Penny Rigg Copper Mill, Cumbria

Conservation Management Plan

Prepared for

The Lake District National Park Authority

On behalf of the DSTC Commoners

Report date: December 2010

Report no. 0091/2-10

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Acknowledgements

It would not have been possible to write this report without the help of a considerable number of people. Initially, we would like to thank Peter Fleming, Alastair Cameron, Don Borthwick, David Bridge, Ian Matheson and countless other members of CATMHS who have contribute their time, research and expertise to the production of this report, including providing many of the images and much of the source material (which they have kindly given their permission for us to reproduce). In particular we would like to thank John Brown who led an excellent site tour at Penny Rigg for us, and to all the members of the CATMHS team working hard to clear the adit after the winter floods – good luck guys! Once more we owe a debt of gratitude to Victoria Slowe, curator of the Ruskin Museum, who has given her time and knowledge and to Julian Lambton of Carter Jonas for discussions on behalf of Rydal Estates. In addition, we are grateful to staff at English Heritage and those at Natural England who have advised on the project including Sue Evans on ecology and Hannah Townley on geology and to Dr Janet Simkin who has provided invaluable advice on lichens. Our appreciation is also due to all those who took part in the Coniston Copper Mines and Penny Rigg questionnaire, and various other members of the local community who have contacted us with thoughts, information and recommendations: we are truly grateful to everyone who contributed. Finally, but by no means least, we would like to thank John Hodgson and Eleanor Kingston of the Lake District National Park Authority (LDNPA) for commissioning the study and for all their help in putting it together. Thanks are also due to their technical team, especially Rosemary Long who stepped into the breach with little notice to provide mapping and data. Our apologies to anyone we have omitted to mention.

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Report date November 2010

Summary

Penny Rigg Copper Mill is a prime example of a single phase, medium sized, 19th century ore dressing and processing plant associated with Tilberthwaite Copper Mine, one of the oldest copper mines in the region. It belongs to an important group of Cumbrian mines, including the Coniston Copper Mines, which together comprise the largest concentration of copper mines outside Devon and Cornwall. As well as the Mill the site also includes Penny Rigg Quarry, an impressive 18th and 19th century quarry pit, Horse Crag Quarry, and a number of smaller slate quarries in the vicinity. Mill, mine and quarries all contribute to a rich and very varied 18th and 19th century industrial landscape which is considered to be of both national and regional significance.

There has been a quarry at Penny Rigg since at least the mid 18th century; extracting the fine blue-green Coniston slate which was used extensively across Northern England as both roofing and flooring material. The quarry was already transporting over 600 tons by 1752 but production slumped in the late 19th century when the Penny Rigg Copper Mill was opened. John Barratt, a local mine owner, saw the potential of opening a tunnel from Penny Rigg to join with the old Tilberthwaite mine at the head of the gill. Tilberthwaite had been operating since the Elizabethan period but was prone to flooding, making it unprofitable and problematic to work. Barratt's level –The Deep or Horse Crag Level - was to eventually measure nearly 1000m long and was intended to drain the mine and improve access. To serve his new venture, Barratt built the Penny Rigg Copper Mill where ore could be sorted, crushed and processed before being sent for smelting. The mine remained in production until the end of the 19th century but was never particularly successful or profitable and the mill closed finally in the 1890s. Following the decline of the mine the quarry once more prospered with production continuing on site well into the 1990s.

The historical and archaeological value of Penny Rigg is largely matched by its ecological significance. It includes part of the Tilberthwaite Gill Site of Special Scientific Interest (SSSI) and a block of Ancient-Semi Natural Woodland; that is woodland believed to have been in existence before 1600. The gorged out rock ledges, micro habitats and the spoil heaps all associated with the historical legacy support some specialised species and communities. Potentially these may include rare lichens. Bats too are likely to thrive in some of the artificial ruins, levels and closeheads. In addition, the setting of the site is significant, located at a transitional point between two different landscapes – the bleak wilderness of the high fell, and the fertile farmland of the valley floor.

