Fig.6.1.3). In 1987 Blake & Arnold was taken over by Hewden Plant Hire, although the site was not re-badged until ten years later. They in turn have been taken over by Ashbrook Plant Hire.

In 1991 Hewdens' proposed making further alterations to the site. These included demolition of the cottages in order to provide additional parking space for their machinery, and to improve vehicular access to the site.³²⁰ The work was carried out in January 1992, since which time there have not been any further alterations (Figs.6.1.4 & 6.1.5).



Fig.6.1.6: Hewden Plant Hire workshop and offices.
The cottages were in the fenced area, centre of picture. (2015)

6.2. The Carter's Cottages (Penlan Cottages)

There were two cottages, both of them being built in around 1890. Originally, they were designated as Carters Cottages, although in the Penrhyn Estate rent rolls they appear as Penlan Cottages (Figs.6.2.1 to 6.2.7). Apparently, they were constructed in stone with a rendered exterior and yellow brick edgings, although this is not evident from the surviving photographs and there is nothing to indicate this from the surviving plans.³²¹ The roof was slate. The cottages were adjoining with No.1 being nearest the main road. The gable end of No.1 was aligned east-west, and that of No.2 was aligned north-south. Both comprised the same accommodation with a kitchen, scullery, and one bedroom to the ground floor, and two bedrooms to the first floor. The initial source of their water supply is not known but from around 1900 it was provided from a pump that was located in the wall facing No.2, opposite what today are Ashbrook's offices (Fig.6.2.8).

³¹⁹ Caernarvonshire County Council Application No. 5690 dated 7th February 1958.

³²⁰ Information provided by Mr Merfyn Jones, Hewden Plant Hire, at a meeting on 19th March 2012.

³²¹ Dr. D.A. Jones, Op cit.

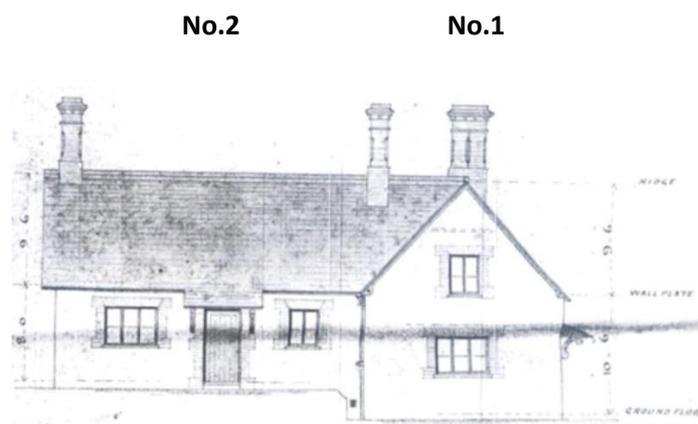


Fig.6.2.1: The Carter's Cottages, front elevation. (c1890)³²²



Fig.6.2.2: Carter's Cottages, rear elevation. (c1890)

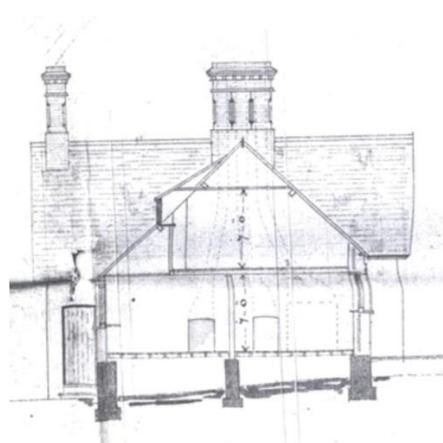


Fig.6.2.3: Carter's Cottages, end section. (c1890)

The pump was manufactured by Glenfield & Kennedy Ltd of Kilmarnock, who at the time was the largest manufacturers of water valves and meters in the Commonwealth.³²³ The company was formed in 1899 following the merger of Kennedy's Patent Water Meter Company and Glenfield Co. Ltd. and based on this it would appear that the pump was not available to the cottages until sometime after this date. It is still in situ today but no longer in use.³²⁴ There were a number of such pumps in Llandegai

³²² Figs.7.2.1 to 7.2.5 BU/Penrhyn Map 59.

³²³ www.futuremuseum.co.uk

³²⁴ Mr Merfyn Jones, Op cit.

Village although only this one survives to the present day. A similar pump still exists in Tal-y-Bont, located in the wall on the corner opposite Ty Mawr. Again it is no longer in use;

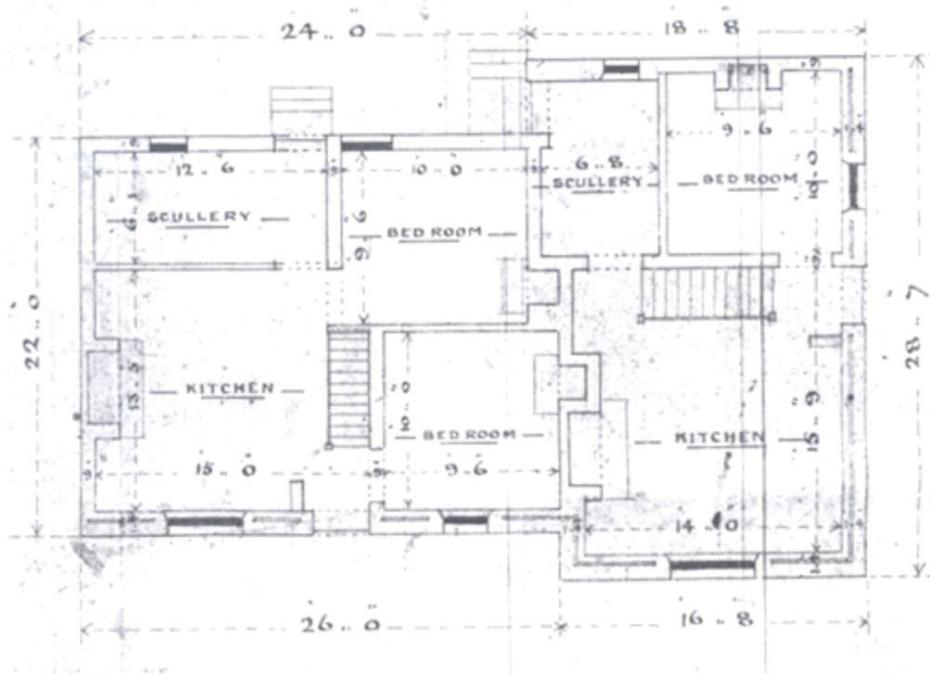


Fig.6.2.4: Carter's Cottages, ground plan. (c1890)

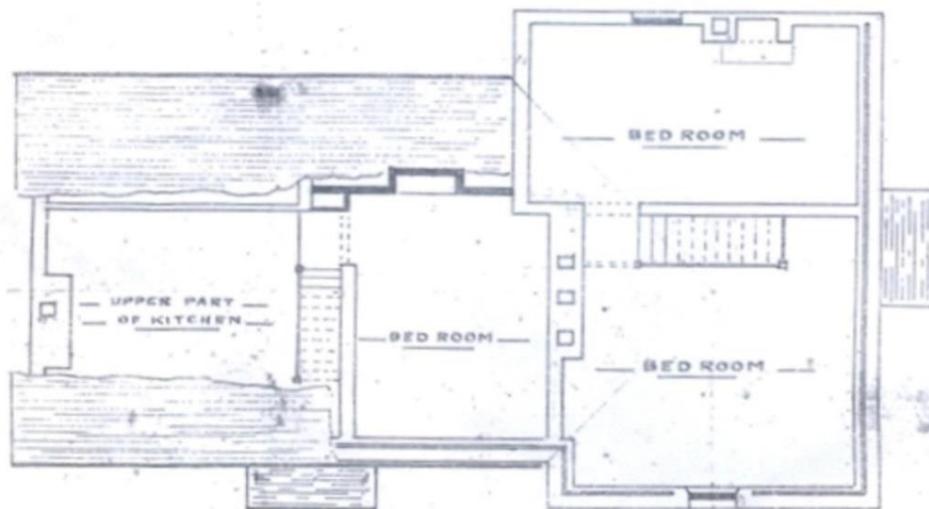


Fig.6.2.5: Carter's Cottages, chamber plan. (c1890)

The first time the cottages appeared in the Penrhyn rent roll was in 1891. The first tenants in one of the cottages were Owen Owen a 56-year-old carter, his wife Margaret, and their 18-year-old daughter Mary. In the other was William Owen, also a 56-year-old carter, his wife Margaret, their daughter Maggie age 21, and their grand-children Ellen age 12, John age 9 and Richard age 5.³²⁵

³²⁵ 1891 Census, Llandegai. PRO/RG12/4669.



Fig.6.2.6 (left): Rear of Tan y Bryn (left) with gable end of Penlan Cottages to right, roof of warehouse in centre at rear. (c1968)³²⁶

Fig.6.2.7 (right): Penlan Cottages with the gable end of No.1 nearest the road. The roof of Blake & Arnold's workshop is to the left with the roof of Alleny's Warehouse in background. (c1968)



Fig.6.2.8: The pump in wall of the Timber Yard. (2012)

A later tenant, at No.1 Penlan Cottages, was John Roberts, who worked as a carter for the Penrhyn Estate during the 1940s. He carried trees from Nant Elin to the saw mill in Trefelin using a horse and trailer, with the trailer having a wheel at the rear to act as a brake. One of his daughters, Gladys, remembers having rides on the horses from the yard down to Trefelin, and having to dismount at the 'tunnel' adjacent to the mill because of the very limited clearance. In 1951 Mr Roberts fell from his cart in Llandegai Village and never recovered from the trauma, eventually spending the rest of his life in hospital. While there were still some draught horses in use at this time, generally the pit props were taken to the siding by lorry.³²⁷ During this same period, the tenants in No. 2 Penlan Cottages were Robert and Eluned Jones and their two sons Dafydd Alun and Idris. Mr Jones has already been mentioned as the van driver and mechanic for the Penrhyn Estate who carried out his work in the upper yard extension at Penlan Mill.³²⁸ Prior to taking up this post he had been an RAC Patrolman in the Penmachno area, and on the outbreak of the Second World War he became a driver for Purple Motors in Bethesda.

The cottages were demolished in January 1992 in order to provide additional parking space and site access for the large plant operated by what was at that time Blake & Arnold (see Section 6.1 above).

³²⁶ Figs.6.2.6 & 6.2.7 Courtesy of Miss Nerys Jones.

³²⁷ The information was provided by Mrs Roberts during a meeting at her home in Rachub on 30th November 2010.

³²⁸ Mr & Mrs Jones and their younger son, Idris, are buried in St Cross Church graveyard, Tal-y-Bont; as while they lived in Llandegai they were members of Gatehouse Chapel, which did not have its own graveyard. Gwynedd Family History Society, *Memorial Inscriptions of the Churchyard at St Cross*, M278, p. 28.

6.3. Amaethwyr Ogwen Ltd

In around 1950 a new building was erected in the field facing the Timber Yard, to the rear of the garden belonging to Penlan Mill Cottage.³²⁹ Initially it consisted of one large bay and was erected for an enterprise called Amaethwyr Ogwen Limited, which was a farmer's co-operative that was formed as a hay drying business. Hay was shipped loose to the plant and once dried it was returned in bales.³³⁰ It continued in operation for approximately five years by which time it had proved to be unsuccessful, and in 1956, it went into liquidation.³³¹ There is little reference to the enterprise other than an entry in the Penrhyn Estate Woods & Forestry Department Accounts, for which there is a record dated 17th April 1951 that shows 'wages £15-12-6'.³³²

The site was subsequently taken over by Allenby's Ltd, a confectionary, wine and tobacco wholesaler, and it is they who extended the building to its present size by adding an additional bay to each side (Fig.6.3.1). Following the retirement of Mr Allenby in the late 1990s the building was taken over by Carters Removal and Storage, who operated their business from there until 2008. The building is now sub-divided into several units and let to a number of small businesses.



Fig.6.3.1: Former hay drying shed in centre, the two side sections being added when it was converted to a warehouse.

6.4. The Penrhyn Iron Mine

The Penrhyn Iron Mine was located at Rhos Uchaf above Llandegai³³³ and was operational in two stages. In 1912 a Take Note was issued by the Penrhyn Estate to T. H. Roberts and E. J. Morris for the sum of £25 per annum, and they worked at the site on a very limited scale, sinking trial shafts (Fig.6.4.1). The following year the site was taken over and developed by the Silurian Iron Ore Company, the lease being dated 19th August 1913 and the annual rental £200.³³⁴ From the available accounts it would appear that initially only a small number of men were involved during the trial period, as shown below:³³⁵

³²⁹ SH 590 705.

³³⁰ Mr Robert Jones of Coed Howel Farm, 21st October 2013. Specifically, he was referring to hay sent by two of his uncles who farmed at Bryn y Neuadd in Llanfairfechan.

³³¹ *The London Gazette*, 15th June 1956.

³³² BU/un-cat, Penrhyn Estate Accounts 3rd April 1947 – 31st March 1951, p.163.

³³³ SH 595699.

³³⁴ BU/PFA/4/176 Rental 1912, p. 44.

³³⁵ Courtesy of Miss M. Muir, Op cit.

1912

Rhos Iron Mine Account

April 1 st	Two shelves at 1/3d each	£0-2-6
	Iron Wheve(?) (second-hand)	£1-3-0
	Pike	£0-3-6
April 13 th	William Griffiths, 2 weeks wages	£2-0-0
	Richard Evans, ditto	£2-0-0
April 27 th	William Griffiths, 2 weeks wages	£2-0-0
	Richard Evans, ditto	£2-0-0
May 4 th	Tom Parry, 1 week	£1-1-0
	Richard Evans, ditto	£1-1-0
	For timber to Mr A.P. Williams	£0-7-6
(Notation: 'May 6 th received a cheque for above acct plus all previous acct of testing)		
May 18 th	Tom Parry, 2 weeks wages	£2-2-0
	Richard Evans, ditto	£2-0-0
June 1 st	John Evans, 2 weeks wages (less 3 ½ days)	£2-2-6
	Morris Evans, 2 weeks wages	£2-0-0
	Tom Parry, ditto	£2-0-0

This pattern continued until the mine became operational in 1913, although there was a marked increase in activity from December 1912.

December 30th to 8th January 1913

To 12 men at 4/- per day (their own tools) (9 working days)	£21-12-0
To John Evans (foreman) ditto	£ 3-5-0
26 [Industrial Insurance] stamps for 13 men	£ 0-6-6
Explosives to Mr W. J. Parry	£ 2-5-6 ½
Smithy Mr T. Williams	£ 0-14-4
Sundries Mr Josiah Hughes	£ 0-11-6
Sundries Mr E. Hughes	£ 0- 4-6
	Total £28-6-10 ½

There was a note appended, addressed to Alex Mackay esq: *'Dear Sir, I have omitted Galvanised Buckets, ropes, etc, as they may be useful to me again'*. Mr Mackay was based in Banbury, but his precise role is not known, although from a note to the account dated 11th January 1913 it would seem that possibly he was either a contractor to, or a manager with, the Silurian Iron Ore Company. The note reads *'Mr Alex Mackay employed an extra 10 men and asked me to pay our 3 men, along with his 10 men, for 9 days as our men was at his command, and I am sending him the account today, and all bills settled within the 9 days from December last, the 30th until 8th inst. (£28-6-10 ½). He asked me to do so at once.'* In each case it would appear that the bills of account were prepared by E. J. Morris and submitted to T. H. Roberts, the Dolgellau ironmonger, for payment. Quite what their relationship was at this time is not clear, although they were partners in various other ventures. Possibly Mr Morris provided the mining expertise, while Mr Roberts provided the financial backing for their ventures.

Throughout this period incidental expenses were also incurred, and these included, for example:

June 1st 1912	W. J. Parry for explosives	£1-1-7
	Thos Williams for Smithy from April 9 th	£0-11-1
	Humphreys & Son for 2 extra shovels	£0-2-6
	J. Hughes for picks, hammers, shafts and winch hook	£0-5-0
	W. Hughes for windlast tub	£0-3-6

In August 1913 the mine became operational and initially the ore was mined open cast, being quarried at the surface. By 1917 the majority of the work was carried out underground by which time it had reached a maximum depth of 126 feet. The 32 men employed at the mine achieved an output of around 200 tons per week, although this was not achieved without some difficulty. The height of production was reached in the year 1915/16 when it rose to 335 tons per week, this being one of only two years in which production exceeded 300 tons: the other being 1914/15. For three of the eight years that the Silurian Iron Ore Company occupied the site production fell below the minimum output of 160 tons. There were two main problems, the first being the nature of the ore itself, and the second the difficulties associated with transportation. Furthermore, in common with all of the Caernarvonshire iron mines it had a high silica content that made it unattractive to ironmasters. It was also contaminated with iron pyrites that had to be removed by hand prior to shipping. Initially smelting of the ore was carried out at Brymbo and Ruabon in North Wales, and latterly at Liverpool and then at Swansea in South Wales.³³⁶

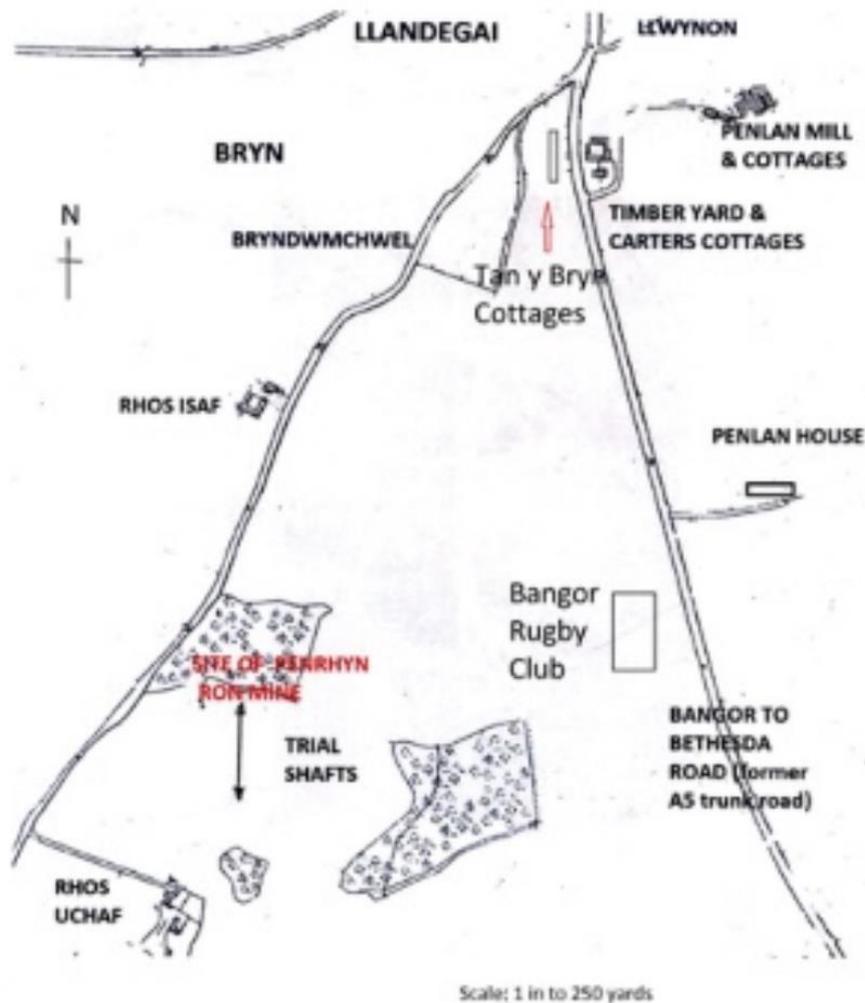


Fig.6.4.1: The site of the Penrhyn Iron Mine at Rhos Uchaf.

³³⁶ <http://www.mindat.org/loc-153506.html>

Following the sinking of the trial shafts a survey report was issued, dated 12th October 1912. The report made the case for opening the mine based on a number of factors, the first being its proximity to the railway facilities at Penlan and the L&NW Railway branch line running to Port Penrhyn. The second factor was that there were two lodes of iron ore already visible on the property, about 50 feet apart. The main lode was around 1050 feet in length and had an average width of over 50 feet, with good compact ore being present at 25 feet. A second lode had been found that was around 35 feet wide, but with the same quality of ore present. According to the report the total area covered by the lodes was 315 acres, although the lease shows that the actual area granted was 392 acres 1 rod and 26 perches. A plan of the area covered by the lease is shown in Fig.6.4.2.

According to the report it was estimated that up to 3,500,000 tons of ore were present which, assuming a price of eight shillings per ton, would have a value of £2,200,000. After costs this would have produced a clear profit of £1,000,000. Initially the arithmetic appears to be incorrect as 3,500,000 x 8/- is £1,400,000. However, as the report subsequently goes on to refer to the level of profitability based upon a daily output of 400 tons with a cost of production of 8/3d per ton and a sales value of 14/- per ton, it is more likely that the initial figures quoted are for comparative purposes only. In either scenario they represent a profitability of around 41-45%. Interestingly part of the cost of production included 3d per ton for running the ore to Penlan Mill where it was to be crushed before being loaded onto railway wagons: the mill and its siding to be part of the lease agreement between the Penrhyn Estate and the mining company.

In addition, the report referred to the size and power of the mill, this being sufficient not only to crush the ore but also to provide the electricity for drilling and lighting up any underground works.³³⁷ Under the terms of the Lease the mining company was entitled not only to have use of the mill and its facilities, but also to erect at the mine site the sheds and machinery necessary for the processing of the ore. This included the erection of up to four kilns, each limited to 30 feet in height.

The lease also permitted the construction of two tramways, one from the mine to Penlan, and the other to the Penryhn Quarry Railway that ran alongside the River Cegin and on to the port. Any ore shipped through the port had to be shipped via vessels chartered by the Anglesey Shipping Company. Thus, the mining company had the choice of either shipping their ore by rail through Penlan, or by ship from the port. The term of the lease was 21 years and the annual rental was two hundred pounds in addition to which royalties of 6d per ton were payable on any output exceeding the £200 rental value (8000 tons in weight), with the output to be measured using a weighbridge. Based on the figures extrapolated from the Penrhyn Estate Rental books, the actual output achieved by the Silurian Iron Ore Company were 12,356 tons for 1913; 15,312 tons for 1915; 16,754 tons for 1916; 11,275 tons for 1917; and 8,295 tons for 1919. Output for 1914, 1918, and 1920 appears to have been less than 8000 tons.³³⁸

There was also to be an annual ground rent of £5 per acre for land occupied by any new railway that the company might lay, and for the years 1915 to 1920 the amount of rental actually paid was £4-11-3. In addition, there was to be an annual rental of £5 for the chute (shown in the rent books as 'shute') that conveyed the ore from the railway into carts, and this was paid for the years 1916 to 1920. There was also to be a royalty of 4d per ton for all minerals conveyed along the Quarry Railway

³³⁷ Gwynedd/XM9801/2

³³⁸ BU/PFA4/177-184.

and 3d per ton for shipments made from the port. No doubt it was these additional costs that caused the mining company to opt for the Penlan route! Finally, in addition to the usual caveats regarding the Estate's retained rights, etc, the mining company was to employ at least 20 properly skilled workmen and keep the mine operating for 50 weeks per year for as long as there was ore to profitably mine. The only exception was where they were unable to do so due to industrial disputes or natural causes such as flooding.³³⁹

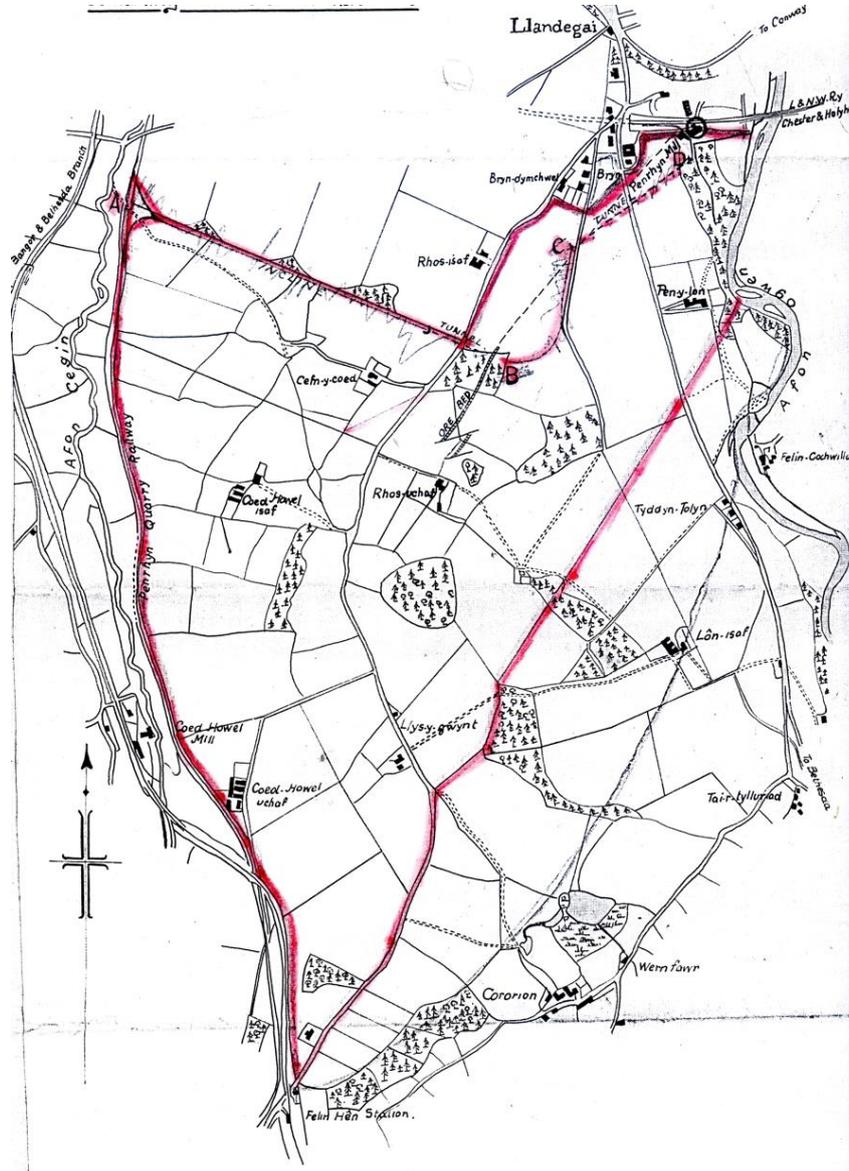


Fig.6.4.2: Area covered by Lease dated 12th October 1912.³⁴⁰

Transportation of the ore proved to be somewhat problematic as it had to be taken from Rhos Uchaf to the private Penrhyn railway siding at Penlan, and although this was no great distance it did involve a good deal of man-handling. The ore was first placed in tubs that then descended on rails down an approximately 190-yard incline; the full tubs drawing up the empty ones. Each of the tipping tubs had

³³⁹ Bangor ms22870. Lease dated 19th August 1913 between Lord Penrhyn and The Silurian Iron Ore Co Limited.

³⁴⁰ Gwynedd/XM9801/2.

a capacity of 2/3rds cubic yards, and in the 1922 Inventory nine are listed, of which four were broken. At the foot of the incline they were then drawn for approximately 457 yards along the flat bed of what formerly had been the route of the original Penrhyn Quarry Tramway, to a point adjacent to No. 6 Tanybryn Cottages.³⁴¹ Much of the route can still be clearly seen today (Figs.6.4.3 to 6.4.7).

Here it was dropped into a chute that conveyed it to carts that stood alongside the main Bangor-Bethesda road (Telford's original Holyhead Road), from where it was drawn a further 200 yards to Penlan Mill. At the mill it was tipped into railway wagons that were then drawn to the private siding before being taken onto the L & NW Railway mainline. The contractor who carted the ore was Mr William Williams of Lon Isaf Farm near Tregarth, who hired men specifically for this work; two of whom lived above the stable at Penlan Mill.³⁴² Anecdotally, during the transfer of ore from the chute into carts gates were drawn across the road to close it.³⁴³

While we know that horse-drawn carts were used by the Silurian Iron Ore Company it is not clear whether the same method was employed by E.J. Morris when he took over the mine. The question arises because in his Memorandum dated 23rd February 1924, Mr Morris lists as two of the necessary items required for working the mine a 2 ½ or 5-ton lorry and a driver. This certainly would have been a practicable solution at that time, as following the end of the First World War there was a large surplus of both readily available. The use of motor transport would certainly have reduced the amount of material handling that was required, particularly if the tubs were run on a tramway down to the road. There is some anecdotal evidence to support this latter option as reputedly there was a turntable half way down the slope where the chute ran.³⁴⁴ The topography of the area also lends support to this theory as the bed of the tramway was originally much lower than today's road level, which would have reduced the gradient even further.

Similarly, we do not know how the tubs were raised and lowered on the incline plane from the mine to the main tramway; whether this was achieved using some form of horse-driven gin or winding drum, or by gravity: although the latter is the most likely option. Nor do we know how the tubs were drawn along the flat bed of the tramway. There is nothing specific in the available documentation to indicate this, although both the Inventory and Memorandum are very detailed. Furthermore, even though the number of tubs is listed there is no mention of horses. However, the Memorandum does list 2 hauliers and a blacksmith and based on this it is safe to assume that horses were used.

The length of the incline plane (190 yards) and the flat tramline bed (457 yards) were both measured on the ground using GPS, in the case of the incline plane with no allowance being made for the gradient. These figures are supported by the number of 14lb sleepers for the 24" gauge rails that are contained in the Inventory dated 7th March 1922, as shown below. This shows 330 yards of sleepers for the incline (2 parallel tracks each 165 yards long), and 449 yards of sleepers for the flat bed. The route followed by the ore carts is shown in Figure 6.4.8, while Figure 6.4.9 shows the route of the incline as it was in 2012. Since then it has considerably deteriorated due to further spread of the marsh grass.

³⁴¹ F.J. North, *Mining for Metals in Wales*, (National Museum of Wales, 1962).

³⁴² Conversation with Mr Williams' son, Mr Glyn Williams, Op cit.

³⁴³ Ibid.

³⁴⁴ Miss Nerys Jones, Op cit.



Fig.6.4.3 (left): Bed of the tramway below Bryn. (2012)
The mine site is marked by the woodland in the background.

Fig.6.4.4 (right): Continuation of tramway bed at Bryndwmchwel. (2012)



Fig.6.4.5 (left): Closed-off section of tramway at Bryndwmchwel, facing north. (2012)

Fig.6.4.6 (right): Continuation of tramway in front of cottages at Bryndwmchwel, facing south. (2012)



Fig.6.4.7: The raised bed at the side of the fence marks the line of the chute as it ran alongside No. 6 Tan y Bryn Cottages, facing east. (2012)

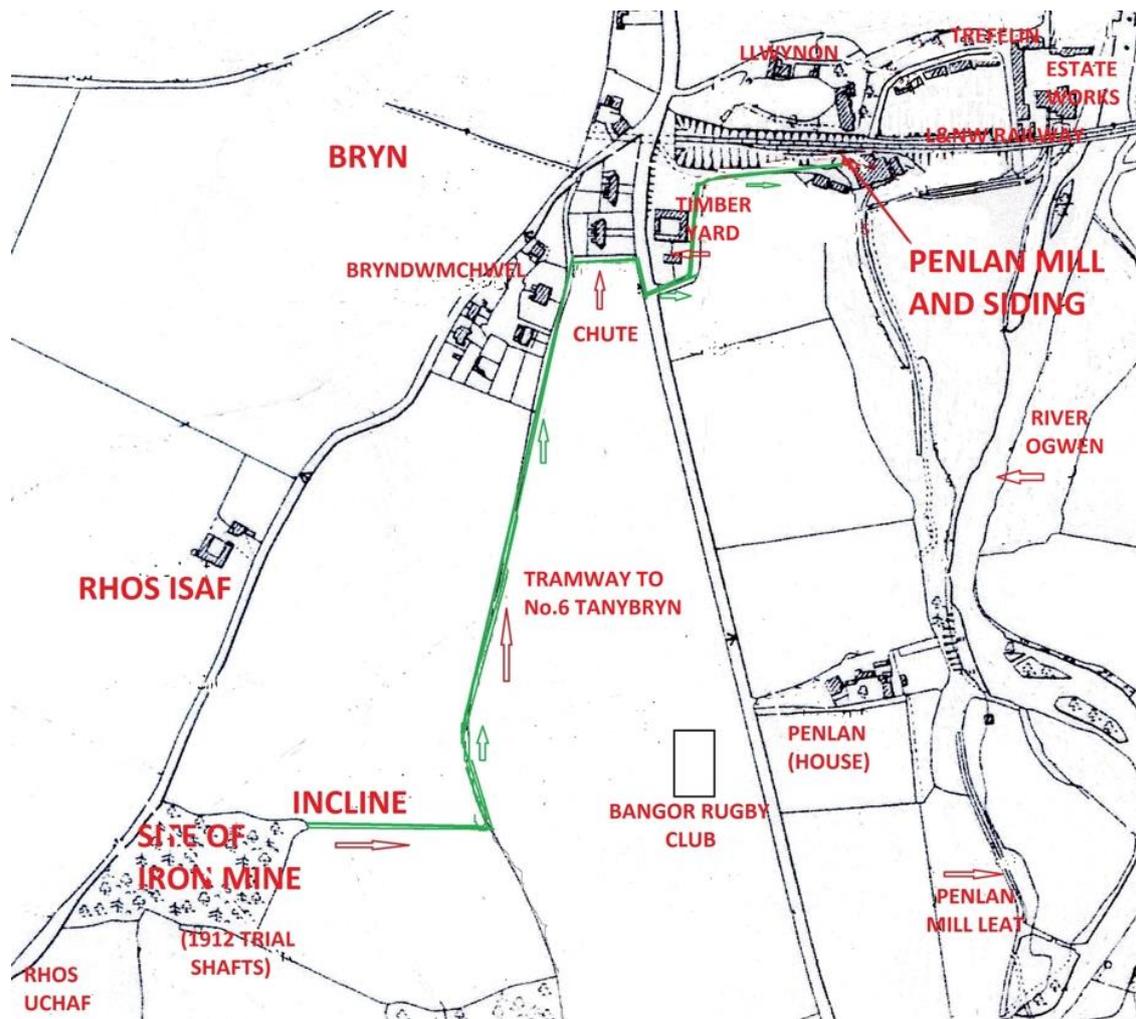


Fig.6.4.8: Route followed by the ore trucks (marked in green).



Fig.6.4.9: Route of the incline, facing west, at which time it was marked by wooden posts that subsequently have been removed.³⁴⁵ (2012)

³⁴⁵ Fig.6.4.9 and Figs.6.4.14 to 6.4.24 have been provided courtesy of David Elis-Williams.

In 1917, despite the desperate need for iron ore to supply the war effort, production was interrupted by a labour dispute. On 31st August of that year an arbiter was appointed by the Chief Industrial Commissioner, and he issued an award giving an increase of wages to the workforce. Subsequently the men were laid off by the Company, together with miners at one of their other sites: the reason given being the lack of a market for their ore. By October 1917 the Company had found a market but only offered to take back part of the workforce, now citing a lack of railway facilities. The men refused, insisting that all of their colleagues should be reinstated. In November the dispute became the subject of a Parliamentary question with the Minister of Munitions, Mr Ellis Davies, being asked to investigate; particularly as in the interim some of the miners had been called up for military service.³⁴⁶ The dispute was eventually resolved, and production continued until 1920, with the work alternating both above and below ground.

An indication of the sort of expenditure incurred by an iron mine at that time can be gleaned from samples taken from the Silurian Iron Ore Company accounts book for the period 7th July 1922 to 26th June 1925 (although which mine is not specified).³⁴⁷ The large quantities of butter and sugar possibly reflect the very heavy nature of the miners' work.

Wages 1922

O. Owens	£2-8-10;	J. Williams	£3-10-0;	A. Williams	£1-10-0.
----------	----------	-------------	----------	-------------	----------

Victuals 1922/23

Butter:

14/7/22	3/-	22/7/22	3/-	27/7/22	3/2d
1/8/22	3/2d	12/8/22	3/6d	16/8/22	3/10d
21/8/22	3/10d	31/8/22	6/-	11/1/23	4/6d

Sugar (cwt):

1/8/22	£2-15-0	8/8/22	£2-16-6	19/8/22	£2-16-6
28/8/22	£2-16-6				

Miscellaneous:

Grease

16/2/24	2/4d	1/3/24	4/8d	14/3/24
---------	------	--------	------	---------

Even though the Silurian Iron Ore Company retained their lease until part way through 1921 (the ground rent payable for that year being only £68-14-0),³⁴⁸ it would appear that from November 1918 another party had been approached with a view to taking it over. A Statement of Account submitted on 7th July 1920 to Lord Penrhyn by Carter Vincent & Co, the Estate's solicitors, shows that the partnership of E.J. Morris and T.H. Roberts had been in consultation with the Estate's agent, Mr Trench, with an initial meeting taking place on 21st November 1918. This was followed by further meetings with Mr Trench on 17th September and 26th October 1919, and after an amount of correspondence a Take Note was finally completed on 31st December 1919.³⁴⁹

³⁴⁶ Hansard, HC Debate 13th November 1917 vol 99 cc217-8.

³⁴⁷ Gwynedd/XM/2070/221.

³⁴⁸ BU/PFA 4/185, p.40.

³⁴⁹ Miss Moira Muir, Op cit.

It would seem that the takeover of the mine by Messrs Morris and Roberts had been initiated not by them but by the Silurian Iron Ore Company, which wanted to extricate themselves from the Penrhyn lease. In an un-dated memo Morris writes:

'Baldwin paid a large sum of money to Mr Trench, they told me, for relieving them of the responsibility of the Rhos Lease, and it is not at all likely Mr Trench really means me to jump into a similar responsibility and risk while such big people like Baldwins have failed to carry on the concern. I have heard McKay tried to find a people to take the concern over to spare indemnity, just as he has done at Travalino Iron Mine, Spain, which is now worked by the two brothers Lennox.

In fact he ransacked all probable smelters in G.Britain to attain that end, so there is now only one way open to get a customer, that is by selling the Ore for certain periods to establish the reputation of the Ore, and this must be dressed by a competent hand, and disregards certain layers of the bed of Ore, besides to clear out the mixed up unmarketable Ore from the mine, as road Macadam, etc. I have big people ready to try 500 tons of the Ore at certain low prices, costs of starting the mine £500'.³⁵⁰

On 2nd April 1921 Mr McKay, on behalf of the Silurian Iron Ore Company, wrote to the Penrhyn Estate stating that their Directors had agreed to surrender the mine and to pay Lord Penrhyn £2,000. Under the terms of their lease they were responsible for reinstating the fencing around the mine site, but in his letter dated 4th April Mr Trench agreed to accept responsibility for this, in exchange for the Company forfeiting the Plant and ore that was still in situ.³⁵¹ This was agreed in a letter dated 15th April, in which it was also agreed that the Foreman would remain on site until the surrender was completed.³⁵² They finally closed the mine on 12th May 1921, with the keys being handed over to Mr Trench on 25th May by a Mr Satow (possibly the Foreman?).

At the time of the handover Mr Trench wrote to the company stating it was agreed that the proportion of rent due to the Estate in respect of the chute was £4-1-6, plus £3-14-3 in respect of occupied land: a total of £7-15-9.³⁵³ It was further agreed that a sum of £86-1-8 was due to the Company in respect of Dead rent paid in advance to 31st July, after deduction of Income Tax already paid by the Estate. The matter was finally settled on 15th June 1921, when Mr Trench forwarded to the Company a final cheque for £23-15-11.³⁵⁴ According to the Estate rent book for that year the annual rental was £200-0-0, no Royalty was due, nor was any land rental paid. A rental of £7-9-3 was paid for the chute.³⁵⁵

The abandonment plan produced in 1922 states that 'Mineral Iron ore found in ventricular veins 4 to 12 feet wide, very much contorted, Pisolitic in structure, and containing 35 to 40% iron; 10 to 20% silica; 0.5 to 2% Sulphur; 0.7 to 1.5% Phosphorous. Lease forfeiting by arrangement with Lessor 25th May 1921'.³⁵⁶ The Plan shows that through the central section the mine was over four levels, there being 30 feet between the top level and mid-level; 16 feet between the mid-level and bottom level; and 70 feet between the bottom level and shaft level.

³⁵⁰ Ibid.

³⁵¹ BU/Penrhyn Add'l mss 3016, p. 778.

³⁵² Ibid, p. 805.

³⁵³ Ibid, p. 887.

³⁵⁴ Ibid, p. 921.

³⁵⁵ BU/PFA/4/184, Rental1920, p. 40.

³⁵⁶ Miss Moira Muir, Op cit, Also, Gwynedd X/AMP/Maps/19, Penrhyn Iron Ore Mine, Abandoned Mine Plan No.7224 Penrhyn.

BUILDINGS

Store House, Galvanized Iron Building, timber and sheeting

Office ditto

Dressing Shed ditto

Smith and Carpenters Shop ditto

Powder Magazine ditto

TOOLS AND MATERIALS

In Store:
2 Loading Forks
5 cwt of Carbide, 50 pairs of Fishplates
4 Doz bolts for Fishplates
56 lbs assorted Nuts
50 lbs of $\frac{3}{4}$ oct, drill steel in bars
300 lbs in 40 drills
18 lbs of $\frac{7}{8}$ inch bars
57 lbs in drills
24 lbs Rivets & $\frac{1}{2}$ cwt bar iron
1 Carbide Can
1 No.5 Rotary Hand Pump with connection
(92 drills in all)

Dressing House Stove

In Office Nil

Smith & Carpenters Shop

Smith's Hearth Anvil and vice
Pairs of Tongs, 1 Fuller
1 Set Stock & Dies
1 Hand Drilling Machine
1 Bench (broken)

On Surface of Mine

2 Jack Rolls and 1 Frame
Incline Brake, Wheel and Frame & Wire Rope
24 Patent Steel Rollers
9 12ft Ladders
150 ft of piping (as scrap)
1 Grind Stone and Frame
1 Galvanized Iron Hut Powder Magazine

24" Gauge Tramline

Level Road 449 yards Steel Sleepers	14lb rails
Incline 330 yards Wood Sleepers	14 lb rails
Bottom Level 363 yards Wood Sleepers	12 lb rails
Middle Level 237 yards Wood Sleepers	12 lb rails
Top Level 300 yards Wood Sleepers	12 lb rails
9 $\frac{2}{3}$ cu yds Tipping Wagons, 4 damaged	
6 Sets Points and Crossings	

As previously had been the case the Agreement also included Penrhyn (Penlan) Mill with all of its associated water courses and buildings; permission to erect up to 4 kilns not exceeding 30 feet in

height; and the railway siding. For these the lessee was to pay an annual rental of £200, plus a Royalty of 6d per ton of ore raised over and above the £200 rental. The remaining clauses were the standard ones which had applied to the Silurian Iron Ore Company. A significant difference was that the agreement did not include a link to the Penrhyn Quarry Railway or use of the port facilities.³⁵⁹

Prior to taking formal possession of the mine Mr Morris had taken a number of ore samples which were independently assessed and found to be of good quality, all of them containing around 45% metallic iron. The assessors were Harry Silverveston of 22 Paradise Street, Birmingham; D.T. Williams & Co of 42 Finsbury Square, London E6; and F. Bainbridge from Pease & Partners Ltd, Middlesbrough. In addition to iron ore the samples showed valuable deposits of manganese.³⁶⁰

On 23rd February 1924 Mr Morris compiled a Memorandum that included the assessor's reports, together with his proposals for the further development of the mine site. In this he described the iron deposits as being in two distinct beds, separated only by two or three inches of shale. The lower bed he described as having a thickness of about five feet, black in colour, and of inferior quality to the upper bed. The ore in the upper bed he described as being reddish-brown in colour, between nine or ten feet in thickness, and as a *'very easy smelting ore, and also easy and cheap to win'*. By contrast the black ore he described as *'much harder, heavy, and will take longer time to smelt'*, and for this reason he advised that the two should not be mixed. His assessment was that about 150,000 tons of good ore could be easily worked with the equipment already to hand. He went on to say that a much more economical long-term proposition would be to put in an adit from the Penrhyn Mill meadow, which was 50 or 60 feet above sea level, and had easy access to the adjacent mainline railway line. The bedded ore deposit crossed the railway at this point, and the mill had a power output of around 100hp, generated by the two 20ft x 6ft water wheels. Furthermore, The North Wales Power Co electric line passed within 2/3 of a mile of the site, and this could provide cheap power for drilling.

In his memorandum Mr Morris also listed the items necessary to work the mine.

1. A new trough above the two water wheels at the mill to regulate the amount of water from the leet.
2. A dynamo from 100 to 150hp and connections (2 pulleys).
3. Three-phase live copper wire from the old mill to the mine (say ½ a mile).
4. A motor and switches, and Drill Sharpener (Holman or Lyersolls).
5. Compressor and Air Receiver.
6. Piping 3" diameter to the faces of workings, also 1 ½" piping to the drills from the main 3" pipe, also a fan for air.
7. Eight stoping drills with 9-foot columns to each drill and 4 'Japs' or small drills to break up large chunks of ore after stoping (two standby stoping drills).
8. A motor lorry (2 ½ or 5 tonnes) to cart the ore across the main road to the railway siding.
9. Men as follows:

6 Rock drillmen, and 6 assistants (6 men and 6 boys)	12 men
2 Breakers	2 men
4 Loaders	4 men
2 Training (?) men	2 men
2 Incline brakemen	1 man

³⁵⁹ Ibid.

³⁶⁰ 'The Particulars of Penrhyn Iron Mine', 23rd February 1924, courtesy of Miss Moira Muir, Op cit.

1 Ditto with horse or miniature engine to run on the bottom	
Line to the hopper	1 man
1 Motor lorry man and a man at the railway siding	2 men
1 Hopper man	1 man
1 Blacksmith for sharpening drills	1 man
	<u>Total 26 men</u>

Based on an average wage of £2-10-0 per week he estimated the total wage bill to be £65. Output of 200 to 250 tons a day at 15/- per ton, say, at destination, would produce on average a clear profit of 5/- per ton, or £300 clear profit per week. On output of 200 tons a day the profit would be £15,600 per year *'which is a very small output as compared the possibilities of the present position of this Iron Mine as it stands and ready to work'*. He went on *'Deduct £600 a year for interest on installation of equipment costs, and depreciation of machinery, and further development for larger output, partly paid by the ore driven through for convenience of stoping the ore'*.³⁶¹

An estimate was also produced based on ore output of 1000 tons per week, using rock-drills.

8 Miners at 50/- per week per man	£20-00-0
10 Fillers and Breakers at 45/- per week per man	22-10-0
2 Hauliers at 50/- per week per man	5-00-0
1 Blacksmith at 50/- per week	2-10-0
2 Timbering men at 50/- per week per man	5-00-0
2 Incline men at 45/- per week per man	4-10-0
1 Siding man at 50/- per week	2-10-0
1 Weighman at 40/- per week	2-00-0
1 Pipe and General Fitter at 50/- per week	2-10-0
4 Ore sorting lads at 30/- per week per man	6-00-0
2 Shift Bosses at 60/- per man per week	6-00-0
2 Tool carriers (Boys) at 20/- per man per week	2-00-0
1 Clerk/Storekeeper at 60/- per week	3-00-0
Royalty at 6d per ton	25-00-0
Explosives	14-00-0
Insurance (say)	3- 4-0
Sundries	5-00-0
Office Expenses	4-00-0
Rates	13-5 ½
Manager	8-00-0
Total cost	£ 143-7-5 ½

He calculated that the annual profit based on 1000 tons per week at 15/- per ton would be £31,512. With an output of 2000 tons a week he estimated that the profit would be more than £63,024 per annum, as many of the above costs would not need to be doubled. If the weekly expenditure was increased to roughly £250 instead of £144, and the weekly profit increased to £1,256, then the annual

³⁶¹ Ibid.

profit would be in the order of £65,312.³⁶² Unfortunately for the partnership the market for iron ore declined following the post war economic downturn and the mine's future potential was never realised, particularly as better quality ore could be obtained elsewhere. This, coupled with the death of Mr Morris, brought to an end any further activity at the site. The last entry in the Rent Book was for 1927, wherein it is notated 'Ceased Nov. 27th'.³⁶³ It is worth noting that in spite of all the estimates that had been produced with regard to the levels of output and profitability from the mine, none were even remotely achieved.

Ostensibly Mr Morris was a gentleman farmer/smallholder, and from at least 1903 until 1926 held the tenancy of the 55-acre Llwyn Celyn Farm on Aber Road, Tal-y-Bont.³⁶⁴ Nonetheless he was eminently qualified to make such projections in connection with the mine, having been involved in the mining industry for a number of years in Caernarvonshire, Anglesey, and beyond. He was a self-educated man who became a Fellow of the Geological Society,³⁶⁵ and from some of the premium receipts issued by The Ocean Accident Guarantee Corporation it would seem that he had been engaged in mining from at least 1904, and continued to be so until his death in 1926.³⁶⁶ On at least two occasions he was in partnership with T. H. Roberts, both at the Abergwyngregin iron ore mine in Caernarvonshire,³⁶⁷ and the Ynys Gwyddil copper mine on Anglesey.³⁶⁸ In 1912 he is listed as the Mine Agent at the Penrhyn Iron Mine, and from 1922-25 as the Owner/Operator. From this it is evident that it was based on his prior knowledge of the operation at Rhos Uchaf that he was able to submit a detailed proposal to the Penrhyn Estate.

Other ventures in which he was involved included were as follows:³⁶⁹

1907-1909	Mine Agent	Tanygarth Arsenic Mine, Llanllechid.
1908-1912	Mine Agent	Llanberis Copper Mine
1914-1915	Mine Agent	Gorddinog Iron Mine, Llanfairfechan.
1915-1916	Owner/Operator	Cae Coch Sulphur Mine, Trefriw.
1916-1919	Owner/Operator	Aber Iron Mine.

He died on 4th December 1926 age 63 and is buried together with his wife Jane in St. Cross churchyard in Tal-y-Bont.³⁷⁰ His only daughter, Jean, and her husband, William James Muir, are also buried there.³⁷¹ In 1927 Jane Morris, his widow, was in negotiation with William Henry Pearson of 21 Chiswell Street, London, (an ore broker with whom Mr Morris had previously dealt), to find the capital for re-opening the mine, and as part of this arrangement she was to apply to Lord Penrhyn for Pearson to buy the Take Note. Eighty percent of any profits were to go to Mrs Morris and the remaining twenty percent to Mr Pearson. There is no evidence to suggest that the proposal ever came to fruition, as this was the time of the General Strike and the beginning of the stock market decline. During this period

³⁶² Ibid.

³⁶³ Rental: BU/PFA4/191, p.40.

³⁶⁴ BU/PFA4/167 to 190.

³⁶⁵ He was elected as a Fellow on 5th December 1917 (no. 5141). Verified by the Society 31st August 2017.

³⁶⁶ BU/PFA4/167 to 190.

³⁶⁷ <http://freepages.genealogy.rootsweb.ancestry.com/cmhrc/lom18nwmnet.htm>, p. 2of 8.

³⁶⁸ Ibid, p. 1of 8.

³⁶⁹ Jeremy Wilkinson, <http://myweb.tiscali.co.uk/hendrecoed/hendrecoed/wilkinson/downloads/entry.txt>

³⁷⁰ Plot A012.

³⁷¹ Plot A029.

the Morris family also attempted to persuade his former partner, Mr T. H. Roberts, to take over the rental of the mine, something he was unwilling to do. Their relationship became acrimonious and it was only after many meetings and much correspondence that matters between them were resolved. Mr Roberts eventually agreed to take over the mine but in the meantime the family had to return all of the tools, etc.³⁷²



Fig.6.4.11 (left): The southern open-cast mine section in operation, 1920. The size of the three workmen in the centre foreground provides an indication of scale.

Fig.6.4.12 (right): The southern section, looking north (1928)



Fig.6.4.13 (left): The southern section, looking south. (1928)

Fig.6.4.14 (right): Northern section looking from above. (1973)

The mine remained unworked and eventually became flooded. All remaining traces were obliterated in 1983, when spoil from the newly constructed Bangor Bypass was dumped on the site.³⁷³ However, fortunately there are some remaining records of the site as it was in the 1920s. These include a

³⁷² Miss M.Muir, Op cit.

³⁷³ <http://www.mindat.org/loc-153506.html>

photograph taken in 1920 which shows the southern opencast section (Fig.6.4.11),³⁷⁴ and two further photographs taken in 1928, which show the site shortly after its abandonment (Figs.6.4.12 & 6.4.13).³⁷⁵ In 1973 David Elis-Williams took a number of contemporary photographs of the site (Figs.6.4.14 to 6.4.20), and perhaps even more fortunately, produced a sketch of the site as it was at that time (Fig.6.4.21).³⁷⁶

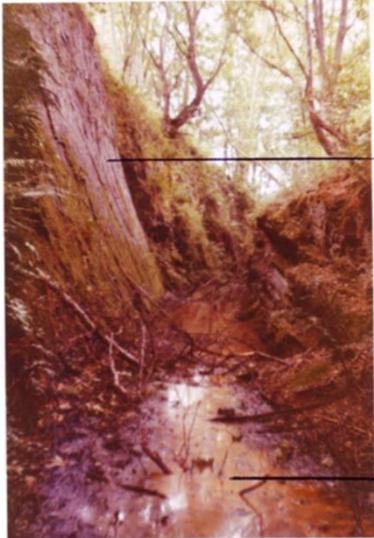


Fig.6.4.15 (left): Northern section looking north. (1973)

Fig.6.4.16 (right): Middle section, looking North. (1973)



Fig.6.4.17 (left): Shaft in the Middle section, looking down. (1973)

Fig.6.4.18 (right): Southern section, Western branch, looking south from above. (1973)

³⁷⁴ Reproduced courtesy of BGS, image reference P207934.

³⁷⁵ Ibid, image references P204543 and P204542.

³⁷⁶ Special thanks are due to David Elis-Williams for generously making this data available.

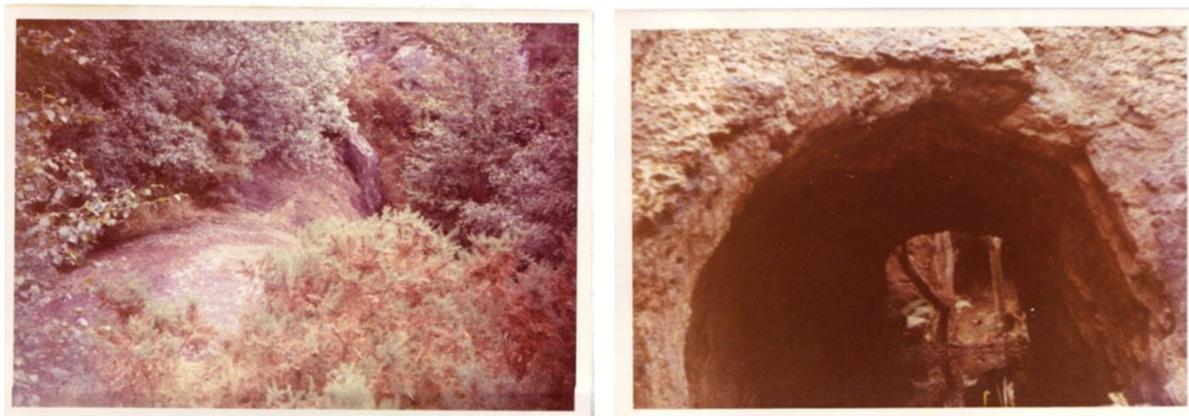


Fig.6.4.19 (left): Overgrown apex of the anticline base in the Southern section. (1973)

Fig.6.4.20 (right): Access tunnel through the anticline base in the Southern section. (1973)

He describes the mine as having been in three sections. The Northern Section comprised the area within the present woodland which contained an open chasm approximately 120 metres in length and varied in depth from 2-10 metres below the land surface: the bottom being roughly horizontal, with the difference being due to the variations in the height of the land (Figs.6.4.14 & 6.4.15). He observed that at this point the ore bed was almost vertical, with the chasm being the result of open mining. There was a pile of loose rock with patchy scrub lying to the southeast of the chasm, possibly being a tip of mine overburden.

The Middle Section he describes as being a short section where the ore bed dip was now 50 degrees, and the chasm a little wider and shallower: around 6 metres (Fig.6.4.16). It is in this section that signs of underground mining were observed, with four shafts following the slant of the ore bed downward. As all of the shafts were flooded to the same level he believes that they were joined underground.

The Southern Section he describes as being more complex, essentially comprising an open-cast pit of up to 15 metres depth below ground level, this being split into eastern and western branches. Figs.6.4.13 and 6.4.18 show the western branch of this section; firstly, as it was in 1928 and secondly, as it was in 1973: the latter highlighting the amount of vegetation growth that had taken place since abandonment. At this point the structure of the ore bed could be observed, which essentially was twisted in an anticline. The shape of the pit was the result of excavation following the ore bed down each side of the anticline. At the centre of the anticline the rounded top of the rock underlying the ore bed could be observed, as shown in Fig.6.4.19. The same structure can also be observed in the foreground of Fig.6.4.11 and the middle ground of Fig.6.4.12. The anticline was penetrated by an access tunnel (Fig.6.4.20). In the eastern branch of this section the remains of a small hut were still visible.

In the early 1980s the new Bangor bypass (A5) was constructed, the line of the new road lying in a cutting slightly westward of the former Bangor to Bethesda road (B4409). The spoil from the construction work was used as infill for the former mine site, with the result that virtually all traces of the mine have been removed. Access to the site is now via a gateway set back from alongside the A5, with the boundary wall of the original road marking the edge of a track leading to a field to the south of the woodland, which according to David Elis-Williams was the site of the middle and southern sections of the mine.

In 2012 Mr Elis-Williams re-visited the site where he observed that the protective plastic sheaths originally placed around saplings planted on the reclaimed land had not been removed, and as a result it was still possible to see the line of the northern section of the mine, together with new planting in the vicinity of the supposed overburden tip to the south east of the site. Also observed was a roadway cut into the base rock, running in a line from the edge of the mine chasm, upwards toward the gateway adjacent to the A5 (Figs.6.4.22 and 6.4.23). The average width of the roadway is 9 feet.

While there are no remaining traces of the original buildings, at a point some 32 feet in from the boundary wall (opposite the gated entrance) and immediately adjacent to the roadway there is a small mound of material measuring some 9 feet in diameter (Fig.6.4.24). To date no attempt has been made to excavate the mound, which on the surface comprises some old bricks, slate, and a broken concrete block. There is also a small piece of timber with an iron nail embedded. It may simply be that the mound was created when the site was back-filled with spoil from the construction of the new A5 road: alternatively, based on its size and location, it could be conjectured that it was the site of either a powder magazine or a gatehouse. However, without further examination it is not possible to fully ascertain either its true extent or purpose.

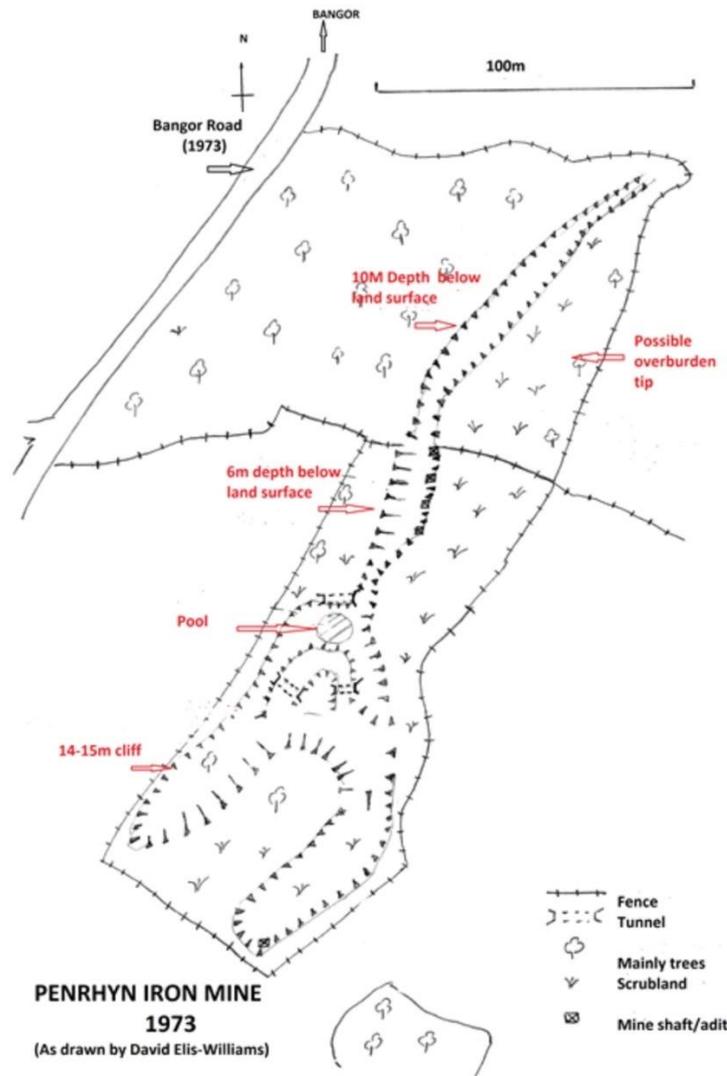


Fig.6.4.21: Plan of the site in 1973.



Fig.6.4.22 (left): The roadway, facing uphill toward the A5. (2012)



Fig.6.4.23 (right): The roadway, facing downhill. (2012)



Fig.6.4.24 (left): Location of the mound (2012)



Fig.6.4.25 (right): E. J. Morris at Llwyn Celyn.³⁷⁷

Prospecting for minerals on the Penrhyn Estate had been ongoing over a very long period. Naturally the development of the slate quarry was the major enterprise, but over the years there had been many other initiatives. For example, in 1772 Robert Jones had been shipping out hone stones from the quarry at Blaen y Nant, at a price of 10/6d per ton '*according to an agreement made with John Pennant Esq by Mr Robert Jones and the late Mr Hughes*'.³⁷⁸ Mr Jones had been renting the Hone Quarry for a number of years, as evidenced by an entry in the Rent roll for 1766, which shows that he owed the sum of £84-0-0 which covered the seven years rental from 1760-66. He made a payment of £12-0-0 on 5th August 1762, and a Mr Matthews had made a further payment of £40-0-0 on his behalf on 2nd July 1764: leaving arrears on the account of £32-0-0.³⁷⁹

³⁷⁷ Miss Moira Muir, Op cit.

³⁷⁸ BU/Penrhyn/1719.

³⁷⁹ BU/Penrhyn/1693.

Searches for coal, ochre, copper, etc. were also made. For example, in 1775, John Lean and others were paid £2-2-6 'for making a trial of Copper ore in Coed y Brain in 1774',³⁸⁰ and on 16th September 1782 Edward Roberts was paid £4-15-0 for digging trials for coal.³⁸¹ On 20th January 1783 Richard David was paid £2-6-8 for 'Trying the sulphurous rock below Moelyci'.³⁸² In 1796 Samuel Worthington and his partners acquired the Estate's mineral rights, continuing to ship chert and hone stone from Nant Ffrancon. Their right to do so was confirmed in a lease dated 25th March 1801, which was confirmation of a previous lease dated 1st August 1796.³⁸³

On 18th March 1815, Articles of Agreement were signed between the Rt. Hon. Ann Susanna, Lady Penrhyn, and G.H. Dawkins Pennant Esq as lessors, and John Roberts of Bangor. The lease pertained to a vein of ore Mr Roberts thought he had found in the Parish of Llanllechid and gave him the right to work it. He believed that it contained lead ore, copper ore, or other minerals. It was agreed that he should pay 1/8th of minerals produced, that the lease was to be for 21 years, and under the same terms of those let to Mr Worthington, saying 'the said mine concern shall be worked in such manner as in the said Lease to Mr Worthington is mentioned as if the same was herein particularly written or copied.'³⁸⁴ The lease did not include the slate quarry.

³⁸⁰ BU/Penrhyn/1726.

³⁸¹ BU/Penrhyn/1737.

³⁸² Ibid.

³⁸³ BU/Penrhyn/mss2033.

³⁸⁴ BU/Penrhyn/ms 2036.

7. The Penrhyn Mills

Throughout much of this work there is reference to the collective ‘Penrhyn Mills’, and at various times this has meant a number of different things. In particular, there has on occasion been some ambiguity with regard to the naming of these mills, which in turn has resulted in some confusion as to the provenance of Penlan Mill (see Section 2, ‘History’), and it is for these reasons that this section is included.

Although it is likely that their history goes back further, from the records currently available the original Penrhyn Mills first appear in the Estate rent rolls in 1666; the tenant from then until 1668 being John Edwards and the annual rental £26-0-0. At that time what was known as ‘Penrhyn Mills’ comprised Melin y Pont [the mill at the bridge: describing its location, as prior to it being relocated in c1820 it was situated adjacent to the original bridge over the River Ogwen], and Melin Hen [even then already known as the ‘hên’ or ‘old’ mill]. By 1677, during the tenure of Sir Robert Williams, second Baronet, the collective had come to include Cochwillan Mill; this previously having been forfeited on 10th July 1622 due to the non-payment of a £10,000 debt.³⁸⁵ [It first appeared in the rent roll in 1622, as ‘The Millne called Melin Coch Willan’³⁸⁶, and only became part of the collective sometime later]. In 1714 they are listed as ‘Llandegay Mills’ and in 1716 as Melin Hen, Melin Isa (formerly known as Melin y Bont), and Melin Ucha.

Identifying the location of Melin Ucha was somewhat problematic as the name does not appear on any maps, and it drifts in and out of the Penrhyn Estate records. Attempts to identify its location proved difficult as the only mills locally with that name, such as Felin Uchaf in Pentir and Aber, did not form part of the Estate at the time of Samuel Worthington & Co.; nor were they located in Llanllechid Parish, which is the location described in the March 1800 Lease agreement between Richard Pennant and Worthington & Co. In parallel with an examination of the Estate records a physical search along the banks of the River Ogwen was also conducted, but again to no avail.

There had been some speculation that it was in fact the ‘Drumbo’ at Nant Gwreiddiog (see Section 3.1), especially as this was located uphill from the River Ogwen. This feature had been in existence prior to George Leigh’s survey and mapping of the Penrhyn Estate which was completed in 1768,³⁸⁷ and his fee for which was £344-15-0.³⁸⁸ However, upon further examination of the early rent rolls it became apparent that Cochwillan Mill and Melin Ucha did not appear together in the rolls, and that apart from in a couple of isolated instances they were in fact mutually exclusive. Upon further reflection it also became apparent that colloquial language was in play, and that the descriptive term ‘ucha(f)’ (upper) in this instance defined its location on the River Ogwen in relation to Felin Isaf, i.e. it was the upper mill in relation to Felin Isa (the lower Mill). Further analysis of the Estate records then confirmed that this was indeed the case, and that the two names, Melin Uchaf and Cochwillan Mill, are interchangeable.

From 1668-1677 the tenant of the Penrhyn Mills was John Williams and the rental remained at £26-0-0 per annum. In 1677, with the collective now including Cochwillan Mill, the tenancy was taken

³⁸⁵ BU/PFA/1/259

³⁸⁶ BU/Penrhyn 1632, p.5. Rent roll dated 23rd September 1622.

³⁸⁷ BU/Map 36(uncat); BU/Map 99.

³⁸⁸ BU/Penrhyn/1698, p. 16, Item 13.

over by John Edwards at Melin Hen, John Griffith at Melin Isa, and Henry Williams at Cochwillan, and the rental increased accordingly to £41-0-0 per annum.³⁸⁹ The tenant in 1716 was Richard Parry who paid a partial rental for that year of £34-12-3, although it seems that his tenure was short lived as by the end of the year the mills were 'In Hand' to the Estate.

During the next two years, it appears that the Estate employed three individual millers to continue with the operation of the mills, and paid their wages accordingly: John Harrys £8-0-0, John Roberts and Evan Morris £5-0-0 each.³⁹⁰ From 1717-1718 the three mills were again 'In hand' to the Estate, before being re-let to Messrs William Hughes and David John Prydderch for a rental of £120-0-0 per annum. In 1724 David Prydderch was replaced by David Jones as the co-tenant, the rental remaining unchanged. In 1732, the tenant is shown as Mr Doulben, the new Agent to the Penrhyn Estate, although it is probable that this merely reflected that the mills had again been taken 'In Hand'. In 1734, there was a further change with the new tenant being Joseph Prichard, Miller. He remained there until 1741 when a Mr Paynter & 'Others' took over, although they only remained as tenants for one year, when William Charles & Partners became the new tenants (the partners being Thomas Robert Owen and John and Mary Griffith). Throughout this period, the rental remained unchanged at £120-0-0 per annum, the only exception being from 1744-1745 when it was reduced to £110-0-0.

From 1753-1759 the new tenants were Messrs Hughes & Weston, with the annual rental remaining at £120-0-0. By 1760 Mr Weston had left the partnership and the mills were under the sole tenancy of Hugh Hughes, the annual rental increasing in 1775 to £150-0-0. On 21st January 1778, a farmer named Morris Rowlands murdered William Williams, one of the millers at Cochwillan Mill, by shooting him and then beating out his brains with a stake; allegedly over a love affair. Rowlands was subsequently hanged in April of that year.³⁹¹

By 1783 Mr Hughes had fallen upon financial hard times and the three mills were again taken 'In Hand' to the Estate, the arrears on the mills and farm being £532-15-0. Richard Pennant wrote off £530-10-0 subject to Mr Hughes giving up possession of the farm, and his other rentals were also discharged to the sum of £190-5-0. At the same time the half-years rent of £75 for the mill and mill tenement that was due on 25th March 1783 from the new tenant, Mr Edward Jones, was applied towards the sum agreed to be laid out in repairing the mills.³⁹² The mills had been re-let to Mr Jones for rental of £150-0-0 per annum and now included the tenement known as Nant Gwreiddiog. This was the first time that the holding at Nant Gwreiddiog became associated with the Penrhyn Mills, and this was to prove to be a significant factor later on.

In 1786, the tenancy passed to William Pierce & Co, who held it until 1790 when it passed to William Williams Jnr. He continued to hold the tenancy until 1797 when it passed to Samuel Worthington & Co. Between 1786- 1797 the annual rental remained at £150-0-0, but in 1798 this increased to £200-0-0 to reflect the newly erected paint mill at Melin Isa. In 1800 the tenancy included all three mills together with the newly constructed flint mill at Nant Gwreiddiog, and this was formalised in the 21-year lease agreement between Richard Pennant and the Liverpool merchants. From the lease, dated of 24th March 1800, we know that at this time the old part of Melin Isa contained '*one pair of*

³⁸⁹ BU/Penrhyn1635, p. 13.

³⁹⁰ BU/1637 p. 34.

³⁹¹ <http://welshnewspapers.llgc.org.uk/en/page/view/3609109/ART81/cochwillan>

³⁹² BU/1737, Rental 1st November.1782, p. 13.

wheat stones in good and sufficient order and repair and was to continue to grind corn for Lord Penrhyn, but that the remaining part of the old mill could be used by Worthington and his partners for their own manufactory: the Estate's tenants would continue to have their corn ground at Melin Hen and Melin Ucha. Furthermore, the newly added part of the mill at Melin Isa could be used for *'the grinding and making of colours'* (the Paint Mill). Although Worthington & Co. held the lease on the Penrhyn Mills their actual day-to-day operation was carried out by employees. For example, at Melin Ucha it would appear that between 1798 and 1799 the miller was Morris Miller, and from 1805 to 1812 it was Griffith Jones, and then his widow.³⁹³

A significant change appears to have taken place at this time in that whilst hitherto the Estate had borne the cost of maintaining the mills and associated waterways, the lease with Worthington & Co. in 1800 to a large extent making this the responsibility of the tenant: the cost of maintaining the Penlan leat being the only exception. It seems likely that a principal factor behind this change was the relatively high cost of maintenance. For example, between 1760 and 1776 the total cost amounted to £719-8-5½, or an average of £42-6-6 per annum. In order to mitigate these costs, in 1760 the annual rental for the three mills was increased from £120 to £150 per annum: an increase of twenty five percent. Details of the costs relating to the mills, and the work undertaken, are included in Section 7.4.

In 1821, the lease between Worthington & Co and the Penrhyn Estate expired. New rental agreements were made with Worthington & Co. retaining the flint mill, tramway and land at Nant Gwreiddiog (Penlan Mill) until 1829, at which time he left the area and the mill remained 'In hand' to the Penrhyn Estate until 1835; the tramway being removed in 1831. (The history of Penlan Mill from this time onwards is contained in Section 2). Meanwhile, in 1821, tenancy of the Penrhyn Mills passed to Griffith Thomas; although as Penlan Mill and the Paint Mill at Melin Isa were still retained by Worthington & Co. it would appear that what was now known as Penrhyn Corn Mills referred to the grist mills at Melin Uchaf and Melin Hen: the rental payable being £120-0-0 in 1821 and £100-0-0 thereafter, the decrease being *'in consideration of the tenant doing repairs'*.³⁹⁴ Between 1813 and 1822 Griffith Thomas had separately rented the house at Melin Ucha (known as Tyddyn Melin Ucha or Tyddyn Melin), which presumably he retained as part of the new rental agreement. The rental payable for Tyddyn Melin during this period was £2-2-0 per annum.³⁹⁵

By 1835 Penlan Mill had been converted to a corn mill and once again became part of the collective 'Corn Mills and land', and the rent roll for that year bears the notation *'Rent on the new and old mills from May 1835 is 350£ (See remarks last rental)'*.³⁹⁶ In 1842 Penlan Mill was again let separately, with the rental for the old mills being £60-0-0 per annum and for the new mill (Penlan) £279-0-0 per annum. The following year this reverted back and Penlan Mill again became part of the collective, but with the annual rental being reduced to £200-0-0. In 1850 Griffith Thomas failed in his enterprises and from 1851 onwards Melin Uchaf (Cochwillan Mill) and Felin Hen were let individually: Melin Isa no longer being a corn mill. Their histories from this point onward are documented separately.

³⁹³ BU/PFA4/53 & 54; BU/2949.

³⁹⁴ BU/Add 2956, p. 19.

³⁹⁵ BU/4/99 & BU/2959.

³⁹⁶ BU/Add 2973, p. 21.

7.1. Felin Isaf and the Estate Yard at Trefelin

The history of Felin Isaf is perhaps the most varied of all the Penrhyn Mills. It first appears in the Penrhyn Estate rent roll in 1666 where it is listed as 'Melin y Bont', and together with Felin Hen was one of the original 'Penrhyn Mills'. There is an earlier reference to a mill near the parish church of Llandygai called 'y Velin Slattas', which appears to have been part of a lease dated 20th July 1622 in favour of Rees apWilliam John, Rees Lewis, and Rees Griffith; one of the signatories being John Williams, Bishop of Lincoln, Lord Keeper of the Great Seal of England. While there is no firm evidence that this was Melin y Bont, from its location it would seem most likely.³⁹⁷

From its earliest days one of the ongoing problems faced by Felin Isaf was the maintenance of its water supply, which came directly from the River Ogwen (Figs.7.1.1 & 7.1.2). Evidence of this can be gleaned from the various rent roll entries, which included several items for '*clearing the mill ditch*' in 1760, repairs to the sluice in 1779 and 1781, building a new quay or dam in 1776, and repairs to the dyke in 1779. It was also in 1776, on the 1st February, that it required forty people to break the ice on the river, '*to set the mill moving*'.³⁹⁸ It was only after 1798 when water was supplied by means of the leat to Penlan Mill that these problems were alleviated (see Sections 3.3 and 4.1). Even then some expenditure was required, such as for making a new floodgate for the saw mill in 1830. New mill stones were required in 1760, 1762, 1774, and 1779, and all of this was in addition to the regular maintenance and repair that was carried out throughout the period. Full details of the expenditure are included in Section 7.4.

After 1798 water to the mill was delivered either directly from the leat or through the Penlan Mill tail race: in both cases being via the spillway with the flow being controlled by means of sluice gates (see Section 4). Originally it had been thought that the water was conveyed via the aqueduct but based on a later plan of the turbine pipeline it would appear that the aqueduct was in fact constructed to convey water to the adjoining slate works and smithy (Fig.7.1.3). On this basis it may well be that the aqueduct was a later construction, only being built when the new buildings were erected in the lower yard; possibly even being contemporary with, or post-dating, the viaduct (see Section 4.3). Part of the reason for the problems with the water flow was the sluggish current of the River Ogwen which, until the course was re-routed in the period around 1820-1824, meandered through the open pasture of Dologwen. Ostensibly the alteration to its course and the concurrent building of weirs was to improve the salmon fishing, with the improved current flow being a benign consequence. The re-routing of the river also brought about a change in the parish boundaries of Llandegai and Llanllechid, one direct consequence of this being the re-location of Capel Ogwen from the parish of Llandegai to the parish of Llanllechid.

Whether the mill was re-built at some stage is not known, although no doubt it went through a series of alterations. A photograph from 1972 shows a stone marked 'TWy 1715' embedded in the walls above and adjacent to the ground floor windows of the workshop (Fig.7.1.8).

Throughout its early years it was exclusively a grist mill grinding corn for the Penrhyn Estate, although shortly after the arrival in Llandegai of Samuel Worthington it underwent a series of changes. In the short term it continued to grind corn, but soon was extended to include a paint mill for grinding

³⁹⁷ BU/PFA/1/261.

³⁹⁸ BU/1725.

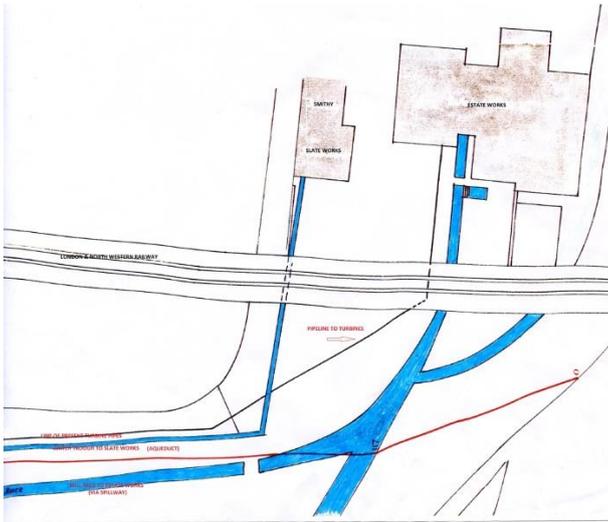


Fig.7.1.3: Water courses to Mill and Slate Works c.1906 with the aqueduct feeding to the Slate Works and Smithy.⁴⁰¹

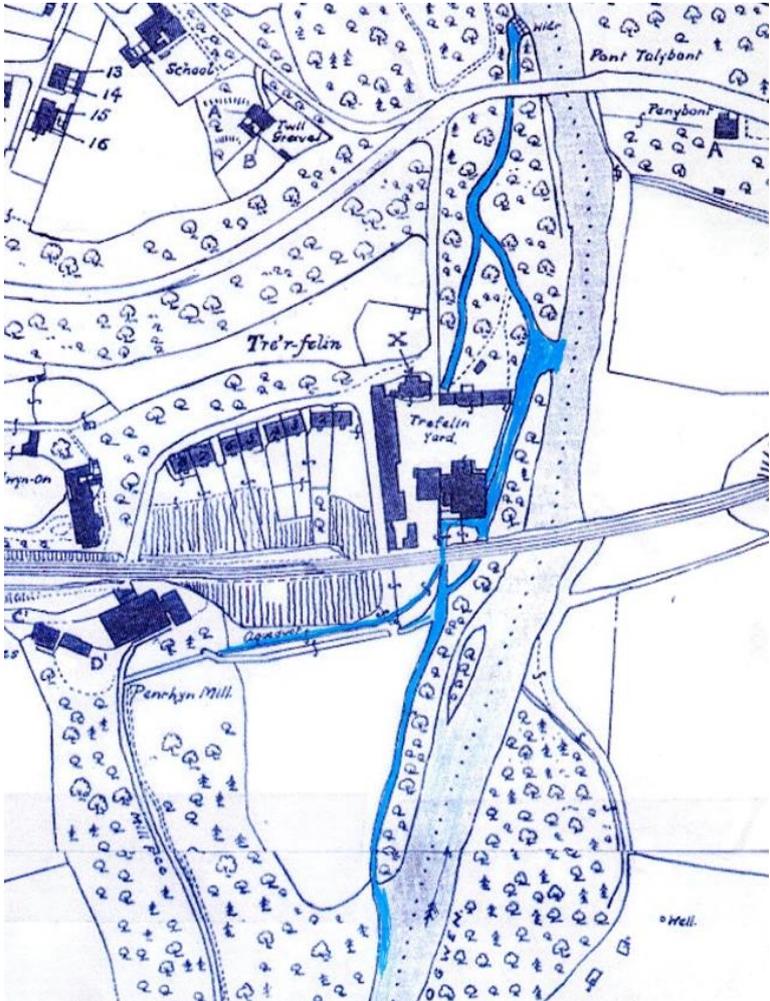


Fig.7.1.4: Revised layout of water courses c.1929.⁴⁰²

⁴⁰¹ BU/Penrhyn Maps No.106 (extract).

⁴⁰² BU/138 (extract).



Fig.7.1.5 (left): Bed of exit race from beneath Tal-y-Bont Bridge. (2012)

Fig.7.1.6 (right): Cascade from exit race to River Ogwen. (2012)

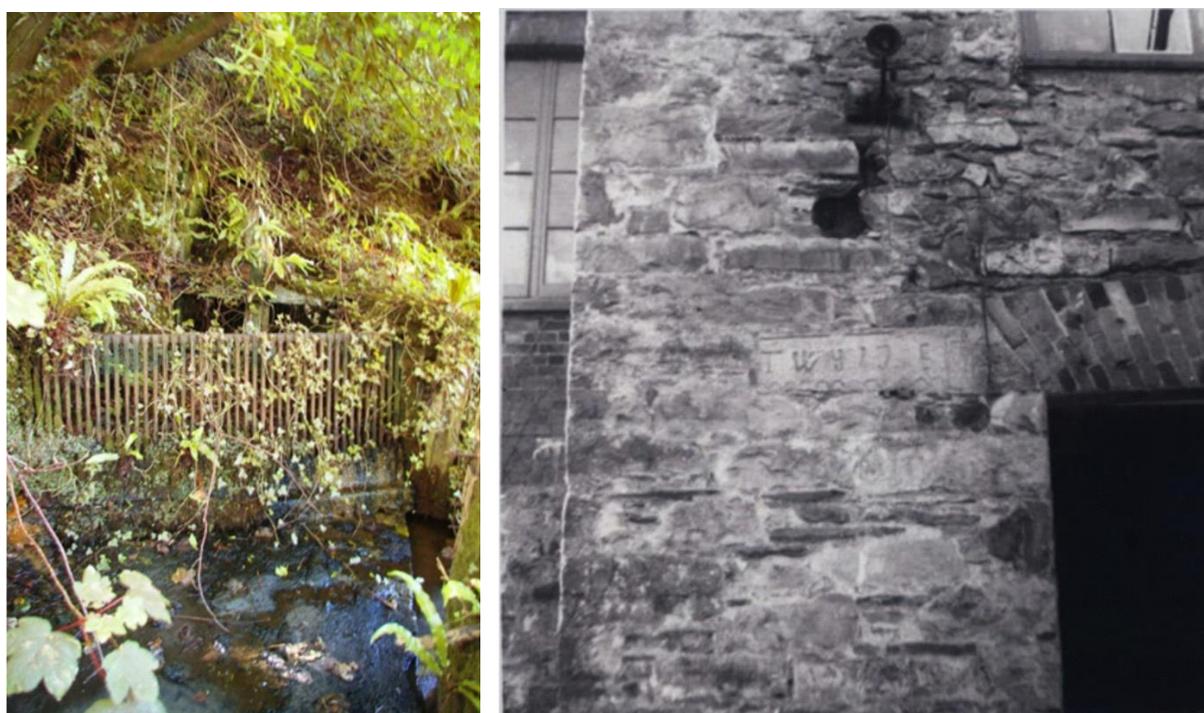


Fig.7.1.7 (left): Junction the exit race with the drain from Llandegai Village. (2012)

Fig.7.1.8 (right): Mason's stone dated 1715 above window openings.⁴⁰³ (1972)

With Worthington's departure from the area in 1829 the mill was taken back in-hand by the Penrhyn Estate and what was now known as Trefelin Yard became the centre for the Penrhyn Estate's Works Department: under the supervision of Mr William Baxter who was the Clerk of Works to the Penrhyn Estate for 22 years. Upon the death of George Hay Dawkins-Pennant in 1840 Mr Baxter received a handsome legacy in recognition of his long and faithful service. He died on 5th March 1841 age 63.⁴⁰⁴

By 1830 Mr Baxter employed almost 100 men who worked in or from the Yard.⁴⁰⁵ These included:

⁴⁰³ Courtesy of Eric Foulkes.

⁴⁰⁴ North Wales Chronicle 9 March 1841.

⁴⁰⁵ BU/Penrhyn ms 2071 Mr Baxter's Yard Account No. 240 of July 26th 1830.

49 Carpenters	2 Coopers	1 Engineer	2 Wheelwrights
1 Slatesman	11 Labourers	7 Smiths	9 Painters
10 Plasterers	1 Labourer (for plasterers)	1 Boy	

The Works Department continued to occupy the Yard, including the saw mill, for the next 126 years. One of the changes that took place during this intervening period was the installation of a turbine at the mill. A similar plan had been mooted for Penlan Mill but did not proceed.

At the time of the handover from Worthington & Sons on 10th March 1829 the machinery and tools in the Yard were valued at £378-4-2, with an additional £133-0-0 being credited to the Ochre Works. The breakdown of the valuation was as follows:⁴⁰⁶

Saw Mill	£310- 1-8
Paint Mill	£48- 7-6
Hone Manufactory & Lathe	£14-10-0
Punching Machine	£5- 5-0

In February 1829 a separate draft agreement was drawn up between Samuel Worthington and his sons Archibald and William on the one part, and Cornelius Roberts of Dolawen on the other part, for Cornelius Roberts to pay for 19 horses with gears employed in conveying slate wagons from the slate quarry to Port Penrhyn, as well as all manure, hay, etc. To this end he (Roberts) was to pay a deposit of £300 into the Carnarvon Bank, with the balance to be paid upon valuation on 31st July 1829.⁴⁰⁷ Over the ensuing years the saw mill continued in use, as did the workshops.

Hone stone production also continued and it would appear that this too this was under the supervision of Mr Baxter. There are no entries in the rent rolls to indicate that the hone mill had been sub-let, and the accounts for the period show that he made a number of disbursements in connection with their production. For example:

April 1830	Morris Roberts 9 days	£0-18-0
	John Griffith 9 days	£0-18-0
	Paid for powder ⁴⁰⁸	£0-6-8
		£2-2-8
18 th May 1830	Morris Roberts 25 days @ 2/-	£2-10-0
	Thomas Griffith 9 1/2 days @ 2/-	£0-19-0
	Paid for 9 lbs of powder	£0-6-0
	On account of blasting B. Ruck(?)	£3-0-0
		£6-8-0
16 th August 1830	3 men, Getting hones, 78 days @ 2/-	£7-16-0
	Paid for 28lbs powder	£0-18-8
		£8-14-8
13 th September 1830	Morris Roberts ⁴⁰⁹ to getting hones 9 @ 2/-	£0-18-0

⁴⁰⁶ BU/ms1977, 'Valuation of Machinery at Ochre and Lower Yard', March 10th, 1829.

⁴⁰⁷ Gwynedd/XM/1959/2.

⁴⁰⁸ BU/Penrhyn ms 2068, No. 89, Statements & Vouchers for April 1930.

⁴⁰⁹ BU/Penrhyn ms 2073, No. 326, Hone Quarry Account for August 1830.

The record shows that for the ten-year period from 1832 the number of boxes shipped was as follows:

1832	49
1833	67
1834	69
1835	96
1836	115
1837	49
1838	73
1839	113
1840	95
1841	89

Average per annum 81.5

The destinations were wide and various, including Alnwick, Arundel, Berwick, Bishop's Stortford, Bristol, Burton on Trent, Carlisle, Chesterfield, Chichester, Coleraine, Dumfries, Enniskellin, Hawick, Kirkwall, Liverpool, London, Maidstone, Oxford, Poole, Runcorn, Swansea, Uppingham, Winchester and Wolverhampton. By far the largest markets were Liverpool and London. If nothing else the range and diversity of these destinations, plus the level of trade, provides clear evidence of the improvements in communication and transportation since the arrival to the area of Richard Pennant and the entrepreneurs.

In 1843 192 boxes were shipped with a value of £651-8-6. In 1844, this rose to 230 boxes with a value of £762-17-6. By 1850 output had slowed with 136 boxes being shipped in in that year and 135 boxes in 1851. The price per box fluctuated throughout this time, but nonetheless fell over the course of five years. In 1843, the average price per box was £3-7-6, in 1844 £3-6-3, in 1850 it was £2-12-9 and in 1851 it was £2-16-7.⁴¹⁰ There is no listed tenant at the Hone Quarry during this period, it too having been taken 'In Hand' by the Penrhyn Estate following Worthington's departure in 1829. The next listed tenant was William Thomas & Co from 1855 onwards.⁴¹¹

Typically, the locally produced hones measured 8" x 2" x 1 ½" and were produced from slate quarried mainly at Pen y Benglog; adjacent to Llyn Idwal and close by the western end of Llyn Ogwen. The first recorded reference to hones originating from this quarry was in a letter written to Lewis Morris of Anglesey by his brother William in 1759.⁴¹² The quarry was taken over by Richard Pennant in 1796, with the mineral rights being assigned to Worthington and his partners shortly thereafter. The Articles of Agreement dated 1st August 1796 and the Counterpart Lease dated 25th March 1801 state that the lease on the quarry, referred to as Blaen y Nant, was to run for a term of 14 years, maximum of 21 years, and that the partners had the right to '*All such copper, lead, tin, calk, calomine, or any other mineral ores, minerals, stone, marble, clays and useful earths as should during the term of 14 years from the date thereof be discovered*'. The rental was £20 per annum with a royalty of 10/- per ton for each ton of hone stone above 100 tons per annum. The lease also stated that if insufficient quantities

⁴¹⁰ Gwynedd/XPQ/89/2.

⁴¹¹ BU/Penrhyn Add/2866, p.7 Item 83.

⁴¹² Ivor E. Davies, 'The Manufacture of Honestones in Gwynedd', *Caernarvonshire Historical Society Transactions*, 37, (1976), p.80.

were found they could relinquish the lease subject to six months' notice: also that the Penrhyn Estate could keep some of the hones for itself.⁴¹³

By 1864 proprietorship of the quarry had been taken over by Thomas Thomas of Hirael, Bangor, who erected a honestone mill at its western end. During the storm that hit north Wales on 7th July 1972 the quarry was filled with rock brought down by the floods, and at the time it was estimated that it would take at least three months for the debris to be cleared.⁴¹⁴

Hones were also produced locally by a number of other manufacturers that included John Williams (Rotherhithe) Co., Garth, Bangor; Humphrey Williams Co, Penlon, Bangor; and Dixon Slate Works, Port Penrhyn. Production also took place in Llanrug, Caernarfon, Groeslon, and Porthmadog; the slate widely being quarried throughout parts of Caernarfonshire.⁴¹⁵

The Estate Yard was not only a place of work but also housed a number of families. For example, in 1841 these included John Williams, a 55-year-old sawyer, together with his wife Mary and their six children. Of these three were boys, John, Robert and Thomas, whose trades were moulder, sawyer, and miller respectively.⁴¹⁶ The eldest daughter, Anne, married a quarryman named William Roberts of 'Incline' on 22nd October 1847 and left home.⁴¹⁷ Mary died in 1850 age 64 and is buried in St Tegai churchyard, Llandegai.⁴¹⁸ John Williams continued to live at the Yard together with four of his children, a lodger named John Hughes, and his grandson John. By 1851 his son John no longer lived at home; Robert continued to be employed as a sawyer; and Thomas, formerly listed as a miller, was listed as a labourer. On 16th March 1855 his second daughter, Margaret, married a 22-year-old Miller from Llandegfan named David Roberts.⁴¹⁹

The Williams family was not the only one residing there and in 1841 other tenants included William Parry an 82-year-old Millwright; John Griffith a 72-year-old Labourer; Richard Owen a 62-year-old Labourer; and John Jones a 25-year-old Gamekeeper.⁴²⁰

By 1901 the family residing there comprised 30-year-old Joseph Anderton, a Foreman Joiner who originated from Lancashire; his wife Clara age 30; their three daughters Jane Ann, Lizzie and Nellie; and their son Ernest.⁴²¹ Shortly afterwards they had another daughter, Clara Emily, who was baptised at St Tegai Church on 5th March 1902. Their second son, William Edward, was baptised five years later on 28th March 1907.⁴²²

Over the years, as the Yard developed, and needs changed, a number of peripheral buildings were added, altered and demolished, and some of these changes can be seen from some of the plans that are still available. In 1845 construction work on the Llandegai section of the Chester & Holyhead Railway began, which included building a very large viaduct across the Trefelin Yard. At the planning

⁴¹³ BU/pp2033.

⁴¹⁴ Liverpool Mercury, 10th July 1972.

⁴¹⁵ Ibid, p.81.

⁴¹⁶ PRO/H0107/1396, 1841 Census, Llandegai, p.3.

⁴¹⁷ St Tegai Register of Marriages 1837-1864.

⁴¹⁸ St Tegai Church, Llandegai, Burial Register for the period 1844-1868.

⁴¹⁹ Op cit.

⁴²⁰ PRO/H0107/1396, Op cit.

⁴²¹ 1901 Census, PRO/RG13/5284.

⁴²² St Tegai Church, Llandegai, Register of Baptisms 1887 to 1974.

stage three possible options had been considered, with the present-day line being the one eventually selected. At that time, the mill site comprised a number of different buildings, as shown in Fig.7.1.10.

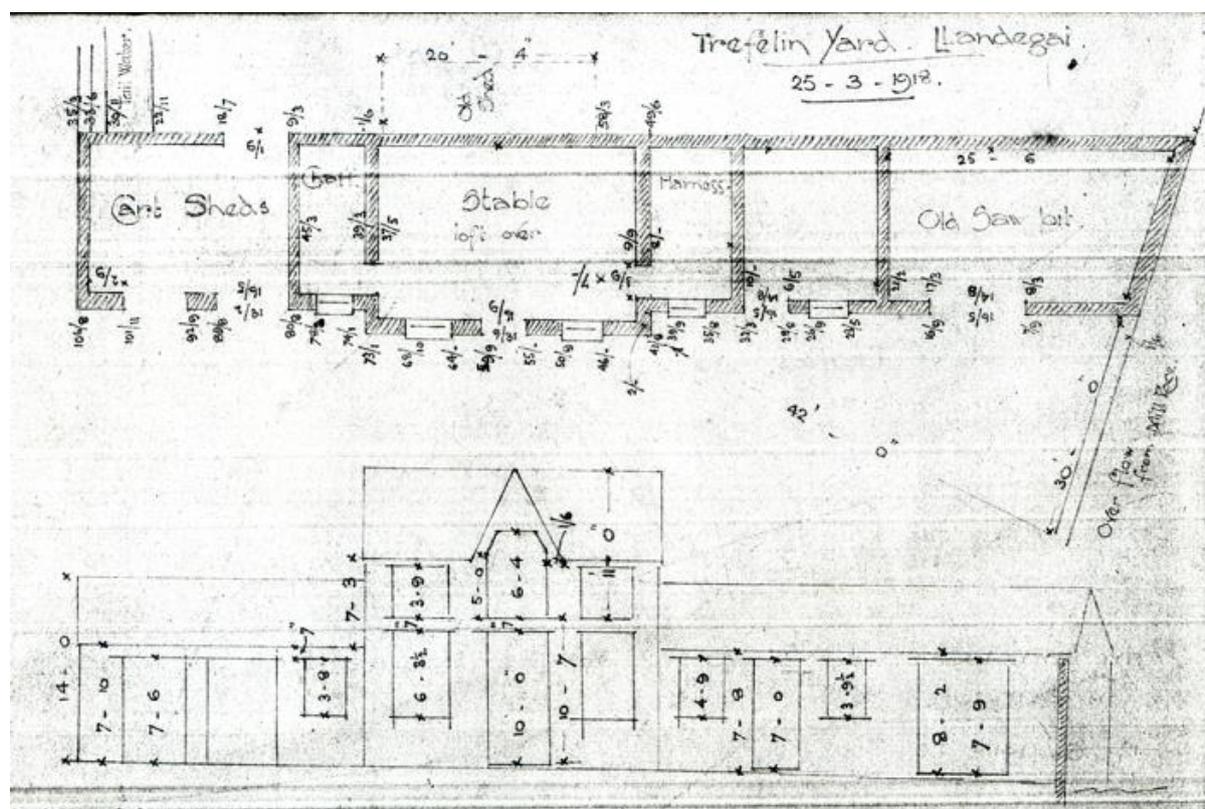


Fig.7.1.9: Layout of the north side of Trefelin Yard.⁴²³ (1918)

In 1909, a new saw was installed, powered through the belt races by a series of pulleys, and at the same time the existing machinery was re-arranged (Fig.7.1.11). The drawings produced at the time indicate that the saw mill was powered by a 16 ft diameter iron wheel, approximately 5'3" wide, situated between the paint shop and weir house. The water was supplied via the stream from the Penlan leat.⁴²⁴ Drawings of the saw mill, both plan and elevation, were made in 1917 (Figs.7.1.12 & 7.1.13) and plans of the north side of Trefelin Yard (Fig.7.1.9) were drawn the following year.