The site is also an important recreational facility which is popular with local mine explorers and with climbers, who traverse a series of bolted routes across the imposing face of Penny Rigg Quarry. The surrounding fells are cherished by walkers and gill scramblers, as well as by more general short-term visitors who come to visit the archaeological remains. Good car parking facilities and road access contribute to its popularity with visitors. The archaeological, geological and ecological importance of the site make it of considerable educational potential, although site interpretation is currently very

poor and there is a need for improvement to enhance the experience and appeal for both existing and new users.

The physical condition of the mill and the quarry buildings is also a cause for concern with the site in immediate need of consolidation, some structures being at considerable risk. This situation has been exacerbated by the winter floods of 2009/10 which washed a swathe of water through the site, undermining some of the mill buildings. However, like many of the country's industrial sites, Penny Rigg is naturally in a state of gradual decline, largely due to the exposed nature of the remains and this is a key part of its character and unique 'sense of place'. Successful management is, therefore, dependant on balancing the process of attrition with conservation needs in order to preserve the mill, mines and quarries for future generations. There are also a number of other factors which potentially threaten the site including mountain bikes and scramblers using the spoil and rid tips, and the re-use of one of the buildings as a bothy. At present there is no form of legislative protection at Penny Rigg in the form of either Listed Building or Scheduled Monument status, although this would be strongly recommended for the future.

Plate 1: *view south west along Penny Rigg Quarry.*

'' The township of Tibberthwaite, which extends to the northern boundary of the County, and is a very hilly tract, abounds with quarries of excellent blue slate."

(Extract from J Corry's History of Lancashire 1825, 529)

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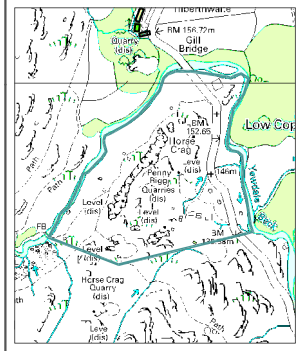
Title:

Figure 1: Site location

Notes:



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1000m

Key:

- Site Boundary
- Scheduled Monument

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1.0 INTRODUCTION

This Conservation Management Plan (the Plan) was commissioned by the Lake District National Parks Authority (LDNPA) as part of the broader assessment looking at the Environmentally Sensitive Area (ESA) of the Coniston Fell, Seathwaite Fell and Torver High Common (DSTC); the Penny Rigg Copper Mill (Figure 1) forming part of this area.

Penny Rigg is a prime example of a single phase 19th century copper mill and ore dressing floors and is particularly important because all the major stages of ore production are preserved on site. Production moved down the site, from north to south, with the ore transported from the crushing house at the top, and then filtering all the way down to the final stage of settling and buddling on the banks of the beck. As such, this is one of the best preserved mills in the county and comparable to the Upper Mill at Coniston Copper Mines; which is actually in a poorer state of preservation although more complex.

As well as the mill there are a varied range of other industrial features in the area which provide a broad context for the site. Not least, this includes the Horse Crag Level or Adit which extended all the way to Tilberthwaite mine and provided ore to the mill. There are also a number of small surface quarries and numerous closeheads in the vicinity, and one large pit quarry: Penny Rigg. Historically, the quarries were of considerable importance to the local economy and there still survives a number of buildings connected with the working and dressing of the stone. Such smaller, more humble, sheds provide a good contrast with the larger, planned mill and together contribute to a rich and very varied 18th and 19th century industrial landscape.

The aim of this document is to develop a strategy for the informed management and conservation of the Penny Rigg Copper Mill and Quarries, some of which might be developed through further agri-environmental funding. Such a strategy must be based on a sound understanding of the various aspects which contribute to the multi-faceted significance of the site including visitor enjoyment, setting and educational potential, as well as their archaeological, historic and ecological importance. An assessment of factors which might potentially jeopardise any aspects of this significance are then considered and a strategy and management plan proposed to mitigate against any of these potential risks and ensure the future preservation, accessibility and enjoyment of the site for all.