The saw mill continued to produce timber and timber products from the Estate's woodlands which included fencing posts, wooden pegs, sawdust, a tool chest, benches, etc. During World War II it also produced a large numbers of pit props. Their products were sold to a wide range of customers both locally and nationally, and these included customers in Bangor, Bethesda, Llanfair PG, Llangwllog, Penmaenmawr, and Wern Bach. For Caernarvonshire County Council they produced creosoted posts, oakfield gates, logs, and sluice gates; for Watkin Jones & Son beech, posts, timber, hardwood, and poles; for Saunders Roe in Beaumaris they produced packing cases and hardwood, as well as sawing their own timber for them. Other customers they supplied were, for example, the National Trust, Messrs Parker (Ancoats) in Manchester, and A. Blackburn at West Felton near Oswestry. The list was long and varied.⁴²⁵

⁴²³ BU/Penrhyn Maps 306.

⁴²⁴ BU/Penrhyn Maps 305.

⁴²⁵ BU/un-cat, 'Penrhyn Estate Accounts Ledger 1947-51'.

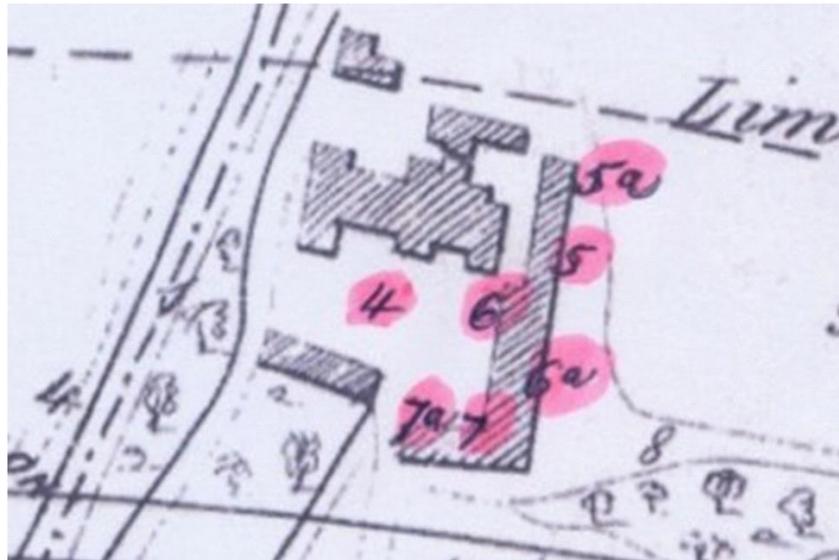


Fig.7.1.10: Buildings at the saw mill c.1844.⁴²⁶

The items marked are (4) the saw mill court; (5) cow house; (5a) stable; (6) house; (6a) stables; (7) stables granary; (7a) house. It is worth noting that at this time the bed of the original Penlan Tramway spur still existed and was only obliterated during the construction of the mainline railway.⁴²⁷

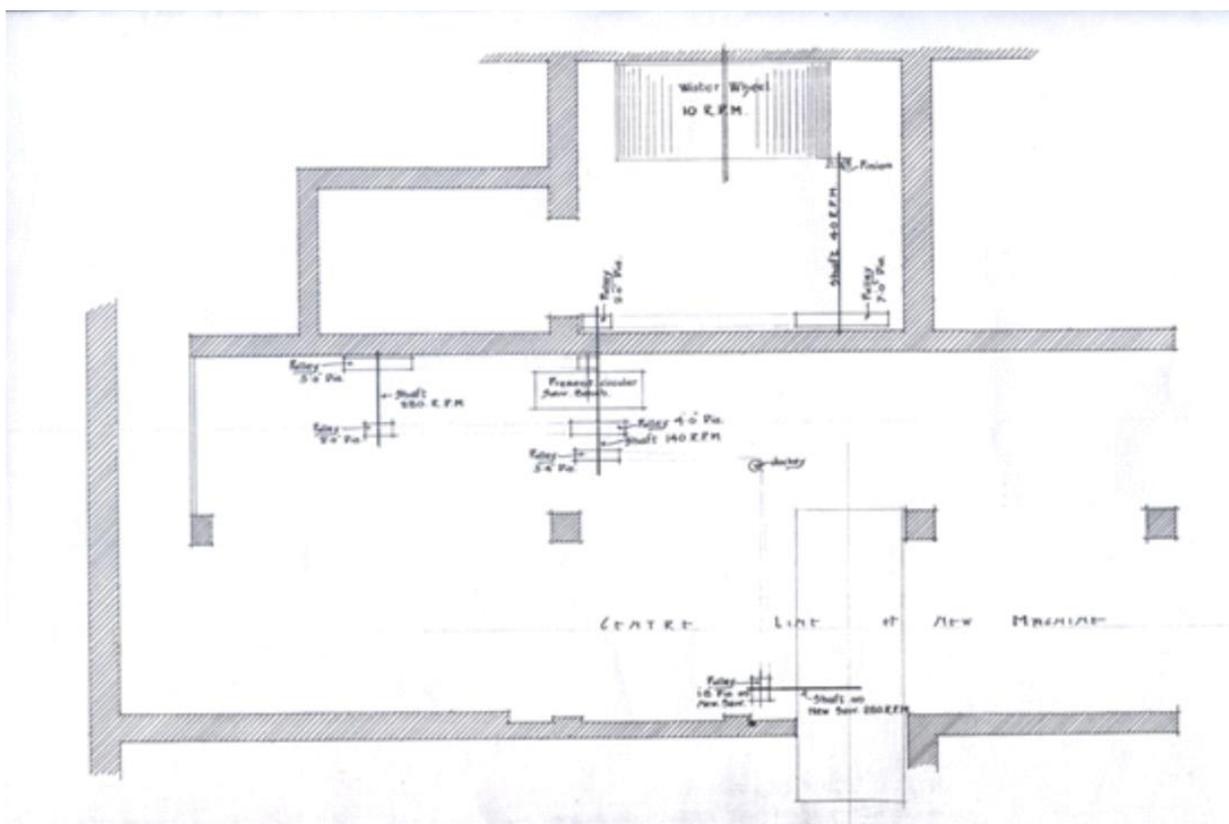


Fig.7.1.11: Plan showing re-arrangement of machinery.⁴²⁸ (1909)

⁴²⁶ Gwynedd /Official Maps & Plans X/R/12 (extract).

⁴²⁷ Ibid, Item 31.

⁴²⁸ BU/Penrhyn Maps 305.

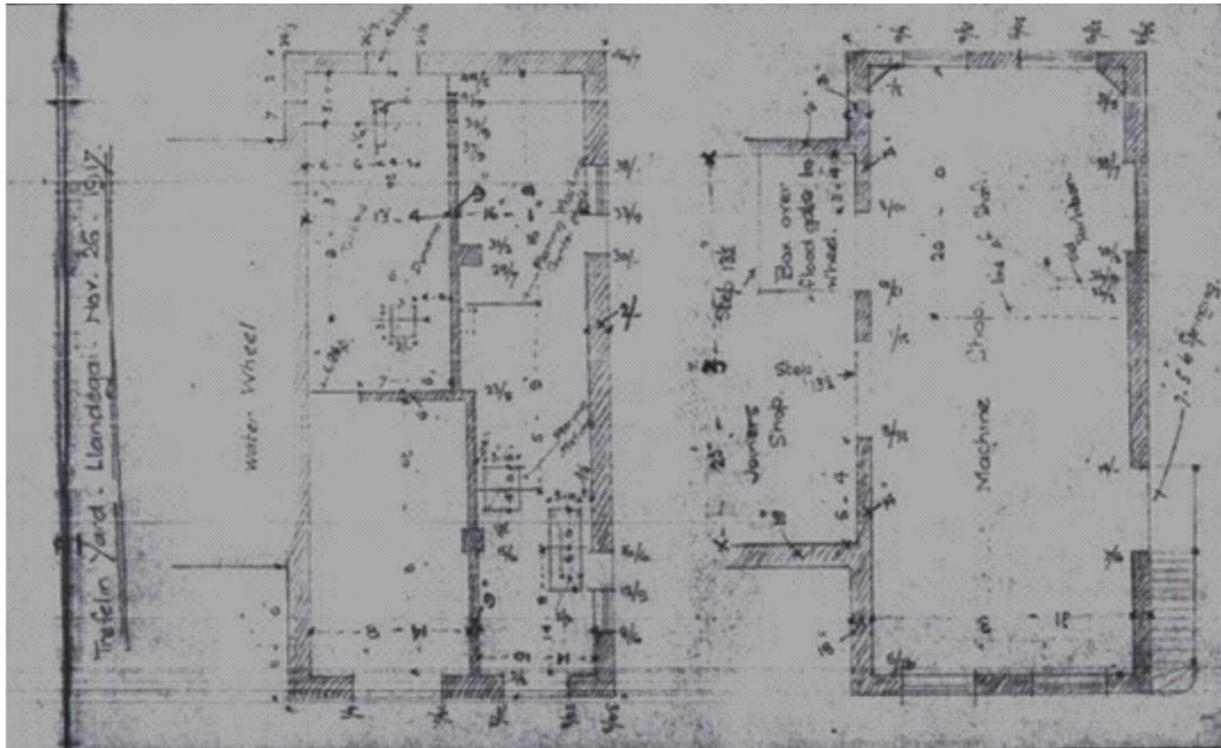


Fig.7.1.12: Plan of the saw mill and workshops.⁴²⁹ (1917)

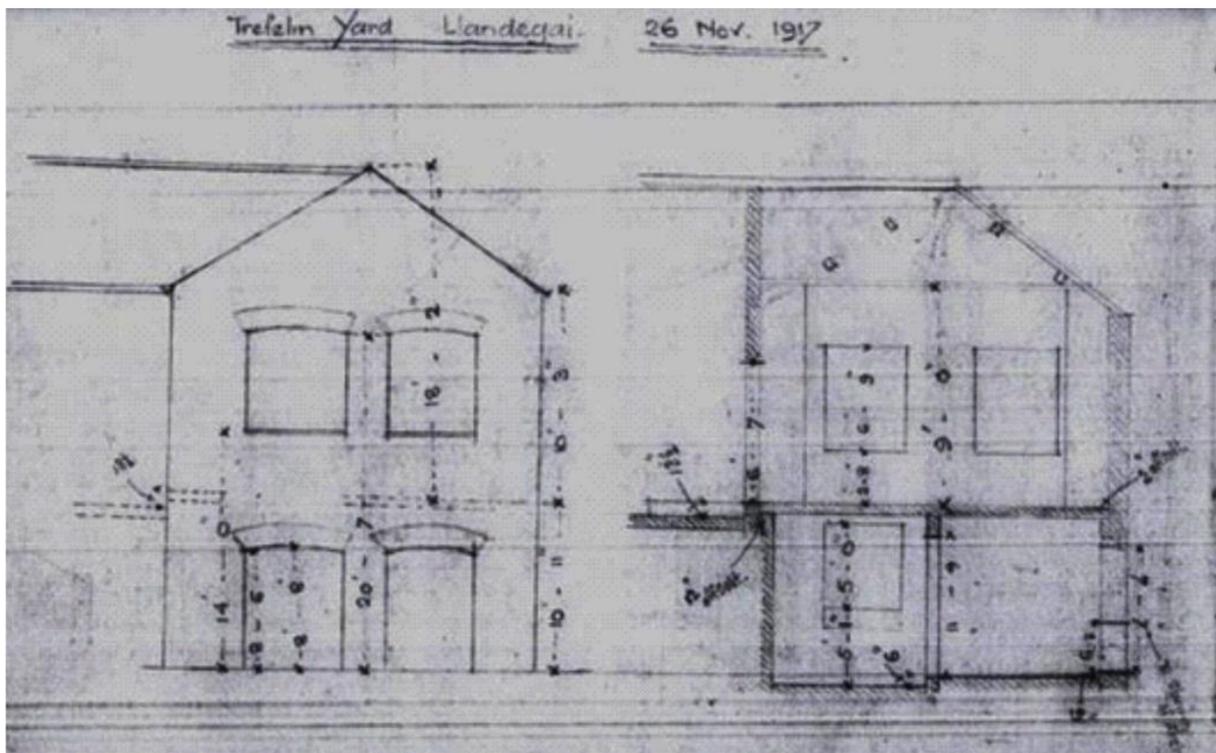


Fig.7.1.13: Elevations of the saw mill and workshops.⁴³⁰ (1917)

⁴²⁹ BU/Penrhyn Maps 306.

⁴³⁰ BU/Penrhyn Maps 306.

The activities of the saw mill were complimented by those of the Forestry & Woods Department that produced much of its timber. In addition, it supplied logs for use by the Estate at Drws Melyn, the Grand Lodge, Port Lodge and Tal-y-Bont Lodge. Between October 1948 and December 1951 this included:

1948	Oct – Dec	6 ½ loads	£2-5-0/load
1949	Jan – Mar	6 loads	
	Apr – Jun	7 loads	
	Jul – Sept	8 loads	
	Oct – Dec	5 loads	
1950	Jan – Mar	3 loads	
	Apr – Jun	5 ½ loads	
	Jul – Sep	4 loads	
	Oct – Dec	2 loads	£2-17-6/load from Nov.
1951	Jan – Mar	2 ½ loads	
	Apr – Jun	2 loads	
	Jul – Sep	2 ½ loads	
	Oct – Dec	3 loads	

By January 1955 the deliveries had greatly reduced, now being delivered by the bag rather than the load. The cost per load also fluctuated being £3-2-6 from January 1952, £3-12-6 from November 1952, £4-0-0 from July 1953, £3-12-6 from December 1953, £4-0-0 from April 1954 and £4-7-6 from September 1954.⁴³¹

During the Second World War the Penrhyn Fire Brigade was formed, which was based in the Estate Yard. Throughout the War a fire watch was conducted there because of the risk posed by the large amount of timber on the site. The person in charge of the Brigade at this time was Mr Frank Pickles, and on 9th December 1942 he wrote to Lt Col. J.G. Wynne Williams, the ARP County Chief Warden, to say that he no longer should have any further responsibility in connection with the Warden's duties as he was now committed to taking over weekend cover at the Yard. This was in response to Col. Wynne Williams' letter of 7th December addressed to Mr Ernest Roberts, Divisional Warden for the Ogwen District, in which he noted that Mr Pickles had not signed for duty, claiming to already be doing over 48 hours per month on fire duty. Col. Wynne Williams had gone on to say that if personnel did not hold an exemption certificate they should be enrolled in some other branch of Civil Defence.⁴³² Also during the War the strategic routes adjoining the Yard were prepared with anti-tank traps, and at Tal-y-Bont these included the road bridge, the railway bridge, and the viaduct above Trefelin Yard.⁴³³

Although a nightly fire watch was kept at the saw mill, from the log it would appear that they had little to contend with. During the two-year period 1941-42 there are only four occasions on which bomb explosions were heard, all of them in 1941: one on 30th May, four on 22nd October, two on 24th October, and one on 1st November. Raiders were heard to pass on 28th May 1941, but no explosions were heard. The only other incidents reported were the occasional Friday night gunnery practice, and

⁴³¹ BU/un-cat, 'Penrhyn Estate Forestry Dept. Ledger of Accounts 1st April 1931 – 5th March 1964'.

⁴³² Gwynedd/XC12/1/28, Caernarvonshire County Council Air Raid Precautions, Nov 1940-31st Dec 1942.

⁴³³ Gwynedd/XC2/8/2, Caernarvonshire County Council Register of Road Blocks and Anti-tank traps Completed. List of road and bridge defences.

the isolated siren alert. The last of these was recorded on Monday 27th July 1942. At such times the level of alert moved from white to yellow, red, or purple; none of the alerts lasting for any length of time.

Throughout 1941 the primary Watcher was a Mr E.A.O. Davies, and from 7th December 1941 and throughout 1942 it was Mr Arthur L. Edwards of 98 Penrhos Road, Bangor. They were relieved for short periods by a large number of part time Watchers who generally appeared to serve for no more than the occasional night. It would seem that generally the Watchers had few duties to perform, allowing time for them to make entries such as the one by Edwin Williams on 21st June 1941. '*A phwy a rydd i lawr wŷr mawr Mon*' ('And who would put down the great men of Anglesey'); or that by W.P. Thomas on 1st March 1941.

*The night was long and dreary
No message red or white
I fell so sad and weary
I longed for eight alright
At last the dawn awakened
I longed to get away
My weary limbs to rest awhile
To bed to dream of better days*

A fellow Watcher annotated this with '*Where ignorance is bliss 'tis folly to be wise*'.⁴³⁴

In 1949, following the death of Hugh Napier Douglas-Pennant, the Penrhyn Estate became liable for what were at the time punitive Death Duties, and the decision was made that a number of the Estate's properties needed to be sold in order to meet them. Among these was the Estate Yard at Trefelin, and in December 1954 the Roads and Bridges General Purposes Sub-Committee of Caernarvonshire County Council met to discuss the possible acquisition of the Yard for use as a depot for the Highways Department. As part of this process the County Surveyor visited the site on 18th April 1955 to make an inspection. Following this the decision was made to proceed and on 3rd May 1955 the Clerk to the County Council wrote to the Penrhyn Estate's solicitors, Carter Vincent & Co, notifying them that the site was to be purchased from the Estate's Trustees for the sum of £5000, and that the County Council would pay the proposed legal fees, as well as contributing £36-15-0 towards the surveyor's fee.⁴³⁵ In order to fund the purchase of the site the Council took out a loan from the Welsh Office, for a sum of £5250 payable over a term of 30 years.

The loan had been subject to approval by both the Ministry of Transport and the Ministry of Housing and Local Government. The proposed area covered under the contract was 5130 square yards for the Yard, plus an additional 1015 square yards for the associated garden. Subsequently this was amended to a total of 5710 square yards or 1.179 acres (Fig.7.1.14). The transfer did not go smoothly as there were issues regarding the continued occupancy of the Mill Manager's house, water rights for the turbine, and also the theft of sheet lead stolen from the gutters and valleys. In addition, the Estate had to remove all of the machinery from the site, including a 5 ton crane which had been sold to the

⁴³⁴ BU/un-cat, 'Penrhyn Saw Mills Fire Watchers Log Book 5th Jan 1941 – 12th Nov 1942.

⁴³⁵ Gwynedd/XC2/6/539, Purchase of Penrhyn Estate Yard by Caernarvon County Council.

Rothwell Timber Co. Ltd of Abergele. The turbine and the pipes running to it from Penlan Mill formed part of the contract, which was finally signed on 12th March 1956.

On 17th April 1956, the Council wrote to British Rail seeking to rent the land beneath the railway arches of the Llandegai viaduct. It was not until 4th December 1956 that the British Rail surveyor visited the site, and following this, in March 1957, it was confirmed that there was no objection to the Council erecting a garage beneath the easterly arch, for which a rental of £15 per annum would be required. On 29th March of that year Civil Defence Headquarters Wales wrote to the Council noting its intention to erect garages on the site for use by Civil Defence vehicles, at a cost of £550. This was approved in principle, but details of the plans were required. However, on 30th September 1957 the Sub-Committee of Caernarvonshire County Council had met to discuss the matter and decided not to proceed with the proposal and instead to acquire alternative premises at 10 and 12 High Street, Caernarvon.⁴³⁶

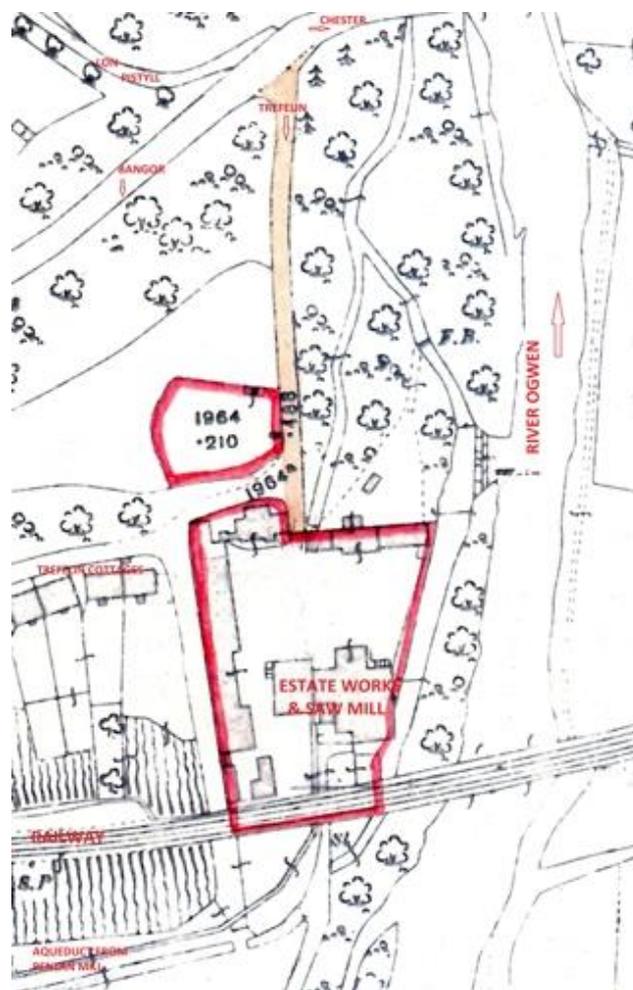


Fig.7.1.14: Yard layout as purchased by Caernarvonshire C.C. in 1955.⁴³⁷

During this same period a request had been made to the Council by the tenant of the former mill manager's house situated in the Yard, regarding permission to take in paying lodgers. After a degree of deliberation, the request was granted, subject to agreement that no cars could be parked at the

⁴³⁶ Gwynedd/XC2/6/467, Tenancy of Estate Yard Cottage, Llandegai Depot.

⁴³⁷ Gwynedd/XC2/6/539 (extract).

premises. In 1964, the tenant became ill and subsequently left the property (which was tied), with a new tenant moving in during November 1965. Rather than being covered by a tenancy agreement the occupants of the house were subject to a Licence for Service Occupancy. Prior to the arrival of the new occupant what was now designated Trefelin House (Fig.7.1.15) was renovated at a total cost of £415. This included £100 for general repairs; £120 for re-flooring the dining room, kitchen and part of the hall; complete rewiring (except for the cooker circuit) and installation of an immersion heater; and £100 for decoration.⁴³⁸



Fig.7.1.15: The former Mill Manager's House at Trefelin.⁴³⁹ (1972)



Fig.7.1.16 (left): The old mill left and right with Worthington's brick extension in the centre. (1972)

Fig.7.1.17 (right): The old mill with dated stones above windows.
Machine room and Joiners workshop above. (1972)

⁴³⁸ Ibid.

⁴³⁹ Figs.7.1.14 to 7.1.18 Courtesy of Eric Foulkes.



Fig.7.1.18 (left): Original stone mill from rear with brick extension to the right.
Openings to water wheel pit to right. (1972)

Fig.7.1.19 (right): Original stone mill to right with red brick extension to left.
Derrick crane used by Forestry Dept, and 6cwt test block. (1972)

It was during the Council's tenure that two important events took place, both of them from an archaeological point of view being detrimental to the site. The first was the demolition of the saw mill, workshop, and some peripheral buildings. The second was the demolition of a section of the leat being that immediately adjacent to the outlet end of the tunnel, this being a direct consequence of the saw mill being demolished as its water supply was no longer being required (see Section 5.1). In 1972 the saw mill closed although what had been known as the Yard, now known as the Depot, continued to be used. Some of the buildings that remained standing at that time are shown below (Figs.7.1.16 to 7.1.19).

In 1978 Eric Foulkes visited the site and recorded that what he describes as 'the second mill' (probably what came to be known as the saw mill), had two overshot wheels, supplied with water via a common trough, in the same way as described for the flint mill. Based on the remaining evidence on the river bank he thought that originally the mill had only one wheel, which was undershot.⁴⁴⁰

In October 1979 Brigadier Trevor wrote that recently he too had visited the site, at which time the saw mill and Estate timber yard still survived: albeit he had strictly unofficially been told that all of the old buildings were likely soon to be demolished and new ones erected.⁴⁴¹ In his report of the visit the Brigadier describes the mill as having three wheels; two to work saws and one to drive a turbine and dynamo. He also recorded that at the time of his visit there were a number of oddments lying around the yard, for example the bell which controlled working hours. Apparently, it also was used as a time signal by the local residents. In addition, his report includes mention of Juliana Isabella Mary Douglas Pennant's (nee Dawkins Pennant) original gravestone, which had been superseded by the monument in Llandegai churchyard; a set of bellows for one of the forges; some heavy ceiling timbers; and a few brackets for supporting the shafting from the water wheels to the saws.

⁴⁴⁰ Correspondence, 9th September 2017.

⁴⁴¹ GAT/PRN 6387.

Prior to the demolition of the mill the layout of the Yard comprised a series of buildings ranged along the entire west side, including a smithy and slate works. The north side comprised the Foreman's/Mill Manager's house (Trefelin House) which stands adjacent to the gated entrance, and then a further terrace of buildings which included cart sheds, a chaff store, a stable, a harness room, a store room and the old saw pit. The mill buildings and workshops occupied the main part of the south and east part of the yard, with the eastern boundary being formed by the River Ogwen. Three new buildings had been added by this time. One was in the south west corner of the site, and another two in the north east, adjacent to the river in the previously unused area outside the main yard (Fig.7.1.20). Demolition of the mill and associated buildings finally took place during October 1980.⁴⁴²



Fig.7.1.20: Extended Yard with new buildings added and the mill building demolished.⁴⁴³

⁴⁴² The event was witnessed at 4pm on 20th October 1980 by Eric Foulkes, who at the time was travelling by on the Chester-bound train.

⁴⁴³ Extracted from http://172.16.55/website/gwyneddmeownol/templates/print_A4Portrait.htm.



Fig.7.1.21 (left): Reception area on north face, replacing what in 1918 had been the site of the cart shed, stable, and harness room.⁴⁴⁴ (2015)



Fig.7.1.22 (right): New buildings to the west side of the yard, replacing what in 1844 had been stables and a granary. (2015)



Fig.7.1.23 (left): Buildings to west side of the Yard, replacing what in 1844 had been a cow shed and stable. (2015)



Fig.7.1.24 (right): Temporary buildings to east side of Yard. (2015)



Fig.7.1.24: Sheds at south end of bottom yard. (2015)

⁴⁴⁴ By kind permission of Celtest Ltd.

In 1990 the Council sold the yard to Celtest Ltd, who in 2007 also purchased the adjoining Penlan Mill and associated woodland. Some of the original buildings have subsequently been refurbished and a number of new industrial buildings have been erected (Figs.7.1.21 to 7.1.25).

The new office suite to the west side of the upper yard (Fig.7.1.22) replaced the original buildings, with the only remaining feature being the stone pillars separating each of the four bays.

7.2. Cochwillan Mill (Melin Uchaf)

According to A. R. Jones the first reference to the mill appears in a register of the lands of the Cochwillan Estate which is dated 1560, although this may have been a copy of an earlier manuscript dating from the 15th century.⁴⁴⁵ The tenancy of the mill between 1677 and 1851 has already been documented above, and from its earliest days until 1851 the mill had been controlled by the Penrhyn Estate and used as a corn mill that the Estate's tenants were obliged to use. One illustrious former resident at the mill was the Welsh hymn writer Henry Williams (1831-1910), also known as 'Alaw Llechid' or 'Esin Alaw', whose works were published between 1853 and 1901.⁴⁴⁶ Apparently he was born at the mill where he spent much of his childhood before eventually moving to Bethesda.⁴⁴⁷ The 1851 Census shows the occupants at that time were Robert Williams, a 38-year-old Labourer; his wife Elizabeth age 39; their son John, a 7-year-old scholar; and daughter Anne age 5. Ellis Davies, a 47-year-old Labourer, also resided there: possibly a lodger, or someone just staying overnight (the Census being a 'snapshot' on the day).

In 1852 a lease was taken out by William Williams and Edward Thomas, both of Tal-y-Bont. William Williams was the miller, and Edward Thomas the tenant at Tal-y-Bont Ucha farm. The annual rental was £10-0-0, and the lease was to run for 20 years from 12th May 1852. The agreement stipulated that the tenants were to lay out at least £200 on the building, with the cost being offset at the rate of 1/20th per annum provided they remained as tenants for this period. The lease was for Cochwillan Corn Mill, 'situate in the Parish of Llandegai or thereabouts' (although it is in Llanllechid Parish), and included 'machinery, millstones and fixtures in or about the premises, offices and outbuildings, ways, water courses, dams, floodgates, sluices, easements, privileges and appointments', but excluded fishing and game rights. As had by now become customary with all Penrhyn Estate lease agreements, the tenants were responsible for repairs and maintenance, as well as paying the tithe, taxes, etc.⁴⁴⁸ Williams and Thomas remained as joint tenants until 1860 when Thomas left the partnership, with Williams remaining as the sole tenant until 1874. In 1875 the tenancy was taken over by John Grey, although in the following year Thomas Grey took over and remained there until 1891.

From 1853 onwards, the rental remained at £10 per annum, only rising in 1882 when there was a four-fold increase to £40. Currently there is no firm evidence available to suggest why such a large increase should have occurred, although it is likely that it was during this period that the mill was rebuilt. Whereas originally it had been a relatively small structure, possibly with a thatched roof, the replacement building is much larger, built of stone, and with a slate roof. During the course of this work the orientation of the building altered by 90 degrees so that instead of the gable end facing east-

⁴⁴⁵ A. R. Jones, 'Melin Cochwillan a'r Melynydd Olaf', *Melin*, 2 (1986).

⁴⁴⁶ www.archiveswales.org.uk

⁴⁴⁷ Conversation with Miss Vera Hughes, Tal-y-Bont, 12th August 2003.

⁴⁴⁸ BU/CV/mss 2280.

west it now faced north-south. The old mill was located adjacent to what today is the garage, with the mill wheel being located adjacent to the west wall.



Fig.7.2.1: The original Cochwillan Mill c.1849. The roof of what became known as 'Factory Cottage' can be seen in the background.⁴⁴⁹

The mill does not appear in any of the trade directories for the years 1844 onwards, this being in contrast to the mills at Aber, Bangor, Bethesda, the Bishop's Mill, Coetmor, Glasinfryn, and Penlan; all of which make an appearance during this period. The only exceptions were the 1880 and 1883 editions of 'Slater's Directory'. In the first it appears under the heading 'Millers' as 'Thomas Gray, Chwyllan, Tal-y-Bont'⁴⁵⁰, and in the second as 'Grey Thomas, Chwyllan, Tal-y-Bont'⁴⁵¹. Perhaps surprisingly it does not merit an entry in the 1886 edition of the 'Caernarvonshire & Anglesey Postal Directory', although the much smaller Felin Hen mill does.

There are no entries in the Rent Roll from 1892 until 1901 when the tenancy was taken over by John Hughes, who until then had been the head miller at Penlan Mill. The rental was set at £25-0-0 per annum and it remained at this level until 1924 when it was reduced to £20-0-0. The following year it was further reduced to £10-0-0. Why the Estate should have reduced the annual rental from £40 in 1883 to £25 in 1902 is not clear, although one can only speculate that having lost the tenant at Penlan Mill, and having little prospect of replacing him, they were anxious not to also have Cochwillan Mill vacant. Another possibility is that with the advent of other more efficient mills, such as the steam mill in Dean Street, Bangor, there was less need for a traditional water mill, and the reduction in rent recognised the corresponding reduction in trade. Nonetheless Mr Hughes continued to work at the

⁴⁴⁹ From a painting by F.R. Lee. By kind permission of the National Trust, Penrhyn Castle.

⁴⁵⁰ 'Slater's Directory of North Wales', (1880), p. 21.

⁴⁵¹ 'Slater's Directory – North Wales, Cheshire and Shropshire with Liverpool', (1883), p.26.

mill until 1955, when it was sold by the Estate as part of the divestment of its portfolio to cover the cost of Death Duties following the death of Hugh Napier Douglas-Pennant, fourth Baron Penrhyn of Llandegai.

From anecdotal evidence it would seem that the mill was still operational during the 1930s and 40s, with horse-drawn carts taking oats there to be ground.⁴⁵² In December 1906 Mr Hughes had been fined 2s 6d plus costs at the Bangor Police Court, for leaving his horse and cart parked on Bangor High Street for a period of approximately 40 minutes. Apparently, he had been told by a police officer that he could stay for five minutes in order to load goods from a shop but had considerably exceeded this time.⁴⁵³ His wife, Maria, died on 11th January 1940 and Mr Hughes on 28th March 1955, age 89. Both are buried in St Cross churchyard, Tal-y-Bont.⁴⁵⁴ They had a son, Thomas, and in 1910 he was listed among those men age under 18 years who were working in the Penrhyn Quarry.⁴⁵⁵

On 2nd July 1956 the mill was purchased by Vernon Stephen Barker for the sum of £500 and the extent of the property purchased was defined as: *'ALL that piece of land situate at Talybont near Bangor in the County of Caernarvon more particularly delineated on the map or plan annexed hereto and therein edged Red Together with the dwelling house and buildings erected thereon and known as 'Felin Cochwillan' Together with the right to a flow of water along the Mill Race shown on the said Plan from the River Ogwen to the premises hereby conveyed (but the Vendors shall not be in any way responsible to provides a supply of water to the said Mill Race) And the right to enter with workmen and appliances upon the said Mill Race and the land immediately adjoining the same for the purpose of inspecting repairing cleaning and clearing the same doing no unnecessary damage in or about the exercise of the said rights and making good all damage that may be done Provided that the right to a flow of water in the Mill Race does not imply or include the right of fishing which is hereby reserved to the Vendors'*⁴⁵⁶ (see Fig.7.2.2).

The conditions attached were that within three months of taking possession the purchaser was to erect and maintain a stock-proof fence along the westerly side of the premises so as to enclose the water wheel. He was also to keep the mill race banks in good order, and in both cases the work was to be carried out without doing unnecessary damage to the adjoining properties. His wife separately purchased the adjoining cottage and land.

Mr Barker had hoped to resume milling grain but in 1990, in spite of receiving a £6000 grant from CADW and investing £8000 of his own money, he was thwarted by Arfon Borough Council and the (then) Welsh Water Authority. The Council's Planning Department told him that he had to apply for planning permission, but that before permission could be granted he would have to provide a car park for the use of visitors: something which he could not do because of the lack of available land.⁴⁵⁷ At the same time the water authority wanted to charge him £2000 a year for taking water from the River Ogwen to the mill race, although subsequently the House of Lords ruled against their ability to do so.

⁴⁵² Miss Vera Hughes, Op cit.

⁴⁵³ *North Wales Observer and Express* 21st December 1906.

⁴⁵⁴ Gwynedd Family History Society, *Memorial Inscriptions of the Churchyard at St Cross*, M278, p. 15.

⁴⁵⁵ Gwynedd/XPQ1913, List of Men under 18 years on 24th November 1910, (Quarry), Setting District III.

⁴⁵⁶ A copy of the transfer document was kindly provided by the present owners of the mill, Howard and Cora Hutchinson.

⁴⁵⁷ *Bangor Mail* 9th May 1990.

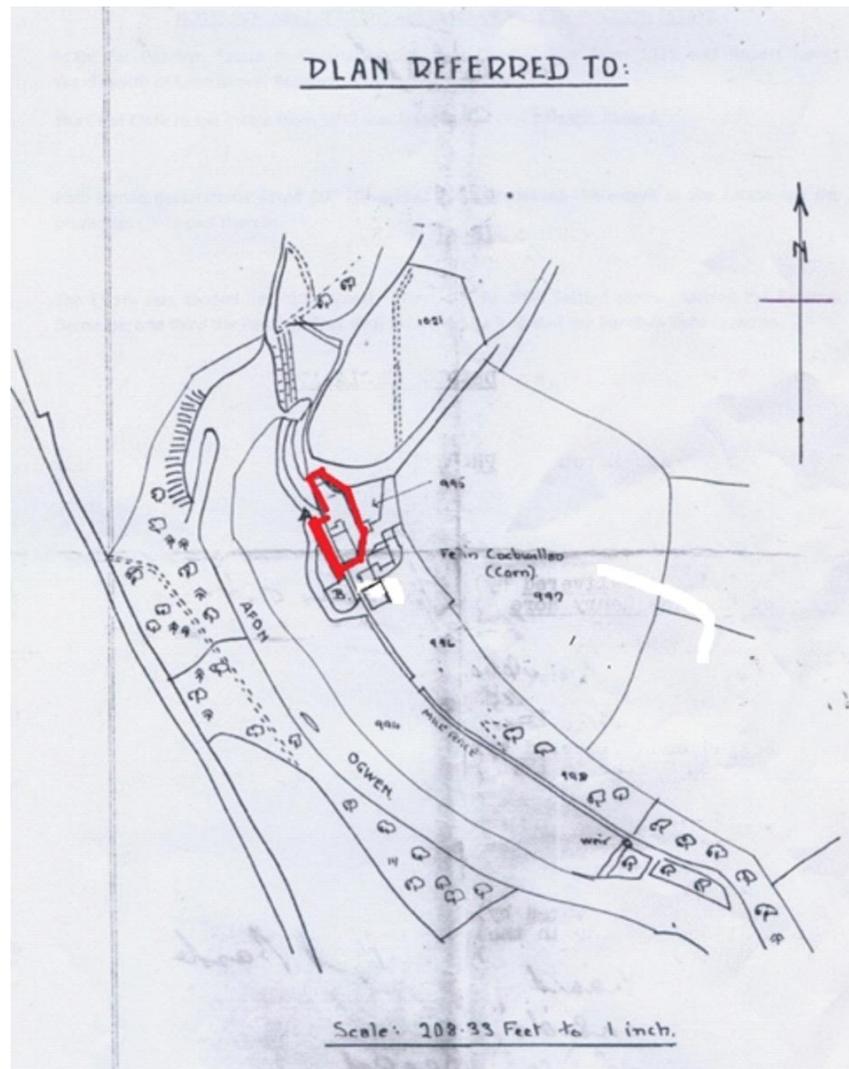


Fig.7.2.2: Plan of the property (highlighted) as purchased by Vernon Barker on 2nd July 1956.⁴⁵⁸



Fig.7.2.3 (left): Cochwillan Mill⁴⁵⁹ (2008)

Fig.7.2.4 (right): The head race. Note additional small pair of wheels in foreground. Mr Barker had intended connecting these to the mill, but the work did not proceed. (2008)

⁴⁵⁸ Courtesy of Howard & Cora Hutchinson.

⁴⁵⁹ Figs.8.2.3 to 8.2.9 By kind permission of Howard & Cora Hutchinson.



Fig.7.2.5: The north gable (2008)



Fig.7.2.6 (left): The wheel and tail race.

Fig.7.2.7 (right): Part of the original exit race, facing north.



Fig.7.2.8 (left): Machinery on the upper floor. (2008)

Fig.7.2.9 (right): The new sluice at the leat entrance from the River Ogwen. (2003)

While being a bricklayer by trade Mr Barker was also skilled in other areas, and as a side-line he built textile machinery; including among other items looms, a spinning jenny, and water frame. His looms were sold both locally and nationally, at least one having been sent to Scotland. One of his Spinning Jennys and a water frame were sent for display to a museum in Lancashire.

In 1980 Frances Llewellyn made an examination of the water wheel which she thought dated from c1800.⁴⁶⁰ It measured 15'3" in diameter by 7' in width and had 8 spokes with 5 paddles per area. There were iron bars linking the rims adjacent to each spoke.

In July 1999 the mill was purchased by Mr Barkers' nephew and his wife, Howard and Cora Hutchinson. It is now listed in the *Mills Open* handbook and is open to the public on selected dates in the year. They have compiled a comprehensive description of the mill and its workings and this can be found at the Cochwillan Mill website,⁴⁶¹ which contains a full description of the mill and its workings.

The Fulling Mill

Locally it is widely believed that at some point Cochwillan Mill had been a fulling mill, with its conversion to a corn mill being forced due to the toxic nature of the cleaning agents used in the fulling process. Reputedly these killed the fish in the River Ogwen, which is a coarse fishing river. While no doubt there may be some foundation to this belief, no specific documentary evidence to support it has been found.

The fulling process, the purpose of which is to produce felt or worsted, comprised a number of distinctly different phases. First the woven wool had to be washed and scoured to remove oils, dirt and other impurities; and during the period in which the mill would have been employed in fulling, the agent that most likely would have been used in this process would have been fuller's earth: an impure form of hydrous aluminium silicate. At one time urine had been widely used for this purpose although by the time Cochwillan Mill was built this had long been superseded.

Once scouring had been completed the wool was thickened by matting the fibres together using a hammering action that increased the fabric's strength and waterproofing: the process being known as felting. The type of material produced was either carding wool, for making woollens, or worsted. Once felting had been completed the material was rinsed out to ensure that it was clean. Felt material can be produced because the hammering action hooks together the microscopic barbs on the surface of the wool, very much in the way Velcro works today.⁴⁶² The final part of the process was to stretch the material on wooden frames known as tenters, to which it was attached by large hooks known as tenterhooks; the area where this was carried out being known as a tenterground. The conversion from a corn mill to a fulling mill would have involved the replacement of the grinding stones by wooden hammers, plus the installation of large tenters.

From the available evidence, in particular the various lease documents, it is clear that certainly during the tenure of Samuel Worthington and Thomas Griffith (1800 to 1850) Cochwillan was a corn mill. In 1802 Samuel Worthington did rent a fulling mill nearby, but only for one year.⁴⁶³ In 1852 when Williams

⁴⁶⁰ RCAHMW 207(MI) N.ACC. P.74.

⁴⁶¹ www.felincochwillan.co.uk.htm

⁴⁶² www.wikipedia.org/wiki/Fulling.

⁴⁶³ BU/Penrhyn Add/Rental 1802.

and Thomas took over the tenancy the lease was for 'Cochwillan Corn Mill' together with all of the attendant machinery which that entailed. From then until 1882 there is nothing to indicate any change, and the only indication that something may have altered at that time was the increase in rental from its long-standing level of £10 per annum to £40 per annum. However, as stated above, more than likely this was due to the mill building being re-built at that time. Certainly, from the arrival of John Hughes in 1901 until the present day it has always been a corn mill.

Notwithstanding the above, if we look at other circumstantial evidence the picture appears to be both ambiguous and contradictory. First, the Welsh word for a fulling mill is 'pandy', from which many place names have originated, e.g. Llyn y Pandy, Pandy Isaf, etc. This term has never been used in connection with Cochwillan Mill, although in the Penrhyn Estate rent rolls other properties are named as fulling mills, a prime case being the (now demolished) mill at Half-Way Bridge on the A5 between Tregarth and Bethesda. It too lies in Llanllechid parish and only 1.2km upstream from Cochwillan. This being the case it then begs the question why the outflow from that mill was not equally toxic: it is the same river running along the same course.

There is a further anomaly in terms of the fabric of the building itself. Examination of the north gable wall shows that it has been altered with a window replacing the upper loading door on the second floor and a doorway inset to the ground floor (Fig.7.2.5). One suggestion put forward to explain these alterations is that prior to them being made, what today comprises the living accommodation once formed part of the working area; possibly for weavers and fullers. This compliments the belief that what today forms the single-storey kitchen was once used as a drying area for cloth that previously had been dyed. This in turn is founded on the fact that originally the east outer wall of the kitchen once had three chimneys (currently only one), with these being inset inside the wall. If this area originally was used for drying previously dyed cloth it would be reasonable to assume that a toxic chemical such as sulphuric acid could have been used as part of the process, as it is a commonly used fixing agent in the dyeing industry. By extension this would help explain the relative toxicity of the outflow from Cochwillan Mill in comparison with that from other fulling mills on the River Ogwen; always assuming that no dyeing took place at them.

However cogent and compelling these arguments appear to be there are two underlying problems with them. Firstly, during the period when it is likely that fulling and dyeing would have taken place (see below) the present-day mill would not have been built; and second it totally contradicts the documentary evidence. What could explain the alterations to the north end of the building is that initially, perhaps prior to the arrival of John Hughes, the miller lived elsewhere; the building subsequently being altered to provide living accommodation.

A further point to consider is the presence of the kiln built against the south wall of the mill. The fact that it is located outside the body of the mill, and the stonework is of poorer quality, possibly indicates that it is an extension that was added some time after the main building was completed. Therefore, as fulling mills do not need a kiln, its late addition could reasonably be construed as evidence that the building had previously been used for fulling prior to the kiln being added, and that the addition of the kiln signalled a change of use. The counter-arguments to this scenario are the same as quoted above. First, that any such activities would have to have taken place in the older and much smaller building, and second, the kilns attached to many corn mills are adjuncts and not part of the original

construction. Furthermore, from the documentary evidence it seems probable that the new building was not constructed until around 1882.

There are further complications. For example, two names that have a long-standing association with Cochwillan Mill are 'Factory' and 'Factory Cottage'. The buildings in question stood adjacent to the mill and certainly were present until at least 1910, at which time a detailed plan of the site was produced (Fig.7.2.10).⁴⁶⁴ This shows the mill in its present form and location, together with both the cottage, the factory, and three other buildings. Today Factory Cottage is a private dwelling now known as Ty Glan yr Afon, and some of the out-buildings still survive. Nothing remains of the factory apart from some footings and what probably was the south gable wall.

In the 1841 Census there is a holding known as 'Factory' with the householder being 40-year-old farmer Richard Hughes and his family.⁴⁶⁵ The household also included John Roberts, a twenty-year-old weaver. There is no mention of the property in the 1851 Census but in 1861 Richard Hughes is still listed (as a farmer), and 25-year-old David Hughes as a woollen manufacturer.⁴⁶⁶

In the same Census a 38-year-old wool spinner named David Pugh is also shown as being resident at the property. In 1871 Mr Hughes's widow, Grace, is listed as the householder with a holding of 11 acres and a wool factory. Her son David is listed as a wool sorter and carder and her two other children, Robert and Sarah, as spinners. There were also two boarders and a servant, their trades being listed as spinner, weaver, and engine feeder respectively.⁴⁶⁷

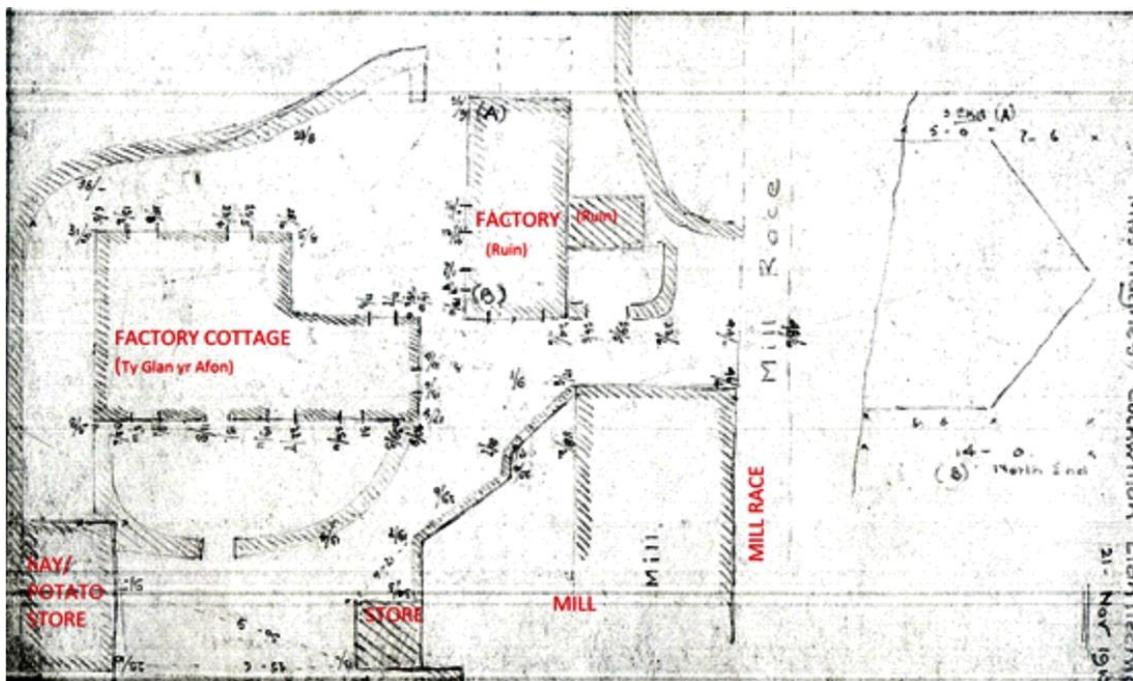


Fig.7.2.10: Plan of Cochwillan Mill site 1910.⁴⁶⁸ The curtilages have altered since the properties were sold in 1955, the Mill being detached from Ty Glan yr Afon and the associated out-buildings.