Brief Description

There has been a quarry at Penny Rigg since at least the mid 18th century, extracting the fine blue-green Coniston slate which was used extensively across Northern England as both roofing and flooring material. In the mid 19th century, John Barratt, who owned the nearby Coniston Copper Mine, first saw the potential of opening a tunnel from Penny Rigg to join with the Tilberthwaite mine at the head of the gill. Tilberthwaite had been operating since the Elizabethan period but was prone to flooding, making it unprofitable and problematic to work. Barratt intended that the new level would

provide drainage for the mine and improve access, allowing ore to be transported direct from the working lode. The tunnel was begun in 1849, but not completed for nearly ten years.

To serve his new venture, Barratt built a copper mill at Penny Rigg where ore could be sorted, crushed and processed before being sent for smelting. The mine and mill remained in production until 1875, when both were sold - along with the Coniston Mine - to Thomas Wynne. Tilberthwaite was subsequently worked intermittently until the end of the century but was never profitable. In contrast, production at the quarry increased as transport improvements, particularly the introduction of the railway, meant the slate could be shipped much more easily over greater distances. The then owner, Thomas Warsop had re-opened Penny Rigg in 1892, and soon after started quarrying the slate around the portal of Horse Crag Level. Finally, in 1897 the copper mill was finally dismantled.

In the 20th century the fortunes of the mine had a brief reprieve but by 1933 production had finally ceased. The quarry continued to operate and a new closehead at Horse Crag was opened by the Swedish mining engineer and prospector, Oscar Gnosspelius, and his partner John W Shaw. However, this too ceased in 1938. Quarrying recommenced on a small scale in 1989 but by 2000, due to problems of access, this also closed, marking the final phase of production.

Structure of the Plan

The Plan has been prepared in stages in accordance with the Heritage Lottery Fund guidance on Conservation Management Planning (HLF 2005).

Stage 1 - Understanding the Heritage – This section is intended to provide a sound understanding of the Penny Rigg Copper Mill and its environment. It includes a summary of the mill's history and how this relates to the surviving archaeology on site. It also includes an assessment of the ecological significance of Penny Rigg, and a consideration of the cultural importance of the site to those who live, work and visit the area. This material is used to inform the second stage of the report. Where further research is needed to properly understand a certain area this is highlighted as 'Gaps in our Understanding' and listed at the end of each relevant section.

Stage 2 - Defining Significance – Based on the understanding of the heritage asset gained through Stage 1, a Statement of Significance has been prepared according to current guidance from English Heritage (English Heritage, 2008). This section aims to place the mill in its local, regional and national context but also to understand what it is that contributes to Penny Rigg's particular significance. The purpose of this is to ensure that this is preserved into the future, and to identify anything which might put the site at risk.

Stage 3 – Protecting Significance – Again, based on the information from site visits made during Stage 1, and through consultation with stakeholders, the key risks and issues facing Penny Rigg have been identified, as well as any potential opportunities. The information in this section includes a

preliminary assessment of condition. This also appears on a site-by-site basis in the accompanying site gazetteer (Appendix 1) and is summarized in Appendix 4. A series of policies have been formulated to address the issues raised in this section. Although often included in a separate section, the current plan places proposed policy alongside the issue concerned so that the information is more immediate and apparent.

Stage 5 – Managing the Future – The Plan culminates in a management plan which proposes a short, mid and long term strategy for the conservation and renovation of the fabric of the site, as well as plan for improving and enhancing the Copper Mill as a heritage asset.

Terminology

There are a number terms which are specific to the copper mining and quarrying industries. A glossary of these has been included in the appendices (Appendix 2). Proper Names are referred to when they denote specific elements of the site such as Powder Store, but where such terms occur without capitalisation then the term is used descriptively rather than referring to a specific structure. Similarly, the Mill is capitalised when it refers to the site specifically. Copper mine - as opposed to Coppermine - has been used throughout except when referring to a specific place or venture e.g. Coppermine Valley. All other spellings and site names are after Holland (Holland 1981). The Level at Penny Rigg is known both as the Deep Adit and Horse Crag Level; the latter has been used throughout this document to avoid any confusion with the Deep Level at Coniston.