⁴⁶⁴ BU/Penrhyn Maps/306 (part).

⁴⁶⁵ PRO/HO107/1396.

⁴⁶⁶ PRO/RG4355.

⁴⁶⁷ PRO/5734.

⁴⁶⁸ BU/Penrhyn Maps 306.

From returns in the following years it would seem that all manufacturing activity had ended by 1881, even though the Hughes family continued to live at the Factory where they were listed as farmers.⁴⁶⁹ In the 1891 census Grace Hughes, now age 88, is listed as living at the Factory, and no trades are listed there.⁴⁷⁰ At the same time the miller, Thomas Gray age 49, is listed at Cochwillan Mill, and there are a number of other men in Tal-y-Bont who are listed in connection with the mills; although it does not specify whether they are Penlan or Cochwillan. These include Owen Lewis of Lon Dwr, age 28, a Miller's Labourer; Gray Owen of Dolhelyg, age 41, a Miller; and Thomas Lewis, age 48, a Miller. The only entry in the 1901 census was Thomas Williams, age 32, a Mill Carter.⁴⁷¹

The Census returns for the adjoining properties at Pentre Felin (which literally means 'Mill Village') also indicate that the production of woollen goods of some description was taking place there. In 1841, there were two main holdings and in one 70-year-old Hugh Prichard and 20-year-old William Roberts were listed as weavers. In the other the head was listed as miller Henry Jones, with 30-year-old wool manufacturer Owen Hughes also being resident. In the second building the 1851 Census lists Richard Hughes as the tenant (also the tenant of 'Factory'), where his occupation is listed as a Farmer & Factoryman. An Owen Jones was also resident there, his occupation being listed as a weaver. There are no further entries for woollen trade workers at either of the Pentre Felin properties after this date.

From the foregoing it would appear that the residents at Factory and Pentre Felin were involved with the woollen trade between 1841 and 1871, centred round the Hughes family. During most of this period very few people were involved, but after the death of Richard Hughes the level of activity increased, under the management of his widow, Grace. By 1871 there were six people involved, working mainly as spinners and weavers.

Throughout this period the use of the property names Cochwillan Mill, Pentre Felin, and Factory are mutually exclusive. What activity took place in relation to the manufacture of woollen goods was entirely separate from the activities of the corn mill. Furthermore, the period during which these activities took place was prior to the construction of the new mill building. What is clear from the documentary record is that a number of activities associated with the wool trade did take place in the vicinity of Cochwillan Mill, and specifically these included sorting, carding, spinning and weaving. Nowhere is there any mention of fulling or dyeing.

There are further complications. The Estate rent rolls for 1759 and 1760 show a Rees Jones renting a house and fulling mill for £6-13-0 per annum. The rent rolls for 1758-1764 show Evan Williams, miller, as renting a house and garden in Pentre Felin, with a notation against the 1766 entry saying 'Lost'. The rent roll for 1762 also shows a William David as the tenant of a house and garden at Pentre Felin, and the entries for 1761, 1762, and 1768 also show Richard Jones, weaver, as being a tenant. In the 1767 rent roll there is an entry saying that a William Matthews rented a house in Pentre Felin, but that '*The floods carried it away*'. From these entries it is evident that Pentre Felin had a history of multiple occupancy and that at times at least some of the tenants had been engaged in either milling or the wool trade.

⁴⁶⁹ PRO/RG11/5579.

⁴⁷⁰ PRO/RG12/4668.

⁴⁷¹ PRO/RG13/5284.

The question of whether or not Cochwillan Mill itself was directly involved in the woollen trade still needs to be addressed, and in response to this there appears to be a number of options. First, the activities that took place in this vicinity were in fact typical of the type of cottage industries that took place throughout many rural areas at that time. For example, in 1841 there were three weavers working at Plas Ova and two at Bryn Tirion, and they were still being employed at Plas Ova in 1851.

Second, if fulling was one of the activities carried out in connection with the Factory, and there is nothing to support this, it could have been carried out at one of the fulling mills nearby. The possibility that this could have been the pandy at Half-Way Bridge was considered, but that was not built until 1847. Similarly, the new 'Pont Pandy', but this was not built until 1859. On this basis, the most likely candidate would have been what is referred to in the Penrhyn rent rolls as the 'Fulling Mill' in Llanllechid parish, which was in operation from at least 1717 until 1877. This is the most likely option as between 1854 and 1884 the property was rented by Richard Hughes and his family, and Grace Hughes was the tenant there in 1877 at which time the rent roll bears the legend 'Old mill pulled down. Now cottage only'.⁴⁷² This date ties in with the census returns for 1881 onwards, which show no further activity taking place from that time on.

Assuming that the mill rented by the Hughes family was where they produced their cloth the next question is where it was located. From the evidence currently available (and cataloguing of the Penrhyn papers is an ongoing process), it is not clear where this mill may have been located. However, certain things can be assumed. First, from the rent rolls we know it was in Llanllechid parish and based on this it must have been located on the east bank of the River Ogwen. Second, it must have been near to the Factory and Pentre Felin as together they formed a single fully integrated enterprise. Therefore, the most likely location would have been immediately adjacent to Cochwillan corn mill, or very close by. The possibility that it may have been the now ruined Factory building was considered but it is evident from the position of its rear wall in relation to the mill race that this would have been unlikely; although the race was altered when the new mill was constructed, which means that the possibility cannot be excluded. Perhaps a more compelling argument against this is that both the Fulling Mill and Factory appear concurrently in the rent rolls.

The most likely option is that the fulling mill was located adjacent to the corn mill, and that they shared a common race. Certainly prior to the new corn mill being built there would have been room on the site for two mills, as the old corn mill was originally located at the north end of the plot, and neither of the earlier mills would have been very large. This would have had the added advantage that the fulling mill would have been immediately adjacent to the Factory, thus minimising the amount of materials handling. It would also satisfy all of the points raised above, with the exception of whether fulling ceased due to chemical pollution; although perhaps this would explain why the old fulling mill was not rebuilt after 1877.

A painting from c.1857 by F.R. Lee shows an un-named old mill located on the east bank of the River Ogwen (the Llanllechid side), in a position that would have placed it adjacent to Cochwillan corn mill (see Fig.7.2.11 below). At this date, the only mills located on this side of the river and owned by the Penrhyn Estate were Cochwillan Mill, Coetmor Mill, and the Fulling Mill. Based on the available

⁴⁷² BU/PFA/4/149.

evidence the painting does not represent either the Cochwillan or Coetmor mills, which would suggest that it is indeed the original fulling mill.



Fig.7.2.11: F.R. Lee, *Mill on the River Ogwen, North Wales, c.1857* oil.

By kind permission of Norfolk Museum Service (Norwich Castle Museum and Art Gallery)

Notwithstanding the above there is evidence of earlier activity at or near the mill site, possibly dating back to 1677. Where it becomes difficult to verify this is that over time the rent roll entries have changed in that in addition to a fulling mill, the names Pwllfannog and Gwerglodd Newydd are also included. In 1677 the rent roll includes an entry for a fulling mill and part of Gwerglodd Newydd, the tenant being Richard Griffith and the rental £2-10-0 a year.⁴⁷³ In 1748 and 1749 there are entries for a fulling mill and land adjacent to Pentre Felin, the tenant again being a Richard Griffith and the rental £3-0-0 a year.⁴⁷⁴ From 1751 to 1769 Ellin Jones, a widow, is listed as the tenant of a fulling mill, sometimes referred to as Pwllfannog, and sometimes in addition to the mill including a house; also on occasion a garden. The rental remained at £3-0-0 a year throughout, although this was always in arrears.⁴⁷⁵ In 1754 Richard Jones, a weaver, also appears as a tenant at Pwllfannog fulling mill and garden, his contribution being £2-5-2; presumably for a part of the year. From 1755 to 1770 he is shown as a tenant at Pentre'r Velin and part of Gwerglodd Newydd, the annual rental being £3-5-0. In 1770 this increased to £4-5-0.⁴⁷⁶

⁴⁷³ BU/Penrhyn/1635, Rental 1677.

⁴⁷⁴ BU/Penrhyn/FB1670.

⁴⁷⁵ BU/Penrhyn/1671-1690.

⁴⁷⁶ BU/Penrhyn/1676-1700.

Based on all of the above it would seem that Cochwillan Mill has, from its inception always been a corn mill and that in around 1882 the original building was replaced by a much larger structure. Furthermore, that originally there was a second mill on the site which was a fulling mill that worked in conjunction with the factory buildings that lay adjacent. This being the case it would seem that the reported problems associated with the fulling process emanated from this building, and not from the corn mill.

7.3. Felin Hen

Located on the B4409 between Glasinfryn and Tregarth in the Parish of Llandegai, Felin Hen was possibly the oldest of the Penrhyn mills, and the smallest.⁴⁷⁷ This is perhaps borne out by the fact that while other of the Estate's mills, such as Aber, Penlan, and the Bishop's Mill, appeared in the various trade directories for North Wales, generally Felin Hen did not. Throughout much of its working life it was jointly let together with Felin Isaf and Felin Uchaf as part of the collective 'Penrhyn Mills', although in common with Felin Uchaf it did not form part of the industrial complex later developed by Samuel Worthington & Company.

The available records show that Felin Hen had been in existence since at least 1666, when it was first listed in the rent roll as part of the Penrhyn Mills. Even at this time it was considered as the 'old' mill, which would indicate that its history goes back much further. Although it was a corn mill at one time there was also a gorse mill at the site, as listed in the rent roll for 1716. According to the 1797 list of Llandegai Tithes the gorse mill was still in operation, being let to Morris Jones & Co.⁴⁷⁸ By 1802 the tenancy had passed to David Roberts who retained it for a number of years.⁴⁷⁹

From the Estate records it is evident that prior to it being let to Worthington & Co regular expenditure was made towards the maintenance and repair of the corn mill. For example, in 1745 and 1749 new slates were purchased, and in 1754 two new millstones. In 1777 and 1781 the kiln was refurbished. Several other repairs were carried out between 1748 and 1781, the cost of which was borne by the Estate. Full details of the various items of expenditure are shown in Section 7.4.

In February 1803 a certain Griffith Jones laid a proposal before Richard Pennant, namely that Melin Hen should be relocated to a new position on the River Ogwen, somewhere between Tyn-y-Clwt and Coytmore. In order to achieve this either the existing mill could be removed, or a new mill erected. His proposal was predicated upon the improved convenience this would afford *'to the quarrymen and all others in the upper end of both parishes'*, as Melin Hen suffered from a lack of water; this being due to the large quantity being taken by the new slate mill. His contention was that it would also benefit the parish of Llandegai as farms would no longer experience a shortage of water in the summer, something they presently suffered when the mill was running day and night. He stated that if this change did not take place the tenants would desert the mill and *'go to other mills where they can be more properly used'*. His report was annotated: *'G. Jones delivered these observations to be layed before Lord Penrhyn. This plan would certainly be a great accommodation to the Quarry – and the water which now supplies Melin Hen would never have occasion to be wholly diverted from the*

⁴⁷⁷ SH 591680.

⁴⁷⁸ BU/PFA/4/53, New rents – Tenants from Year to Year, entry No. 7.

⁴⁷⁹ BU/2946, Rental 1802.

watercourse that brings the water to Llandegai'.⁴⁸⁰ There is no indication that this proposal was adopted and certainly Felin Hen continued in use for many years later, continuing to form part of the collective 'Penrhyn Mills'.



Fig.7.3.1 (left): The remaining mill buildings at Felin Hen, with the original mill to far left⁴⁸¹. (2011)

Fig.7.3.2 (right): Site of the head race exiting from the mill pond, (2011)



Fig.7.3.3 (left): the Gable end of Mill Cottage with mill pond in foreground (2011)

Fig.7.3.4 (right): Likely location of the water wheel. (2011)

The primary cause for the lack of consistency in the supply of water to the mill was a dispute regarding control of its source. Unlike the other Penrhyn mills in the area which obtained their water directly from either the River Ogwen or River Cegin, the water to Felin Hen came from Marchlyn Bach Pool, which in turn formed the parish boundary between Llandegai and Llandeiniolen. All of the lands in Llandegai belonged to George Hay Dawkins-Pennant of Penrhyn, whereas the lands in Llandeiniolen belonged to his great rival Thomas Assheton Smith of Vaynol. As the stream left the pool it divided into two main channels, one going to Pentir and on to Carnarvon, and the other to Felin Hen and on to Llandegai. Historically, at the point where the stream divided the water flow had been controlled

⁴⁸⁰ BU/PFA/12/3.

⁴⁸¹ Figs.7.3.1 to 7.3.5 By kind permission of Mr Nicholas Taylor.

in order to ensure an equal supply, and the means by which this had been implemented was the insertion into the stream of a large stone, known locally as the Bishop's Stone (see Fig.7.3.6)



Fig.7.3.5: Mill Cottage, Felin Hen. (2011)



Fig. 7.3.6: Disputed water supply to Felin Hen, 1820.⁴⁸²

⁴⁸² BU/Penrhyn 768 (extract).

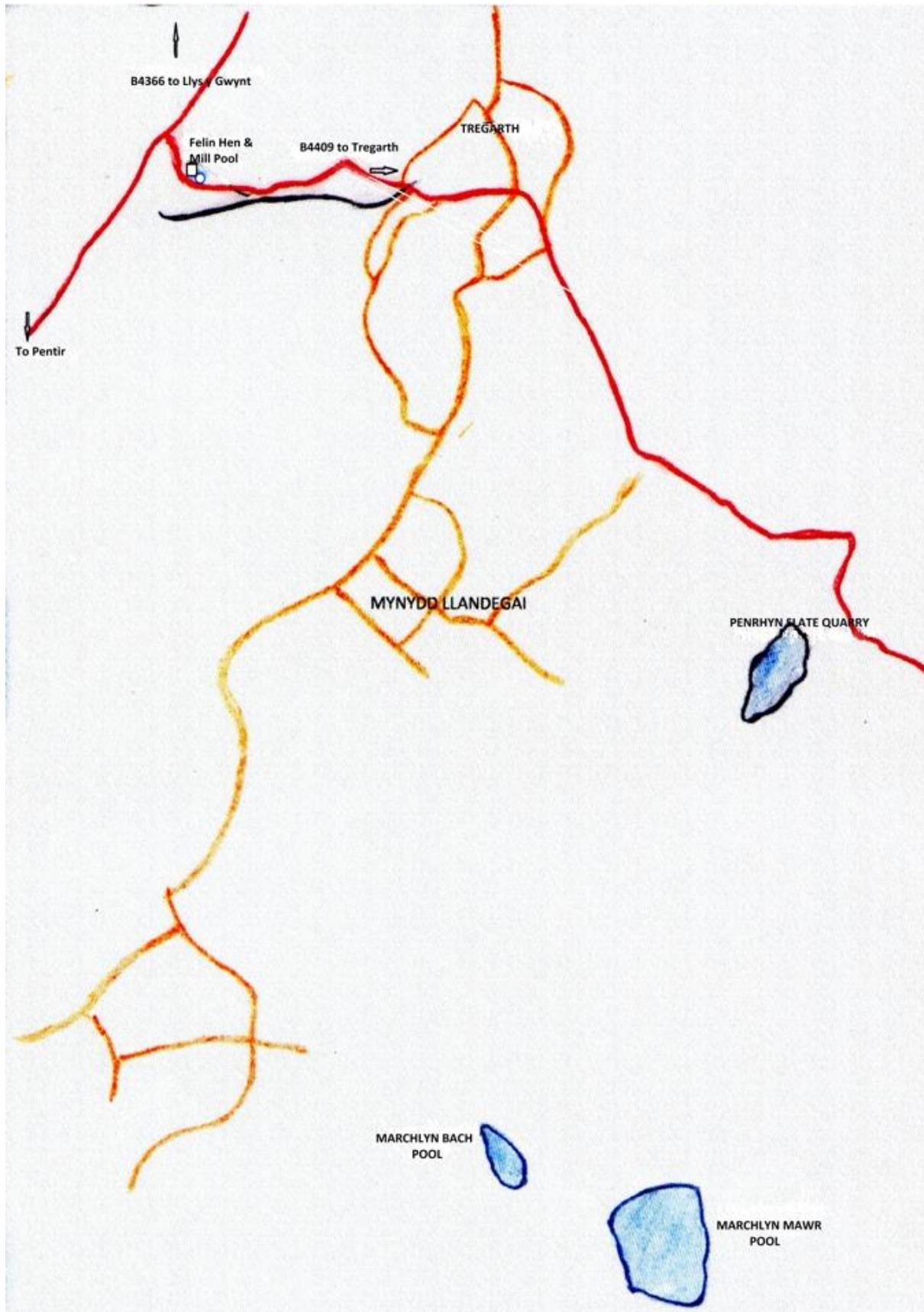


Fig.7.3.7: Location of Felin Hen & the Marchlyn Pools (not to scale)

In 1799 James Greenfield (the Quarry engineer) had walked the bounds to the stone with the inhabitants of Llandegai, Bangor, and Llandeiniolen, and at that time the stone was moved, by consent, and fixed in the middle of the stream to ensure an equal flow of water. However, over the ensuing years it was claimed that the tenants of Llandeiniolen had increased the size of the channel on their side of the stone, thus increasing the flow of water to Pentir and Carnarvon and resulting in a shortage of water to Felin Hen and Llandegai. By 1819 the issue had become fractious and a number of claims and counter claims were made. Evidence was gathered, and legal opinions sought, until finally the matter went before the courts.

In 1820, the two litigants agreed to go to arbitration, with the appointed arbiter being Jeffries Spranger of Lincolns Inn. The two landowners did not appear themselves but appointed their tenants as plaintiff and defendant; these being Griffith Thomas the miller at Felin Hen and Thomas Williams the miller at Pentir Mill respectively. One of the main concerns was that if one of the parties were found to have control of the stream the other would go out of business. On 10th February 1821 Mr Jeffries Spranger determined that both parties should have equal rights to the stream, that the division of water should be at the Bishop's Stone as had been the custom, and that the channels to each side of the stone should be no less than fourteen inches deep. If necessary, the surrounding ground was to be altered to ensure this. His decision was confirmed on 9th March 1821 and ratified in the Carnarvon County Court on 27th August of that year.⁴⁸³

In 1850 the fortunes of Griffith Thomas & Son, the then tenants, failed. From this point onwards, all of the Penrhyn mills were let separately, with the tenancy of what was described as 'Felin Hen and Land' passing to John Rogers. In the 1841 census he was listed as the miller: probably working for Griffith Thomas. He was 40 years of age at the time and lived at the mill together with his wife Catherine, also age 40, their sons Thomas and Elias, both age 9, and daughters Ann age 6 and Mary age 2. Living with them were Ann Thomas age 7 and David Roberts.⁴⁸⁴ The rent book entry for 1851 shows that the annual rental payable was £7-0-0 and against this there is a note saying '*Reduced since last rental. Tenant failed*'. By this time Thomas had become a blacksmith and Elias a joiner, although by now their ages appear to have been more accurately given: Thomas being 19 and Elias 18. Mary was age 12 and listed in the census as a scholar. Interestingly, during the intervening ten years Catherine had aged *thirteen* years and was now 53, and there is no mention of any of the other members of the household.

In addition to Felin Hen mill the 1851 census also lists ten other households with the address 'Felin Hen', although they had no direct connection with the mill itself.⁴⁸⁵ In 1860 the mill rental was increased to £8-10-0, the increase being 'for new buildings'.⁴⁸⁶ By 1869 the tenancy had passed to Henry Williams with the rental remaining at £8-10-0 per annum. There are no further entries for the mill in the census from 1871 to 1901. He retained the tenancy until 1903 when it passed to W. H. Williams, with the rental remaining unchanged. In 1922, it increased to £12-0-0 per annum, at which level it remained until 1934. Mr Williams died in 1924 and the tenancy was taken over by his Executors who retained it until 1933. In 1934, the new tenant was William Roberts who held it for the next three years at an increased rental of £15-0-0 per annum. Owen Jones became the new tenant in 1938 at

⁴⁸³ See BU/762-774.

⁴⁸⁴ PRO/H0107/1396.

⁴⁸⁵ PRO/H0107/2518.

⁴⁸⁶ BU/Penrhyn Add 2869, p. 25.

which time the rental was reduced to £12-0-0, and in February of that year the rateable value was set at £5-0-0.⁴⁸⁷ Little evidence has been found to indicate whether the mill continued in operation throughout this time, or when it was de-commissioned.

In a report by John D. Wood & Co. of London, dated 11th January 1957, it was recommended that Felin Hen (listed as comprising 12 acres 3 rods and 12 perches), and Felin Hen Uchaf (listed as 14 acres 1 rod 28 perches) should be sold by the Penrhyn Estate as part of its property disposal programme. However, as the same report also included a number of other properties which have been retained to the present day, it is not clear whether it was sold at that time.⁴⁸⁸ Today it is in private ownership and there is little structural evidence remaining apart from a small rectangular stone-built single storey structure with contiguous stone sheds adjacent (possibly those erected in 1860). The mill pond is located behind and above the mill building, and the mill cottage is adjacent. From the remaining evidence, it would appear to have had one small water wheel.

7.4. Costs Relating to the Mills

This summary has been compiled from the available Estate records, although as many of these are missing the list is by no means complete. It does, however, provide a reasonable guide as to the level of expenditure incurred over time in maintaining and upgrading the Penrhyn Mills. As can be seen in some years the expenditure was considerable, and it is probably for this reason that from c1800 onwards the mills were let on the basis that primarily the tenant was responsible for their maintenance.

Section 7.4.1 contains a summary of expenditure on the mills broken down by year, and Section 7.4.2 contains a breakdown of expenditure on specific mills, by mill name. There are some anomalies within the report, due mainly to the way in which the Agent in post at the time compiled his accounts. Indeed, some of the accounts were duplicated (usually when there had been a change of Agent), although wherever this has occurred the duplicated records have, as far as possible, been omitted. In many instances there was no distinction within the account entries as to which specific mill(s) the particular item of expenditure related, and for this reason they appear under the general heading 'Penrhyn Mills'. Some entries cover not only the mills but also other properties, for example, in 1751 there is an entry relating to 'Sundry repairs at Penrhyn, Llandegai, Bangor and the Mills'. In 1763 there is an entry which refers to a payment being made to the Millwright for repairing *five* mills, and in 1781 there are entries relating to materials for 'Penrhyn House and the Mills'; these being during the period when Samuel Wyatt was fashioning the replacement manor house for Richard Pennant. Nonetheless it is not thought that these composite entries unduly distort the substance of the report or invalidate use of the available data.

⁴⁸⁷ Gwynedd/XB14/103 (part), Penrhyn Estate Rating: Parish of Llandegai, February 1938, Entry No. 477.

⁴⁸⁸ BU/Penrhyn Un-cat Box 6.

The inclusion of the data pertaining to the Penrhyn Mills, namely Melin Hen, Melin Isa, and Melin Ucha, is to provide a perspective as to the status of the mills prior to the arrival in Llandegai of Samuel Worthington and his partners: Penlan Mill, with which they are closely associated, not having been built at this time. Because of their lack of immediate relevance, the other mills within the Estate, for example the fulling mills and later holdings such as Aber Mill, Bishop's Mill, etc, are not included.

A summary of expenditure on the Penrhyn Mills, by year.

1716		
Melin Isa		0- 0- 7
Penrhyn Mills		30- 4- 6
	Total	£30-5-1
1717		
Penrhyn Mills		8-12- 8
	Total	£8-12-8
1739		
Penrhyn Mills		5-10- 9
	Total	£5-10-9
1740		
Penrhyn Mills		3- 5- 0
	Total	£3-5-0
1744		
Penrhyn Mills		0- 3- 0
	Total	£0-3-0
1745		
Penrhyn Mills		60- 2- 1
	Total	£60-2-1
1746		
Penrhyn Mills		0-10- 0
	Total	£0-10-0
1747		
Penrhyn Mills		30- 7- 3
	Total	£30-7-3
1748		
Melin Hen		1- 2- 6
Penrhyn Mills		11- 3- 2 ½
	Total	£12-5-8 ½
1749		
Melin Hen		0-12- 4 ½
Penrhyn Mills		15-13- 3
	Total	£16-5-7 ½
1750		
Penrhyn Mills		23- 0-11 ½
	Total	£23-0-11 ½
1751		

Penrhyn Mills	10-13- 2 ½
Total	£10-13-2 ½
1752	
Penrhyn Mills	88- 9- 2 ½
Total	£88-9-2 ½
1753	
Penrhyn Mills	11-16- 6
Total	£11-16-6
1754	
Melin Hen	10-15- 0
Melin Isa	0- 8- 6
Penrhyn Mills	1- 5- 0
Total	£12-8-6
1755	
Penrhyn Mills	26- 9- 4
Total	£26-9-4
1756	
Penrhyn Mills	12-11-10 ½
Total	£12-11-10 ½
1757	
Penrhyn Mills	53-19- 4
Total	£53-19-4
1758	
Penrhyn Mills	4- 1- 6
Total	£4-1-6
1759	
Melin Hen	2-19- 6
Penrhyn Mills	13-17- 5
Total	£16-16-11
1760	
Melin Isa	22-14- 0
Penrhyn Mills	73-18- 9
Total	£96-12-9
1761	
Penrhyn Mills	78- 1- 9
Total	£78-1-9
1762	
Cochwillan (Melin Ucha)	7- 9-0
Melin Hen	6- 0-0
Melin Isa	10- 3-0
Penrhyn Mills	4-16-6
Total	£28-8-6
1763	
Melin Hen	0-10- 0
Penrhyn Mills	24-18-11

	Total	£25-8-11
1764		
Cochwillan (Melin Ucha)		6- 2- 2
Melin Hen		6-12- 2
Melin Isa		6- 2- 2
Penrhyn Mills		6-11- 9
	Total	£25-8-3
1765		
Penrhyn Mills		10- 5- 1
	Total	£10-5-1
1766		
Penrhyn Mills		10- 5- 8
	Total	£10-5-8
1767		
Melin Hen		8- 3- 6 ½
Penrhyn Mills		59- 5-0
	Total	£67-8-6 ½
1768		
Melin Isa		27- 0- 0
Penrhyn Mills		24-15-4
	Total	£51-15-4
1769		
Penrhyn Mills		29-16-10 ½
	Total	£29-16-10 ½
1770		
Penrhyn Mills		31- 0- 6
	Total	£31-0-6
1771		
Penrhyn Mills		40-19- 3
	Total	£40-19-3
1772		
Melin Hen		0-13- 1
Penrhyn Mills		35- 7- 3
	Total	£36-0-4
1773		
Cochwillan (Melin Ucha)		0- 1-0
Penrhyn Mills		2- 6-2
	Total	£2-7-2
1774		
Cochwillan (Melin Ucha)		35- 1-4 ½
Melin Isa		13-15-6
Penrhyn Mills		15-14-2 ½
	Total	£64-11-1

1775	
Cochwillan (Melin Ucha)	37-12-5 ½
Melin Hen	0- 1- 0
Melin Isa	0- 9-10
Penrhyn Mills	34-19-0 ½
Total	£73-2-4
1776	
Cochwillan (Melin Ucha)	6- 9- 0 ½
Melin Isa	2- 6- 6
Penrhyn Mills	39- 0- 5
Total	£47-15-11 ½
1777	
Cochwillan (Melin Ucha)	0-18- 8
Melin Hen	4- 3- 1
Melin Isa	0- 2- 0
Penrhyn Mills	6-16- 7 ½
Total	£12-0-4 ½
1778	
Cochwillan (Melin Ucha)	0-18- 5
Melin Hen	0-10- 6
Penrhyn Mills	10-19-11
Total	£12-8-10
1779	
Cochwillan (Melin Ucha)	2- 1- 3
Melin Isa	9- 1-11
Penrhyn Mills	33- 2- 4
Total	£44-5-6
1780	
Melin Isa	1- 9- 6
Penrhyn Mills	11- 8- 3 ½
Total	£12-17-9 ½
1781	
Melin Hen	3- 7- 6
Melin Isa	0-12-10 ½
Penrhyn Mills	5-12- 6 ½
Total	£9-12-11
1782	
Penrhyn Mills	5-11- 6
Total	£5-11-6
1783	
Penrhyn Mills	30- 0- 0
Total	£30-0-0
1830	

Melin Isa	6- 2- 0 ½
Total	£6-2-0 ½

1878

Cochwillan (Melin Ucha)	2- 8-1
Penrhyn Mills	6-15- 0
Total	£9-3-1

Totals	£ S D
Cochwillan Mill	99- 1- 5 ½
Melin Hen	45-10- 3
Melin Isa	100- 8- 5
Penrhyn Mills	1044- 4- 8 ½
Total for all mills	1289- 4-10

Expenditure on the Penrhyn Mills, by mill name.

Cochwillan Mill

1762 For carrying 2 millstones from Anglesey to Aberkegin £0-19-0 BU/1689 P.13 Item 24

1762 Item 11. Paid to Harry Parry Millwright for repairing Melin Hen & Cochwillan Mill making new water troughs and new Hoppers and new covers for the stones Coggwheel, Waterwheel & setting a pair new Stones and a new floodgate. £12-0-0 BU/1690 P. 13

1762 Item 30 Paid for cutting and setting two millstones to £0-10-0 BU/1690 P. 13

7.5.1773 To Owen Wm Thomas for assisting in turning water to Cochwillan Mill. £0-1-0 BU/1721 P. 11

4.3.1774 Pd for mending the water wheel at Cochwillan Mill. £0-1-0 BU/1721 P. 11

29.5.1774 Pd Humphrey Jones for repairs at Cochwillan Mill. £0-1-0 BU/1723 P. 11

13.8.1774 Pd a bill for Mason's work at Cochwillan Mill. £3-1-8 BU/1723 P. 11

30.8.1774 Pd John Hughes in part of his bill for Millwright's work at Cochwillan Mill. £20-0-0 BU/1723 P. 11

12.9.1774 Pd Owen Wm Thomas for sawing timber for Cochwillan Mill. £6-11-6 BU/1723 P. 11

9.10.1774 Pd Wm Parry's bill for nails for the mill. £0-11-11 BU/1723 P. 11

24.10.1774 Pd John Williams for Blacksmith's work in repair of Cochwillan Mill. £3-14-8 BU/1723 P. 11

24.10.1774 Also paid him for sundries at the mill & for gate irons for the gate set into Coed y Brain £0-11-7 ½ BU/1723 P. 11

24.10.1774 Pd the Labourer for turning the Ogwen River to the Mill. £0-8-0 BU/1723 P. 11

11.1.1775 Pd John Hughes the remainder of his bill for repairing of Cochwillan Mill. £10-4-4 BU/1723 P. 11

20.1.1775 Pd Richard Parry the slater for work done at Penrhyn House and Cochwillan Mill. £7-16-0 BU/1723 P. 11

20.1.1775 Pd John Lewis for tarr for the use of Cochwillan Mill. £0-13-4 BU/1723 P. 13

20.1.1775 Pd Wm Griffith for a Cord and oil to Cochwillan Mill. £0-2-1 ½ BU/1723 P. 13

12.6.1775 A pair of millstones for Melin Ucha £14-14-0 BU/1725 p. 11 ****Known as Melin Ucha from here on*****

- 17.6.1775 Pd the Labourer for turning water to the mill £0-8-8 BU/PP1726
- 2.10.1775 Pd Harry Parry for the water carriage of the millstones from Penmon to Abercegin £1-1-0 BU/1725 p. 11
- 18.10.1775 Pd Harry Parry millwrights bill £2-13-0 BU/1726 p. 13
- 19.1.1776 Pd self (Samuel Wright) for iron for Melin Ucha £0-1-2 BU/1725 p. 13
- 8.4.1776 Pd the Millwright's bill for putting up a pair of millstones at Cochwillan Mill. £4-3-11 BU/1725
- 2.7.1776 Pd for Smith's work in setting up the new millstones at Melin Ucha £1-3-5 BU/1727 p. 10
- 8.10.1776 Pd Owen Wm Thomas sawyers bill for repairing Melin Ucha kiln £0-17-10 ½ BU/ 1727 p. 10
- 28.10.1776 Pd Wm David for Mason's work in repairs at Melin Ucha £0-2-8 BU/1727 p. 10
- 20.1.1777 Pd Wm David & Wm Griffith for flooring Melin Ucha £0-18-8 BU/1727 p.10
- 21.5.1778 Paid Griffith Williams, mason, for pinning and daubing the gable end at Melin Ucha £0-1-4 BU/1730
- 17.7.1778 Pd Richard Prichard for clearing the mill race at Melin Ucha £0-3-0 BU/1731 p. 11
- 19.9.1778 Pd Owen Wm Thomas, sawyer, for flooring Melin Ucha & cutting hollies, thorns and alders for cogs and rounds for the mills £0-14-1 BU/1731 p. 11
- 27.5.1779 Pd Wm Jones for 500 lath nails for repairs at Melin Ucha £0-1-3 BU/1733 p. 11
- 6.8.1779 Pd Labourers for clearing the river above Melin Ucha, clearing the Nurseries, etc. £2-0-0 BU/1733 p. 11
- 1852 Lease between EGDP and Wm Wms (miller) and Ed Thomas of Tal-y-Bont Ucha. TENANTS TO PAY FOR OWNE REPAIRS. BU/CV/mss2277
- 1878 Repairs as per Building Dept £2-8-1 BU/Add 2901

Melin Hen

- 6.3.1745 250 slates used at Melin Hen. (Robt Bridge to Yonge/Warburton) BU/1658
- 1748 Pd Wm John Stuckley, mason, a bill for repair at Melin Hen £1-2-6 BU/Penrhyn/1670 Item 10
- 1749 Item 30 Pd for slates for Melin Hen and the Hall. £0-12-4 ½ BU/1670
- 1754 Item 52 Pd John Roberts for drawing two millstones to Melin Hen. £1-5-0 BU/1676
- 1754 Item 53 Pd Wm Owen, Quarryman, for two millstones at £4-15-0 each £9-10-0 BU/1676
- 1759 To pd Henry Parry, Millwright's bill for repair done at Melin Hen. £2-19-6 BU/1685 P. 16 Item 27
- 1762 Item 11. Paid to Harry Parry Millwright for repairing Melin Hen & Cochwillan Mill making new water troughs and new hoppers and new covers for the Stones cogwheel, Water wheel & setting a pair new stones and a new Floodgate. £12-8-0 BU/PP1690 P. 13
- 1763 To Pd Mason's bill for work done at Melin Hen. £0-10-0 BU/1690 P. 17 Item 35
- 1764 Millwright for work done at Melin Hen & Melin isa. £18-6-6 BU/1689 P. 18 Item 33.
- 1764 Mason's bill for work at Melin Hen. £0-10-0 BU/1689 P. 18 Item 35.
- 1767 Masons for repairing Melin Hen & sundries. £5-18-11 ½ BU/1696 P. 11 Item 34.
- 1767 Pd for carrying lime & timber to repair Melin Hen. £1-1-3 BU/1696 P. 11 Item 36.
- 1767 Pd Labourers for attending masons at Melin Hen. £1-3-4 BU/1696 P. 11 Item 37.

- 1772 To the sawyer a bill for sawing timber to rebuild the Grates at Felin Hen and setting them up. £0-13-1 BU/Penrhyn.1720
- 11.9.1775 Paid Wm Prichard for plastering the wall. £0-1-0 BU/1725
- 23.8.1777 Pd the Labourer's bill for making a Road at the upper end of Coed y Brain and opening the sluice at Melin Hen. £2-14-6 BU/1729. P. 11
- 26.8.1777 Pd the mason for repairing the wall of Melin Hen kiln. £0-5-0 BU/1729 P. 11
- 30.9.1777 Pd the Slater's bill for slating Melin Hen kiln. £1-2-4 BU/1729 P. 11
- 28.12.1777 Pd Richard David for Mason's work at Melin Hen. £0-1-3 BU/1730
- 20.1.1778 Pd Richard Parry for slates for repairing Melin Hen. £0-10-6 BU/1730
- 20.9.1781 Paid Mr James Riding of Runcorn for 2500 bricks at 23s6d per 1000 for repairing Melin Hen kiln. £2-18-9 BU/1736 P.10
- 22.9.1781 Paid Mr Wm Jones of Carnarvon for a cord to heave up the Millstones at Melin Hen. £0-8-9 BU/1736 P.10

Melin Isa

- 1716 Payment for a sieve for Velin Isa. £0-0-7 BU/1637 P. 34.
- 1754 Wm Thomas's bill of work at Melin Isa. £0-8-6 BU/1676 Item 2
- 1760 To pd for a pair of Millstones for Melin Isa. £10-10-0 BU/1685 p. 19 Item 42
- 1760 To paid Miners in clearing the mill's ditch £0-6-0 BU/1685 p. 19 Item 43
- 1760 Ditto for more work done there £0-8-4 BU/1685 P. 19 Item 44
- 1760 Wm Hughes masons's bill £0-5-0 BU/1685 p. 19 Item 45
- 1760 Miners for more work done at the watercourses of Melin Isa. £0-5-0 BU/1685 P. 19 Item 46
- 1760 Labourer at the said ditch. £0-3-4 BU/1685 P. 19 Item 47
- 1760 Pd John Hughes Carpenter. £0-3-4 BU/1685 P. 19 Item 48
- 1760 Smith's bill for work done at Melin Isa. £9-8-6 BU/1685 P. 19 Item 51
- 1760 Another smith's bill. £0-19-0 BU/1685 P. 19 Item 52
- 1760 Smith's bill £0-5-6 BU/1686 P. 18 Item 50.
- 1762 Item 33 Paid for two millstones for Melin Isa. £9-11-0 BU/1690 P. 13
- 1762 Millwright's bill. £0-12-0BU/1689 P. 14 Item 40.
- 1764 Millwright for work done at Melin Hen & Melin Isa. £18-6-6 BU/1689 P. 18 Item 33.
- 1768 Henry Parry millwright for repairing Melin isa Mill. £27-0-0 BU/1698 P. 17 Item 18.
- 18.5.1774 Pd by John Owen of Penmaen for a pair of millstones for Llandegai mill and carriage by water. £13-12-0 BU/1723 P.11
- 12.6.1774 Pd for several persons for assisting in landing the millstones from the boat and afterwards in conveying them to Llandegai mill. £0-3-6 BU/1723 P.11
- 27.1.1775 Pd Matt Hughes for two small bills for Llandegai Mill. £0-2-4 BU/1723 P. 13
- 10.4.1775 Pd Griffith Jones, sadler, for a strap to the. ran at Llandegai Mill had before Lady Day. £0-7-6 BU/1723 P. 13
- 21.2.1776 Paid for two horse loads of moss for the wall at Melin Isa £0-1-6 BU/1725
- 23.9.1776 Pd Wm Pierce for drawing stones in the river to make a quay or dam to turn water to Melin Isa. £1-15-0 BU/1727 P. 10
- 9.4.1776 Paid the mason for work at Melin Isa £0-10-0 BU/1725
- 6.6.1777 Pd John Roberts, miller, for repairs done at Melin Isa. £0-2-0 BU/1729 P. 11
- 5.6.1779 Pd Smith for work done on Melin Isa sluice. £0-2-6 BU/1733 P. 11

- 19.6.1779 Pd Wm Williams, sawyer, for sawing timber for putting up a new millstone and making new sluice, etc. £0-11-8 BU/1733 P. 11
- 23.6.1779 Pd for ale according to custom for several people who assisted in setting up the new millstone at Melin Isa. £0-2-6 BU/1733 P. 11
- 29.6.1779 Pd John Rowland & Richard Prichard, labourers, for repairing the dyke or weare for turning water to the mill. £1-11-0 BU/1733 P. 11
- 12.7.1779 Pd the Smith for making a new spindle for Melin Isa and other work done there in setting up the new stone. £0-13-0 BU/1733 P. 11
- 22.7.1779 Pd John Hughes millwright his bill for setting up the new millstone and other repairs done on the sluices. £6-1-3 BU/1733 P. 11
- 30.9.1780 Pd John Roberts the Miller for laying Boards on the water chest at Melin Isa & mending the sluices. £0-1-0 BU/1735
- 30.9.1780 Pd the Labourer's from 16th instant to this day. £1-8-6 BU/1735
13. 1.1781 Pd David Roberts Smith for a pair of hinges to Melin Isa. £0-1-6 BU/1735
- 29.10.1781 Paid John Summers of Beaumaris for a wavy brass (?) for heaving up the sluice of Llandegai Mill £0-11-4 ½ BU/ 1736 p. 12
- 3.4.1830 To cutting open timber for the saw mill viz: 896 ft Birch at 3/6 per ft £1-11-4 ½ 554 ft Deal at 2/10 per ft £0-15-8 Total £2-7-0 ½ (Acct for Thomas Williams, sawyer) BU/2068 No. 92 (d).
- 26.7.1830 1 day 1 man at Felin Isa witewashing at Wm Parry. £0-3-0. BU/2071 No. 240 (c)
- 5.10.1830 To making a new Floodgate at the Timber Saw Mill, Llwynon: Bill from Rowland Robert, mason, to GHDP. Masons 18 days @ 3/- £2-14-0
Labourers 9 days @ 2/- £0-18-0 £3-12-0

The Penrhyn Mills (General)

- 20.6.1716 Payment for allowance for keeping two servants to look after yd, woods, mills, house and other locations. £12-0-0 BU/1637 P. 33.
- 1716 Payment for baskets for ye mills and mending old * £0-4-6 BU/1637 P. 34.
- 1716 To a year's wages for the millers £18-0-0 (John Harrys £8-0-0, John Roberts £5-0-0, Evan Morris £5-0-0.) BU/1637 P. 34.
- 11.11.1717 Deduction for millstones £7-10-0 Two horses keeping £34-7-0 BU/1637 P. 116.
- 1.12.1717 For ye mill repairs £1-2-8 BU/1637 P. 116.
- 1739 Sundry repairs at the three corn mills. £5-10-9 BU/1655 Item 43
- 1740 Sundry repairs at the three corn mills. £3-5-0 BU/1645 Item 44
- 15.12.1744 Pd Wm Bevan for work done in the mill dams £0-3-0 BU/1658
- 27.2.1745 2300 Slates used at the Mills. (Robt Bridge to Yonge/Warburton) BU/1658
- 19.3.1745 Paid Wm Baker Shopkeeper for sundry trips to the Mills. £4-7-0 BU/1658
- 21.3.1745 Paid the Mill partners a bill for repairs. £0-16-0 BU/1658
- 12.5.1745 Paid Wm David Williams the remainder of his bill for Law Business, Millstones, etc. £25-13-8 BU/1658
- 31.10.1745 Paid John Prichard Morris Millwright a bill. £5-10-0 BU/1658
- 31.10.1745 Paid Wm Rees Labourer £0-14-0 BU/1658
- 31.8.1745 Paid Ellis Williams Labourer £1-0-0 BU/1658
- 31.10.1745 Paid John Griffith Owen a bill for work at the Mills £2-17-6 BU/1658
- 31.10.1745 Paid Edmund Griffith Owen bill for work at the Mills £4-6-0 BU/1658

- 31.10.1745 Paid William David Carpenter bill for work at the Mills £2-6-5 BU/1658
- 31.10.1745 Paid Wm John Stuckley Mason bill for work at the Mills. £3-17-0 BU/1658
- 31.10.1745 Paid John Prichard Morris Millwright a bill. £5-10-0 BU/1658
- 31.10.1745 Paid Thomas Jones Blacksmith for work at the Mills. £1-0-6 BU/1658
- 31.10.1745 Paid Owen Evan for work at the Mills £2-4-0 BU/1658
- 27.8.1746 Pd carriage of a millstone from Anglesey £0-10-0 BU/1660
- 14.2.1747 Pd Wm John Stuckley, Mason's bill. £0-19-0 BU/1661
- 11.4.1747 Pd a bill for Millstones. £11-10-0 BU/1660
- 29.5.1747 Pd Edmund Griffith Owen a bill for Millwright and Carpenter work from Oct 1745 to this day. £4-9-6 BU/1660
- 29.5.1747 Pd Griffith John Owen the like £1-8-6 BU/1660
- 29.5.1747 Pd Owen Evan Sawyer a bill. £0-13-4 BU/1660
- 17.6.1747 Paid Wm Baker Shopkeeper a bill for sundry things to Penrhyn Mills etc. £2-19-11 BU/1660
- 17.6.1747 Pd Thos Williams a bill of Disbursement on account of Penrhyn Mills etc. £1-4-4 BU/1660
- 17.6.1747 Pd the Labourers bill for sundry sorts of work at Penrhyn, Hall, Mills and Demesne from October 1745 exclusive to 4th April 1747 Inclusive. £7-2-8 BU/1660
- 1748 Item 31 Paid Mr Baker Shopkeeper's bill of Nails etc for Penrhyn & the Mills. £2-8-8 BU/1670 Item 46.
- 1748 Paid for Slates for Penrhyn Hall & the Mills. £2-13-7 ½ BU/1670
- 31.5.1748 Pd Edmund Griffith Owen a bill for Carpenters' & millwrights' work at Penrhyn Hall, mills, and several tenements. £3-14-0 BU/1662
- 31.5.1748 Pd John Griffith Owen the like. £1-11-6 BU/1662
- 2.6.1748 Pd Wm Baker, shopkeeper, a bill for sundries to the mills. £0-15-5 BU/1662
- 5.5.1749 800 Slates for Penrhyn Mills. BU/1670
- 1749 Item 6 Pd Wm Edwards Shopkeeper for Nails for the Mills. £1-0-0 BU/1670
- 1749 Item 8 Pd Wm Baker a bill for Locks for Penrhyn & the Mills. £0-10-5 BU/1670
- 1749 Item 15 Pd Owen Evan & George Evan sawiers a bill of repairs at Penrhyn & the Mills. £6-11-8 BU/1670 Item 15
- 1749 Item 25 Pd Pierce Prichard Smith's bill for two years for repairs at Penrhyn and the Mills. £2-14-2 BU/1670
- 1749 Pd Henry Tobias, Slater's bill for repairs at Penrhyn & the Mills £3-17-0 BU/1670 Item 18
- 1749 Pd Richard Parry, Slater, bill for repairs at Penrhyn & the Mills. £1-0-0 BU/1670 Item 19
- 1750 Item 19 Pd Wm Baker for iron & nails for the mills. £0-6-1 ½ BU/1675 P. 18
- 1750 Item 21 Pd Wm Edwards shopkeeper a bill for nails for the mills. £1-12-6 BU/1675 P. 18
- 1750 Item 26 Pd Owen Evan, sawyer, for sawing and other repairs at Penrhyn and the mills. £3-13-4 BU/1675 P. 19
- 1750 Item 27 Pd George Evan the like. £2-1-4 BU/1675 P. 19
- 1750 Item 30 Pd Morris Jones, millwright, for repairs at the mill. £4-1-0 BU/1675 P. 19
- 1750 Item 38 Pd Edmund Griffith carpenter for sundry repairs at Penrhyn and mills. £6-6-0 BU/1675 P. 19

- 1750 Item 44 Pd for 6200 slates for Penrhyn and the mills. £1-5-0 BU/1675 P. 19
- 1750 Item 46 Pd Wm Edwards shopkeeper for nails for the mills. £1-5-8 BU/1675 P. 19
- 1750 Item 50 Pd Smith's bill for repairs at Penrhyn and the mills. £2-10-0 BU/1675 P. 19
- 17.12.1751 Pd John Griffith Owen, Edmund Griffith Owen, and Pierce Ellis Carpenter's for sundry repairs at Penrhyn, Llandegai, Bangor and the Mills. £10-13-2 ½ BU/1671 Item 9.
- 9.1.1752 Paid Richard Jones Millwright for viewing the Mills. £0-1-0 BU/1671 p.16 Item 12.
- 20.1.1752 Paid Wm Edwards shopkeeper for nails for the Mills etc. £1-14-4 BU/1671 p.16 Item 16.
- 9.3.1752 Paid for three millstones for the Mills. £15-0-0 BU/1671 p.17 Item 21.
- 9.3.1752 Paid for carrying the millstones from Penmon to Aberckgin. £1-10-0 BU/1671 p.17 Item 22.
- 22.6.1752 Paid John Roberts for assisting to carry three millstones to the Mills from the Waterside. £0-8-0 BU/1671 p.17 Item 38.
- 27.8.1752 Paid several Labourers for opening the watercourse & other work. £0-10-0 BU/1671 p.17 Item 48.
- 1752 Paid John Roberts for assisting to draw Millstone to the Mill. £0-2-6 BU/1672, P. 21
- 1752 Paid Wm Forster & Other millwrights for new work done at the Mill. £21-7-8 BU/1672, p.21 Item 51.
- 1752 Paid Expences of a Purpose Messenger to go to Congleton in Cheshire with Mill Irons to be repaired. £1-4-0 BU/1672 p.21 Item 52.
- 1752 Paid Thomas Ellis Carpenter's work done at the Mills. £1-15-0 BU/1672 p.21 Item 53.
- 1752 Paid Edmund Griffith the like. £2-10-0 BU/1672 p.21 Item 54.
- 1752 Paid Pierce Ellis carpenter for work at the Mill. £5-2-9 BU/1672 p.21 Item 57.
- 1752 Paid Mr Weston's bill for repairs to the Mill. £10-12-7 BU/1672 p.21 Item 60.
- 1752 Paid Mr Baker for Deal Boards for the Mill. £7-3-0 BU/1672 p.21 Item 61.
- 1752 Paid Mr Rathbone of Liverpool for the same. £7-0-0 BU/1672 p.21 Item 62.
- 1752 Paid Wm Edwards Shopkeeper's bill of nails for the Mill. £2-4-2 ½ BU/1672 p.21 Item 63.
- 1752 Paid Wm Owen of Penmon for a Millstone for the Mill. £4-15-0 BU/1672 p.21 Item 64.
- 1752 Paid Pierce Ellis Carpenter for work at the Mill. £3-15-0 BU/1672 p.22 Item 65.
- 1752 Paid Thomas Ellis Carpenter for work at the Mill. £1-4-2 BU/1672 p.22 Item 68.
- 1752 Paid Wm Prichard for carrying Millstones from Penmon to Abercegin. £0-10-0 BU/1672 p.22 Item 69.
- 1753 Wm John Stuckley masons' bill £1-5-6 BU/1674 Item 9
- 1753 Owen Williams sawyers bill £3-7-8 BU/1674 Item 10
- 1753 Thomas Ellis sawyers bill £1-7-6 BU/1674 Item 11
- 1753 Pd Millwright's bill. £0-15-6 BU/1674 Item 14.
- 1753 Pierce Prichard smith's bill £4-13-8 BU/1674 Item 15
- 1753 John Lee millwright bill. £0-6-8 BU/1674 Item 35.
- 1754 David Williams for repairing the mill dam £0-2-6 BU/PP1676 Item 4
- 1754 Wm Prichard's bill for carrying stone to the mill and attending masons £0-4-6 BU/PP1676 Item 16
- 1754 Henry Griffiths labourers bill for work done at the mill £0-3-0 BU/PP1676 Item 44
- 1754 Timothy Dwrings bill for cutting timber to the mills £0-7-6 BU/PP1676 Item 45
- 1754 Terrance Nowland's bill for cutting timber to the mills £0-7-6 BU/PP1676 Item 46

- 1755 Hugh Jones for carrying 2 millstones from Penmon to Aberkegin for Penrhyn mills. £1-0-0 BU/1674 Item 8.
- 1755 Mason's bill for repairing the mills. £0-18-4 BU/1674 Item 38.
- 1755 Pierce Ellis carpenter's bill for two years for sundry work done upon Penrhyn Estate and mills. £20-17-6 BU/1674 Item 39.
- 1755 Edmund Griffith for carpenter's work done at Penrhyn and mills. £3-13-6 BU/1674 Item 40.
- 1756 Pierce Prichard smith's bill, colliers, mills, and estate £2-18-10½ BU/ 1681 Item 13.
- 1756 Pierce Prichard smith's bill colliers, mills, and estate. £0-17-4 BU/1682 Item 13.
- 1756 Pierce Ellis carpenter's bill sundry work on Estate and mills. £7-1-8 BU/1681 Item 18.
- 1756 Edmund Griffith Owen carpenter's bill for Penrhyn and mills £1-14-0 BU/1681 Item 26.
- 1757 Robert Owen for carrying clay for the mill. £0-2-0 BU/1683 Item 22.
- 1757 To paid Hugh Jones for carrying 2 mill stones from Penmon to Aberkegin for Penrhyn Mill. £1-0-0 BU/1680 p.9 Item 8.
- 1757 To paid Masons bill for repairing the Mills. £0-18-4 BU/1680 p.9 Item 38.
- 1757 To paid for carpenters' work done at Penrhyn & Mills. £3-13-6 BU/1680 p.9 Item 40.
- 1757 To paid Mr Weston for cash laid out by him for the repairs of Penrhyn Mills and for tools to the colliers & for jacks £48-5-6 BU/1680 p.9 Item 45.
- 1758 Pierce Prichard smith's bill Estate and Mills. £4-1-6 BU/1683 Item 7.
- 1759 To paid Henry Parry Millwright's bill £3-1-9 BU/1685 p.16 Item 22
- 1759 To paid Edmund Griffiths' Owen (woodman) for repairing 5 mills for one year as per agreement (His salary was in 2 parts, one half being as above). £4-0-0 BU/1685 p. 17 Item 32
- 1759 Wm Edwards shopkeeper goods for Estate & Mills. £3-13-11 BU/1686 p.15 Item 18.
- 1759 Henry Owen Millwright's bill. £3-1-9 BU/1686 p.15 Item 22.
- 1760 To pd Smith's bill for repairing the Mills £0-14-5 BU/1685 p.18 Item 9
- 1760 To Pd Wm Ellis for cutting timber for the Mills. £0-3-4 BU/1685 p.18 Item 13
- 1760 To Edmund Griffith Owen for Repairing Penrhyn Mills. £4-0-0 BU/1685 p.18 Item 20
- 1760 To Henry Parry for repairing Penrhyn Mills. £2-8-0 BU/1685 P. 18 Item 25
- 1760 To pd Cutting Timber & Piling bark to repair Penrhyn Mills. £1-12-0 BU/1685 P. 18 Item 27
- 1760 To Paid carrying two millstones from Anglesea to Aberkegin. £0-16-0 BU/1685 p.19 Item 36
- 1760*** To paid Henry Parry for MAKING A NEW MILL as per agreement. £60-0-0 BU/1685 p.19 Item 37
- 1760 Pd for Brasses for the use of the Mills £4-5-0 BU/1685 p.19 Item 49
- 1761 Sawiers bill for work on Estate & Mills. £20-2-4 ½ BU/1688 p.19 Item 4.
- 1761 Richard Edwards turner's bill work on mills. £0-2-6 BU/1688 p.19 item 11.
- 1761 For drawing timber, lime, sand, & gravel towards repairing the Mills. £5-14-0 BU/1688 p.19 Item 23
- 1761 Morris Williams for carrying clay and sand to the mill. £0-12-6 BU/1688 p.19 Item 25.
- 1761 John Edmunds carpenter's bill & sawyer £2-17-6 BU/1688 p.19 Item 26.
- 1761 Richard Parry slater's bill £2-8-0 BU/1688 p.19 Item 27.
- 1761 Glazier's bill £2-17-0 BU/1688 p.18 Item 28.

- 1761 Wm Edwards' bill for iron, nails etc for use of the Mills. £37-17-0 BU/1688 p.19 Item 29.
- 1761 Henry Parry bill for making the Boulting mill & new fastening the new mill. £3-0-7 BU/1688 p.20 Item 30.
- 1761 Mr Green for mill brasses (braces?) £1-7-0 BU/1688 p.20 Item 31.
- 1761 Wm Baker's bill for Deal Boards for the mill. £0-18-0 BU/1688 p.20 Item 36.
- 1761 Wm Griffiths shopkeeper bill for nails towards the Mills. £0-5-3 ½ BU/1688 p.20 Item 38.
- 1762 Pierce Prichard for drawing timber to the mills £0-7-0 BU/1689 p. 13 Item 17
- 1762 For carrying two millstones from Anglesey to Aberkegin £0-19-0 BU/1689 p. 13 Item 24
- 1762 Item 21 Paid for a new Mill Brass. £1-6-6 BU/1690 p.13.
- 1762 Item 40 Paid Millwright's bill. £0-12-0 BU/1690 p.14.
- 1762 Paving stones for the mills. £1-2-0 BU/1689 p.14 Item 54.
- 1762 Wm David's masons bill. £0-10-0 BU/1689 p.14 Item 55.
- 1763 To paid bill for Nails, Iron, etc for the Mills & Estate. £11-18-0 BU/1690 p.15 Item 21
- 1763 To paid for two Gudgeons for the Mills. £1-7-10 BU/1690 p.16 Item 31
- 1763 To paid Thomas Ellis for the carriage of the same (Gudgeons) from Wrexham Furnace. £0-10-0 BU/1690 p.16 Item 32
- 1763 To paid Millwright for repairing the FIVE Mills as per receipt. £6-5-5 BU/1690 p.16 Item 34
- 1763 To paid the the Smith's bill on account of the Mills and Estate. £2-14-11 BU/1690 p.16 Item 37.
- 1764 To paid at Wrexham Furnace for two Gudgeons for the Mills. £1-10-9 BU/1690 P. 17 Item 27
- 1764 To paid for the carriage of the same (gudgeons) by a purpose messenger. £0-12-0 BU/1690 P. 17 Item 28
- 1764 To pd Millwright for work done at Melin Hen, Melin Isa and Melin Ucha. £18-6-6 BU/1690 P. 17 Item 33.
- 1764 To pd the Smith's bill for sundry work done on the Estate and Mills. £4-9-0 BU/1690 p.17 Item 34.
- 1765 Owen Wm Thomas' bill for sawing timber for the use of the Mills & sundry work on Estate. £10-5-1 BU/1691 Item 1.
- 1766 Josiah Mills, carpenter, sundry work done on Estate & Mills. £8-3-3 BU/1693 p.12 Item 11.
- 1766 Smith's bill for whole year sundry work done on Estate & Mills. £2-2-5 BU/1693 p.12 item 12.
- 1767 Millwright's bill. £7-0-9 BU/1696 p.11 Item 4.
- 1767 Labourer's and Mason's bill for work done at the River Ogwen and Mill. £24-15-1 ½ BU/1696 p.11 Item 7.
- 1767 Labourer for clearing the mill dam & other works. £8-16-6 BU/1696 p.11 Item 13.
- 1767 Labourer's bill on account of the mill. £12-12-7 ½ BU/1696 p.11 Item 14.
- 1767 Labourer and Mason's bill for work done about the River and Mills. £3-7-0 BU/1696 p.11 Item 21.
- 1767 Smith's bill for mills & Estate. £2-13-0 BU/1696 p.11 Item 27.

- 1768 Smith's bill on account of Mill & Estate £2-17-5 BU/1698 p.16 Item 3
- 1768 Smith's bill on account of the Mills & Estate sundries. £4-7-6 BU/1698 p.17 item 19.
- 1768 Carpenter's bill on account of Estate & Mills £10-9-0 BU/1698 p. 6 Item 4
- 1768 Wm Edwards' bill for nails, iron, etc for use of the mills and Estate £6-5-8 BU/1698 p.16 Item 7
- 1768 For digging stones to repair the mill £0-15-19 BU/1698 p.16 Item 8
- 1769 Pd Mason's bill for repairing stable at the mill and building a new kiln. £7-18-4 BU/1698 p.17 Item 1.
- 1769 For a pair of millstones. £10-0-0 BU/1698 P. 17 Item 3.
- 1769 Slater's bill on account of the mills. £2-13-4 BU/1698 p.17 Item 4.
- 1769 Sawiers bill on account of the mill. £2-3-10 ½ BU/1698 p.17 Item 5.
- 1769 Griffith Evans for drawing timber, gravel and lime £5-14-4 BU/1698 p.18 Item 6.
- 1769 Hugh Williams boatman for carrying 2 millstones £1-0-0 BU/1698 p.18 Item 7.
- 1769 Masons for repairs done at the mill. £0-7-0 BU/1698 p.18 Item 12.
- 1770 To pd Henry Parry Millwright's bill for repairs done on the Mills. £4-12-0 BU/PP1701 p.10 Item 12
- 1770 To pd Josiah Mills for repairs done at the Mills. £1-2-0 BU/PP1701 p.10 Item 16
- 1770 To pd Mr William Edwards bill on account of the Mills. £10-12-0 BU/PP1701 Item 19
- 1770 To Pd Mason's bill £6-2-6 BU/1702 p.10 Item 17
- 1770 To pd Carpenter's bill £8-12-0 BU/1702 p.10 Item 18
- 1771 Paid Labourer's bill Work done on the Estate making quay on the side of the Ogwen River & at the Mills. £ 2-0-0 BU/1716 Item 5.
- 1771 Paid Henry Parry Millwright's bill. £13-0-0 BU/1716 Item 10.
- 1771 Paid Workmen's bill in opening the mill sluice, etc £5-4-9 BU/1716 Item 11.
- 1771 Paid John Jones Sadler's bill for a strap to the mill. £1-4-0 BU/1716 Item 12.
- 1771 Paid Hugh Williams Boatman for Lime Stones for the use of the House and Mill. £2-7-0 BU/1716 Item 16.
- 1771 To pd Labourer work on the Estate & the Mills. £2-0-0 BU/1703 Item 5
- 1771 To pd for tiles for the kiln. £1-17-6 BU/1703 Item 8
- 1771 Freight for the above. £0-6-0 BU/1703 Item 9
- 1771 Pd to Henry Parry Millwright's bill. £13-0-0 BU/1703 Item 10
- 1771 To pd Workmen's bill in opening the mill sluice, etc. £5-4-9 BU/1703 Item 11
- 1771 To pd John Jones, Sadler's bill for a strap to the Mill. £1-4-0 BU/1703 Item 12
- 1771 To pd Hugh Williams, boatman, for limestones for the use of the house and mills. £2-7-0 BU/1703 Item 16
- 1772 To Griffith Evans a bill for drawing timber and other things for repairs at the Mills and Penrhyn House. £2-10-1 BU/1720
- 1772 To the Slater a bill for repairs at the Mills and at Penrhyn. £0-11-4 BU/1720
- 1772 To Mr Wm Edwards a bill for Iron Nails and to the Mills. £2-17-0 BU/1720
- 1772 To Hugh Williams a bill for sawing for the use of the Mills. £1-8-10 BU/
- 1772 To the Blacksmith a bill for work at the Mill. £3-7-6 BU/1720
- 1772 To Harry Parry the Millwright a bill for repairs at the Mill. £24-12-6 BU/1720
- 28.6.1773 To the Mason for work done at the mill £0-4-0 BU/1721 p. 11
- 1.10.1773 For making two sifters for the mill £0-4-0 BU/1721 p. 11

- 1772/73 To Jane Griffiths (the widow of Joseph Prichard) a bill for Smith's work done at the mills. £1-18-2 BU/1719 P. 10
- 18.1.1774 Paid for turning water to the mill £0-5-0 BU/1721 p.11
- 19.1.1774 Paid for sawing for use of the mill £0-12-8 BU/1721 p.11
- 24.1.1774 Paid for four sheep skins for making sieves for the mill £0-4-8 BU/1721 p.11
- 25.1.1774 Pd Griffith Evans bill for drawing timber, lime, gravel, etc to Penrhyn and the mill £2-0-7 BU/1721 p. 11
- 20.6.1774 Pd Owen Wm Thomas the sawyer his bill for falling trees for repairing the mill & other uses £3-3-0 BU/1723 p. 11
- 28.6. 1774 Pd Mr Evans of Carnarvon for a new mill pin £0-8-2 BU/1723 p.11
- 20.7.1774 Pd Griffith Evans his bill for teamwork in drawing gravel & water for repairs of Penrhyn house and the mill £1-0-0 BU/1723 p. 11
- 30.8.1774 Pd Mr Green of Carnarvon for a mill brass £0-15-9 BU/ 1723 p.11
- 7.11.1774 Pd John Edmund his bill for carpenter's work in repairing of Penrhyn House and the mill. £7-4-4 ½ BU/1723 P. 11
- 1775 Rec'd of John Lewis & partners for 57 horse loads of bark of timber for repairs to the Mills at 3/6d per load. £9-19-6 BU/1723 P. 10
- 11.1.1775*** Paid John Hughes the millwright for examining and valuing the repairs wanting at the three mills BEFORE LETTING them. £0-15-0 BU/1723 P. 11
- 20.1.1775 Pd Hugh John Thomas the limeburner's bill for lime for repairs (to the Mills). £4-17-4 BU/1723 P. 12
- 20.1.1775 Pd Wm Pierce for teamwork in drawing the millstones and timber & other materials to the mills. £4-9-6 BU/1723 P. 12
- 20.1.1775 Pd Wm Edwards his bill for nails, iron for the mills & for repairs at Penrhyn. £8-10-1 BU/1723 P. 13
- 26.9.1775 Paid for ale for the Assistants in getting the millstones out of the boat. £0-2-0 BU/1725
- 2.10.1775 Paid Harry Parry for the water carriage of the millstones from Penmon to Abercegin. £1-0-0 BU/1725
- 5.10.1775 Pd Wm Pierce bill for drawing timber to the mills & repair of millstones £1-17-0 BU/PP1726 p. 11
- 5.10.1775 Pd the ale for the assistants in conveying the millstones to the mill £0-2-0 BU/PP1726 p. 11
- 5.10.1775 Pd for sawing timber for repair of the mills £0-11-1 ½ BU/PP1726 p. 11
- 18.10.1775 Paid Harry Parry the Millwright's bill £2-13-0 BU/1725
- 30.12.1775 Paid Wm Griffiths for straw to turn the water at the mill sluice £0-1-8 BU/1725
- 12.1.1776 Paid the sawyers bill for the mill sluice £1-17-2 ½ BU/1725
- 18.1.1776 Paid Richard Parry the slater's bill Penrhyn and the Mills £3-12-0 BU/1725
- 19.1.1776 Paid Hugh John Thomas for Lime to Penrhyn and the Mills £2-3-8 BU/1725
- 20.1.1776 Paid the Labourers for work at the Plantation and the Mills £2-15-10 BU/1726 P. 13
- 20.1.1776 Paid Wm Pierce for teamwork to Penrhyn and the Mills £0-18-4 BU/1725
- 1.2.1776* Paid for ale for about 40 people assisting to BREAK THE ICE in the river to set the Mill moving. £0-5-0 BU/1725
- 13.3.1776 Paid John Edmund for 2000 laths for repairs at Penrhyn and the Mills £2-2-0 BU/1725
- 19.3.1776 Paid Wm Parry for nails for repairs at Penrhyn and the Mills £0-8-0 BU/1725

- 23.5.1776 Pd John Edmund for carpenter work at Penrhyn and the Mill £1-5-10 BU/1725
- 30.5.1776 Pd Richard Parry the Slater's bill at Penrhyn and the Mills £5-10-0 BU/1725
- 30.5.1776 Pd self (Samuel Wright) for Iron and Nails for repairs at Penrhyn and the Mills £0-19-7 ½ BU/1725
- 1.6.1776 Pd Wm Pierce for drawing timber and gravel to Penrhyn house and mills for repairs. £1-2-9 BU/1727 p.10
- 17.6.1776 Pd the labourer for work by the Days in fencing and securing the hedges around Coedy Brain andthe mill race. £3-16-6 BU/1727 p.10
- 2.7.1776 Pd the labourer for work done at the Plantation and Mills. £4-18-6 BU/1727 p.10
- 19.9.1776 Pd Owen Wm Thomas the sawyers bill for falling trees at Tyddyn Canol for repairs at the Mills (etc). £2-7-2 BU/1727 p.10
- 28.10.1776 Pd the Labourers bill for work done in the plantations and in the river at the mill weare £4-18-0 BU/PP1727
- 20.1.1777 Pd Owen Wm Thomas for work at Penrhyn Mills. £1-9-8 ½ BU/ 1727 p.10
- 27.1.1777 Pd Hugh John Thomas the lime burner for repairs at Penrhyn House and the Mills. £3-5-6 BU/1727 p.10
- 28.1.1777 Pd Wm Williams bill for nails for repairs at Penrhyn house and the Mills. £0-14-3 BU/1727 p.10
- 3.7.1777 Pd Wm Pearse for drawing Timber to Penrhyn and the Mills for repairs, as by receipt. £0-8-10 BU/1730
- 4.7.1777 Pd the Blacksmith's bill for Iron Works at the Mills. £0-4-8 BU/1730
- 4.9.1777 Pd the glazier for a new skylight at the mill. £0-3-0 BU/1729 p.11
- 24.9.1777 Pd Wm David for Mason's work at the Mills. £0-10-8 BU/1729 p.11
- 13.1.1778 Pd the Blacksmith for Ironwork at the Mills. £0-13-10 ½ BU/1729 p.11
- 20.1.1778 Pd John Williams for Locks, Nails and other things for repairs at Penrhyn and the Mills. £2-2-4 BU/1730
- 27.1.1778 David John Edmund for dry timber for repairs in the mills. £1-1-9 BU/1729 p.11
- 23.5.1778 Pd Wm Pierce for teamwork in drawing materials for the repair at the Mills and the Lime Kiln from 3rd July 1777 to this day. £3-1-6 BU/1730
- 26.6.1778 Pd John Edmond for 1500 laths for future repairs at the House and buildings Penrhyn and the Mills. £1-13-9 BU/1730
- 1.7.1778 Pd Owen Wm Thomas Sawyer for hewing and dressing three mill shafts for future repairs at the Mills & laid in the water to be preserved. £0-6-2 BU/1730
- 30.10.1778 Pd the carpenter's bill for repairs done on the Penrhyn stable and Mills. £2-0-6 ½ BU/1731 p.11
- 23.1.1779 Pd Hugh John Thomas, lime burner, for repairing the house and buildings at Penrhyn and the mills. £8-15-0 BU/1731 p.11
- 23.1.1779 Richard Parry, slater, pd for repairs on house, buildings and mills. £19-2-8 BU/1731 p.11
- 25.1.1779 Pd Wm Pearse for drawing timber for repairs at Penrhyn and the mills. £3-0-6 BU/1731 p.11
- 26.1.1779 Pd Wm Williams bill for nails for repairs. £0-12-0 BU/1731 p.11
- 8.5.1779 Pd Morris Pierce millwright's bill for work done in the mills as per bill. £0-2-8 BU/1731 p.11

- 25.6.1779 Pd Wm Rowland, labourer, for work done in the wood about the mills. £1-8-6 BU/1733 p.11
- 15.11.1779 Pd for snagging & cross cutting trees at Park y Moch for the mills. £0-1-0 BU/1733 p.11
- 22.1.1780 Pd slaters for repairs at Penrhyn and Mills. £4-16-8 BU/1733 p.11
- 25.2.1780****The great storm that shattered the roof of Penrhyn Barn. 1000 large slates needed to repair it.*****
- 14.4.1780 Pd Wm Pierce bill for drawing timber, gravel, etc from 25th Jan 1779 to now for repairs at Penrhyn and Mills. £1-11-0 BU/1733 p.11
- 24.4.1780 Pd sawyers & carpenters bill for work done at Penrhyn and Mills. £2-14-5 ½ BU/1733 p.11
- 17.5.1780 Pd the Smith's bill for Ironwork at the Penrhyn coalyard and the Mills. £0-2-2 BU/1735
- 22.7.1780 Pd the Labourer's for clearing the Nurseries opening the Ditches ... Water to the Mills, etc. £1-1-0 BU/1735
- 16.9.1780 Pd the Labourer's bill for opening the Mill races. £1-3-0 BU/1735
- 24.1.1781 Pd Wm Williams for Iron & Nails used at Penrhyn and the Mills. £1-9-4 ½ BU/1735
- 24.1.1781 Pd Hugh John Thomas the Limeburner's bill for lime to Penrhyn and the Mills from 22nd January 1780. £3-5-4 BU/1735
- 16.5.1781 Paid Owen Owen for falling Alders at Gwern Byart and carrying them to Conway for making Turns for the Mills. £0-9-6 BU/1736 p.10
- 11.6.1781 Paid Rich'd Williams the Sawyer a bill for falling Hollies for the Mills. £0-2-4 BU/1736 p.10
- 28.6.1781 Paid the Water Carriage of six large Alders from Conway to Aber Ceggin at Gwern Byart for the use of the Mills. £0-6-0 BU/1736 p.10
- 16.1.1782 Paid Wm Williams Tanybwllch for dry timber for spindles to the Mill. £0-17-10 BU/1737 p.2 Item 131
- 9.7.1782 Paid John Hughes of Carnarvon for making an Estimation of the Repairs necessary to be done at the three Penrhyn Mills. £0-5-0 BU/1737 p.10
- 21.10.1782 Pd Slater's bill for patching at Penrhyn & the Mills & also whitewashing the Church. £4-8-8 BU/1737 p.12
- 1782 (By this time Hugh Hughes was in arrears on the Mills and farm to the tune of £532-15-0. £530-10-0 Written off by Richard Pennant, subject to H. Hughes giving up the possession of the farm. His other rents also discharged £190-5-0)
- 5.2.1783 Sent to Wm Williams a bill for £30 to be paid to Mr Edward Jones upon account of the Penrhyn Mills for a new Mill Stone etc. £30-0-0 BU/1737 p.14
- 1878 Repairs as per Building Dept £6-15-0 BU/Add2901

7.5. Other Penrhyn Mills

Emphasis has been placed on the three mills collectively known as 'The Penrhyn Mills' because of their relevance to the context of Penlan Mill and the associated enterprises undertaken by Samuel Worthington & Co. However, they were not the only mills acquired by the Penrhyn Estate. Some were significant, and others were of a very minor nature, but all had a part to play. What is most significant is that apart from Penlan Mill few of them were 'new builds' by the Estate after the 18th century; instead being purchased from other landowners. While not proposing to provide a detailed history of

these additional properties it is thought to be worthwhile including them in summary form, in the event that someone should wish to study them further. From a document headed 'Final Concord' dated 6th October 1715 we know that the Estate had eight mills at that time, and more were added later.⁴⁸⁹ The information listed has been gleaned from the Estate rental records and, where relevant, any supporting material. As there are gaps in those records, so there will be gaps in the data shown below.

Aber Mill (1844-1938)

Bishop's Mill (1817-1938)

Coetmor Mill (1795-1936)

Fulling Mill, Llandegai (1756-1767)

Fulling Mill, Llanllechid (1717-1862)

Glasinfryn Fulling Mill (1848-1871)

Glasinfryn Corn Mill/Coed Howell Mill (1844-1885)

Gorse Mill Dinas ***

Gorse Mill Felin Hen ***** Bk 3 p. 33

Gorse Mill Talysarn (Llandegai) ***

Grinding Stone Mill, Llandegai (1786-1799)

Gwaen y Pandy Fulling Mill (1763-1767) Pandy Half Way (1848-1938)

Pwllfanog Fulling Mill (1757-1768)

In addition to the above there were many small gorse mills attached to individual farms.

⁴⁸⁹ BU/PFA/1/502

8. Finds

The Finds have been designated a unique identification in the format nn/nn/nnn, with the first two numbers denoting the year in which they were found, followed by the excavation day, and then the sequential serial number starting from 001. In some instances, this is followed by the grid reference. For example, 11/07/001 (P1) indicates that it was the first item recorded (001) on day 7 (07) in the year 2011 (11), and that it was found in square P1. On occasion it has not been possible to precisely record this information, as due to unplanned breaks between excavation and recording several of the labels were destroyed: the result of the damp storage conditions and the voracity of the insect life! In such cases the Finds have been allocated a Group number (GRP) or Miscellaneous number (MISC).

The run of numbers is not necessarily contiguous as by using the excavation diaries, videos, and other notes it has been possible to retrospectively identify some of the miscellaneous items and re-designate them

A major problem with recording the Finds has been that from 1955 to 2005 the site was used as an informal waste 'dump', and the vast majority of items are not contemporary with the mill. Nonetheless, for the sake of completeness they are included in the report, although in many instances without photographs, and generally without dimensions being recorded. Furthermore, as the recording was carried out over a number of years, interspersed with several unplanned breaks, there are a number of occasions where some of the data is missing. Unfortunately, this was unavoidable, although nevertheless essentially the record is still complete in terms of content.

A full photographic record of all items found on the site has been lodged with Gwynedd Archaeological Trust in Bangor, the Archive and Special Collections Department at Bangor University, and the Gwynedd County Archive in Caernarfon. For ease of cross-referencing the Finds have been recorded in excavation sequence number whereas within the body of this report they have been grouped under material type, e.g. glass, leather, etc.

8.1. Glass

05/03/002 The broken-off neck of a 'Pepsi' bottle with cap in place.

05/18/004 (A4) A clear glass codd bottle, intact apart from the neck, and marked
THOMAS & EDWARDS
THE CASTLE WORKS
(trademark of a castle)
CARNARVON (Fig. 8.1.1)

05/27/001 (G7) A ½ pint clear glass bottle marked 'Valley Creamery Ltd, Colwyn Bay'.

05/31/006 (B6) A ½ pint beer bottle, brown, marked IND COOPE & ALLSOPP LTD. (No photo)

05/37/003 An intact codd bottle marked 'Thomas Williams, Victoria Stores, Pwllheli'. /Fig. 8.1.2)

06/01/001 (I1) Six fragments of green glass.

06/01/002 (I1) Part of the base from a brown glass bottle bearing the markings
3796

62

5



Fig. 8.1.1 (left)

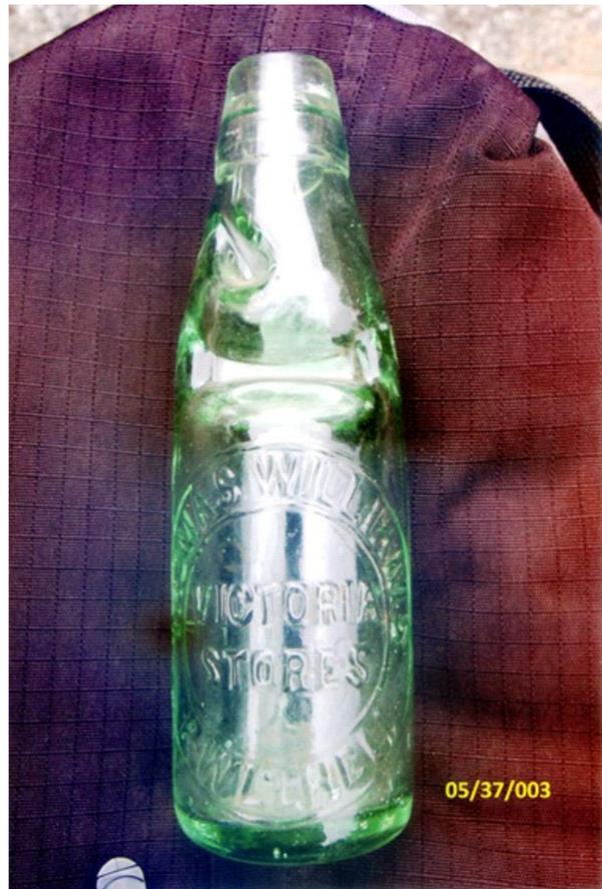


Fig. 8.1.2 (right)

06/01/007 (I1) A fragment of white smoked glass.

06/02/001 (J1) Five fragments of green glass, all unconnected.

06/02/003 (K2) A miniature spirits bottle, the cap of which is marked 'Haig'.

06/03/008 (H3) An intact clear glass jar with a white metal screw cap rusted on. The jar contains some form of viscous material which is dark brown in colour (unable to open the cap). 65mm tall x 65mm diameter base, marked

AA879

H 12

06/04/004 (K2) A round clear glass jar, intact, with screw cap. 104mm tall x 50mm diameter.

06/04/005 (K2) A small clear glass bottle marked "Schweppes". 155mm tall x 48mm diameter base.

06/08/006 (H5) An intact small brown glass jar with white metal screw top. 125mm tall x 45mm diameter base.

06/08/007 (H5) An intact small brown glass bottle, probably 'Babycham' or similar. The base is marked S

854

C

165mm tall x 45mm diameter base.

06/20/009 (K10) A piece of heavy, thick, clear glass, conical in shape, possibly the top of the codd bottle (05/18/002). Some lettering is still visible, viz:

ARK

D

Co

09/05/002 (M1) A small clear glass jar, slightly rectangular in shape. 130mm tall x 40mm one side and 46mm the other. The round neck has a screw top, and the internal diameter of the neck is 30mm.

09/10/005 (E2) A square clear glass jar with a round neck that has a pouring lip to one corner. 160mm tall x 90mm square. The round top has a 70mm internal diameter.

09/10/006 (E2) A round clear glass jar with a white metal lid marked 'Crosse & Blackwell'. 160mm x 75mm diameter at the base.

09/10/016 (E2) A small, flat, clear glass bottle with a corroded screw top. 160mm x 60mm x 33mm.

09/11/002 (E2) A square clear glass jar with a round neck, and a roller inside the jar.

09/11/005 (E2) A small fragment of thin, dimpled, clear glass.

10/01/013 (F1) A fragment of green glass bottle glass. There is an amount of dimpling above which are the letters 'EPOSI' (part of 'deposit'?) 80mm x 50mm x 2.5mm.

10/06/003 (I8) A small brown glass beer bottle, embossed 'No deposit' on two sides, just above a dimpled ring where the body starts to taper towards the neck. 177.5mm tall x 55mm diameter at the base. The markings on the base are

3796

(odd symbol) 78

6

10/07/001 (H8) A 'Waterman's' ink bottle with a rusted-on cap. 57.5mm tall x 53mm at the widest point x 30mm deep.

10/31/002 (Tail race) A glass paste jar with horizontal raised markings around the outside. No trademark evident. 88mm tall x 40mm across the neck and 38mm across the base.

10/50/004 (Q16) A small clear glass phial 65mm tall x 17mm diameter base and 19mm diameter at the top, before it steps in for the neck. The neck is 14mm outside diameter and 8mm inside. The opening is round, but slightly offset, so that the outside opening is irregular.

10/50/005 (Q16) A brown glass 'Bovril' jar 80mm tall. The markings on the base say 'Bottle made in England'. The markings on one bulbous end says

4 oz

BOVRIL

LIMITED

This is repeated on the other end, but with '301' beneath the word 'Limited'. There are some further indecipherable characters to the base.

10/50/007 (Q16) Fragments of brown glass, mostly unconnected. One is marked 'BOV' is probably is part of a Bovril jar.

10/50/008 (Q16) Five fragments of brown ribbed glass. One piece is marked 'JEYES' and another 'BOT'.

- 10/50/009 (Q16) Seven fragments of smoked white glass, possibly from a lamp shade or similar.
- 10/50/013 (Q16) A small green-glass bottle with a broken neck and missing base.
- 10/50/015 (Q16) Numerous fragments of jade-green glass, 2 mm thick. Possibly a lamp shade or vase.
- 10/50/022 (Q16) Six fragments of clear glass with a slight blue/green tinge from a square-sided bottle. Two of the parts carry the marking 'NE BITTERS' and another bears the letters 'ANS'.
- 10/50/023 (Q16) A large number of pieces of clear glass, although they are too fragmented to determine any relationship to each other.
- 10/50/024 (Q16) (pt) (a) a small oval-shaped piece of clear glass; and a piece of thick green bottle glass.
- 10/50/028 (Q17) A large number of jar and bottle glass fragments, all but one being clear.
- 10/50/029 (Q17) Several fragments of fine jade-green glass, plus one piece of white smoked glass.
- 10/50/038 (Q16) Nine fragments of clear glass, 2 with a green tinge, one with a blue tinge, and 2 with a ribbed pattern around the top edge.
- 10/50/039 (Q16) A fragment of white smoked glass.
- 10/50/040 (Q16) Two fragments of dark brown bottle glass, and 3 fragments of light brown bottle glass, one of them ribbed and with the letters 'TLED'.
- 10/50/ (Q15) (pt) Eight miscellaneous fragments of clear glass.
- 10/51/008 (Q15) Miscellaneous fragments of brown glass.
- 10/51/009 (Q15) Miscellaneous fragments of green glass.
- 10/51/010 (Q15) Numerous fragments of clear glass.
- 10/51/011 (Q15) Miscellaneous fragments of clear glass, with a slight blue/green tinge.
- 10/51/016 (Q15) A small flat-sided clear glass bottle 100mm tall x 45mm x 34mm. The base is marked:
A757
C 5
UGB
- 10/51/017 (Q15) A clear glass square jar with a round neck. The body is 35mm x 35mm and the round neck is 38mm tall with a 25mm external diameter.
- 10/51/022 (Q16) Several fragments of clear glass.
- 10/51/023 (Q16) Two fragments of coloured glass.
- 10/51/031 (Q14) Seven fragments of very fine white glass, probably from an oil lamp shade.
- 10/51/032 (Q14) A fragment of smoked white glass.
- 10/51/033 (Q14) Numerous miscellaneous fragments of glass, some clear and some coloured.
- 10/52/001 (Q10) Three pieces of glass with coloured pattern. All from the same item.
- 10/52/002 (Q13) (pt) Eight miscellaneous fragments of clear glass.

10/52/004 (Q11) Three glass fragments. Two are part of a square (sauce?) bottle, and the other is part of the lip of a clear glass jar/vase and has small dimples below the lip.

10/52/009 (Q12) Three fragments of green bottle glass.

10/52/011 (Q12) Four fragments of clear bottle glass. One has a greenish tinge and is marked:

HAW & Co LD

S

5

10/52/012 (Q12) A small clear-glass bottle 135mm tall with hexagonal sides. Two of the panels are vertically ribbed and the panel between them bears the lettering 'NOT TO BE TAKEN'.

10/53/002 (R13) Eight miscellaneous fragments of glass: brown, dark green, light green and clear.

10/53/004 (R12) A small clear glass bottle 88mm tall x 28mm diameter base and 20mm outside diameter neck.

10/53/006 (R12) A small clear glass round jar with screw thread. 37mm tall x 55mm diameter wide.

10/53/007 (R12) Eight fragments of clear glass and 3 fragments of green glass. All unconnected.

10/54/001 (A2) A large soft-drink bottle with the legend 'Cantrell & Cochrane Ltd' around the base and in the stopper. 285mm overall height plus the stopper. Below the neck the top 55mm is patterned all around the body.

10/54/002 (S12) A shard of green bottle glass.

10/54/007 (R12) Two pieces of green bottle glass, one being the base with the letters 'FCC' on the base.

10/54/013 (Q12) Six fragments of green bottle glass.

10/55/003 (T12) Two fragments of glass, one green and the other clear.

10/55/004 (Q10) A fragment of smoked white glass with a pink, blue, and yellow pattern.

10/55/006 (R12) Twelve fragments of fine glass, green on the outside and white on the inside. Probably part of a vase or lamp shade.

10/55/009 (R12) Four miscellaneous fragments of coloured glass.

10/55/011 (S12) Seven miscellaneous fragments of glass; 2 green and the rest clear.

10/55/013 (S12) A small fragment of thin glass, white on one side and green on the other.

10/56/003 (R11) The broken base of a clear glass jar with markings as follows:

B

K LO

8

583

2

10/56/004 (R11) Two fragments of thin glass, green on one side and white on the other. Also, a fragment of clear green-tinged glass.

10/56/008 (R9/10) A fragment of smoked white glass with a blue and yellow pattern.

- 10/56/009 (R9/10) One small fragment of glass, green on one side and white on the other.
- 10/56/012 (R9/10) One small fragment of clear glass (un-marked).
- 10/57/001 (T12/U12) A small brown glass 'Lysol' bottle with the registered trademark, cross-hatching, and lettering 'NOT TO BE TAKEN'.
- 10/57/002 (T12/U12) Several fragments of bottle glass, some clear, some blue, and one green.
- 10/57/004 (T12/U12) One very small fragment of fine glass, green on one side and white on the other.
- 10/61/006 (R11) A fragment from a quality glass ornament, Dark green on the outside and white on the inside.
- 10/61/022 (J11) (a) Two fragments of blue bottle glass; (b) one fragment of white glass.
- 10/62/003 (T10) Three fragments of white glass tableware.
- 10/65/003 (U11) (pt) (a) A small glass bottle 110mm tall with a broken neck; (b) 2 fragments of clear glass.
- 10/72/002 (Q9/R9) A large number of fragments of smoked white glass with a pink, yellow and blue random pattern.
- 10/MISC/008 (G17) A small clear glass jar, curved, 77mm tall, 40mm diameter at base and 12mm diameter at outer neck.
- 11/14/001 (ZA4) A clear glass bottle, square sided, with two sides indented. It has a round neck for a stopper. One of the indented sides has raised lettering 'DADDIES' and the opposite side 'SAUCE'. 130mm tall x 35mm square with a 23mm external neck diameter.
- 11/14/002 (ZA5) A small cylindrical clear glass bottle, possibly a drug phial. 65mm tall x 20mm diameter. The neck is 15mm long x 15mm external diameter.
- 11/17/001 (Spoil from cobbled road) A cylindrical clear glass bottle; possibly a medicine bottle. 85mm tall x 36mm base diameter. The stopped neck is 25mm long x 20mm external diameter.
- 11/17/002 A hexagonal clear glass bottle with 3 smooth sides and one side vertically ribbed. One side has raised lettering 'NOT TO BE TAKEN'. It has a threaded top with the neck being 20mm in diameter externally. It is 132mm tall x 43mm across the sides of the base. Each side is 25mm wide and the neck is 20mm long.
- 11/17/003 (Spoil) The broken base of a brown glass (ale) bottle. It has raised lettering to one side
- C W** Bros
- PENMAENMAWR
- The glass is 5mm thick and the base is 75mm in diameter.
- 11/17/004 (Spoil) The broken base of a green glass beer bottle with raised lettering ...'RTON IND COOPE &'
- The thickness of the glass varies between 7mm and 9mm. The diameter at the base is 72mm.
- 11/32/001 (Rubble outside NE corner of stable) A small clear glass screw-top bottle 55mm tall x 30mm across the flat side and 20mm across the narrow side. The inside diameter of the neck is 13mm. Raised letters 'UGB 1' on the base.

11/34/002 (Q16) Six fragments of jade-green glass, probably from tableware.

11/34/004 (Q16) (a) A complete green-glass wine bottle; (b) a Bovril jar; (c) a small round brown-glass bottle 65mm tall x 32mm diameter base, with threaded top; (d) a small elliptical clear-glass bottle with a long round neck. It is 70mm tall x 37mm/22mm base. The neck is 25mm long.

11/57/001 (Arch 2 enclosure) A small clear glass phial 40mm x 18mm diameter.

11/57/012 (F3) The broken end of a green glass bottle. The base is marked

C S & Co LTD

5765

The side is marked 'RE', being part of the word 'Brewery'.

11/57/013 (F3/G3) A piece of clear glass bottle, probably square, with raised lettering

DAVID W

NE & S

Maximum length 94mm, 59mm wide, and 3mm thick.

11/57/015 (F3) The broken end of a green glass bottle.

11/57/016 (Arch 2 enclosure) Two pieces of green bottle glass, each carrying different lettering.

(a) L MERC

BANG

&

LLANGEFNI

(on base)

1652

O Ld

(b) &

LLANGEFNI

(on base)

1652

CO Ld

11/57/017 (Arch 2 enclosure) Three miscellaneous fragments of green bottle glass (not connected).

11/57/018 (Arch 2 enclosure) The end of a green glass bottle marked

COOPE & Co Ld BUR

(Inde Coope, Burton)

11/57/019 (Arch 2 enclosure) A fragment of clear glass with a circular motif; stem protruding. (No photo)

11/58/003 (Arch 2 channel) An octagonal sided brown glass bottle 100mm x 40mm with 20mm outside diameter around the neck.

11/58/005 (Arch 2 channel) A 4oz brown-glass Bovril jar.

11/58/006 (Arch 2 channel) A square clear-glass ink bottle marked 'Fields Ink & Gum'. 47mm square body, 50mm high. It has a round neck with 33mm outside diameter neck.

11/58/009 (Outside drain to water wheel pit) A slender brown-glass bottle, intact, similar to a 'Babycham' bottle. It has the number '1959' on the base. Also, the broken base of a brown-glass bottle marked:

U525

C 3

UGB

11/58/020 (Arch 3 enclosure) A fragment of clear glass jar.

11/59/013 (Arch 3 enclosure) Two Bovril jars, a small green-glass spirits bottle, and a badly stained clear glass sauce bottle.

11/61/003 (Arch 2 enclosure) A small fragment of dark-brown glass.

11/62/003 (Arch 3 enclosure) An intact green glass beer bottle bearing the legend 'Ind Coope & Co Ld', 'Burton on Trent', and 'Trade Mark'. It also bears a raised figure of Britannia.

G/MISC/001 A small clear glass square jar with round neck. 'HEINZ GREAT BRITAIN' on the base. 100mm tall x 50mm square base and 47mm outside diameter neck.

G/MISC/002 An intact small clear glass bottle with the words
'SANITAS
DISINFECTANT'

on two sides. 160mm tall x 60mm diameter base.

G/MISC/004 Fragments of clear glass from a square jar with a round neck.

G/MISC/005 A large brown glass bottle, intact, with the lettering 'Samuel Smith Ltd'. 260mm tall x 75mm diameter.

G/MISC/006 A large clear glass bottle, intact, with screw top. It bears the lettering 'SPARDAL. M.W.C Ltd MANCHESTER'. 280mm tall x 80mm diameter base. The screw top says 'JEWSBURY & BROWN LTD MANCHESTER' with 'J & B' in the centre of the top.

G/MISC/007 A large clear glass bottle, intact, with screw top and raised diamond-shaped pattern to top half. It bears the inscription 'CANTRELL & COCHRANE LTD'. 280mm tall x 80mm diameter base.

G/MISC/008 A clear glass sauce bottle, intact, with heavily rusted white screw top. 155mm tall x 55mm diameter base, which is inscribed

BA19

H.P. FOODS

// UO

G/MISC/009 An intact small clear glass bottle with flat sides and a plastic screw top with an indecipherable logo. 120mm tall x 45mm wide x 25mm deep.

G/MISC/010 An intact clear glass bottle with a damaged white screw top. 185mm tall x 50mm diameter base. No markings.

G/MISC/011 An intact clear glass bottle marked 'Caernarvon Dairies Ltd'. 215mm tall x 75mm diameter base marked

V 681

R 1

UGB

G/MISC/012 An intact clear glass 'Schweppes' tonic bottle. 155mm tall x 48mm diameter base.

G/MISC/013 An intact clear glass 'Robertsons' jam jar with metal cover bearing the 'Golliwog' logo. 120mm tall x 57mm diameter base.

G/MISC/014 An intact clear glass jar with the inscription '8665 7' around the bottom edge. 135mm tall x 58mm diameter base.

G/MISC/015 An intact dimpled round clear glass jar with metal screw top marked 'Shake Well/ ready to serve'. (Probably a tomato juice bottle) 190mm tall x 60mm diameter base.

G/MISC/018 A clear glass jar with fluted sides, and part of the base broken off. (paste jar?) 95mm tall x 35mm octagonal base.

G/MISC/019 An intact small clear glass jar with a silver metal screw top. 65mm tall x 50mm diameter base.

G/MISC/021 Several fragments of green bottle glass ('Martini').

G/MISC/022 A fragment of brown bottle glass; a fragment of clear reinforced window glass; and a fragment of clear bottle glass.

G/MISC/023 A fragment of green bottle glass inscribed

ROW

WINE ME

GRP10/001 A small glass bottle with slight green tinge. 50mm diameter base, 60mm tall overall. The neck is broken.