Each of the main features has been ascribed a unique project identification number, listed and detailed in the accompanying site gazetteer (Appendix 1) and illustrated in Figure 4. Imperial measurements have been used in the historic text as this is system in which the equipment was designed, however, the measurements taken during the site survey are in metric, although conversions have been included where relevant (i.e. for wheel diameters)[1].

Scope of the project

The project covers an 11 hectare area which extends to east and west of the Coniston to High Tilberthwaite Road (Figure 2). This includes the Copper Mill, the main quarry to the north and the 19th century Copper Mine. This area was chosen as a cohesive project group - bound by period, ownership and use - but industrial remains can be found on both sides of Tilberthwaite Gill and Yewdale Beck, extending out all the way along to Tilberthwaite Mines (HER 3151) and beyond. There is some reference made to this material where relevant but it has not been covered in detail except for the small quarry and related building (2071 and 2072) to the south-west of Horse Crag Quarry. This does not form part of the project area but was felt to be important enough to warrant inclusion: it does form part of the original HER (18493).

[1] Basic conversions include: 1ft (12 inches) equals 0.31m; 1 fathom (6ft) equal 1.83m, and 1 ton equals 1.02 metric tonnes

Unfortunately, it was necessary to limit the project area in this manner but hopefully the recommendations made will be applicable to other sites across the fells in the longer term. The project covers only above ground features and not any of the below ground archaeology; although this has been referred to where relevant

Consultation and Stakeholders

A number of official bodies, groups and individuals have an interest in the Penny Rigg and have been consulted in the preparation of this Plan (although not all responded). The following list of stakeholders is divided into two groups. The first are those who have some day-to-day involvement with the site, either in terms of management or as regular users. The second group are interested parties contacted in the review and consultation exercise, this includes potential users of the site in the future.

Those stakeholders identified as playing a key role in the future of the mill were (in no specific order):

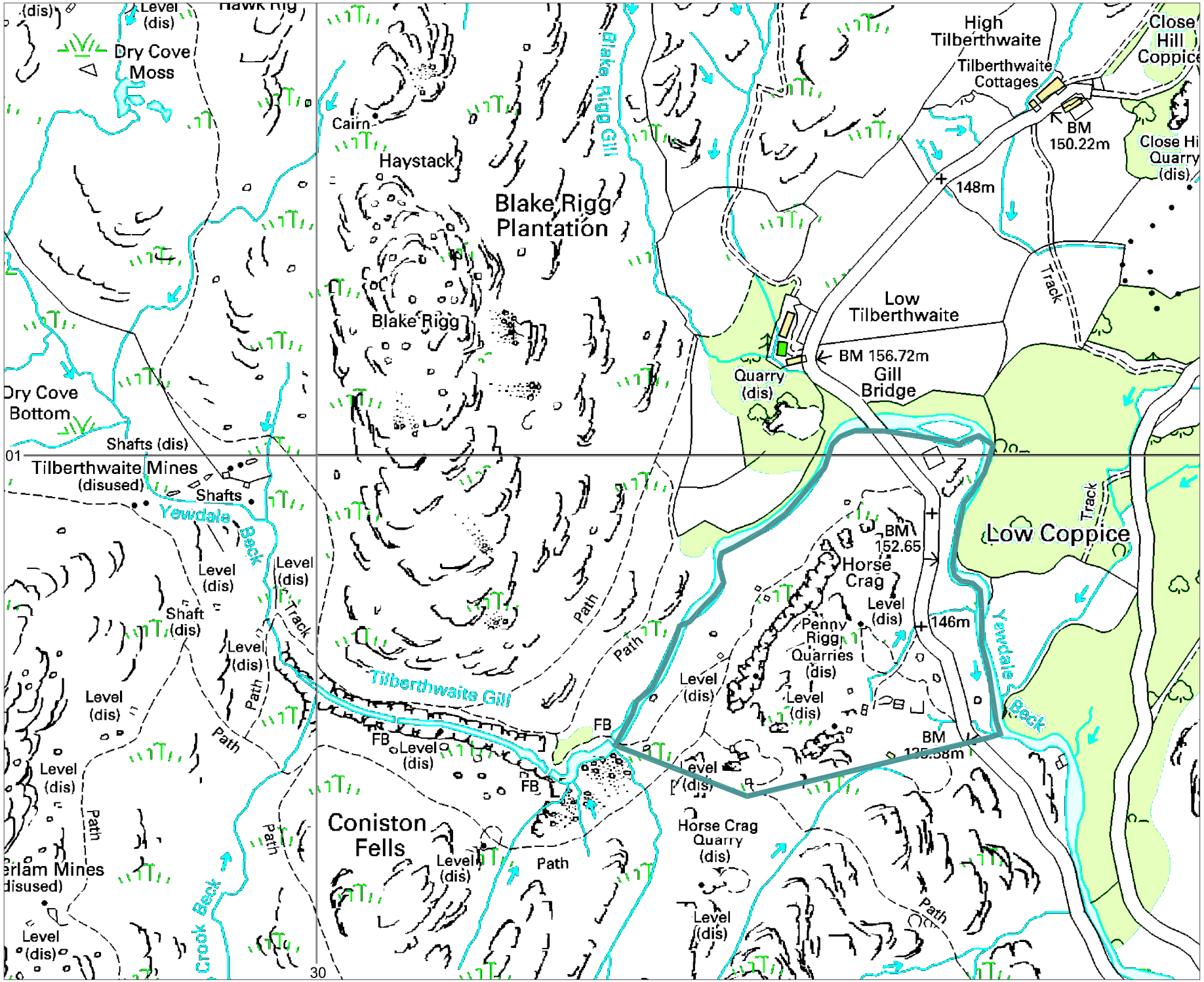
- The Lake District National Park
- Rydal Estates (land owners)
- Cumbria Amenity Trust Mining History Society (CATMHS)
- The DSTC Commoners Association
- Natural England
- English Heritage