GRP10/004 Seven fragments of clear glass, unconnected.

GRP12/002 A fragment of clear bottle glass.

GRP13/006 Five fragments of clear glass; one of them stained.

GRP13/007 Four fragments of brown and green bottle glass.

GRP16/004 A long-necked Bovril jar.

GRP17/011 Three pieces of smoked white glass.

GRP18/002 A fragment of jade-green glass.

GRP18/003 Part of the neck from a green glass bottle.

GRP19/001 Numerous fragments of jade-coloured glass.

GRP22/005 Two fragments of white smoked glass.

GRP23/002 Numerous fragments of clear glass.

GRP25/003 Two fragments of clear glass, the base of a straight-edge bottle; both stained.

GRP26/002 A brown glass 'Lysol' bottle.

GRP26/003 A small, flat, clear glass pill bottle with threaded neck. Heavily rust stained. 65mm tall x 39mm x 17mm.

GRP31/008 A small clear glass bottle with dimpled pattern at the start of the neck and around the base. The neck is threaded. 156mm tall with 52mm diameter base.

GRP35/006 The base of a green glass bottle with the word 'HANLEY' along the lower side.

8.2. Leather

05/07/007 An old leather boot.

06/03/001 (J2) A badly damaged leather boot.

06/07/002 (M4) The remains of a leather boot, with 5 eyelets.

06/15/001 (N6) Remains of a leather shoe.

09/15/005 (E1) A piece of leather drive belt. 600mm overall x 70mm x 7mm (Fig. 8.2.1)



Fig. 8.2.1

09/15/006 (E1) A fragment of leather drive belt 88mm x 56mm at its widest point x 5mm thick. Appears to have had holes punched at one end, although only one is distinct.

09/15/007 (E1) A fragment of leather drive belt which appears to have been bonded to metal; possibly the joint. 177mm overall x 90mm x 7mm (9mm in places, where there is metal). There are a series of holes on both edges.

09/15/033 (F1) A small piece of leather drive belt 150mm at its longest point x 90mm x 5mm. Also, a fragment of leather belt 70mm x 25mm max x 5mm tapering down to 1mm.

10/13/004 A small piece of leather drive belt of irregular shape, 115mm max x 45mm max x 5mm.

10/19/005 (I16) The remains of a leather-soled shoe.

10/50/024 (Q16) (pt) A small fragment of shoe leather.

10/51/018 (Q17) A large number of leather fragments from one or more leather boots.

10/54/014 (Q12) A piece of leather from an old shoe.

GRP9/005 Part of the sole from a leather shoe.

GRP23/003 The heel from a leather boot/shoe.

GRP26/001 Five pieces of leather from an old boot.

GRP34/002 A small piece of shoe leather.

GRP35/011 A small piece of boot leather with 5 eyelets inset.

GRP38/002 Two small pieces of shoe leather.

GRP39/004 A small piece of boot leather with 5 eyelets inset.

L/MISC/001 Fragments of leather from an old hobnail boot.

L/MISC/002 Four pieces of leather from an old boot/shoe.

L/MISC/004 A leather boot with rubber sole.

L/MISC/005 A leather boot with leather sole.

8.3. Metal

05/02/001 (G2) A heavily rusted piece of sheet metal with a round opening, possibly the top of an oil drum, or similar.

05/03/004 A distorted piece of metal bar, slightly curved. 300mm overall x 40mm x 5mm.

05/04/001 (E1) A large, bent, bolt. The shank is square except for the threaded section. Maximum 250mm long. The head is 30mm x 30mm x 10mm.

05/05/001 (G2) An odd piece of metal casting shaped like the letter 'h'. There are grooves on both sides of the vertical legs. (Fig. 8.3.1)



Fig. 8.3.1 (left)



Fig. 8.3.2 (right)

05/06/002 A piece of round threaded metal with wing nut attached to one end. The other end is flattened and has 2 rivets through. 165mm overall, approximately 18mm diameter thread. The flat part is 65mm x 30mm x 3mm.

05/06/003 A square-head bolt, bent, 115mm long. The head is 20mm x 20mm x 10mm.

05/07/004 (F5) Two pieces of heavy gauge wire 6mm in diameter. One is in two parts, joined by the wire being twisted into two interlocking eyelets.

05/07/005 (F3) A round-head bolt 190mm x 12mm diameter.

05/07/010 Two very rusted and encrusted wire nails 85mm long.

05/08/001 (C1) 20 links of heavily rusted metal chain. (Fig. 8.3.2)

05/08/005 (C1) One piece of a large metal hinge 485mm overall x 35mm x 5mm. Four round holes 6mm diameter, 3 with screws still in them. The rounded socket end is 35mm outside diameter and 20mm inside diameter.

05/08/006 (C1) Two round-ended hopper cups. (Fig. 8.3.3)

05/08/007 (C1) A metal peg with a rounded extrusion at the head, The head has a round hole through it. 173mm overall of which the shank is 150mm.

05/12/001 (A4) Three iron nails, 190mm, 140mm and 110mm long respectively.

05/18/003 (A4) A rectangular 'ring' with rounded edges. The top side has a raised curved surface to each side, and underneath these appear as inverted. To the underside there are round 'legs' to each corner.

05/29/001 (G8) A light duty hinge of modern design 270mm long x 140mm along the end flange.

05/31/004 A large iron nail embedded into a piece of wood. The nail is 17mm in diameter and there is 190mm of it visible. The piece of wood into which it is embedded measures approximately 80mm x 65mm x 45mm, and it is curved on all planes. grp35/010

06/01/003 (I1) A piece of round metal bar 147mm x 10mm diameter.

06/01/004 (I1) A very heavily rusted and encrusted piece of wire rope. 90mm long x 15mm diameter.

06/01/005 (I1) A heavily rusted and encrusted iron nail 115mm long.



Fig. 8.3.3 (left)



Fig. 8.3.4 (right)

06/01/008 (I8) A small piece of wire rope 9cm long.

06/03/004 (A7) An unidentified iron bracket. It measures 270mm at its widest point, and 22.5mm at its thickest. There is a bolt with nut attached through each of the two side arms, the bolts being 60mm long x 10mm diameter. They have a semi-domed head and tapered shank, square at the top. The nuts are 20mm square.

06/03/005 (A7) A long round metal bar, bent at 90 degrees at one end, threaded at the other. There is a hexagonal nut and square washer at the thread end. 400mm x 20mm diameter on the threaded leg, 95mm x 20mm diameter on the short leg. The washer is 66mm x 62mm x 6mm.

06/03/009 (J2) A heavy iron bracket comprising 2 flat metal side pieces joined at one end by a curved round metal bar. There are two metal bolts through the side pieces, plus the remains of the timber which would have been inserted between them. (Fig. 8.3.4)

06/04/002 (I3) A round metal bar 250mm x 15mm overall. Each end is bent down at 90 degrees and flattened, and there is half a round hole in both ends. Approximately two thirds of the length of the bar is kinked to form a semi-circular loop.

06/06/001 (H4) Four pieces of metal mesh, all with the same mesh size. Possibly from a flour sieve. (Fig. 8.3.5)

06/06/003 (I4) A piece of round metal bar 152mm x 9mm diameter.

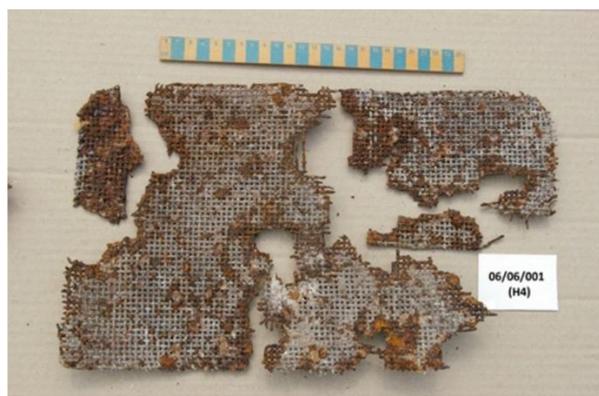


Fig. 8.3.5 (left)



Fig. 8.3.6 (right)



Fig. 8.3.7 (left)



Fig. 8.3.8 (right)

06/06/004 (I4) A metal pin with round metal ring attached, such as used to tether animals in a stall. The pin is 200mm overall and tapered 25mm at the top end and 10mm at the bottom end. It is 12mm thick. The top is hooked, the return being 70mm. The ring is 70mm in diameter x 9mm thick. (Fig. 8.3.6)

06/06/002 (H4) A piece of metal mesh, but with a larger mesh size than above. (Fig. 8.3.7)

06/06/005 (H4) A coach bolt 250mm x 12mm with 50mm of thread.

06/06/006 (J4) An iron nail 145mm long.

06/06/008 (I4) A flat metal plate 307mm x 43mm at one end and 35mm the other. 4mm thick. One square hole in the centre and one at each end. There is an iron nail protruding through each of the end holes, being 100mm and 90mm long respectively.

06/07/003 (M4) A metal fencing eyelet 170mm x 5mm diameter, with the open eyelet being 13mm in diameter.

06/07/004 (M4) A twisted piece of metal, as if from a pulley system. 90mm max x 50mm max x approx. 10mm.

06/08/001 (I5) Two pieces of curved cast iron, possibly from a pipe. The first piece is approximately 200mm x 100mm x 2mm, and the second 95mm x 50mm x 2mm.

06/08/002 (I5) A piece of curved cast iron 107mm max x 25mm on the outside edge x 25mm on side. There is a groove 10mm wide to each side of the edge.

06/08/003 (I5) A small heavily encrusted iron nail, slightly curved. 75mm overall.

06/08/005 (possibly part of 05/05/001) A broken cast iron assembly comprising two parallel bars 230mm/220mm x 25mm x 25mm. Along the full length of each bar there is a channel on both sides 8mm wide at the deepest point. There are protrusions to the outer edge of both bars, at one end. In between them there is a rectangular joining piece, and a round one. (Fig. 8.3.8)

06/08/008 (H5) A metal dome head bolt 177mm x 20mm.

06/08/009 (H5) A piece of metal plate 170mm x 100mm at one end and 90mm at the other. 20mm thick

06/09/001 (J6) A metal screw with a square upper shank and round threaded lower shank. 65mm overall with the square shank being 30mm x 20mm x 20mm. The threaded portion is 35mm long.

06/09/002 (H6) A flat, curved, iron pin, pointed at one end and with a sheared-off head at the other 140mm x 25mm at the head, 5mm at the tip. 6mm thick.

06/10/001 (H8) Half of a cast-iron axle housing comprising a rectangular metal base with an elongated hole at each end. Two raised pieces rising from one side, with a half-round gap between them. The top of these raised sections have a round hole through the top, and a square hole at the bottom. The base is 170mm x 45mm x 14mm, and the central gap is 36mm: for housing the shaft. (Fig. 4.3.9)

06/10/002 (H8) A metal shaft, squared at each end. There is a round collar separating the squared ends from the main shaft. 142mm overall. The square sections are 47mm x 47mm and the main shaft is 33mm in diameter. The collars are 8mm wide.



Fig. 8.3.9 (left)

Fig. 8.3.10 (right)

06/10/003 (H8) The centre hub of a drive belt wheel with the remains of 3 arms protruding from it (one longer than the others). There is a round hole through the central boss, which has an oil-filler hole to one side. (Fig. 8.3.10)

06/10/004 (H8) A small section of the outer surface of a drive wheel, 160mm x 52mm x 3mm.

06/11/001 (O1) A 'Z' shaped piece of metal 155mm over centre section, 115mm on one leg and 37mm over the shorter leg. 50mm wide x 8mm thick. One round hole 14mm diameter in the centre of the short leg, 2 round holes 14mm diameter in the longer leg.

06/11/002 (O1) A curved piece of cast iron, probably an arc section from a belt drive wheel. There is the broken off remains of an arm to the inner (concave) side. 230mm x 110mm x 5mm.

06/11/003 (O1) A piece of heavy cast metal, semi-elliptical with a round hole offset to the curved side. 225mm x 70mm at the outer curve, x 25mm. The hole is 30mm in diameter.

06/11/004 (O1) A piece of flat metal bar with one curved end and one notched end (although probably designed that way). 155mm max x 70mm x 4mm.

06/11/006 (O1) A metal bolt 280mm x 20mm with a square head 35mm x 30mm x 10mm.

06/11/007 (O2) Three very rusty iron nails, one snapped off. 130mm, 150mm and 60mm long respectively.

06/11/008 (O2) An iron nail 120mm long.

06/11/009 (O2) A round metal bar 300mm x 25mm diameter.

06/13/001 (C9) A very heavy cast iron base plate 360mm x 205mm x 45mm with a 25mm diameter hole at each corner, and an elongated hole 50mm x 25mm set centrally in front of them. There is a 140mm wide channel set centrally across the top of the plate. The casting bears the legend
3H BR

1964

at one end, and

ST

at the other.

06/15/002 (N6) Pieces of light mesh 180mm x 80mm max. (Fig. 8.3.11)

06/15/004 (B10) (a) A heavily encrusted square-head bolt 140mm long. The head is 18mm x 14mm x 6mm; (b) a heavily encrusted metal rod 176mm long x 7mm diameter; (c) a metal pin 78mm long x 20mm diameter, with a flat round head 28mm in diameter.

06/15/005 (B10) A very rusted and bent iron nail.

06/17/001 A heavy triangular-shaped piece of cast iron with a swollen neck area and a lip around the top edge; probably the top of a drainage down pipe.

06/17/002 (B12) A large metal square head bolt 295mm x 20mm diameter. The head is 32mm x 32mm x 8mm.

06/17/003 (B11) A piece of angled iron, 100mm max x 52mm x 6mm on one end and 18mm on the angled edge.

06/17/004 (B11) An iron nail 115mm long.

06/18/001 (K9) A square nut 25mm x 25mm x 7mm with the badly rusted remnant of a bolt protruding from one side.

06/18/002 (C12) An iron nail 93mm long.

06/20/001 (K10) A very large metal pin 525mm x 25mm. One end is tapered and flat, like a screwdriver blade.

06/20/003 (K10) Three iron nails, 233mm, 160mm and 110mm respectively.

06/20/004 (K10) A metal peg with one end flattened and having 2 round holes through. Possibly this could be an old hand tool. 210mm overall. Tapered square end 120mm x 10mm x 10mm at top, 10mm x 1mm at end. The flat section is 90mm x 22mm x 2mm.

06/20/005 (K10) An irregular-shaped piece of heavily rusted metal plate/sheet. Maximum dimensions are 360mm x 185mm x 3.5mm. There is a metal lug 65mm x 20mm to one side.

06/20/006 (K10) A bracket from an iron bedstead, with timber still attached.

06/20/007 (K10) A wedge-shaped piece of metal 240mm x 53mm x 8mm (average). The top end looks as though it has been sheared off.

06/20/008 (K10) A piece of metal plate with one edge lipped. 130mm x 60mm x 6mm (17mm on lipped edge).

06/20/012 (K10) Four miscellaneous pieces of metal, (a) a wire nail 155mm long; (b) a round and bent metal bar 180mm x 8mm diameter; (c) a coil spring; (d) a small piece of metal sheet with a bolt passing through, and a nut on the end of the bolt.

09/09/001 (G1) The remains of a heavy metal bolt or shaft with two large hexagonal nuts rusted in place.

09/10/001 (E2) A cast-iron housing, probably the bottom half of one used for locating a spindle or shaft. The base plate is 260mm long x 75mm wide x 15mm thick. In the centre of the plate there are two vertical sections 55mm apart. There is a vertical hole through each of these, which would have housed bolts for securing the two halves of the housing together. There is also an elongated hole at each end of the base plate, enabling the base to be bolted to a mounting plate. The holes are 30mm x 17.5mm. (Fig. 8.3.12)

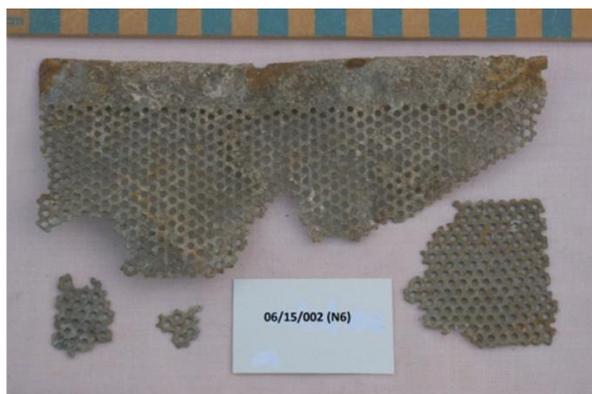


Fig. 8.3.11 (left)



Fig. 8.3.12 (right)

09/10/002 (E2) A flat metal plate 85mm square x 5mm thick. In the centre there is a hole 30mm square.

09/10/003 (E2) Part of a metal housing with a bolt attached to it. (Similar to item 09/10/001). The plate section is 115mm long (but broken off) x 37.5mm x 16mm. There is an elongated hole at one end measuring 25mm x 12.5mm. There is also a vertical section which looks like part of the shaft holder, and this has a bolt with nut attached inserted into it. Between the two there is a broken piece of top plate.

09/10/007 & 09/10/008 (E2) Two sections of a cast-iron wheel for a belt drive. Each part comprises a part of the 72.5mm outer circumference of the wheel, and the attached arm. They appear to be part of the wheel shown at 09/10/009.

09/10/009 (E2) A round drive shaft 750mm long x 30mm in diameter. At one end there is a square lug 23mm square x 40mm long (the lug tapers up to 26mm square). At the point where the lug joins the round shaft there is a round collar 50mm in diameter. Almost centrally along the shaft there is the centre boss of a wheel, with two curved arms protruding. At the end of each arm there is the remains of the outer circumference of a wheel, measuring 72.5mm wide x 7mm thick. There would have been four arms originally, the other being shown as 09/10/007 and 09/10/008. On this basis the diameter of the wheel would have been 380mm. (Fig. 8.3.13)



Fig. 8.3.13

09/10/010 (E2) Another curved piece of the outer circumference of the drive wheel shown above. It measures 220mm overall (on the curve) x 72.5mm wide x 7mm thick.

09/10/011 (E2) Part of a bolt or shaft, with a large nut attached. The bolt is 40mm in diameter and the nut is hexagonal measuring, 70mm across x 37.5mm thick. There is also a round washer attached to the bolt, measuring 75mm in diameter x 10mm thick.

09/10/012 (E2) A piece of metal resembling a squared letter 'C' lying on its back. It measures 90mm across the upright arms x 80mm in height x 20mm thick. Possibly it would have been rectangular, but one side has been opened up.

09/10/013 (E2) The headless shank of a heavily encrusted metal bolt. 230mm long x 20mm diameter, tapered at the thread end.

09/10/014 (E2) A metal strip 520mm x 25mm x 5mm. At one end there is a 90-degree upturn 25mm high.

09/10/015 (E2) A small strip of encrusted metal 93mm x 27mm x 6mm. There is a 7.5mm diameter hole 20mm from one end, and half a hole of the same diameter at the edge of the opposite end.

09/10/018 (E2) Six pieces of thin gauge metal sheet, each being 170mm wide and 1mm thick. The longest piece measures 500mm.

09/10/021 (E2) Two badly corroded fragments of metal, flat on one side. On the reverse they appear to be encrusted with a non-specific material. Each piece is approximately 75mm long x 50mm wide.

09/11/006 (E2) Two very large metal bolts with square heads. They measure 445mm and 385mm respectively and both are 30mm in diameter. The heads measure 50mm x 50mm x 20mm.

09/11/007 (E2) A flat metal plate 490mm max x 90mm x 10mm. There is an oblong hole 50mm x 30mm through each end. The plate has been slightly distorted due to pressure when the bolts were tightened through it. (It looks like one of the plates from beneath the large slate mounting slab, acting as a washer or spacing plate.)

09/12/001 (E1) Five links of heavy metal chain.

09/12/002 (E1) A flat metal plate with a raised channel to one end, running width ways across the flat surface. One square hole in the centre, just in front of the second edge of the channel.

09/13/001 (D1) A very large square head screw 190mm x 17mm diameter. The head is 26mm x 26mm x 12mm.

09/13/002 (D1) A coach bolt 165mm x 13mm diameter, with a round head. Square nut and washer attached.

09/14/001(D1) A machined steel housing 85mm x 75mm x 46mm with a semi-round channel machined through one side.

09/14/002 (E1) A coach bolt 200mm x 15mm at the head of the shaft.

09/14/003 (E1) A metal pin with a flat tapered shaft. It has a round hole through the wide part of the shaft, 135mm from the end. It is 160mm long overall.

09/14/004 (E1) An iron nail 110mm long with a piece of wood attached to the head.

09/14/005 (E1) An irregular-shaped piece of iron plate, almost triangular. 155mm base x 130mm vertically x 20mm thick.

09/14/006 (E1) Three pieces of iron each approximately 55mm square x 30mm thick. In each case the underside is heavily scored, but not to a regular pattern.

09/14/007 (E1) A broken-off piece of iron, roughly triangular in shape. 142mm x 65mm x 160mm and 27mm thick.

09/14/008 (E1) Four pieces of iron of uniform size, each slightly curved and tapered at one end. 130mm x 50mm x 17mm at the thick end and 7mm at the tapered end.

09/14/010 (E1) A flat metal wedge 110mm x 54mm x 5mm at the thick end and 2.5mm at the narrow end.

09/14/011 (E1) A piece of metal plate 123mm x 40mm x 17mm, tapered towards one end.

09/14/012 (E1) A rectangular piece of flat metal 80mm x 95mm x 7.5mm with a 25mm diameter round hole through the centre.

09/14/013 (E1) A small piece of cast-iron pipe 170mm x 6.5mm x 2.5mm (max).

09/15/001 (E1) A heavily encrusted metal hinge 580mm long x 45mm wide and 10mm thick.

09/15/003 (E1) A slightly wedge-shaped piece of iron 133mm x 50mm x 15mm at the thick end and 8mm at the tapered end.

09/15/004 (E1) A piece of metal, heavily encrusted on one side. 110mm x 50mm x 6mm at the thick end and 1.5mm at the tapered end.

09/15/008 (E1) (in 2 parts) The remains of what probably was a tin can. Part one comprises the main body and base, and part 2 the lid. It is 180mm long x 70mm wide x 1mm thick. The ends are rounded, and there is evidence of tinning on both pieces. The body is 46mm deep.

09/15/009 (E1) A flat piece of metal 155mm x 80mm x 6mm.

09/15/010 (E1) A triangular-shaped piece of iron, heavily encrusted in places. 100mm x 65mm at base, tapering to a point. The edge is tapered, going from 37mm to 31mm.

09/15/011 (E1) A piece of heavily encrusted metal, 102mm x 51mm x 5mm, tapering to 1mm at the other end.

09/15/012 (E1) A piece of heavily encrusted wedge-shaped iron 130mm x 54mm x 18mm at the thick end and 12mm at the other.

09/15/013 (E1) A piece of heavily encrusted wedge-shaped iron 110mm x 52mm x 4mm at the thick end and 1.5mm at the other.

09/15/014 (E1) A piece of galvanised sheet metal which is attached to a piece of wood by seven galvanised nails. The sheet is 110mm wide x a maximum length of 90mm x 1mm thick.

09/15/021 (D1) A rusted metal bolt with heavy encrustation at one end and a square nut at the other. It measures 150mm x 13mm, and the nut is 25mm x 25mm. It passes through a piece of broken iron bracket. The bracket is approximately 70mm x 60mm with elongated holes 35mm x 20mm.

09/15/022 (D1) What appears to be a very heavily encrusted iron nail 90mm x 15mm at one end and 8mm at the other.

09/15/026 (D1) A length of heavy gauge wire 380mm x 5mm.

09/15/031 (F1) A piece of lead sheet 250mm x 70mm x 2mm. There are notches at each end, 50mm deep and 25mm wide.

09/15/032 (F1) A large heavily encrusted square-head metal bolt. It measures 270mm x 17mm, and the head is 33mm x 33mm x 10mm.

09/15/036 (F1) Two iron nuts with the end of an iron bolt or shaft through the centre. The nuts are 70mm across x 33mm deep, and the bolt/shaft is 40mm in diameter.

09/15/038 (F1) An encrusted triangular-shaped piece of iron 115mm max x 80mm at its widest point and 30mm at the narrowest. The average thickness is 40mm.

09/15/039 (F1) An encrusted triangular-shaped piece of iron 133mm max x 65mm at its widest point and 10mm at the narrowest. The average thickness is 30mm.

09/15/040 (F1) An encrusted triangular-shaped piece of iron 105mm long x 70mm wide at one end and 10mm at the other x 40mm thick.

09/15/041 (F1) An encrusted triangular-shaped piece of iron 100mm x 75mm at its widest point and 20mm at the narrowest x 40mm thick.

09/15/042 (F1) A heavily encrusted and slightly wedge-shaped piece of metal 130mm long x 50mm wide x 15mm thick at one end and 10mm thick at the other.

09/15/043 (F1) A flat piece of metal, possibly galvanised, notched at one end, with one of the arms of the notch bent back to approximately 80 degrees. There are two round holes at the opposite end. It measures 100mm across the straight back edge, 95mm in length, and is 4mm thick.

10/01/012 (F1) An angled iron bracket, lipped, encrusted to one end, and with a lug to the underside of one arm. The vertical leg is 85mm long to the outside, 65mm to the inside. The horizontal arm measures 100mm. The lug is dovetail in shape and measures 17mm on one edge and 15mm on the other. It is 5mm deep. The lipped edge is 13mm wide and the un-lipped edge is 5mm.

10/01/014 (F1) A bent piece of galvanised metal sheet, 150mm x 90mm on the longer return x 1mm thick.

10/01/016 (F1) A flat rectangular piece of wedge-shaped metal 115mm x 50mm x 4mm at the thick end, and 2mm at the other end.

10/04/001 (A7) Two lengths of thick strand wire rope 580mm and 470mm respectively. Both heavily encrusted, they are approximately 20mm in diameter.

10/04/002 (A7) Three lengths of wire rope 480, 340, and 270mm long respectively. They have narrower gauge strands than those in 10/04/001, being 18mm in diameter. (Fig. 8.3.14)

10/13/002 (O18) A curved rim section of a drive wheel 130mm x 85mm x 4mm.

10/13/003 (O18) A large metal bolt 430mm x 18mm diameter with a square metal plate attached (the bolt goes through the plate). The bolt has a flat round head 30mm in diameter, and the plate is 75mm square.



Fig. 8.3.14 (left)



Fig. 8.3.15 (right)

10/13/005 A square head metal screw 115mm overall. The head is 40mm x 40mm x 10mm. The first 20mm of the shank is 23mm square, and then round with 55mm of thread.

10/18/001 (K17) A metal disc with a raised extrusion to one side. (Indented on the other side). 122mm diameter x 9mm thick.

10/19/001 (J16) A round metal rod 435mm long x 12mm diameter with an 80mm return at one end. Possibly a drop bolt(?).

10/19/002 (J16) An encrusted square metal bar with a return of approximately 50 degrees at one end and a tapered flat at the other. The length of the main straight section is 220mm and the return is 65mm. The length of the slightly bent tapered flat is approximately 70mm. The bar is 12mm square, tapering down to 2mm.

10/19/007 (J16) A flat metal bar 230mm x 30mm.

10/19/008 (I16) A square head metal bolt 105mm overall x 15mm diameter shaft. The head is 23mm square.

10/19/009 (K17) An irregular-shaped piece of flat metal plate, 210mm max x 150mm at its widest point x 5mm thick.

10/19/010 (K17) A curved section of metal 170mm x 40mm x 7mm. There is a lip standing at 90 degrees, 20mm high.

10/22/001 (J14) A bent metal spike approximately 205mm long. 12mm diameter at one end tapering to 4mm at the other

10/22/003 (K15) A heavily encrusted square-head bolt. The shaft measures 65mm x 15mm diameter and the head is 26mm square x 21mm deep.

10/22/004 (J15) A very heavily encrusted metal bolt, square head at one end, and with a square nut at the other. Two round metal washers at the head end.

10/34/002 (E13) A long heavily encrusted square-head bolt. Directly against the head there is a large square washer or flange. It is not possible say whether the flange is physically attached to the head as the bolt is so badly encrusted. The overall length is 120mm and the diameter 16mm. The head is 25mm square x 15mm. The flange/washer is 52.5mm square x 5mm. (No photo)

10/35/001 (E11) An odd-shaped piece of fabricated metal that appears to be part of a bracket or assembly. It comprises a flat arm 185mm long x 27.5mm wide and 4mm thick at the free end, 6mm thick at the attached end. There are three round holes at 45mm centres, each 7.5mm in diameter. At the attached end the plane moves through 90 degrees so that the shaped part is now edge on. It is 300mm overall x an average of 27.7mm wide x 11mm thick. There is a curved 'kink' 100mm from the attached end. The other end appears to have been broken (Fig. 8.3.15).

10/37/001 (G10/G11) A flat metal stake 330mm overall x 24mm x 4mm. It tapers to a point at one end. Attached at 90 degrees to the non-pointed end there is a threaded bolt, attached by 2 square nuts. The outer end of the bolt has a half-round bracket attached, possibly half of a gutter bracket.

10/38/001 (I13) A heavily encrusted round-head metal bolt with a square nut attached. 80mm overall x 18mm diameter. The head is 37.5mm in diameter x 6mm deep. The nut is 30mm square x 4mm deep.

10/39/001 (L14) A heavily encrusted metal bolt washer and nut attached. The bolt is 100mm long overall x 18mm diameter and has a head 30mm square x 16mm deep. The shank is threaded for the bottom 30mm. The washer is 40mm in diameter x 3mm thick, and the nut is hexagonal, 33mm across x 20mm deep.

10/39/002 (L14) Two heavily encrusted metal nuts 33mm across the flats x 22mm deep. The diameter of the thread is 18mm.

10/39/003 (L14) A heavily encrusted round head wire nail 125mm long.

10/39/004 (L14) A heavily encrusted piece of iron bar, 14mm square x 120mm long, with a slight bow along its length.

10/39/005 (L14) A piece of iron bar, shaped as though to form a handle of some sort. 100mm overall x 18mm wide x 10mm thick. The ends suggest that it has been broken away from another piece of metal.

10/40/001 (M17) A heavily encrusted square-head bolt 250mm long x 20mm diameter. The head measures 32.5mm square x 16mm deep.

10/41/001 (N16) Four miscellaneous pieces of metal, including a wedge-shaped bar 260mm x 33mm. 11mm thick at the head and 2.5mm at the tip.

10/41/002 (N16) A flanged metal bar 170mm overall, curving towards one end. 47.5mm wide x 6mm thick on the non-flanged edge and 15mm thick on the flanged edge. The flange is 10mm wide. On the outer, flat, side there is a wedge-shaped lug 25mm x 7mm at the wide end, tapering to zero. There are two round holes in the same side, one each side of the lug. Both contain broken/bent screws embedded within them. (No photo)

10/41/003 (N16) A flanged metal bar 110mm long overall x 51mm wide x 6mm thick on the non-flanged edge and 18mm thick on the flanged edge. The flange is 11mm wide. (No photo)

10/41/004 (N16) A cast iron assembly 145mm long overall. It comprises an end plate 77mm x 50mm and this in turn faces a slightly larger surface with a square washer or flange attached to it. There is a round hole 15mm in diameter through the three pieces. At right angles to the end plate there are two sides extending out, at 90 degrees to each other. Both are tapered away from the end plate. The larger side goes from 70mm wide where it is attached, to 60mm where it is broken off. It is 6mm thick. The bottom edge is 50mm at the attached edge, tapering to 15mm where it is broken off. (No photo)

10/42/002 (O17) A heavily encrusted square-head metal bolt with a round washer attached beneath the head. 115mm overall x 10mm diameter with a 20mm square head.

10/43/001 (o16) A square-head metal bolt with a heavily encrusted head, 165mm overall x 12mm diameter. The actual shaft measures 150mm, of which 40mm is threaded. The head measures 20mm x 20mm x 12mm.

10/44/001 (K12) A piece of cast metal. Roughly 'L'-shaped but with an extension protruding from the back (vertical) side.

10/44/002 (L11) A roughly triangular-shaped piece of metal 90mm x 70mm x 20mm.

10/44/003 (L10) A bent hexagonal headed bolt 160mm x 10mm diameter. The head is 20mm across.

10/46/001 (H9) A crane hook assembly comprising a rectangular metal frame 300mm long x 125mm wide x 45mm deep in the centre, widening to 55mm at one end and 50mm at the other. There is a circular iron ring at one end of the frame, and a large iron hook at the other. In each of the long sides of the frame, 130mm from the ring end, one side has a hole 23mm square. The opposite side has a matching round hole 25mm in diameter. Where the holes are, the sides of the frame have been widened to retain strength. The widening is in the form of a triangle protruding from beneath and above the side. The ring has a 65mm outer diameter and 35mm inner diameter. The hook is a maximum of 150mm overall, with the actual hook being 100mm. It has an average thickness of 32mm. Whereas once both the hook and ring probably would have swivelled, they now are corroded. (Fig. 8.3.16)



Fig. 8.3.16

10/46/002 (H9) A round-head metal bolt, which appears to be corroded onto another piece of metal at the end opposite the head. The overall length is 103mm and the shank is 10mm in diameter. The head is 20mm in diameter and 5mm deep. The opposite end to the head appears to be embedded into some sort of sleeve, but the encrustation and corrosion make it impossible to tell.

10/48/001 (Q12) A heavily encrusted square-head bolt 115mm long. It has a smooth shank for the top 50mm and is threaded for the bottom 55mm. The diameter of the smooth part is 12.5mm and for the thread end it is 10mm. The head measures 17.5mm square x 10mm.

10/50/001 (Q13) A heavily encrusted length of channel iron 690mm x 70mm on the flat sides x 55mm on the channel sides. The inside width of the channel is 28mm.

10/50/025 (Q15) A heavily encrusted round-head metal coach bolt 68mm x 10mm diameter. There is a square nut and round washer at one end.

10/51/001 (Q15) A slightly 'S'-shaped iron casting 200mm max x 30mm max x 27mm.

10/51/002 (Q15) A small piece of iron casting, roughly fan-shaped. The curved edge is 20mm wide, and the inner area 6mm thick. The outer edge has a groove/channel.

10/51/004 (Q15) Two fragments of curved iron, probably from a pipe or channel.

10/51/019 (Q17) An iron casting 280mm max x 110mm x 10mm on the inner surface and 30mm on the outer lipped surface.

10/51/020 (Q17) A heavy iron nail 147mm long.

10/51/021 (Q17) (pt) A badly rusted piece of square metal tube 50mm max in length x 25mm each side. Only 2 ¼ sides remain.

10/52/005 (Q11) A curved metal bracket 150mm x 7.5mm diameter. The inside curve is 70mm.

10/52/006 (Q11) A piece of finished metal bar, bent over on itself to form a crook. 180mm x 15mm x 16mm (double thickness). The width at the extremity of the curve is 90mm.

10/52/007 (Q11) A roughly triangular piece of metal plate 80mm x 65mm at base x 10mm thick.

10/53/001 (R13) (a) A flat strip of lead 150mm long x 42mm wide at one end, 38mm at the other x 3mm thick. There is a small hole, offset, at the narrow end, probably caused by a nail. (b) A heavily rusted round metal bar, possibly a bolt, 170mm x 11mm with the remains of a head at one end. (c) A small iron nail 70mm. (d) A bent piece of metal 150mm x 17mm x 3mm.

10/53/009 (R12) An iron nail 80mm long.

10/54/004 (R12) A piece of iron tube, probably electrical conduit, bent to banana shape and with internally threaded connectors at each end. 210mm overall x 28mm diameter.

10/54/005 (R12) An iron nail 130mm long.

10/54/006 (R12) A piece of flat iron casting with a lip to one edge and 2 round holes through. There is a further lip protruding to the outside edge at 90 degrees.

10/55/002 (T12) A small heavily rusted piece of flat metal. One end is tapered and the other rounded with a hole through the centre. 95mm overall, 21mm across the rounded end and 5mm at the tapered end. Maximum of 3mm thick.

10/55/012 (S12) A round metal pin 150mm overall x 12mm diameter. Tapered at one end and curved.

10/57/003 (T12) A heavy threaded metal pin with a square head. 120mm x 20mm diameter thread, 25mm diameter beneath the head. The head itself is 30mm square x 33mm long, and there is 38mm of thread.

10/61/003 (S12) A heavily encrusted metal bolt 85mm overall x 15mm diameter. The head is approximately 25mm square.

10/61/005 (T11) A heavily encrusted wire nail 150mm long.

10/61/011 (a) A square metal bar, slightly bent and pointed at each end. 400mm x 8mm; (b) A flat metal strip 83mm x 22mm x 2mm, notched at one end and with a single round hole through the

centre.; (c) A square head bolt 105mm x 12mm, with the head being 20mm square. The thread is heavily corroded; (d) An iron nail 135mm long.

10/61/012 (S11) An iron nail 215mm overall.

10/61/016 (S11) A curved section of cast iron gutter.

10/61/017 (S11) An irregular-shaped piece of iron 145mm max x 65mm max x 8mm.

10/61/018 (S11) A roughly square metal casting with a wide base, a groove to each side at the outer edge, and a curved section to one side with a hole through the centre.

10/61/019 (R11) A flat piece of iron plate 255mm x 75mm x 10mm.

10/62/001 (S10) A large square-head metal bolt (bent) 500mm x 20mm diameter, with the head measuring 32mm square x 16mm.

10/65/001 (U11) (a) An iron bracket comprising a flat, tapered, pin, with a curved 'hook' at the broad end: possibly a gutter bracket; (b) An iron nail 120mm long; (c) The broken end of a very large nail or spike, 110mm x 22mm at the top, and 5mm at the bottom.

10/66/001 (V11) Half of a belt drive wheel with 3 broken off arms to the inner side. 230mm outside diameter x 42mm x 10mm. (Fig. 8.3.17)



Fig. 8.3.17 (left)



Fig. 8.3.18 (right)

10/66/002 (V11) A heavily rusted iron nail with the pointed end kinked at 90 degrees. 97mm overall.

10/66/003 (V11) An irregular-shaped piece of metal plate with a lip to one edge. 105mm max x 70mm x 5mm at the lipped edge, and 3mm at the other.

10/66/004 (V11) A piece of curved cast iron, probably part of a gutter. Max 138mm x 65mm x 2.5mm.

10/66/007 (V11) A modern round head wire nail 54mm overall.

10/67/001 (X11) A heavily encrusted metal assembly with a 'banana'-shaped recess between two plates, with a flange offset to one edge.

10/67/003 (V11) A broken piece of hearth basket together with a small part of one of its legs

10/67/004 (V11) A metal 'T' hinge.

10/67/005 (V11) A triangular shaped piece of flat metal plate with a lip to the base side.

10/67/006 (V11) A heavy metal coach bolt with dome head. 180mm x 20mm diameter.

10/67/007 (V11) Four miscellaneous pieces of metal comprising (a) a triangular metal bar 200mm long; (b) a distorted flat metal strip 160mm x 24mm x 0.5mm; (c) a metal clip with two arms, one 100mm and the other 70mm, x 23mm x 2mm; (d) the end section of a square iron nail with a square head, 60mm x 10mm.

10/67/013 (W11) The hub of a cast iron metal drive wheel with 4 protruding arms. (Fig. 8.3.18)

10/67/014 (W11) A piece of angle iron 125mm max with sides 51mm and 28mm respectively x 3mm thick.

10/67/015 (W11) A heavily rusted iron nail, minus head, 75mm long.

10/67/016 (W11) A rectangular metal plate 102mm x 98mm x 2mm. Attached with two rivets there is a round metal hook 220mm overall x 8mm diameter.

10/68 (X10) (a) Two small pieces of iron casting; (b) a bent piece of metal bar; (c) two iron nails; (d) two small miscellaneous pieces of iron.

10/69/003 (X6) Two pieces of iron: (a) 190mm x 22mm at the square end, 11mm at the narrow end before it becomes rounded. Slightly bowed. 5mm thick. The round end is 22mm in diameter with a 6mm hole set off-centre. (b) A square bar, kinked, 140mm x 20mm x 14mm.

10/70/001 (X3) Part of a cast iron assembly, repaired to join a break. 270mm x 130mm max.

10/70/003 (X3) Two pieces of iron casting comprising a flat plate with raised edges on one side. Both part of the same unit.

10/70/004 (X4) Four pieces of cast iron, part of an assembly.

10/70/005 (X4) Two pieces of iron, both part of the same (possibly hinged) item.

10/70/007 (X4) A large iron nail and two miscellaneous iron fragments.

10/70/ (X3) Four miscellaneous pieces of metal.

10/71/002 (X2) Two pieces of flat metal plate (a) 94mm x 75mm (max) x 3.5mm; (b) 75mm x 65mm (max) x 3.5mm.

10/71/003 (X2) A triangular-shaped piece of metal with the remains of a lipped flange to the long side. 195mm x 82mm x 3.5mm. The lip is 11mm thick.

10/73/004 (R8) A heavily corroded metal bar, possibly a bolt. 233mm x 12mm (max).

10/MISC/001 (G-K17) Two very large coarsely threaded bolts with square heads, and a round collar attached to the head. 190mm overall with 100mm of thread. The head is 25mm x 25mm x 20mm and the collar is 45mm in diameter. The shanks are 20mm in diameter at the base, and 25mm in diameter at the collar.

10/MISC/003 (G-K17) A large square head bolt, the shank being square apart from the threaded portion. 158mm x 18mm square shank (17mm diameter thread). 105mm of the shank is unthreaded. The head is 30mm square x 11mm deep.

10/MISC/004 (G-K17) A round head coach bolt 200mm x 13mm diameter, with the head being 28mm in diameter.

10/MISC/005 (G-K17) A large, bent, iron nail. 100mm long to the bend, with a 60mm right angle return. 10mm thick at the top, tapering to 1.5mm at the bottom. Also, a straight iron nail 155mm long.

10/MISC/006 (G-K17) A round metal washer with 40mm outer diameter, 20 mm inner diameter. 2mm thick.

10/MISC/007 (G-K17) Strands from a wire rope.

10/MISC/010 (G-K17) A 'J'-shaped metal bracket with 5 screws protruding to the inner edge. 215mm max x 12mm x 3. The inside of the curved portion is 75mm wide.

10/MISC/011 (G-K17) A heavily encrusted curved piece of iron with a raised flange to the inner edge. There is one hole visible in the flat side. The flange protrudes to one side but is inset on other (opposite) side. 220mm max x 30mm.

10/MISC/013 (G-K17) A heavily rusted flat metal strip 245mm overall x 25mm x 1.5mm. Also, a strip 210mm x approximately 10mm x 2mm with a screw protruding.

10/MISC/014 (G-K17) Part of a section of cast iron pipe, originally black, 290mm max x 100mm.

11/19/001 A piece of what appears to be a broken metal tang.

11/19/002 A miscellaneous piece of metal that appears to be part of a shaft with a heavy head at one end.

11/19/003 A horseshoe.

11/28/001 (I9/I10) A metal bolt 360mm long overall. The head is 30mm square x 10mm thick. The main part of the shank (300mm) is square and measures 12mm x 12mm. Although corroded, it seems that the bottom 30mm is round and threaded.

11/28/002 (I9/I10) A heavily encrusted metal bolt with a square head and shank, only the end of the shank being round and threaded. Approximately 215mm long overall with the shank being 15mm square. The head is 30mm square x 10mm.

11/28/003 (I9/I10) A very heavily encrusted nail 117mm long. It has flat sides and tapers from head to tip.

11/28/004 (I9/I10) An iron casting, roughly square, with a gap in one edge. It has three and a half sides and has been either bent or cast to this shape. The corners are rounded. Possibly it once was square, with a piece being broken off. Approximately 95mm x 95mm externally, 62mm x 62mm internally. The sides are 15mm wide x 15mm thick.

11/28/005 (H9) A large and very heavy cast-iron gulley trap, coated with Dr Angus Smith's solution. Cylindrical, with a hook bend protruding from the bottom side.

11/28/007 (H9) A long round metal bar, bent in the middle, and with a thread at each end. On each thread there is a hexagonal nut. Approximately 500mm overall x 15mm diameter. The nuts are 30mm across.

11/28/008 (H9) A square metal bar with a rounded section at each end. 315mm overall x 32mm x 32mm. The rounded ends are 25mm in diameter, x 40mm long at one end and 35mm at the other. (Fig. 8.3.19)

11/28/009 (H9) Two pieces of perforated metal sheet, as used to filter or drain a trap.



Fig. 8.3.19

11/50/001 (Q13) A heavily corroded metal bar 167mm x 18mm x 4 mm with a lug extruding from one face. Possibly a latch?

11/54/002 (Head race above launder) A bent iron nail 120mm x 7mm.

11/57/023 (Arch 2 enclosure) A square piece of flat metal 84mm x 87mm with a 17mm square hole through the centre.

11/58/001 (Arch 2 channel) A metal assembly comprising a flat metal plate 160mm x 50mm x 5mm, with a square hole at each end. Through one there is a bolt 410mm overall x 12mm, bent at the top and with a square nut on the thread end. The top part (half of the shaft) is square. Through the other hole there is an 'S'-shaped round metal bar with a washer and square nut at each end. At the bottom of the longer section there is a square lug.

11/58/002 (Arch 2 channel) A very heavily corroded and encrusted mortice lock approx. 85mm x 90mm x 23mm.

11/58/008 (Drain to water wheel pit) A square metal peg with a 90 degree return at the top. 145mm x 17mm x 14mm. The return is 40mm overall.

11/58/015 (Arch 3 enclosure) A round metal bar 540mm long approx., bent towards one end, and then flattened. 18mm diameter.

11/58/016 (Arch 3 enclosure) Two heavy metal castings, each with pieces of timber still attached via coach bolts. There is a thin metal sheet between the casting and the timber. They look as though they have been part of a coupling assembly, or suspension.

11/58/018 (Arch 3 enclosure) A rectangular metal connecting piece as used in fencing, with elongated holes in 2 sides. It has been squashed flat. 130mm x 135mm (in squashed state) x 2mm gauge metal.

11/58/019 (Arch 3 enclosure) A very rusted metal assembly which appears to comprise an angle iron with metal plate attached. 160mm x 65mm at the widest point. The angle is 22mm x 22mm.

11/59/001 (Arch 3 enclosure) A heavily encrusted square head nail 230mm overall. The head is 25mm x 25mm x 10mm.

11/59/002 (arch 3 enclosure) A square head bolt 150mm overall with 45mm of thread. The head is 25mm x 25mm x 6mm.

11/59/003 (Arch 3 enclosure) A very heavily encrusted square head bolt with nut attached. 140mm overall x approx. 25mm diameter shaft. The head is 35mm x 35mm x 10mm.

11/59/005 (Arch 3 enclosure) A heavily rusted and encrusted iron nail, minus the head. 150mm overall.

11/59/006 (Arch 3 enclosure) A heavily rusted and encrusted square head bolt with a square nut attached. 85mm overall.

11/59/007 (Arch 3 enclosure) A very heavily encrusted piece of metal (originally round) 70mm overall.

11/59/008 (Arch 3 enclosure) A small irregular-shaped piece of metal 140mm max x 60mm max x 15mm.

11/59/018 (Arch 3 enclosure) Four iron nails of various sizes and condition, three of them heavily corroded or encrusted, also a metal bolt. The dimensions are as follows: (a) 130mm x 30mm x 10mm with square head; (b) 125mm (broken off) x 17mm at the top, 10mm at the tip. Badly damaged but appears to have a square head; (c) 130mm x 10mm approx., badly damaged; (d) the lower end of a shank approx 10mm square, badly damaged; (e) a metal square head bolt, with part of the head missing, the overall dimensions are 180mm x 12mm, with the top 60 mm of the shank being square.

11/59/019 Arch 3 enclosure A badly rusted metal assembly which appears to comprise an angle iron with metal plate attached. 160mm x 65mm at its widest point. The angle iron is 22mm x 22mm.

11/59/020 (Arch 3 enclosure) Nine pieces of corroded metal, including a knuckle joint; the remains of a pronged cylinder; part of a suspension joint; 2 metal pins; a curved metal strip; a length of flat metal strip; a slightly curved metal bar; and a piece of casting. All of these parts appear to have come from a motor car or something similar.

11/61/002 (Arch 2 enclosure) A heavily rusted piece of flat iron bar 218mm x approx. 50mm x 7mm. Slightly bent in the middle. (No photo)

11/61/005 (Arch 1) An iron screw 112mm overall with a square head and round shank. The head is 20mm x 20mm x 5mm, and there is 50mm of thread on the shank.