Other parties consulted included:

- Mines of Lakelands Exploration Society (MOLES)
- Local Schools
- Local Outdoor Groups
- The Coniston Local History Group
- The Parish Council
- The Ruskin Museum

A general questionnaire (Appendix 3) covering both Coniston Copper Mines and Penny Rigg Mill, was sent out to most of those listed above. People were also encouraged to telephone or email with their thoughts, concerns and issues. Those stakeholders who had a more direct association with the day-to-day management of the site where consulted directly and invited to comment on the draft report.

Plate 2: *general view across the Penny Rigg Copper Mill in 2009 (photo courtesy of Alistair Cameron)*



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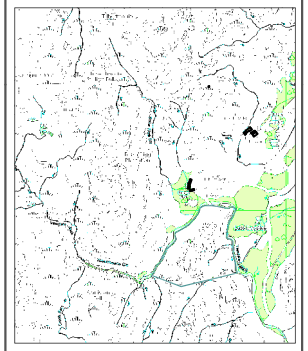
PENNY RIGG COPPER MILL CONSERVATION MANAGEMENT PLAN

SITE:	Penny Rigg Copper Mill

Title:

Figure 2: Project area

Notes:



North

Scale: 1:4000

200m

Key:

Project Boundary

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2.0 UNDERSTANDING THE SITE

2.1 BACKGROUND INFORMATION

Location

Penny Rigg Copper Mill (SD 30638 00739) is located approximately 3km north of Coniston in the southern Lake District (Figure 1). The site lies predominately on the western side of the Coniston to High Tilberthwaite road, although features do continue on the east side of the road, extending down to the bank to Yewdale Beck. The Copper Mill, and adjacent quarry, sits on a promontory at the base of the fells which is almost encircled by the beck which runs down from its source on Tilberthwaite High Fell. The water flows through the steep sides of a rock cut gully where it becomes the Tilberthwaite Gill before shallowing out and meandering around Horse Crag to once more form the Yewdale. The beck eventually flows into Coniston Water just north of the village at Robin Wray. The beck bounds the site on three sides, running swiftly through the rock strewn gill to the west and slower over the sand banks and gravels to the east. To the south, a series of small streams snake down from the surrounding high ground to converge with the beck along its course.

Old mines and quarries are scattered all across this wild landscape. At the head of the beck lies Tilberthwaite mine, first formed under the auspices of the Mines Royal in the 16th century but continued to produce ore well into the 19th century; although never as successful as Coniston Copper Mines further to the west. Further north are the remains of Greenburn mine, another early venture, and to the west Wetherlam mine. There was some mining in the 18th century but by this stage the area around the head of the lake was possibly becoming more famous for its quarries which produced a fined grained blue-green slate which was to become renowned across much of the north of the country as roofing material.

Penny Rigg is accessed via a sharp branch off the A593 which runs to the north of Coniston. The road climbs steeply past the site - the ruins of the mill clearly visible from the road – and there is a small LDNPA car park where the road bends around the bottom of the Horse Crag promontory. From the car park steps lead up to the quarry which is popular with walkers and climbers. The site is 135.58m OD at its lowest point - on the road to the south of the mill - and just over 200m at the top of Horse Crag.

Ownership

The site is owned by the Le Fleming family and forms part of the Rydal Estates, administered by Carter Jonas LLP of Kendal. One of the Copper Mill buildings (2032) is let out for occasional use by the estate (J Lambton *pers. com*). This building has been roofed over and a wood burner or heater of some kind installed.

Statutory Designations

The Copper Mill, Level and adjacent Quarry are not protected by any statutory archaeological designation, although that they do form part of the Lake District National Park Historic Environment Record and are so offered limited protection via the planning process. The nearest Listed Building is High Tilberthwaite Farmhouse (LB 2/58), a 17th century roughcast stone building, with a local slate roof, which lies just 120m north of the project area.

The site was reviewed by English Heritage as part of Stage Three Monument Protection Programme (MMP) looking at the quarrying industry. Recorded as *'Tilberthwaite Quarry - adit, stable, dressing shed, hut, spoil heaps, tramway, working face'* - it was recommended as being a site of '*clear national importance, for which statutory protection will normally be appropriate'* but as yet no further action has been taken.[1]

Site of Special Scientific Interest (SSSI)

A small section at the north western edge of the site is part of the Tilberthwaite Gill Site of Special Scientific Interest (SSSI). As such the ecology of this area is protected under the Wildlife and Countryside Act 1987 as amended by the Countryside and Rights of Way Act 2000. This means that Natural England needs to be contacted before any activity is undertaken which could threaten the notified features of the site both within the boundary of the site or in its hinterland, which might be considered to be substantial parts of the surrounding area. This would include changes to drainage, spraying and any ground or standing structure disturbance.

Ancient Semi-Natural Woodland (ASNW)

The Tilberthwaite Gill is also a pocket of Ancient Semi-Natural Woodland; that is woodland believed to have been in existence before 1600. The long continuity of semi-natural ancient woods, and their undisturbed soils, makes them a valuable natural habitat with the potential to support a huge range of wildlife. On the eastern side of the project area the site borders a second, larger, block of ASNW - the Bakestone Barrow Woods.

These designations have direct implications for the management of the archaeological resource. In the first instance, the implementation of any remedial or conservation works on the archaeology would need to take into consideration any potential impact on the SSSI and ancient woodland, both direct and indirect. Likewise, the conservation of the natural environment has the capacity, in some cases, to conflict with the conservation of an historic site.

2.2 THE GEOLOGY OF THE SITE

The geology of the region comprises of rhyolitic and andesite lava flows interbedded with hardened

[1] Citing online reference ' Quarrying' > http://www.cumbria-industries.org.uk/quarrying.htm, assessed 19/09/10

volcaniclastic dust and ashes. This volcanic activity was the result of the closure of the Lapetus Ocean by subduction, some 500 million years ago. Subsequently this has given rise to a succession of deposits - some of which measures up to 8km thick - and is collectively known as the Borrowdale Volcanic Group. Later tectonic activity resulted in a cleaving and faulting of the sequence, and the folding and tilting of the rocks. Cleaving is manifest most clearly in slate deposits which occur across the fells, while the faulting resulted in the formation of mineral rich fissures, concentrated and transported by hydrothermal fluids. These fissures, or veins, contain a complex mixture of different minerals which for mining purposes may be divided into two categories: ore and gangue (Fleming 2007, Adams 1988, Holland 1981).