11/62/004 (Arch 2 enc) A flat metal bar 220mm x 50mm.

GRP1/001 (Pt) A metal bolt 175mm x 8mm. The head is missing but there is a hexagonal nut on one end. Heavily encrusted.

GRP2/001 A rectangular metal plate 240mm x 63mm x 15mm, with a 15mm diameter round hole to one end. There is evidence that it was attached to other metal, as one edge appears to have been sheared away.

GRP2/002 A heavy metal casting. The base is 200mm x 105mm x 20mm. On the top surface there is an extrusion running the entire length, with branches off at one end, just off centre.

GRP2/003 A cast metal assembly 140mm overall x 85mm max. There is a base plate with an angled piece of metal at 90 degrees. There is a 15mm diameter round hole through the base plate.

GRP2/004 A piece of iron plate 165mm overall x 45mm x 6mm on one edge and 15mm on the opposite edge, which is lipped. One end is rounded off and at this end there is a screw rusted into a round hole. Adjacent to this there is a small ridge raised up.

GRP3/002 A square head bolt with square shank until the thread, when it becomes round. 180mm overall x 12mm square shank and 12mm round thread.

GRP3/003 Eight pieces of badly rusted light metal, two of them curved.

GRP3/004 A badly rusted round-ended metal cup, possibly from a hopper.

GRP3/006 An 'L'-shaped bracket with a round socket to the outside of one edge (a hinge?) There is an elongated hole below the socket, and a round hole at the outer end of the return leg. 7mm thick x 25mm wide on the return leg and 40mm wide on the longer leg. The longer leg is 155mm and the return leg 100mm. The socket is 30mm outside diameter and 14mm inside diameter.

GRP4/001 Four pieces of twisted heavy gauge wire.

GRP4/002 An iron bracket from a metal-framed bed, with wood still attached

GRP4/005 A badly rusted piece of sheet metal, square at one end, and with a curved section cut out on one edge. 360mm overall x 150mm wide on top edge.

GRP5/003 Three metal bolts, one cut short and another with a nut and washer encrusted on.

GRP5/004 Two small iron nails.

GRP5/005 Nine small pieces of metal of varying shapes and sizes.

GRP5/006 A piece of iron, angled, and roughly triangular in shape. Curved.

GRP5/007 A roughly triangular-shaped piece of iron with a raised edge to two sides. Heavily encrusted.

GRP7/001 A semi-circular piece of light metal plate with a notch cut out of the bottom (straight) edge, and a small round lug attached. 320mm along the straight edge, 150mm to the apex of the curve. 5mm thick. It appears to be the door of a boiler or stove.

GRP7/007 A round metal bolt with nut encrusted to it. 220mm overall x 8mm diameter.

GRP7/010 A piece of bowed metal strip 365mm overall x 45mm x 4mm. Each end is tapered, the width across the taper being 20mm. There is round hole through the centre.



Fig. 8.3.20

GRP7/011 The sheared off end of a metal bracket 130mm x 75mm along the straight edge and 45mm across the curved end. There is a hole through the centre of the curve. (From a side view it resembles a drawing of an aeroplane.) One edge is angled along its length.

GRP8/001 Three square head metal bolts (a) 280mm x 18mm diameter x 33mm square head; (b) 170mm (sheared) x 10mm diameter; (c) 122mm max x 10mm diameter.

GRP8/002 A small, heavy, metal hinge 212mm x 27mm x 5mm. The socket end has a 27mm outside diameter, and 13mm inside diameter.

GRP8/003 A bent iron nail 128mm long.

GRP9/001 A square-shape metal cup, probably from a conveyor or hopper. (Fig. 8.3.20)

GRP9/007 A small piece of heavy metal mesh (?)

GRP9/008 Two pieces of rusted metal strip 50mm wide.

GRP9/009 A strip of metal 390mm x 50mm x 3mm with round holes 15mm in diameter in the centre and one end. There is a square hole 15mm x 15mm at the other end.

GRP9/010 A square head bolt 90mm x 18mm diameter with the head being 28mm x 28mm.

GRP9/012 Three fabricated round-ended cups and a foot plate, probably from a hopper.

GRP9/013 A large metal spike or nail with a round shank 25mm in diameter at one end, and a square shank 25mm x 25mm from half way. It tapers to a point at one end. 320mm overall.

GRP9/014 A heavy metal bar 235mm x 25mm x 20mm.

GRP9/015 Three miscellaneous pieces of metal.

GRP10/003 Three miscellaneous pieces of metal.

GRP11/003 Several strands from a wire rope, together with a badly rust-stained piece of thin rope. 200mm x 6mm.

GRP11/005 A long metal bolt, square at the head end and round at the thread. Square nut attached, and a square washer on the shaft. The bolt passes through a piece of wood and then a heavily rusted piece of metal. Overall length of the bolt is 400mm. The wood is 380mm x 75mm max.

GRP11/006 An 'L'-shaped metal rod, pointed at one end and flattened at the other. The pointed leg is 140mm long and the flat leg 120mm. Approximately 10mm in diameter.

GRP11/007 A badly rusted piece of square metal tube max 70mm long with 25mm sides.

GRP12/ 001 Three heavily rusted and encrusted nails.

GRP13/004 A heavy iron casting with a flat top and curved long leg. A bolt through the flat top.

GRP13/005 A heavily rusted round head bolt with a hexagonal nut on the thread end. 220mm x 13mm diameter.

GRP13/008 Three small curved pieces of cast iron (either a gutter or pipe).

GRP13/009 A piece of metal plate, irregular in shape, max 100mm x 70mm x 7mm.

GRP13/010 A small metal plate with rounded corners. 110mm x 25mm x 4mm. There is a round hole with 6mm diameter at one end, and at the other there is a round bar at 90 degrees. 47mm max x approx. 14mm diameter. Heavily encrusted.

GRP14/001 Two rectangular flat metal plates 96mm x 63mm x 6mm and 110mm x 52mm x 6mm.

GRP14/002 Six miscellaneous pieces of metal, all badly rusted.

GRP15/001 A very large screw with a square head, attached to which is a round flange. 195mm overall in length. The shank is 25mm in diameter at the top, 20mm at the thread end. The head is 25mm x 25mm x 25mm. The flange has a 45mm diameter.

GRP15/003 A heavily rusted piece of miscellaneous metal 170mm x 45mm.

GRP16/006 A large square head bolt with square nut attached. 170mm long with 20mm square shaft and 20mm round shaft for the thread. Also, a part of another similar bolt minus head and thread. 133mm long x 20mm.

GRP16/007 A round head bolt, bent. 170mm x 12mm diameter.

GRP18/001 An iron nail 130mm long.

GRP21/001 A flat metal plate 250mm x 70mm x 13mm.

GRP21/003 Two iron nails 104mm and 90mm long respectively.

GRP21/005 A badly rusted and encrusted bolt with a hexagonal head. There is part of a round washer encrusted to it. 170mm x 7mm diameter.

GRP23/001 A piece of badly rusted thin metal sheet, maximum 500mm x 170mm x 1.5mm.

GRP23/008 Three miscellaneous pieces of badly rusted metal.

GRP24/001 An iron nail 160mm long.

GRP24/003 A heavy odd-shaped piece of iron, maximum 157mm x 65mm x 20mm.

GRP24/004 A small piece of thin metal, slightly curved. Maximum 94mm x 57mm x 1mm.

GRP25/001 Two wedge-shaped pieces of metal 280mm x 50mm. 14mm thick at one end and 2mm at the other.

GRP25/002 A small piece of metal, almost elliptical in end profile. 80mm x 35mm x 16mm across at its widest point.

GRP26/004 Two iron nails, one 85mm long, the other much larger and bent to 90 degrees. Both heavily rusted and encrusted.

GRP26/005 A large heavily encrusted square-head screw with a round washer attached. 140mm x 13mm diameter.

GRP26/006 A half-round (gutter?) bracket with bolt attached. There are 2 square nuts on the shaft.

GRP28/001 A flat metal plate with a hole at each end, and a ring attached centrally on one side. 230mm x 80mm x 4mm. The holes are elongated and measure 16mm x 20mm. The ring has a 50mm external diameter and 23mm internal diameter. (See GRP29/001: possibly they are connected)



Fig. 8.3.21 (left)

Fig. 8.3.22 (right)

GRP28/002 A small, badly corroded, coach bolt. 80mm long x 8mm diameter at the thread end, 3mm diameter at the middle of the shank. There is a hexagonal nut and round washer attached.

GRP29/001 A round metal door hook/holder, bent to 90 degrees at the sharp, pointed, end; with a round eye at the end of the long arm. 365mm x 12mm on the long leg, with the eye having a 24mm external diameter and 10mm internal diameter. The return leg is 75mm long, tapering to a point. (see GRP28/001: possibly they are connected) (Fig. 8.3.21)

GRP29/004 Two pieces of flat metal bar 210mm x 30mm x 8mm with a half-round notch taken from each end.

GRP29/006 The flat base from one of the round-ended hopper cups.

GRP29/007 An iron nail 115mm long.

GRP29/008 A heavy piece of iron 130mm x 75mm x 20mm with a rectangular hole through, 42mm x 28mm. On one side there are 2 ridges running crossways, 7mm tall x 7mm wide.

GRP29/009 A small metal wedge 108mm x 50mm x 5mm at the thick edge and 0.5mm at the thin end.

GRP29/010 A metal spike with the pointed end broken off. The elongated head is flattened with a round hole through the centre. 165mm long, of which the head is 60mm x 26mm wide. The shaft is tapered from the head downwards, at which point it is 20mm x 10mm.

GRP30/001 A metal round-head bolt. Immediately beneath the head, to one side, there is a spline 20mm long. The bolt is 147mm x 23mm diameter.

GRP30/002 Two curved iron castings with a rectangular footplate at one end. There is a round bolt with a square nut through one of the plates, and a heavily encrusted nut on the other.

GRP31/001 Eight links of heavy metal chain, 525mm in total length. Each link is 80mm long x 45mm wide x 11mm thick.

GRP31/002 A piece of cast iron frame, possibly from a free-standing piece of farm/mill machinery, with the face of the 'Green Man' on both sides. Maximum 175mm x 65mm x 23mm. (Fig. 8.3.22)

GRP31/003 A square metal peg 315mm long x 13mm x 13mm. Pointed at one end, the other end being bent flat to 90 degrees. The flat portion is 57mm x 17mm x 3.5mm and has a round hole through, which is countersunk for a screw.

GRP31/004 A round-head bolt 170mm overall x 13mm diameter, with a 27mm square nut on one end and 2 badly rusted round washers on the shaft.

GRP31/005 A piece of decorative cast iron possibly associated with GRP31/002.

GRP31/006 A heavy metal bracket assembly comprising 2 parallel arms 130mm x 43mm x 10mm. They are joined by a cross piece which has a round top through which there is a round hole. The outer diameter is 150mm and the inner diameter 25mm. Passing through both arms there are 2 round-head bolts with square nuts. (Fig. 8.3.23)

GRP31/007 A badly rusted iron nail with missing head. 100mm long.

GRP32/006 Three large square screws measuring 200mm x 15mm diameter; 170mm x 12mm diameter with a round washer attached to the head; 136mm x 12mm diameter with a round washer on the shaft.

GRP32/007 A galvanised foot rung, as used inside manholes, etc.

GRP32/009 A truncated iron nail or spike, square at one end and round at the other. 170mm long.

GRP32/011 Three miscellaneous pieces of metal bar, all slightly wedge-shaped, one curved and another twisted up to an angle at one end. (a) 260mm x 55mm x 10mm (3mm at the twisted end); (b) 235mm x 40mm x 6mm (2mm at the taper); (c) 210mm (to curve) x 40mm x 6mm (3mm at taper).

GRP32/012 A miscellaneous piece of metal 180mm long, one edge slightly curved and the other of irregular shape.

GRP33/001 A very large iron nail or spike with flattened extension to the head. 330mm overall with 260mm of shaft which tapers from 20mm to 18mm at the top to 12mm x 3mm at the bottom. The top extension piece is a maximum of 25mm x 2mm.

GRP34/001 Four iron nails, being respectively 157mm; 140mm; 110mm (snapped half way); and 158mm, with a round disc at one end.

GRP35/007 Two round-head metal bolts, being 207mm x 10mm and 165mm x 15mm diameter respectively.



Fig. 8.3.23 (left)



Fig. 8.3.24 (right)

GRP35/010 Three small pieces of heavily rusted wire rope 18mm in diameter.

GRP35/013 Two miscellaneous pieces of metal, both badly rusted. One is flat sheet with one edge turned up at 90 degrees, and the other is flat bar, bent to approximately 120 degrees at one end.

GRP36/003 A square-head metal bolt 106mm x 16mm diameter. The head is 27mm x 27mm x 15mm.

GRP36/004 A small strip of badly rusted sheet metal 160mm x 40mm x 1.5mm.

GRP39/005 A very badly rusted metal assembly comprising a flat metal plate, pointed at one end, attached to which is a piece of slate, followed by an 'L'-shaped metal bar; joined by a square-head bolt. There is also a square-head bolt through the vertical arm of the 'L'-shaped bar. The base bar is 150mm x 25mm x 10mm.

GRP40/001 Six metal bolts: (a) 230mm x 13mm shank with a square top and round bottom part. It has a round head with a square nut and round washer attached; (b) 130mm x 15mm diameter shank with a hexagonal head; (c) 145mm x mm shank with a square top and round bottom part, square nut attached; (d) 112mm x 10mm diameter shank with a hexagonal head; (e) 95mm x 10mm shank with a square head and round bottom part, square nut attached; (f) 70mm x 15mm diameter with hexagonal head.

GRP40/003 A round metal bar 280mm x 20mm diameter, embedded into a round piece of timber 130mm long.

GRP40/005 Three miscellaneous pieces of metal, comprising: (a) a square plate 60mm x 57mm x 16mm with a round hole 15mm diameter in the centre; (b) a metal bar 100mm x 35mm x 7mm; (c) an odd-shaped piece of cast iron 120mm x 80mm x 25mm with a round hole 7mm in diameter.

GRP40/006 Two large screws with square heads (one has a round washer beneath the head). 140mm x 13mm diameter shank.

GRP40/007 A large lazy-'L' shaped metal spike with a square shaft. 260mm x 20mm x 20mm shaft (at top) tapering to a point. The return is 90mm long.

GRP40/008 Three iron nails: (a) 250mm long with a flattened round head; (b) 180mm long with a square head. The shank is round at the top and chiselled square at the bottom; (c) 155mm long.

GRP41/003 A curved metal bar 140mm long x 37mm at the wide end of the flat side, 30mm at the narrow side. The apex of the curved end is 37mm, tapering down to 28mm at the narrow end.

GRP42/001 A heavy metal assembly comprising a square base 250mm x 260mm x 60mm at the edge. To the underside it is hollow, the thickness of the edges being 7.5mm. The inside was lined with timber, a couple of pieces of which have partially survived. Attached to the top surface is a metal housing in two parts, with a round collar set into it. This is attached to the base via a base plate cast into the top of the main block, with a wooden washer/packing piece between. It is designed to hold one of the belt drive shafts. (Fig. 8.3.24)

GRP42/002 A piece of iron 120mm x 45mm x 7mm. There are 2 round holes through, with screws still inset. One end curves to form an arc. On one surface there is a small lug, and the opposite surface is lipped on one edge, with remnants of timber still along the lip, together with the protruding screws.

GRP42/003 A small cast iron bracket 110mm x 50mm x 20mm, rounded at each end and with a hole through the rounded section. The top is raised laterally across the centre and recessed beneath. This appears to be the top half of a mounting.

GRP42/004 An iron nail 90mm long.

M/MISC/003 A piece of metal plate 250mm x 75mm x 10mm.

M/MISC/004 Two sides of a very large metal hinge 590mm to longest side, 550mm to the shorter. The longer side has the round head for receiving the pin, 56mm broad x 5mm thick. The two parts are held together by two coach bolts.

M/MISC/005 A square metal plate, possibly wedge-shaped, with a round hole through the centre. 85mm x 85mm x 10mm at one edge, and 4mm at the opposite edge. The hole is 15mm in diameter.

M/MISC/006 A half-round metal bracket with arms on each side. Small round hole through the apex of the curve. 170mm between the ends of the arms. 83mm inside radius to curve. 12mm wide x 4mm thick.

M/MISC/007 A length of twisted wire 380mm x 5mm diameter.

M/MISC/008 A round metal bar 156mm x 33mm diameter.

M/MISC/009 A heavy metal round collar, 60mm outside diameter, 33mm inside diameter x 40mm tall.

M/MISC/011 A small fragment of metal mesh.

M/MISC/013 A small metal wedge 110mm x 47mm x 15mm at the thick end, 3mm at the other.

M/MISC/014 Eight miscellaneous fragments of badly rusted metal.

MB/MISC/001 A square head metal bolt with a round washer rusted onto the thread. 80mm overall x 18mm diameter shaft. 30mm x 30mm x 5mm head, 38mm x 7mm washer.

MB/MISC/002 A long metal bolt 490mm x 16mm. Hexagonal head one end, and a hexagonal nut at the other.

MB/MISC/003 A large round head metal bolt 380mm x 20mm with a square metal plate encrusted to the shaft. The plate is 75mm x 75mm x 5mm.

8.4. Pottery/Chinaware

05/07/001 Several fragments of high quality blue and white pottery with gold rings to the outside edge of some pieces. In the round outer edge of some pieces there are a number of small holes to the bottom edge, indicating that they are from a toilet pan. The other pieces appear to come from a matching wash basin. While these appear to be high status, apparently such fittings were fairly common in several of the Penrhyn properties.⁴⁹⁰ (Fig. 8.4.1-2)

05/07/002 Two fragments of glazed blue and white pottery.

05/07/003 Two miscellaneous fragments of glazed blue and white pottery.

⁴⁹⁰ As per Emyr Hughes, Head Forester to the Penrhyn Estate.



Fig. 8.4.1 (left)

Fig. 8.4.2 (right)



Fig. 8.4.3 (left)



Fig. 8.4.4 (right)

05/37/001 A cream-coloured jar marked
GRAND MEDAL OF MERIT VIENNA 1870
JAMES KELLER & SONS
DUNDEE
MARMALADE
ONLY PRIZE MEDAL FOR MARMALADE
LONDON 1862
The neck of the jar is slightly chipped, otherwise it is intact. The base is marked '7VF'. (Fig. 8.4.3)

05/37/002 An intact light brown glazed drinks bottle marked
EDWARD NOBLE
TRADE MARK
(then the picture of a dragon beneath which are the words
COCH Y DOYRY)
REGISTERED
CARNARVON
(Fig. 8.4.4)

06/01/006 (I1) Three miscellaneous fragments of glazed pottery, all coloured.

06/03/002 Three pieces of heavy glazed cream-coloured pottery, part of a large pot or jar.

06/03/003 A semi-circular piece of pottery, originally white but now discoloured and rust stained. The surface tapers up from the base, and all of the surfaces are flat, which would suggest that it is not part of a neck.

06/03/011 (H3) A formed piece of heavy glazed, white, ceramic, probably from a urinal. Also, a small fragment of the same material.

06/07/005 (M4) Four fragments of white chinaware, 2 stained with rust. Also, a fragment of white tableware, part of a base, also rust stained.

06/07/006 (M5) Two fragments of white tableware, one with a badly cracked glaze.

06/20/011 (K10) A small curved piece of white ceramic. Possibly another part of 06/03/003.

09/06/001 (Q7) Pieces of a chimney pot.

09/10/017 (E2) A fragments of pottery, white on one side and white with blue stripes on the other. 35mm x 14mm x 4mm.

09/12/003 (E1) A fragment of glazed wide-ribbed pottery from a 'Hartley's' preserve jar.

09/12/004 (E1) A fragment of glazed blue and black pottery.

09/15/023 (D1) A fragment of glazed wide-ribbed pottery from a 'Hartley's' preserve jar (matches 09/12/003). 44mm x 50mm x 4mm.

10/04/004 (A7) A fragment of glazed brown pottery with blue and white markings on one side. Plain cream on the other side. 50mm x 45mm x 5mm.

10/06/001 (H8) A fragment of glazed blue pottery with part of two white stripes. 45mm x 24mm x 4mm.

10/06/002 (H8) A fragment of glazed white pottery 46mm max x 40mm max. It appears to be a base piece as it tapers from 7.5mm at the broad end to 4mm at the pointed end (although the glazed surface has been chipped off at the thinner end).

10/07/004 A fragment of glazed white pottery 46mm x 40mm. It appears to be a base piece as it tapers from 7.5mm at the broad end to 4mm at the pointed end (although the glazed surface has been chipped off at the thinner end).

10/13/001 (P17) Nine fragments of glazed dark blue and white pottery. (Fig. 8.4.5)



Fig. 8.4.5 (left)



Fig. 8.4.6 (right)

10/22/002 (J14) A fragment from a cream-coloured pottery jar base. The lettering on the base includes
IV

BEAR

Wm P. HART

LABEL

ENE

10/36/001 (G3) A piece from a glazed, cream, ribbed jar 90mm max x 77mm x 5mm. The ribs are vertical and in bands 20mm apart. Each band contains 10 ribs.

10/48/002 (Q12) The lid of a 'Brown Betty' teapot, slightly chipped. 70mm diameter x 30mm deep. (See GRP25/005)

10/48/003 (Q12) A fragment of off-white pottery, part of a base for a cup or jug. The sides are reeded. On the base is the word 'AYNSLEY' and a small part of a symbol, too small to clearly see.

10/48/004 (Q12) A fragment of white porcelain. No distinguishing marks.

10/50/002 (Q17) A cream-coloured storage jar 140mm tall x 92.5mm diameter base. The outside lip has an 89mm diameter, 73mm internal. There are two narrow grooves around the top of the main body, but no identifying marks. (Fig. 8.4.6)

10/50/003 (Q16) A brown earthenware ink bottle 115mm tall x 54mm diameter base. It tapers to 88mm at the neck, which has a diameter of 15mm at the opening. It is lipped to one side for pouring. No identifying marks. (Fig. 8.4.7)

10/50/006 (Q16) Eight fragments of glazed fawn-coloured pottery, probably from a large mixing bowl, or possibly a vase.

10/50/010 (Q16) Numerous fragments of glazed pottery, probably from a large vase. Cream background with a brown woven pattern around the neck, and a red rose and green leaf motif. The inner side is red.



Fig. 8.4.7

10/50/011 (Q16) Several fragments of glazed pottery with a cream background and turquoise green motif, outlined in threads of gold.

10/50/012 (Q16) Numerous fragments of glazed fawn-coloured ribbed pottery from a preserve jar. The ribs are close together 10 at a time, with a wider gap between each set of 10.

10/50/014 (Q16) Fragments of glazed pottery, as above, with the ribs 25mm apart.

10/50/016 (Q16) Numerous fragments from a Hartley's preserve jar with sides ribbed 10mm apart. Placed together 2 parts of the base read:

NOT

GENUINE UNLESS

BEARING

Wm HARTLEY'S

LABEL

10/50/017 (Q16) Fragments of plain white chinaware, one piece having a narrow gold band around the top.

10/50/018 (Q16) Four fragments of glazed white pottery, 3 of which are parts of a plate.

10/50/019 (Q16) Five fragments of glazed white pottery with a scalloped edge and pattern. Parts of a plate.

10/50/020 (Q16) Five miscellaneous fragments of glazed coloured pottery.

10/50/021 (Q16) Numerous miscellaneous fragments of unconnected glazed pottery.

10/50/024 (Q16) (pt) A fragment of unglazed earthenware.

10/50/026 (Q15) Part of the base from a 'Hartley's' preserve jar. The remaining markings are:

RPOOL

And the trademark.

10/50/027 (Q15) Three pieces of pottery from the base of a 'Hartley's' preserve jar (which fits 10/50/026 above). They are marked 'DON & LIV' (London and Liverpool).

10/50/030 (Q17) Numerous fragments of glazed light brown pottery, white on the inside. Part of a large mixing bowl.

10/50/031 (Q17) Several fragments of glazed navy/brown/green pottery with small white flowers and gold leaf.

10/50/032 (Q17) Five fragments of preserve jar, 2 wide ribbed and 3 narrow ribbed.

10/50/033 (Q17) Numerous fragments of glazed pottery with a brown basket weave design, red on the inside. Some of the pieces have a pale green design.

10/50/034 (Q17) Two fragments of glazed white and green tableware with a gold leaf band.

10/50/035 (Q17) Numerous fragments of glazed white tableware, some with coloured patterns.

10/50/036 (Q17) Seven fragments of glazed cream pottery, some with ridged banded design and gold leaf pattern.

10/51/005 (Q15) Miscellaneous fragments from a 'Hartley's' jam jar.

10/51/006 (Q15) Numerous miscellaneous fragments of glazed fawn-coloured pottery.

10/51/007 (Q15) Miscellaneous fragments from a narrow-ribbed preserve jar.

10/51/012 (Q15) Numerous miscellaneous fragments of white pottery.

10/51/013 (Q15) Fragments of a white cup, with ribbed pattern.

10/51/014 (Q15) Various fragments of brown/green/red pottery, as in 10/50/010.

10/51/015 (Q15) Six fragments of fine white chinaware.

10/51/024 (Q16) Two fragments from a 'Hartley's' wide ribbed preserve jar.

10/51/025 (Q16) Three miscellaneous fragments of glazed cream-coloured pottery.

10/51/026 (Q14) Numerous fragments from 'Hartley's' preserve jars, one close ribbed and the others alternate ribbed.

10/51/027 (Q14) Numerous fragments of white fluted tableware.

10/51/028 (Q14) Numerous fragments of glazed white tableware with green floral design. The glaze is badly cracked.

10/51/029 (Q14) A piece of very thick glazed cream-coloured pottery.

10/51/030 (Q14) A fragment of glazed pottery, cream and light green on one side, and red to the inner face.

10/52 (Q13) Ten miscellaneous fragments of pottery.

10/52/002 (Q13) (pt) Ten miscellaneous fragments of pottery. (No photo)

10/52/003 (Q11) Five fragments of glazed pottery, including one piece of white chinaware. Two have a pink hue to one side, and light fawn to the other. One has a blue and white pattern and another a green and white pattern.

10/52/010 (Q12) Three fragments of glazed pottery, two with a light green pattern.

10/53/003 (R13) (pt) Eight miscellaneous fragments of glazed pottery.

10/53/005 (R12) Ten fragments of glazed pottery, fawn on the outside and white on the inside. Parts of a large bowl or pot.

- 10/53/008 (R12) Six fragments of glazed white pottery with a blue floral design.
- 10/53/010 (R12) Seven fragments of miscellaneous glazed white pottery. One has a dark green pattern along the rim; one bears the words 'VIENNA EXHIBITION'; and one has traces of a gilt pattern.
- 10/53/011 (R12) Five miscellaneous fragments of glazed coloured pottery.
- 10/53/012 (R12) Two fragments of fine white glass/porcelain.
- 10/54/003 (S12) Five unconnected fragments of white pottery, one with a black chequered pattern.
- 10/54/008 (R12) Two fragments of glazed white pottery.
- 10/54/009 (Q12) Several fragments of white pottery, one with a blue pattern and one with blue print:
R & SON
MARMALADE
EEN
DON
- 10/54/010 (Q12) Two fragments of heavy glazed pottery, fawn on one side and light brown on the other.
- 10/54/011 (Q12) A fragment of narrow ribbed preserve jar.
- 10/54/012 (Q12) Two very small fragments of white chinaware.
- 10/55/001 (T12) Twenty fragments of miscellaneous glazed pottery.
- 10/55/005 (Q10) A fragment of glazed cream-coloured pottery.
- 10/55/007 (R12) Three miscellaneous fragments of glazed white pottery.
- 10/55/008 (R12) A fragment from a 'Hartley's' wide ribbed preserve jar.
- 10/55/010 (S12) Numerous fragments of miscellaneous glazed pottery, some coloured.
- 10/55/014 (S12) Several fragments of fine white chinaware, one with a narrow gold band.
- 10/55/015 (S12) Two fragments of heavy glazed pottery, one fawn and the other brown.
- 10/56/001 (R11) Two fragments of decorative chinaware, one of them highly coloured in blue and gold. The smaller fragment is white and has evidence of gilt at the base.
- 10/56/002 (R11) The broken top of a pot jar, conical in shape and light brown in colour.
- 10/56/005 (R11) A small piece of glazed white pottery.
- 10/56/006 (R9/R10) Several fragments from a 'Hartley's' preserve jar, with wide ribbed spacing.
- 10/56/007 (R9/R10) A fragment from a narrow ribbed preserve jar.
- 10/56/010 (R9/R10) Six fragments of glazed white tableware.
- 10/56/011 (R9/R10) Three miscellaneous fragments of glazed pottery.
- 10/56/013 (R9/R10) A piece of patterned glazed white decorative tile with cement still attached (a bathroom tile).
- 10/57/005 (T12/U12) Two fragments of preserve jar, one wide ribbed and one medium ribbed.
- 10/57/006 (T12/U12) Six fragments of white chinaware.

10/57/007 (T12/U12) Numerous fragments of glazed tableware, some white and some coloured.

10/61/001 (S12) A piece of glazed pottery, cream on the outside and with a green pattern inside. Slightly curved at the top. Max 50mm x 50mm x 6mm.

10/61/002 (S12) Three pieces of a glazed white pottery jar.

10/61/004 (R11) Four small fragments of glazed pottery: (a) dark green outside, mustard inside, broken handle; (b) pink and grey ribbed outside, dark pink inside; (c) blue and white outside, white inside; (d) white with orange spot. Decorative design, appears to be part of a base.

10/61/007 (S12) Eight pieces of heavy glazed, white, sanitary ware.

10/61/008 (S12) A small piece of glazed white pottery with text in red on the outside; plus, the words 'Stationers Hall'.

10/61/009 Two fragments of plain white porcelain tableware, one marked

MAD

IN

GERM

(made in Germany) the lettering being inside two concentric circles.

10/61/010 A fragment of narrow ribbed preserve jar.

10/61/013 (S11) Three fragments of heavy glazed, white, sanitary ware.

10/61/014 (S11) Several fragments of glazed pottery, one heavily patterned and 2 coloured.

10/61/015 (S11) Five fragments from a 'Hartley's' preserve jar.

10/61/020 (R11) (a) A fragment of glazed white pottery with light blue pattern; (b) a fragment of from a wide-ribbed 'Hartley's' preserve jar.

10/61/024 (J11) A fragment of wide ribbed preserve jar.

10/61/025 (J11) Numerous fragments of glazed pottery in various shades: white, cream, green, some patterned.

10/62 (S10) Nine miscellaneous fragments of pottery.

10/62/002 (T10) Three fragments of miscellaneous glazed pottery.

10/65/002 (U10) Fragments from various styles of glazed pottery, some coloured.

10/65/003 (U11) (pt) Two fragments of white porcelain.

10/66/005 (V11) Eight fragments of glazed white pottery, 4 of them with coloured patterns. Also, a fragment of heavier glazed pottery, cream on one side and white on the other.

10/66/006 (V11) Two fragments from a wide ribbed 'Hartley's' preserve jar.

10/67/002 (X11) Two pieces from a large cream jar, one of the pieces being from a neck, and slightly darker in colour.

10/67/008 (V11) Eleven pieces of heavy glazed, white, sanitary ware.

10/67/009 (V11) A fragment from a wide ribbed 'Hartley's' preserve jar.

10/67/010 (V11) Three fragments of glazed white pottery.

10/67/011 (W11) Four fragments of glazed white pottery, 2 plain, one with a green band around the top, and one with a blue pattern.

10/67/012 (W11) A piece of terracotta pottery with black glaze.

10/67(X11) (pt 'b') A small fragment of white and grey patterned pottery.

10/68 (X10) (pt) Three miscellaneous fragments of pottery; four fragments of ceramic, one of which has the word 'Prosecuted' still visible.

10/69/001 (X7) Eight fragments from two different ribbed preserve jars.

10/69/002 (X7) Three fragments of patterned pottery; 6 fragments of plain white pottery; and one fragment of pale blue glassware.

10/69/004 (X9) Three fragments of pottery, one white with yellow and black pattern, and the other two fragments from a Hartley's preserve jar.

10/69/005 (X6) Seven fragments of pottery, 4 coloured blue and white (although only 2 from the same piece), one fawn, and 2 white.

10/69/006 (X8) Eight fragments from a close-ribbed preserve jar.

10/69/007 (X8) Six fragments from a Hartley's preserve jar.

10/69/008 (X8) Six miscellaneous fragments of pottery, one with a blue pattern.

10/70/008 (X5) Part of a ceramic rim, probably from a wash basin.

10/70/009 (X5) Five very small fragments of ceramic pottery, 2 of them coloured.

10/71/001 (X2) A thick piece of glazed fawn-coloured pottery 81mm max x 45mm x 8mm. Possibly part of a large jar?

10/72/003 (Q9) Four miscellaneous pieces of white glazed tableware.

10/72/004 (Q9/R9) Two fragments of white glazed ceramic with light blue pattern. (Not from the same item, different pattern and different thickness.)

10/76/001 (Q8) A large piece of vitreous clay pipe with rings around one end.

10/76/002 (Q8) A small piece of vitreous clay pipe (as above).

11/28/006 (H9) Seven pieces of white sanitary-ware, possibly part of a waste trap. One piece is cylindrical and marked 'Twyfords', 'Hanley' and bears the symbol of a Staffordshire knot.

11/32/002 (Cobbled road to NE of stable) A fragment of glazed pottery approx. 95mm max x 55mm x 8mm. It appears to be the top of a vase as it slopes inwards for half of its width. Two decorative grooves mark the change of plane. It has a light brown outer surface and dark cream inner.

11/34/003 (Q16) A piece from a 'Hartley's' preserve jar.

11/57/002 (Arch 2 enclosure) Fragments of glazed white pottery with blue floral design.

11/57/003 (Arch 2 enclosure) Two fragments of ribbed preserve jar.

11/57/004 (Arch 2 enclosure) Several fragments from Hartley's preserve jars.

11/57/005 (Arch 2 enclosure) Numerous fragments from a ribbed Hartley's preserve jar.

11/57/006 (Arch 2 enclosure) A heavy piece of orange pottery, the top of a large jar or pot. There are four rings to the inner face.

11/57/007 (G3) A large piece of glazed white pottery with light blue floral design and with an outward-curving lip. 180mm x 75mm x 6mm.

11/57/008 (Arch 2 enclosure) Three fragments of glazed cream-coloured pottery from the neck of a large storage jar.

11/57/009 (Arch 2 enclosure) Two curved fragments of glazed white pottery.

11/57/010 (Arch 2 enclosure) Two fragments of glazed dark green pottery.

11/57/011 (G3) A fragment of glazed blue and white pottery. Blue in bands around the outside. Probably from a vase. Roughly triangular in shape 67mm to base and 66mm across the lip. 3mm thick.

11/57/014 (F3/G3) A fragment of porcelain, possibly from a plate. White with floral design and a gold band. Max 40mm x 30mm x 1.5mm with a raised rim at the base.

11/57/020 (Arch 2 enclosure) A small fragment of glazed pottery: cream with a mottled brown pattern.

11/57/021 (F3/G3) A fragment of glazed white glazed 93mm x 65mm x 7mm. It is inscribed with the word 'MINTONS' inside a globe.

11/57/024 (Arch 2 enclosure) A fragment of lightly glazed chocolate-brown pottery. Roughly triangular in shape 95mm max x 63mm max x 16mm thick.

11/58/007 (Arch 2 channel) Six pieces of miscellaneous glazed pottery.

11/58/010 (Drain to water wheel pit) Several fragments of various types of miscellaneous glazed tableware.

11/58/011 (Drain to water wheel pit) A fragment from the base of a 'Hartley's' preserve jar.

11/59/004 (Arch 3 enclosure) A discoloured piece of lightly glazed dark brown pottery. Lipped, as if the top of a jar.

11/59/009 (Arch 3 enclosure) Miscellaneous fragments of 'Hartley's' preserve jars with 25mm ribbing. The items are pitch stained.

11/59/010 (Arch 3 enclosure) Miscellaneous fragments of 'Hartley's' preserve jars with 12mm ribbing. Pitch stained.

11/59/011 (Arch 3 enclosure) Two pieces of a preserve jar with narrow ribbing.

11/59/012 (Arch 3 enclosure) Four fragments of 'Hartley's' preserve jar with alternate 25mm and 12mm ribbing.

11/59/014 (Arch 3 enclosure) Various pieces of glazed white pottery, 2 patterned and 4 coloured.

11/59/015 (Arch 3 enclosure) Fragments of white porcelain, some badly stained.

11/59/016 (Arch 3 enclosure) Numerous fragments of glazed pottery, none of them white. Pitch stained.

11/59/017 (Arch 3 enclosure) Fragments of glazed white tableware. Pitch stained.

- 11/61/004 (Arch 1) The broken lid of a 'Brown Betty' teapot, and 2 small fragments of glazed white pottery, one ribbed.
- GRP5/002 A fragment of glazed white pottery with blue & green floral design.
- GRP7/002 A fragment of glazed light brown pottery, apparently the neck of a large jar.
- GRP9/003 A piece of heavy glazed, white, pottery.
- GRP9/006 Two miscellaneous fragments of glazed pottery.
- GRP10/002 Eleven fragments of glazed cream-coloured pottery decorated with gold rings. (See also GRP23/005)
- GRP10/005 Numerous fragments of glazed tableware, some with patterns.
- GRP10/006 Numerous fragments of glazed pottery.
- GRP10/007 Eight fragment of cream-coloured glazed pottery with a wavy surface.
- GRP12/005 Several fragments of glazed pottery, some plain and some coloured.
- GRP13/001 Several miscellaneous fragments of glazed pottery, some coloured.
- GRP13/002 Two fragments of white chinaware.
- GRP13/003 Two fragments of heavy, glazed, fawn-coloured pottery.
- GRP15/002 Three miscellaneous fragments of glazed pottery (one coloured). Also, a fragment of white chinaware.
- GRP16/001 Three fragments from a wide ribbed 'Hartley's' preserve jar.
- GRP16/002 Two fragments from a narrow ribbed preserve jar.
- GRP16/003 Two fragments from a 'Hartley's' preserve jar, both wide and narrow ribbed.
- GRP16/005 Numerous fragments of glazed tableware, some patterned.
- GRP17/001 Numerous fragments from a wide ribbed 'Hartley's' preserve jar.
- GRP17/002 Five fragments from a preserve jar, with intermediate ribbing.
- GRP17/003 Nine fragments of narrow ribbed preserve jar.
- GRP17/004 Two fragments of glazed light brown pottery, probably from a large mixing bowl.
- GRP17/005 Two fragments of white chinaware, one with mauve floral design.
- GRP17/006 Numerous miscellaneous fragments of pottery.
- GRP17/007 Three fragments of glazed white tableware with a narrow gold band. (All three fit together.)
- GRP17/008 Six fragments of off-white tableware with a turquoise pattern.
- GRP17/010 Six fragments of glazed and coloured pottery, from a vase or similar.
- GRP18/004 Eight miscellaneous fragments of glazed tableware, 3 with a dark blue edge.
- GRP18/005 Three fragments of glazed cream-coloured pottery, probably from a preserve jar.
- GRP18/006 Part of the base of a glazed pot, dark green on the outside and brown on the inside.

GRP21/006 Three miscellaneous fragments of heavy glazed pottery (1 white, one light brown on one side, and one with a dark blue outer surface and brown inner surface.

GRP21/007 Two fragments of white tableware, one with a green circle motif containing the letters 'S.I. of W'.

GRP22/001 Nine fragments of wide-ribbed pottery from a 'Hartley's' preserve jar.

GRP22/002 Five fragments from medium-ribbed preserve jars.

GRP22/003 Ten fragments from narrow-ribbed preserve jars.

GRP22/004 Four fragments of white chinaware.

GRP22/006 A fragment of glazed light brown pottery, white to the inside surface. Possibly from a mixing bowl?

GRP22/007 Numerous miscellaneous pieces of glazed pottery.

GRP22/008 Two fragments of glazed cream-coloured pottery with a ribbed pattern. (Similar pieces were found elsewhere.)

GRP23/004 Several miscellaneous fragments of glazed white tableware with coloured designs.

GRP23/005 Several fragments of glazed cream-coloured tableware with gold band design. (See also GRP10/002)

GRP23/006 Several fragments of glazed cream-coloured tableware.

GRP23/007 A fragment of narrow-ribbed preserve jar.

GRP25/004 Two fragments of glazed white pottery, one with a blue floral design.

GRP25/005 (a) A fragment of brown pottery, glazed on the outside only; (b) the broken lid of a 'Brown Betty' teapot; (c) a piece of glazed preserve jar, but without ribbing.

GRP25/006 A fragment of narrow-ribbed preserve jar.

GRP29/005 Four fragments of glazed cream and brown pottery, part of a large jar.

GRP30/004 A fragment of ribbed preserve jar, the ribbing being a mixture of both medium and wide.

GRP35/009 A fragment of thick, glazed, light fawn pottery, with pitch to the inside surface.

GRP37/001 Ten miscellaneous fragments of glazed pottery, including one very thick piece. Several have a coloured pattern.

GRP39/001 Two fragments of glazed light-fawn pottery, light brown around the top edge. Heavily covered with pitch.

GRP41/002 A fragment of glazed buff-coloured ceramic, part of a bath or sink.

GRP41/004 Five fragments of miscellaneous glazed white pottery.

GRP41/005 A fragment of narrow-ribbed preserve jar.

M/POT/001 A piece of glazed light brown and light fawn pottery, with a handle to one side beneath a round neck. The inner surface is light fawn.

M/POT/002 Three fragments of glazed light brown and light fawn pottery with raised pattern near the neck. The inner surface is light fawn.

M/POT/003 A fragment of heavy glazed white pottery.

8.5. Slate & Stone

05/31/002 (B6) A piece of slate with '407' painted on one side (the '4' being indistinct).

05/31/003 (B6) Three miscellaneous pieces of slate tile, each marked with white paint.

05/31/005 (B6) A piece of slate with a (indistinct) number painted on one side.

06/04/003 (J3) A miscellaneous piece of slate marked with an indistinct figure '2' in white paint.

06/07/001 (M4) A rectangular piece of slate 145mm x 140mm x 20mm with a hexagonal nut in one corner. The nut measured 25mm across x 10mm deep.

10/37/002 (H13) An irregular shaped piece of slate 280mm max x 190mm max x 22mm max with two 18mm round holes drilled through. In one of the holes there is a metal peg (the offcut from a bolt) 90mm x 13mm diameter, partially threaded.

10/43/002 (O16) A piece of rough concrete with maximum dimensions 180mm x 170mm x 60mm. There is a piece of bone 80mm x 18mm embedded in the lower surface.

11/07/001 (P1) A length of machined slate 410mm x 55mm diameter. Parts are broken, but it has a flat section at one end 65mm long and 15mm deep. Along the entire length there is a 'V'-shaped groove 20mm deep. (It has been suggested that this is part of a ridging tile, as used by Penrhyn Estate). (Fig. 8.5.1)



Fig. 8.5.1

11/54/001 (Head race above launder) Two pieces of cement with a defined channel where the sluice post stood.

11/59/019 Two pieces of slate strip, (a) 160mm x 30mm x 20mm; (b) 135mm x 40 mm (average) x 35mm, rust stained. Both found in Arch 3 enclosure.

GRP11/002 A stone wedge 57mm from the thick end to the narrow edge x 65mm wide. 20mm on the thick edge and 3mm on the narrow edge.

GRP12/004 A piece of stone, roughly saddle-shaped.

GRP39/003 A small piece of slate tile with paint marking.

8.6. Tools

05/03/001 A badly tarnished dessert spoon, worn to the front edge.

05/03/003 (G2) A fan-shaped blade with a round shaft to the smaller end. 90mm x 70mm x 3mm. The shaft is 45mm x 10mm diameter

05/18/001 (A4-A5) A large grain-moving screw, intact, 2.24m long with the round wooden shaft being 10.2cm in diameter. It has a total of 19 metal screw blades in total. The ends of the shaft are capped with steel bands and the first 35.5cm of the shaft has a metal sheath around it. The screw has been transferred to Cochwillan Mill for display and safe keeping. (Fig. 8.6.1)

06/03/006 (H3) The head of a shovel complete with tang, but minus the handle.

06/03/010 (H3) A very badly rusted kitchen knife with part of the blade and handle intact. The blade is 20mm long and the handle 135mm long.

06/10/005 The blade of a half-round metal file 200mm long x 30mm (half-round).

09/05/001 (K4) An open-ended spanner 200mm overall with a 23mm width opening at one end and 18mm opening at the other.

09/05/003 (P2/P3) A metal double-edged hammer head, diamond-shaped, 195mm x 35mm at its widest point and 40mm deep.

09/15/034 (F1) A metal double-edged hammer head, diamond-shaped, 175mm x 40mm x 30mm in the centre, tapering to 1mm at the edge of each end.

10/01/002 (E1) A heavily encrusted metal rasp. The blade is 290mm x 40mm x 10mm and the tang is 80mm long.

10/01/015 (F1) Two heavily rusted pieces of metal tube, probably from the handle of a hand tool such as a rake or fork. The remains of the tang are still in one half of the tube.



Fig. 8.6.1 (left)



Fig. 8.6.2 (right)

10/16/001 A heavy metal key or spanner, probably used for operating the sluices, or possibly tightening the large bolts holding down machinery. It appears to have been fabricated from several different pieces of metal. Now located at Cochwillan Mill for display and safe keeping. (Fig. 8.6.2)

10/22/005 (K16) The end of an old pitch-fork comprising 70mm of the head and 2 tines.

10/22/006 (J14) The remains of a pitch-fork with 2 tines still in place, one broken.

10/34/001 (D10) What appears to be a single tine, or one half of the head of a pitchfork, attached to the tang. 320mm overall.

10/42/017 A heavily encrusted fan-shaped blade. 98mm wide at the widest point of the fan, 45mm at the narrowest. 70mm overall length. The blade is attached to a round metal shaft 50mm x 10mm diameter. The blade itself is 2mm thick.

10/51/003 (Q15) The remains of a knife handle plus part of the blade.

10/51/021 (Q17) (pt) (a) Possibly a small rear lamp for a bicycle. Black body with an orange cover to top. (b) What appears to be a small pulley wheel with 50mm diameter x 10mm wide.

10/61/021 (T10) A badly rusted tool head comprising the end of the handle socket and a single crook. 150mm x 75mm.

10/61/023 (J11) A badly rusted and heavily encrusted penknife.

10/MISC/002 (G-K17) An iron double-ended hammer head. 260mm x 40mm x 30mm at the centre edge, 2mm at the sharp edge.

10/MISC/009 (G-K17) What appears to be the blade from a garden hand trowel. 130mm x 75mm max at the handle end. Heavily rusted.

11/34/001 (Q16) A badly rusted tubular piece of metal, possibly from the end of a garden implement such as a rake. Max 170mm x 28mm external diameter.

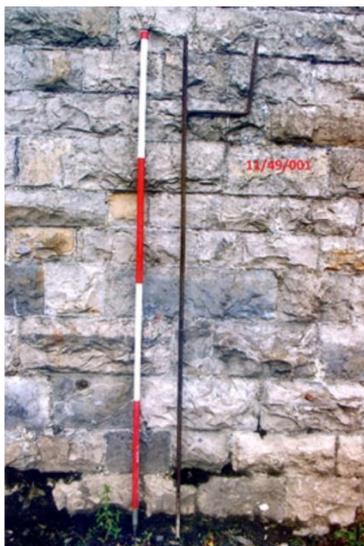


Fig. 8.6.3 (left)

Fig. 8.6.4 (right)

11/49/001 A tool for moving the leather drive belts across the pulley wheels. It measures 2.143m overall and 175mm in diameter, with a 7mm chamfer to each side. One end is flattened for the last 20mm, and the flattened part has a notch 10mm deep inset. The other end has an 'L'-shaped bracket to one side, in effect forming a 2-pronged yolk. The yolk is 290mm in depth x 260mm wide at the mouth and 240mm at the base. (Fig. 8.6.3)

GRP3/005 A badly rusted file 237mm overall. The blade is 197mm long x 40mm x 10mm, and the tang is 40mm x 10mm.

GRP7/006 A small and very heavily encrusted 'Stilson' wrench.

GRP9/004 A piece of wood, shaped on one side, and with a nail protruding through the shaped end. Possibly part of a wooden grain shovel. (Fig. 8.6.4)

GRP32/003 Two parts of a vehicle jack.

L/MISC/003 Two sides of a hedge-layers glove/mitten. Although the stitching has come apart and the two sides are separate, the glove is still complete.

M/MISC/001 A file 295mm long x 35mm and with a 75mm tang.

8.7. Wood

05/18/002 (A4-5) A very large wooden beam 4.82m long x 355mm x 254mm. (Fig. 8.7.1)

05/26/001 (C-D6) A piece of timber 143cm long x 14cm at its widest point x 23cm.

05/31/001 (B6) A shaped piece of wood with a large iron nail or peg embedded in it. The wood is curved, as though for something to slide across it. The maximum dimensions are 135mm x 90mm x 55mm. The metal peg protrudes 140mm and it is approximately 16mm in diameter, rounded at the top but square after the first 80mm.

06/03/007 (H3) An irregular-shaped piece of wood 325mm x 75mm x 40mm max with white paint on the 40mm edge. There is a large, bent, iron nail protruding 160mm from one end.

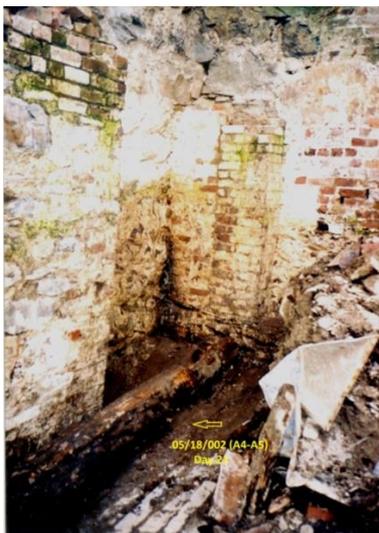


Fig. 8.7.1 (left)

Fig. 8.7.2 (right)

06/06/007 (H4) A piece of timber 675mm max x 85mm max x 72mm. There is half of a shaft housing mounted on top, held in place with 2 coach bolts and 25mm square head nuts. There are threaded bolts protruding upwards from the housing, set to receive its upper half. (Fig. 8.7.2)

06/15/003 (B10) A large piece of timber 117cm x 20cm at its widest point.

06/20/013 (K10) A small knife-shaped piece of wood 190mm x 34mm max x 4mm max.

09/10/019 (E2) A piece of timber 140mm x 100mm max x 25mm.

09/10/022 (E2) A small piece of wood approximately 30mm square at one end x 40mm long, then tapering to a finger 60mm x 15mm x 7mm.

09/13/003 (E1) A badly damaged piece of timber 630mm x 120mm x 55mm. Heavily affected by woodworm.

09/13/004 (E1) A piece of wood 220mm max x 190mm x 55mm.

09/15/002 (E1) A small piece of wood 376mm x 20mm x 15mm at the thick end, tapering to 2mm at the opposite end.

09/15/015 (E1) An irregular-shaped piece of wood that has been heavily weathered. 180mm max x 90mm max x 30mm max. There is an odd protrusion which looks like a nail but is wood and seems to be part of the timber (a knot?). It runs diagonally across the width and protrudes from the edge by 40mm.

09/15/016 (E1) An irregular-shaped piece of timber 460mm max x 170mm max x 25mm thick.

09/15/017 (D1) A piece of timber 510mm x 120mm at one end and 110mm at the other x 55mm thick. There are indications that the edge of the 120mm wide end has been cut away for a length of 200mm to facilitate it being joined to something else.

09/15/018 (D1) A piece of timber 290mm x 160mm x 35mm.

09/15/019 (D1) A wooden wedge 260mm x 95mm x 50mm thick at one end and 20mm at the other.

09/15/020 (D1) A piece of timber 160mm max x 105mm max x 55mm

09/15/024 (D1) A shaped piece of timber, somewhat resembling a knife or mixing spoon. 252mm x 20mm at the 'handle' end and 33mm at the 'blade' end. The 'handle' is 12mm thick and the 'blade' 4mm.

09/15/025 (D1) A piece of timber 230mm max x 55mm max x 25mm.

09/15/027 (D1) A piece of timber 230mm x 32mm max x 20mm.

09/15/028 (D1) A small piece of machined wood 195mm x 18mm max x 13mm max. There appears to be a small tenon sticking out of one edge, measuring 20mm x 8mm x 2.5mm.

09/15/029 (D1) A fragment of timber 240mm max x 20mm max x 13mm max. Again, there is a small tenon protruding from one edge, measuring 23mm x 6mm x 3mm.

09/15/030 (F1) A piece of timber 440mm x 235mm at one end and 210mm at the other x 25mm thick. There is a crude notch 110mm x 25mm in one end.

09/15/035 (F1) A small block of timber 172mm x 78mm x 27mm.

09/15/037 (F1) A small piece of timber 190mm max x 70mm max x an average of 30mm thick.



Fig. 8.7.3 (left)



Fig. 8.7.4 (right)

09/15/044 (D1) A badly damaged piece of timber 510mm x 120mm x 55mm. A hole has been cut through one end, probably for a tenon joint.

10/01/001 (E1) A heavy piece of timber 335mm x 190mm x 75mm. Found 1500mm down in the fly-wheel pit.

10/01/003 (E1) A piece of timber 380mm long x 90mm x 17mm thick on one edge and 10mm thick on the other. One edge is chamfered like a skirting board.

10/01/004 (E1) A machined wooden block comprising a flat base with 2 parallel raised strips along its length. The two strips have been angled by inserting wooden wedges. 380mm long x 100mm wide x 40mm thick. The strips are 30mm wide and the channel between them is 15mm.

10/01/005 (E1) A curved piece of timber formed into an arc. 360mm overall x 57.5mm on one flat surface and 50mm on the other. Possibly part of a window frame. (Fig. 8.7.3)

10/01/006 (E1) A wooden wedge 190mm long x 67mm wide x 15mm at the thick end and 5mm at the other.

10/01/008 (E1) A piece of timber with triangular profile. 250mm x 43mm on one flat, 28mm on side 2 and 35mm on side 3.

10/01/009 (E1) A piece of timber, machined on one side to form a lip. 34mm long x 30mm x 20mm on the back edge (13mm before the lip). The end profile is 30mm along the base x 20mm vertical to one side and 13mm on the other, to where the lip begins. The lip is 15mm x 15mm.

10/01/010 (E1) A finger-shaped piece of wood 150mm overall x 36mm at the thickest end and 8mm at the narrowest.

10/01/011 (E1) Three miscellaneous pieces of timber.

10/01/017 (F1) An irregular-shaped strip of wood that appears to have been machined. 380mm long, 10mm x 7mm at one end and 17mm square at the other, not including the groove that once was there.

10/01/018 (F1) An irregular, roughly 'whale'-shaped, piece of wood, 257mm max overall x 47mm at the widest point. Roughly triangular on the back edge.

10/13/006 A badly damaged piece of timber, heavily rust stained. 660mm overall x 80mm max x 55mm max. (Destroyed as it was riddled with woodworm.)

- 11/54/003 (Head race above launder) Two pieces of rotten timber, each with an iron nail protruding.
- 11/58/017 (Arch 3 enclosure) A rust-stained piece of timber 430mm overall x 70mm x 50mm. There is a metal plate 230mm x 50mm x 10mm attached to the 50mm top side, secured by 2 square head bolts and nuts that go right through. (Fig. 8.7.4)
- GRP1/005 Five small pieces of wood of different shapes and sizes.
- GRP7/004 Two small pieces of heavily rust-stained wood.
- GRP20/003 Two small pieces of wood.
- GRP24/002 A small mis-shaped piece of wood, heavily encrusted with metal.
- GRP32/002 A small wedge-shaped piece of wood 110mm x 78mm max x 22mm at the thick end and 11mm at the thin end.
- GRP34/003 A small fragment of wood.
- GRP35/005 A rounded lump of very rough material, possibly a piece of burnt wood. Approximately 130mm x 130mm x 40mm.
- GRP35/012 Two small pieces of heavily rust-stained wood, one with a small piece of galvanised metal sheet attached.
- GRP36/001 A small wooden wedge 188mm x 64mm x 13mm at the thick end and 5mm at the thin end.
- GRP36/002 A thin strip of wood 340mm x 19mm x 13mm max.
- GRP40/004 A small piece of rotted wood 200mm x 40mm x 55mm.
- W/MISC/004 A small piece of irregular-shaped wood with metal encrusted to one side. 190mm x 34mm x 20mm max.

8.8. Miscellaneous Items

- 05/06/001 A 'Record' No. 4 shotgun cartridge casing.
- 05/07/008 (F3) A 'Hovis' loaf wrapper.
- 05/07/009 (F3) A plastic toy fireman.
- 05/08/002 (B1) A Cadbury's 'Wurly' bar wrapper.
- 05/08/003 (C1) A piece of honeycomb tile from a drying floor.
- 05/08/004 (C1) A buckle.
- 05/09/001 A square floor tile 24cm x 24cm. (Fig. 8.8.1)
- 06/02/002 (K2) A miscellaneous piece of green plastic.
- 06/04/001 (L2) A piece of decorative tile with twisted knot pattern, 118mm x (av) 70mm. Possibly part of a bathroom dado.
- 06/08/004 (I5) Eleven small pieces of plaster with the remains of green paint to one side.
- 06/09/003 (H6) Three small pieces of plaster with green paint to one side.

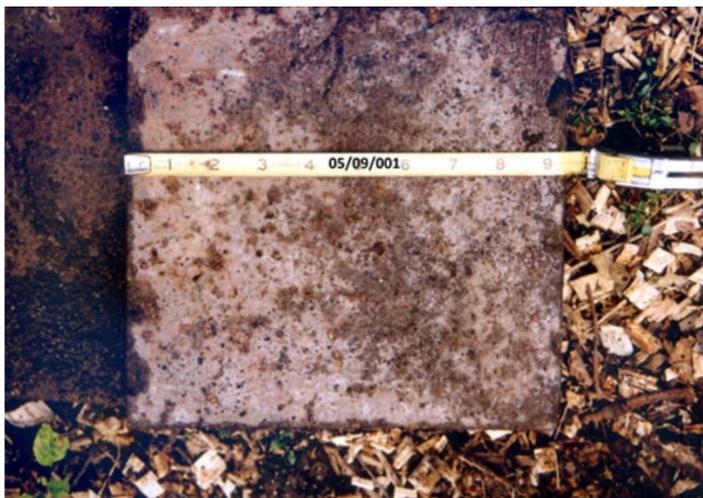


Fig. 8.8.1 (left)



Fig. 8.8.2 (right)

06/20/002 (K10) A valve from an internal combustion engine.

06/20/010 (K10) A small piece of plaster with green paint to one side.

09/10/020 (E2) A small piece of unidentified material, most closely resembling clinker. 95mm max long x 50mm wide x 17mm thick. Curved on one side, as though it had been wrapped around a pipe or similar shaped object. At one end there are what appear to be strata.

09/11/003 (E2) A 'Golden Wonder' Prawn Cocktail flavour crisp packet. It has a Best Before date of '15MAR97'.

09/11/004 (E2) A modern bayonet-fit light bulb.

10/01/007 (E1) A small sample of discoloured soil (stained green) taken for analysis. Unfortunately, it was lost in the laboratory.

10/04/005 (A7) A somewhat distorted white enamel jug 163mm tall x 130mm (approx.) base. At the top it measures approximately 95mm. It has a handle on one side, and a pouring lip on the opposite one.

10/19/003 (I16) What looks like the shaft of a bicycle pedal, attached to a dynamo.

10/19/004 (H16) A broken ceramic electrical insulator, as found on telegraph poles.

10/19/006 (I15) An intact ceramic insulator.

10/31/001 (Tail race) An iron kettle. (Fig. 8.8.2)

10/43/003 (O16) Fragments of a 'Golden Wonder' crisp packet, Salt and Vinegar flavour. The cost marked on the packet is 5d (therefore pre-1970). On the reverse side there is faded printing which appears to mention training for the Olympic Games (possibly 1968). (No photo)

10/50/024 (Q16) (pt) A screw bottle top marked 'IND COOPE & CO LTD.'

10/50/037 (Q17) A small sea shell and an unidentified piece of discoloured chalk-like material.

10/52/008 (Q12) Three unidentified animal bones.

10/52/013 (Q13) (pt) A metal drawer handle 117mm overall width.



Fig. 8.8.3 (left)

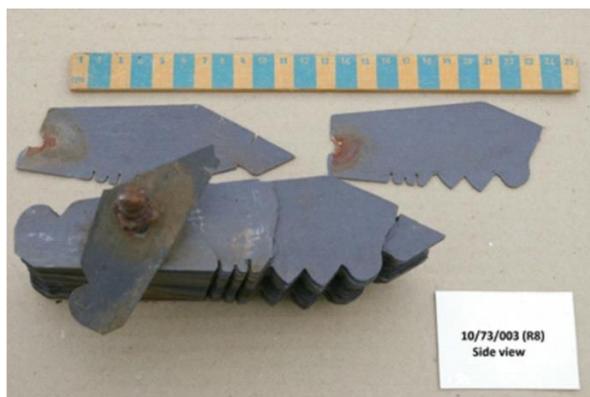


Fig. 8.8.4 (right)

10/53/003 (R13) (pt) An unmarked ceramic bottle stopper.

10/67/ (X11) (pt 'a') Part of the wrapper from a 'Twix' bar.

10/70/002 (X3) A heavily rusted padlock.

10/70/006 (X4) A door-latch receiver plate.

10/72/001 (Q9/R9) A piece of cast iron grating, possibly from a hearth. Part of the handle remains, as does some of the base. The body is 155mm long x 175mm wide. The handle is 100mm long x 26mm wide where it joins the main body. There is a hole in the open end of the handle, indicating that probably it had a further extension piece to it. The diamond-shaped holes in the body of the grating are 60mm x 25mm. (Fig. 8.8.3)

10/73/001 (R8) Two parts of a chromium-plated hub cap.

10/73/002 (R8) A yellow die-cast toy car (Dinky Toy) marked
'Lotus Europa (Prov. Pat. No. 46371/68 (UK))'

10/73/003 (R8) A slate fan (decorative work piece). Almost complete, with 2 broken blades. (Fig. 8.8.4)

10/73/005 Vehicle number plate, registration OUX 904.

10/MISC/012 (G-K17) A heavily rusted piece of metal sheet with what looks like a dynamo assembly attached.

11/57/022 (Arch 2 enclosure) Five pieces of honeycomb tile from a drying floor. (Fig. 8.8.5)

11/59/016 (Arch 3 enclosure) (pt) A small rubber connector, similar to a tap rubber, but much smaller. 50mm overall.

11/61/001 (Arch 2 enclosure) Four pieces of honeycomb tile from a drying floor.

11/62/001 (Arch 3 enclosure) A piece of honeycomb tile from a drying floor. Roughly triangular in shape with the sides measuring a maximum of 120mm x 95mm x 80mm. It is 44mm thick. The honeycomb squares measure 18mm x 18mm and the top side has corresponding small round holes clustered in 3 rows of 3 and measuring 3mm in diameter. The tile has been darkened as a result of being exposed to severe heat.

11/62/002 (Arch 3 enclosure) A piece of honeycomb tile from a drying floor. Approximately 135mm x 117mm x 43mm thick. The composition is as above.

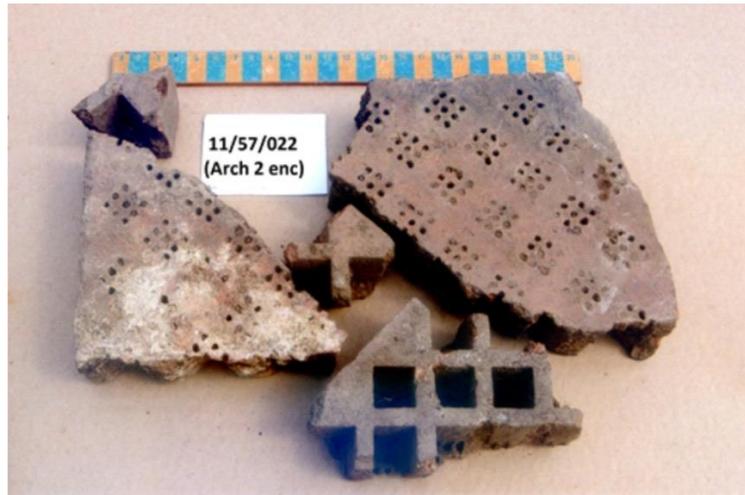


Fig. 8.8.5

11/63/001 (Arch 2 enclosure) Two pieces of honeycomb tile from a drying floor.

GRP1/004 Five pieces of plaster, painted green to one side.

GRP9/002 The remains of an air freshener can.

GRP16/009 A small piece of light grey plastic.

GRP17/009 A piece of wall plaster painted green on one side.

GRP21/009 A small piece from a 'Cadbury's Snack' wrapper.

GRP40/002 A piece of wall plaster painted green on one side.

GRP41/001 A square ceramic isolator switch with electrical cable attached (3 wires: red, black and earth). The switch is marked:

MEM DIX

10 AMPS 250 VOLTS

LINE NEUTRAL

PUSH ON PULL OFF

9. Bibliography

The major part of the history relating to the Penrhyn Mills is based on archive material that primarily is held by the Archive and Special Collections Department at Bangor University and the Gwynedd County Archive in Caernarfon. The physical description of Penlan Mill and its environs is based entirely on the excavation work carried out between 2005 and 2011; the only exception being some original archive material created in 1980 by Frances Llewelyn. In all cases the source is clearly accredited in the footnotes. The material relating to the Penrhyn Iron Mine was loaned by Miss Moira Muir, the grand-daughter of E.J. Morris who originally opened the mine; although this material has subsequently donated to the Gwynedd Archive in Caernarfon.

Primary Sources

Archive Documents

BU/Un-cat, Penrhyn Estate Forestry Dept Ledger of Accounts 1st April 1931-5th March 1964.

BU/Un-cat, Penrhyn Estate Saw Mill Account April 1947-31st March 1951.

BU/Un-cat, Penrhyn Estate Accounts 3rd April 1947-31st March 1951.

BU/Un-cat, Penrhyn Saw Mills Fire Watchers Log Book 5th Jan 1941-12th Nov 1942.

BU/4/99

BU/138.

BU/140.

BU/762-774.

BU/1637

BU/1645.

BU/1655.

BU/1658.

BU/1660-1662.

BU/1670-1672.

BU/1674-1676.

BU/1680-1683.

BU/1685-1686.

BU/1688-91.

BU/1693.

BU/1696.

BU/1698.

BU/1701-1703.

BU/1716.

BU/1719-1721.

BU/1723.

BU/1725-1727.

BU/1729-1731.

BU/1733.

BU/1735-1737.

BU/2068.

BU/2071.

BU/2949.

BU/2959.

BU/ms211 (13th March 1601-2).

BU ms 19063/Penrhyn 1971.

BU/ms1977, Valuation of Machinery at Ochre and Lower Yard, March 10th, 1829.

BU ms 22870.

BU/ms 2935

BU/2946 Rent Roll 1802.

BU/Carter Vincent mss 2277.

BU/Carter Vincent mss 2278, draft lease of 27th February 1852.

BU/Carter Vincent mss 2280.

BU/Penrhyn/Add/2806, 'No.5 Rental 1794'.

BU/Penrhyn Add/Rental 1802.

BU/Penrhyn Add 2813, 2815-20, 2954.

BU/Penrhyn Add 2835, James Wyatt's accounts for 1835-1842.

BU/Penrhyn Add. 2866 'Rental 1857'.

BU/Penrhyn Add 2869.

BU/Penrhyn Add. 2877 'Rental 1868'.

BU/Penrhyn Add 2901.

BU/Penrhyn Add. 2946

BU/Penrhyn Add. 2956-2958, 2960-2969.

- BU/Penrhyn Add. 2957 'Rental 1821'.
BU/Penrhyn Add.2959 'Rental 1822'.
BU/Penrhyn Add. 2973 'Rental 1836'.
BU/Penrhyn Add. 2980 'Rental 1842'.
BU/Penrhyn Add mss 3016.
BU/Penrhyn ms 26 (Un-cat).
BU/Penrhyn ms 42.
BU/Penrhyn 131.
BU/Penrhyn 138.
BU/Penrhyn ms 183.
BU/Penrhyn192 (undated)
BU/Penrhyn 768.
BU/Penrhyn mss811-815.
BU/Penrhyn/1043-44.
BU/Penrhyn 1632, Rent Roll 23rd September 1622.
BU/Penrhyn 1635.Rent Roll 1677.
BU/Penrhyn/1637.
BU/Penrhyn/1671-1700, Rental Rent Rolls.
BU/Penrhyn/1719
BU/Penrhyn/1721.
BU/Penrhyn/1726.
BU/Penrhyn/1730.
BU/Penrhyn/1737, Rental 1st November 1782.
BU/Penrhyn ms1741.
BU/Penrhyn/ mss 1800.
BU/Penrhyn/ms1976, Account of Flint brought down from 12th May 1826 to 12th May 1827, signed by Robert Spooner 23rd January 1828.
BU/Penrhyn ms1978, lease awarded to Richard Herbert, 3rd September 1768.
BU/Penrhyn ms2033, lease for mineral rights, 1796.
BU/Penrhyn/ms 2036.
BU/Penrhyn ms 2068, Statements and Vouchers for April 1930.

BU/Penrhyn ms 2071, Mr Baxter's Yard Account No. 240, 1830.
BU/Penrhyn ms 2073, No.326, Hone Quarry Account for August 1830.
BU/Penrhyn/Rental 1796/97 (Un-cat).
BU/Penrhyn 17 (Un-cat) 'Rental 1851'.
BU/Penrhyn 192 (Un-cat) (Plan).
BU/Penrhyn ms22870.
BU/Penrhyn 2809.
BU/Penrhyn ms2941, 'Planting at Penrhyn '97'
BU/Penrhyn (Un-cat Box 6.
BU/PP2033 Indenture dated 25th March 1801.
BU/PFA/1/12/14.
BU/PFA/1/259.
BU/PFA/1/261.
BU/PFA/1/502.
BU/PFA/2/29, 1883, Lease on Penlan Mill.
BU/PFA/2/54.
BU/PFA/2/59, Lease dated 10th December 1883.
BU/PFA/4/53.
BU/PFA/4/54 (1798)
BU/PFA/4/55 (1799).
BU/PFA/4/149.
BU/PFA4/167-190.
BU/PFA/4/176, Rental 1912.
BU/PFA4/177-184.
BU/PFA4/184, Rental 1920.
BU/PFA4/185.
BU/PFA4/191.
BU/PFA/6/32.
BU/PFA/12/2
BU/PFA/12/3 'State of the Capel Curig Road account on 24th June 1806'.
BU/PFA/12/5.

BU/PFA/12/11.

BU/PFA/12/14.

BU/PFA/12/16.

BU/PFA/12/17.

BU/PFA/12/14.

BU/PP2054.

CRO, Knutsford Marriage Register 1783.

GAT/PRN 6387.

Gwynedd X/AMP/Maps/19, Penrhyn Iron Mine, Abandoned Mine Plan No.7224 Penrhyn.

Gwynedd XB14/1 Minutes of the meeting of Ogwen RDC, 29th November 1895.

Gwynedd/XB.14.98.

Gwynedd/XB.14.113, Ogwen Rural District Council Rate Book 1954-55.

Gwynedd XC2/3/205, 'Plans and Sections of Intended Sewers and Rising Main, Drg. No.2, Sheet A' 30th August 1973. (Plan Reference no. 03/9/2A)

Gwynedd/XC2/6/467, Tenancy of Estate Yard Cottage, Llandegai Depot.

Gwynedd/XC2/6/539, Purchase of Penrhyn Estate Yard by Caernarvon County Council.

Gwynedd/XC2/8/2, Caernavonshire County Council Register of Road Blocks and Anti-tank traps Completed List of road and bridge defences.

Gwynedd/XC12/1/28, Caernavonshire County Council Air Raid Precautions, Nov.1940-31st Dec 1942.

Gwynedd X/Friars Addn/40.

Gwynedd XM/1959/1, Lease document dated 24th March 1800.

Gwynedd/XM3156/8.

Gwynedd/XM3156/9, 'Payments made during Construction of the Railroad from Quarry'.

Gwynedd XM/1959/1.

Gwynedd XM/1959/3 'Articles of Agreement Indented' dated 10th February 1929.

Gwynedd/XM/2070/221.

Gwynedd XM/5171/1.

Gwynedd XM 9801/2, 'The Penrhyn Iron Mine-Near Bangor, North Wales', 12th October 1912.

Gwynedd XM/Maps/437/8.

Gwynedd X/Plans B/189.

Gwynedd X/Plans RD/39.

Barrie K. Lill, *Richard Pennant, Samuel Worthington, and the Mill at Penlan*

Gwynedd X/Poole/6353.

Gwynedd/XPQ/89/2.

Gwynedd/XPQ1913.

Gwynedd X/R/12, Official Maps & Plans, 'Chester & Holyhead Railway, Book of Reference to plan of Line to complete the Communication from Chester to Holyhead', November 1844.

Gwynedd Family History Society, *Memorial Inscriptions of the Churchyard at St Cross*, M278.

Hansard, HC Debate 13th November 1917, vol 99 cc217-8.

LRO/380MD47, *Herculaneum Pottery Minute Book*.

University of Manchester Library, Ref.GB 133 Eng MS 1344, *Minute Book of the Macclesfield Copper Company*.

PRO/5734.

PRO/H0107/1396 1841 Census, Llandegai.

PRO/H0107/2518 1851 Census, Llandegai.

PRO/PRO/RG9/4352 1861 Census, Llandegai.

PRO/RG10/5730 1871 Census, Llandegai.

PRO/RG11/5577 1881 Census, Llandegai.

PRO/RG12/4669 1891 Census, Llandegai.

PRO/RG13/5284 1901 Census, Llandegai.

St Tegai Church Register of Marriages 1837-64.

St Tegai Church Burial Register for the period 1844-1868.

St Tegai Church Register of Baptisms 1887-1974.

Books

Robert Copeland, *A short history of pottery raw material and the Cheddleton Flint Mill*, (Hanley, 1972)

J.Evans, *The Beauties of England and Wales (North Wales)* (London, 1812)

T. Evans, *Walks Through Wales* (2nd Edition), (London, 1819)

Richard Fenton, *Tours in Wales 1804-1813* (John Fisher, ed.), (London, 1917)

H.D. Hughes, *Antiquities of Llandegai and Llanllechid* (Caernarvon, 1883)

E. Hyde Hall, *A Description of Caernarvonshire (1809-1811)* (Caernarvon, 1952)

Raymond Millbank, *The Highs and Lows of an Evacuee: North Wales 1939-45*, (2006)

No. Owen, *Caernarvonshire, a sketch of its history*, 1792.

Maps and Plans

BU/Map 36 (Un-cat)

BU/Map 99.

BU/PenrhynMap 59.
 BU/Penrhyn Maps No. 106.
 BU/Penrhyn Map 202, 'Leveling for Canal 1799 with Estimate'.
 BU/Penrhyn/Maps 305.
 BU/Penrhyn/Maps 306.
 OS Outdoor Leisure 17.

Newspapers and Journals

Bangor Mail 9th May 1990.
Gore's General Advertiser, 15th December 1796.
Gore's General Advertizer, 24th April 1800.
Liverpool Mercury 10th July 1972.
London Gazette, 9th February and 13th April 1800.
London Gazette Issue 15665.
London Gazette, 15th June 1956.
North Wales Chronicle 10th May 1836.
North Wales Chronicle 9th March 1841.
North Wales Chronicle 28th April 1846.
North Wales Chronicle 26th May 1846
North Wales Chronicle 9th June 1846.
North Wales Chronicle 8th September 1846.
North Wales Chronicle 26th January 1847.
North Wales Chronicle 2nd March 1847.
North Wales Chronicle 23rd March 1847.
North Wales Chronicle 26th September 1848.
North Wales Chronicle 25th November 1848.
North Wales Observer and Express, 21st December 19-6.
Slater's Directory of Liverpool and its Environs, 1844.
Slater's (Late Pigot & Co.) Royal National and Commercial Directory and Topography, (Manchester & London, 1850).
Slater's (Late Pigot & Co.) Royal National and Commercial Directory and Topography (Manchester & London, 1853).
Slater's Directory of North Wales 1856.
Slater's (Late Pigot & Co.) Royal National and Commercial Directory and Topography 1858-0, (London, 1859)
Slater's Directory of North Wales, 1880.
Slater's Directory-North Wales, Cheshire, and Shropshire with Liverpool 1883
Slater's Directory-Western, 1868

Barrie K. Lill, *Richard Pennant, Samuel Worthington, and the Mill at Penlan*

Slater's Directory of North & Mid Wales 1895.

Sutton's Directory of North Wales, 1890.

The Caledonian Mercury, 31st December 1804, Issue 12998.

Worrall's Directory of North Wales' 1874.

Paintings, Engravings, and Images

BGS Images reference P204542,P204543, and P207934.

F.R.Lee, Fishing on the River Ogwen, c.1840.

F.R. Lee, Mill on the River Ogwe, North Wales, c.1857.

Gwynedd/XP, '*Penrhyn Castle from Penlan*', (Newman & Barclay, London, c.1840).

RCAHMW Documents

RCAHMW207 (MI) N.ACC.P.74.

Secondary Sources

Books & Journals

(Author unknown), Photocrom Co. Ltd, *The Penrhyn Quarry* (London, c.1925)

P.E. Baugham, *The Chester & Holyhead Railway, Volume One: The Main Line up to 1880*, (Newton Abbot, 1972)

J.I.C. Boyd, *Narrow Gauge Railways in North Caernarvonshire, Vol.II, The Penrhyn Quarry Railways* (Usk, 1985)

Ivor E. Davies, 'The Manufacture of Honestones in Gwynedd', *Caernarvonshire Historical Society Transactions*, 37, (1976)

E.H. Douglas Pennant, *The Welsh Families of Penrhyn* (Gwasg Ffrancon, 1985)

J.M. Dunn, *The Chester & Holyhead Railway*, (Oakwood, 1968)

CRO, Miss Estelle Dyke, *Chester Archaeological Society*, Vol. XXXVII, pt.II, 1949.

David Gwyn, *Gwynedd Inheriting a Revolution: The Archaeology of Industrialisation in North-West Wales*, (Chichester, 2006)

David Gwyn and Marilyn Palmer (eds), 'The Landscape Archaeology of the Vale of Ffestiniog', *Industrial Archaeology Review*, Vol.XXVII, May 2005

Douglas B. Hague, 'Penrhyn Castle', *Caernarvonshire Historical Society Transactions*, 20 (1959)

Peter Hyland, *The Herculaneum Pottery, Liverpool's Forgotten Glory* (Liverpool, 2005)

M. Hughes, 'The Holyhead Road 1810-1842: A Study in Highway Administration' (Thesis, BU, 1963)

A.R. Jones, 'Melin Cochwillan a'r Melinydd Olaf', *Melin*, 2 (1986)

Peter Ellis Jones, 'The Wyatts of Lime Grove, Llandygai', *Caernarvonshire Historical Society Transactions*, 42 (1981).

Jean Lindsay, 'The Pennants and Jamaica', *Caernarvonshire Historical Society Transactions*, 43 (1982)

F.J. North, *Mining for Metals in Wales*, (National Museum of Wales, 1962)

Jim Woodward-Nutt, *Mills Open, Windmills and Watermills Open to the Public*, (London, 2004)

Oxford Dictionary of National Biography.

N. Owen, *Caernarvonshire, a sketch of its history* (London, 1972)

Marilyn Palmer, Michael Nevell & Mark Sissons, *Industrial Archaeological Handbook* (York, 2012)

Quartermaine, Trinder & Turner, *Thomas Telford's Holyhead Road*, (York, 2003)

R.T.Pritchard, 'The Caernarvonshire Turnpike Trust', *Caernarvonshire Historical Society Transactions*, 17 (1956)

R.T. Pritchard, 'The Post Road in Caernarvonshire', *Caernarvonshire Historical Society Transactions*, 13 (1952)

D. Morgan Rees, *Mines, Mills and Furnaces*, (London, 1969)

John Martin Robinson, 'Samuel Wyatt, Architect' (Thesis, Oriel College, Oxford, 1974). (Bodleian Library, Oxford).

Mike Shiel-Davies, *Watermills of Cumbria* (Nelson, 1978)

Martin Watts, *The Archaeology of Mills & Milling*, (Stroud, 2002)

C.J. Williams, 'The Llandudno Copper Mines', *Caernarvonshire Historical Society Transactions*, 33 (1972)

William Williams, 'A Survey of the Ancient and Present State of the County of Caernarvon', (Trans by E.G. Jones), *Caernarvonshire Historical Society Transactions*, 36, (1975)

Websites

www.archiveswales.org.uk.

www.gracesguide.co.uk/Clarke_and_Dunham.

http://en.wikipedia.org/wiki/Brickwork#Brick_dimensions.

http://en.wikipedia.org/wiki/Brick_tax.

<http://en.wikipedia.org/wiki/Brick>.

http://en.wikipedia.org/wiki/Water_wheel#Undershot_wheel.

www.felincochwillan.co.uk.htm.

<http://freepages.genealogy.rootsweb.ancestry.com/cmhc/lom18wmet.htm>

<http://myweb.tiscali.co.uk/henrecoed/wilkinson/downloads/entry.txt>.

www.futuremuseum.co.uk.

www.mindat.org/loc-153506.html.

www.spanglefish.com.

www.britishlistedbuildings.co.uk/101330335-flint-central-part-of-higher-washford-mill-congleton.

www.wikipedia.org/wiki/Fulling.

www.tapataalk.com/groups/ourscouseforum/herculaneum-pottery-toxteth-t1174.html

<http://welshnewspapers.llgc.org.uk/en/page/view/3609109/ART81/cochwillan>

Appendices

Appendix I: Site Drawings, Coordinates, and Spot Heights

The drawings reflect the site as it was left at the end of 2011. Although a number of alterations have subsequently been made to the site since that date, these in the main relating to the civil works carried out by the owners as part of flood alleviation measures. As they were carried out some time after excavation work had been completed they are not reflected in the drawings.

I.1 Plans and Elevations

- Plan 1 Plan of the complete site, coloured, with grid and levels.
- Plan 2 Plan of the Inner Mill (original flint mill) and cobbled road, coloured, with grid and levels.
- Plan 3 Plan of the Outer Mill (Warehouse Extension) and Stable, coloured, with grid and levels.
- Plan 4 Plan of the Mill, Stable, Spillway, and cobbled road; coloured, with grid.
- Plan 5 Plan of the Upper Yard, with levels.
- Plan 6 Plan of the Spillway, with levels.
- Plan 7 Elevations.

The original plan of the inner mill was draughted by Frances Llewelyn and Barrie Lill. All of the other plans were draughted by Barrie and Ivy Lill. The elevations are based on those originally drawn in 1980 by Frances Llewelyn and her students, updated to show additional detail found during excavation work. The digitalisation of all plans and elevations was carried out by Katharina Moeller.

I.2 Penlan Mill Co-ordinates and Spot Heights

The co-ordinates relating to the Penlan Mill site were taken using a Leica RX1250TC GPS Rover and a Leica TCRP1205 total station where GPS signal was obscured due to the proximity of high elevations, mainly the Railway line viaduct and upstanding remains of the building.

The survey was carried out by Raimund Karl and Barrie Lill on 1st October 2011.

The spot heights are marked on Drawings 1,2,3,5 and 6.

Point ID, Easting, Northing, Ortho Height (in OSGB 84 National Grid Coordinates)

Date: 01/10/2011

0001, 259990.107, 370644.181, 30.045	0008, 260007.151, 370633.264, 29.929
0002, 259995.984, 370646.273, 29.810	0009, 260005.462, 370629.907, 29.899
0003, 260005.451, 370634.429, 30.039	0010, 260006.066, 370631.258, 28.330
0004, 259995.541, 370629.418, 30.767	0011, 260005.894, 370632.369, 28.810
0005, 259990.635, 370637.773, 30.144	0012, 260008.157, 370633.444, 28.241
0006, 260002.049, 370628.732, 30.034	0013, 260009.962, 370633.823, 28.012
0007, 260003.831, 370631.595, 30.042	0014, 260010.009, 370633.686, 27.927
	0015, 260010.108, 370633.414, 27.727

0016, 260010.171, 370633.138, 27.843
0017, 260010.242, 370633.094, 27.915
0018, 260010.609, 370632.429, 27.978
0019, 260010.713, 370631.366, 28.058
0020, 260004.170, 370621.303, 28.195
0021, 259997.613, 370616.062, 28.281
0022, 260040.213, 370626.144, 20.479
0023, 260043.327, 370626.055, 20.231
0024, 260043.329, 370626.058, 20.230
0025, 260045.478, 370625.957, 19.551
0026, 260052.141, 370626.096, 18.846
0027, 260052.866, 370625.705, 17.957
0028, 260060.544, 370625.854, 18.673
0029, 260060.280, 370625.956, 17.589
0030, 260052.716, 370624.401, 18.935
0031, 260044.729, 370623.370, 19.735
0032, 260032.738, 370646.289, 23.062
0033, 260033.646, 370646.188, 22.887
0034, 260032.457, 370646.998, 22.978
0035, 260032.155, 370647.502, 23.088
0036, 260030.601, 370650.498, 23.267
0037, 260030.442, 370649.736, 23.188
0038, 260028.473, 370648.765, 23.317
0039, 260028.404, 370647.851, 23.207
0040, 260029.370, 370645.849, 23.179
0041, 260031.475, 370641.400, 22.973
0042, 260028.033, 370648.875, 23.400
0043, 260025.268, 370654.754, 23.372
0044, 260024.905, 370653.893, 23.337
0045, 260025.280, 370652.924, 23.015
0046, 260025.959, 370651.285, 23.125
0047, 260025.971, 370651.289, 23.126
0048, 260024.830, 370650.371, 23.167
0049, 260023.651, 370652.872, 23.393
0050, 260022.682, 370652.759, 23.453
0051, 260020.084, 370651.752, 23.473
0052, 260019.543, 370652.869, 23.444
0053, 260018.878, 370651.413, 23.479
0054, 260017.951, 370652.432, 23.834
0055, 260025.803, 370645.706, 23.228
0056, 260027.639, 370639.391, 23.160
0057, 260027.095, 370639.398, 23.265
0058, 260026.583, 370639.200, 23.389
0059, 260025.629, 370638.500, 23.804
0060, 260025.912, 370639.215, 23.577
0061, 260025.240, 370636.036, 23.659
0062, 260025.915, 370636.442, 23.501
0063, 260024.688, 370640.636, 23.777
0064, 260024.143, 370641.772, 23.522
0065, 260023.595, 370642.812, 23.878
Date: 11/04/2012

STATION1, 260023.453, 370657.426, 23.451
0070, 260022.605, 370641.675, 24.179
0071, 260021.368, 370642.088, 23.909
0072, 260020.138, 370641.747, 23.309
0073, 260020.095, 370640.414, 24.245
0074, 260017.488, 370640.092, 24.190
0075, 260014.756, 370637.675, 24.100
0076, 260014.776, 370639.116, 24.200
0077, 260015.336, 370639.036, 23.781
0078, 260012.482, 370638.385, 24.530
0079, 260013.006, 370639.509, 24.352
0080, 260011.680, 370638.376, 23.618
0081, 260012.492, 370640.081, 23.042
0082, 260013.688, 370640.390, 23.377
0083, 260015.169, 370641.252, 23.565
0084, 260011.417, 370639.448, 24.252
0085, 260010.027, 370637.756, 24.267
0086, 260008.085, 370635.957, 24.174
0087, 260007.079, 370638.203, 24.086
0088, 260005.620, 370640.373, 24.056
0089, 260008.488, 370639.948, 24.239
0090, 260011.191, 370641.247, 24.255
0091, 260012.257, 370642.279, 24.345
0092, 260011.283, 370642.547, 23.463
0093, 260012.555, 370642.885, 23.324
0094, 260010.960, 370643.288, 24.201
0095, 260010.907, 370644.030, 23.664
0096, 260008.079, 370642.857, 24.226
0097, 260009.481, 370639.632, 24.031
0098, 260012.027, 370640.886, 23.992
0099, 260013.388, 370645.621, 24.238
0100, 260014.535, 370642.880, 24.232
0101, 260017.030, 370643.706, 24.208
0102, 260016.432, 370645.337, 24.032
0103, 260017.576, 370643.200, 24.014
0104, 260018.182, 370643.901, 24.088
0105, 260018.165, 370643.932, 24.088
0106, 260022.081, 370643.949, 24.293
0107, 260021.489, 370644.952, 24.422
0108, 260021.347, 370645.835, 23.746
0109, 260015.870, 370647.238, 24.337
0110, 260017.401, 370647.859, 24.625
0111, 260018.378, 370648.450, 24.727
0112, 260018.880, 370648.500, 24.787
0113, 260020.240, 370645.937, 24.242
0114, 260019.651, 370647.219, 23.881
0115, 260019.980, 370647.452, 23.583
0116, 260022.868, 370645.739, 22.839
0117, 260025.201, 370646.750, 22.341
0118, 260024.956, 370647.086, 22.239
0119, 260026.983, 370658.276, 23.316

0120, 260028.188, 370652.389, 23.244	0155, 260016.368, 370651.954, 24.102
0121, 260030.456, 370647.005, 23.161	0156, 260014.878, 370656.422, 24.177
0122, 260031.331, 370645.553, 23.010	0157, 260017.712, 370648.809, 24.206
0123, 260031.575, 370640.767, 22.915	0158, 260011.355, 370651.501, 24.205
0124, 260025.381, 370638.114, 23.520	
0125, 260035.309, 370632.714, 22.055	STATION2, 260020.198, 370608.650, 27.105
0126, 260036.081, 370631.910, 21.135	0159, 260014.359, 370633.019, 24.498
0127, 260020.546, 370651.358, 22.953	0160, 260014.536, 370632.713, 23.599
0128, 260014.510, 370658.949, 24.325	0161, 260014.945, 370631.693, 24.415
0129, 259999.841, 370653.329, 25.031	0162, 260015.634, 370632.440, 24.228
0130, 259968.821, 370643.663, 30.806	0163, 260017.422, 370634.113, 24.533
0131, 260013.963, 370656.887, 23.916	0164, 260017.483, 370633.795, 23.643
0132, 260014.744, 370657.215, 23.806	0165, 260017.158, 370632.674, 24.192
0133, 260015.986, 370656.642, 23.823	0166, 260016.909, 370633.182, 24.087
0134, 260017.163, 370653.838, 23.782	0167, 260018.481, 370633.500, 24.114
0135, 260018.041, 370652.533, 23.760	0168, 260012.998, 370630.247, 25.135
0136, 260018.958, 370651.257, 23.445	0169, 260016.329, 370632.555, 23.942
0137, 260018.396, 370650.226, 24.140	0170, 260016.989, 370631.748, 24.253
0138, 260016.542, 370653.860, 24.136	0171, 260018.978, 370634.587, 23.907
0139, 260015.138, 370656.915, 24.265	0172, 260020.602, 370635.317, 23.613
0140, 260010.721, 370654.721, 24.196	0173, 260021.303, 370635.622, 23.628
0141, 260008.540, 370653.742, 24.364	0174, 260020.286, 370635.840, 24.497
0142, 260008.347, 370651.791, 24.196	0175, 260020.870, 370633.656, 23.948
0143, 260010.101, 370647.702, 24.248	0176, 260022.060, 370635.317, 23.462
0144, 260011.284, 370645.737, 23.875	0177, 260023.378, 370635.730, 23.406
0145, 260001.995, 370651.067, 24.681	0178, 260024.943, 370635.753, 23.600
0146, 260001.980, 370650.501, 24.474	0179, bad reading (no coordinates logged)
0147, 260005.007, 370646.112, 24.354	0180, 260004.042, 370627.589, 30.023
0148, 260006.321, 370643.297, 24.196	0181, 260003.592, 370622.442, 30.005
0149, 260005.070, 370649.222, 24.300	0182, 260005.266, 370621.918, 29.527
0150, 260007.391, 370646.239, 24.157	0183, 260004.372, 370621.015, 28.193
0151, 260008.635, 370646.867, 24.115	0184, 259999.055, 370620.086, 28.107
0152, 260010.849, 370646.730, 23.915	0185, 259999.186, 370596.072, 28.323
0153, 260010.550, 370647.190, 24.088	0186, 260016.225, 370534.780, 28.934
0154, 260012.170, 370646.579, 23.320	0187, 260032.595, 370505.182, 28.833

Appendix II: Wyatt's Description of the Penrhyn Tramway

The following entry was made by Benjamin Wyatt in the Visitors Book of the Capel Curig Hotel at some time between 21st and 29th October 1803 and relates to his 'invention' of the Penrhyn Tramway.

'1803

Account of the Penrhyn Iron Railway by the Inventor, Mr Benjamin Wyatt.

The following Account of the Penrhyn Railway, will, I flatter myself, be acceptable to many of your Readers.

The Rail hitherto made use of in most Railways is a flat one, three feet in length, with a rib on one edge to give it strength, and to prevent the Wheels [which have a flat rim] from running off.

Observing that these Rails were frequently obstructed by Stones & Dirt lodging upon them; that they were obliged to be fastened to single Stones or Blocks on account of their not rising sufficiently high above the Sills to admit of graveling the Horse-path; that the sharp Rib standing up was dangerous for the Horses; that the Strength of the Rail was applied the wrong way; & that less surface would create less friction; led me to consider if some better form of Rail could not be applied: the oval presented itself as the best adapted to correct all the Faults of the flat Rail, & I have the Satisfaction to say that it has completely answered the Purpose, in a Railway lately executed for Lord Penrhyn, from his Lordship's Slate-quarry in Carnarvonshire, to PortPenrhyn, the place of Shipping. The wheel made use of on this Rail has a concave Rim, so contrived in its form, & the wheels so fixed upon their Axis, as to move with the greatest facility in the sharpest curves that can be required. It is plain, by inspecting the Section of this Rail, that no Dirt can lodge upon it; that it must be stronger than any other form of the same Weight, to resist both the perpendicular & lateral Pressure; that it must occasion very little friction; that it presents no Danger to the Horses; & that it may be placed upon the Sills, so as to admit of a sufficient quantity of Gravel to cover them.

These Advantages have so forcibly struck all who have seen & examined this Road, that I have been induced to lay it before the Publick thro' the Medium of the Repository of Arts and Manufactures. The Penrhyn Railway is six Miles and a quarter in length, divided into five Stages. It has three-eighths of an inch in a yard, with three Inclines; was begun in October 1800, and was finished in July 1801.

On this Railway two Horses will draw 24 Waggons on Stage six times a Day, and carry 24 Tons each journey, which is 144 Tons per Day. This Quantity used to employ 144 Carts, and 400 Horses; so that ten Horses will, by means of this Railway, do the Work of four hundred.⁴⁹¹

It is interesting to note that while Wyatt claimed to be the inventor of the iron tramway, he did not patent it. Possibly this was because he could not be sure that it was indeed his own conception, particularly as in July 1793 William Jessop, writing from Holyhead, had already submitted such a proposal to Lord Penrhyn.⁴⁹² In his submission Jessop proposed the use of iron rails with small horse-drawn carriages running on cylindrical iron wheels. The overall cost was estimated to be no more than £5000, with annual savings of between £1000 and £1500 per annum. This compared with Dadford's estimate of £3400 for a canal (plus major running costs); or £8328-5-0 for a tramway. However, as generally the eventual tramway is credited to Benjamin Wyatt, it is likely that he merely adapted the ideas put forward by Jessop and Dadford and claimed them for his own.

In September 1801 a calculation was made comparing the cost of conveying slates from the Quarry to the Port, by using the rail road instead of the traditional horse and cart. Based on a total shipment of 72 tons per day the saving was estimated to be £3369-12-0 per year. Based on shipments of 108 tons per day this rose to £5054-8-0, and on 144 tons per day to £6739-4-0. These figures were based on 6 journeys a day with 15 wagons per horse. Each horse would travel from 12-14 miles; sometimes more than 6 journeys to make up for accidents and delays.⁴⁹³

⁴⁹¹ Gwynedd/XM/5171/1. This is an extract from the Visitor's Book' of the Capel Curig Hotel; apparently written by Wyatt himself. It appears between entries dated 21st October 1803 and 29th October 1803.

⁴⁹² BU/PFA/12/14(a). Submission to Lord Penrhyn dated 21st July 1798, countering Dadford's proposal for a canal.

⁴⁹³ BU/PFA/12/11.