Copper

Ore has been mined for its mineral content since the Bronze Age (*c.* 2300 – 700BC) while gangue minerals are those which are largely considered to be commercially worthless such as quartz, baryte, fluorite and calcite. The primary suite of minerals at Tilberthwaite are chalcopyrite, arsenopyrite and iron pyrites; the principal copper ore being a brass-yellow chalcopyrite (Holland 1981). Sometime large bodies of ore are found in a pure state, but often it is mixed with gangue, necessitating crushing and dressing to extract the ore (Adams 1998, 12). In rare cases, where the mineral content was high or the enterprise small, this would be undertaken by hand, but more generally this process would be conducted at a copper mill like Penny Rigg. Within the copper mill the raw mineral would be sorted, crushed and filtered leaving a copper concentrate to be sent for smelting.

Slate

The slate of the Borrowdale series is comprised of fine volcanic dust and ash and found across the region at Tilberthwaite, Borrowdale and Honister (Davies-Shiel & Marshall 1969, 154). It is very different from the dark blue upper Silurian slate found at Kirkby or the Silurian, Ordovician and Cambrian slate found in the Welsh quarries. The Borrowdale slate has a distinct green hue, caused by the high percentage of ferrous oxide in the stone, and it was this colour, as well as the non-porous and non-staining nature of the material, which contributed to its popularity in the 18th and early 19th century, making it for a time the most popular roofing slate in the north of England.

2.3 HISTORIC LANDSCAPE CHARACTER AND SETTING

Tilberthwaite lies on the southern edge of the Cumbrian High Fells District (NCA 8) .[2] This is a landscape characterised by rugged mountains, radiating ridges, steep scarps and glaciated valleys, all contrasting with the green dales of the valley bottoms which contain lakes, rivers, woods and forests. The wild exposed open fells are covered with rough grassland, dwarf shrub heaths, peatlands and bracken, with large areas of outcropping rock and screes. In the south the harder Borrowdale Volcanics result in rugged scenery of exposed crags, ridges and the dramatic vertical rock exposures

[2] Citing online reference 'The Cumbrian Fells, National Character Area 8' > http://www.naturalengland.org.uk/Images/jca08_tcm6-4982.pdf, accessed 23/08/10

characteristic of the Helvellyn, Sca Fell, Buttermere and Langdale ranges. The presence of rock basins, gills, tarns, waterfalls and fast-flowing streams form distinctive elements in the landscape, many of which can be seen across the project area.

The exposed hillsides provide upland grazing - drained by narrow gills and streams - while the lower fells and gently sloping valleys support semi-improved and improved grasslands. In some areas this has resulted in a mosaic of semi-improved grasslands, woodland blocks and scrubby vegetation characteristic of marginal farmland. Off the fells, on the more fertile land of the valley bottom, the landscape is more open with an array of unimproved and semi-improved pastures spreading across the undulating hillsides. The fields are predominantly divided by stone walls and contain small lakes, tarns and ponds as well as small-scale rocky outcrops. Settlement is clustered around small hamlets and farmsteads, many medieval in origin, although the buildings largely date to the 17th and 18th centuries. They are constructed of local, rubble built stone with the distinctive Coniston slate green slate roofs.

Plate 4: *a dividing point between two landscapes: surrounding Penny Rigg on three sides are the hills of the Tilberthwaite and Coniston Fells but in the distance - the east - the land falls down to the fertile farmland of the valley floor.*

Penny Rigg sits on a point dividing the landscape of the fells and the valley lowland. To the north, south and west the expanse of the fells rise up, but to the east the land falls away down to the base of the hanging valley. This marks a transition between the wild, barren landscape of the fells and the more pastoral 'tame' fields and farms of the valley and moraine.

Views

There are a limited number of long views and vistas from the high ground on top of Horse Crag, but

predominantly the undulations of the landscape mean that the majority of views are short, but nevertheless dramatic. The place has a rather intriguing quality to it with things always seeming to lie behind the next crest, or beyond the next turn. This contributes to a feeling of anticipation and discovery which is very much intrinsic to the site's 'sense of place'. It also makes it very easy to become disorientated.

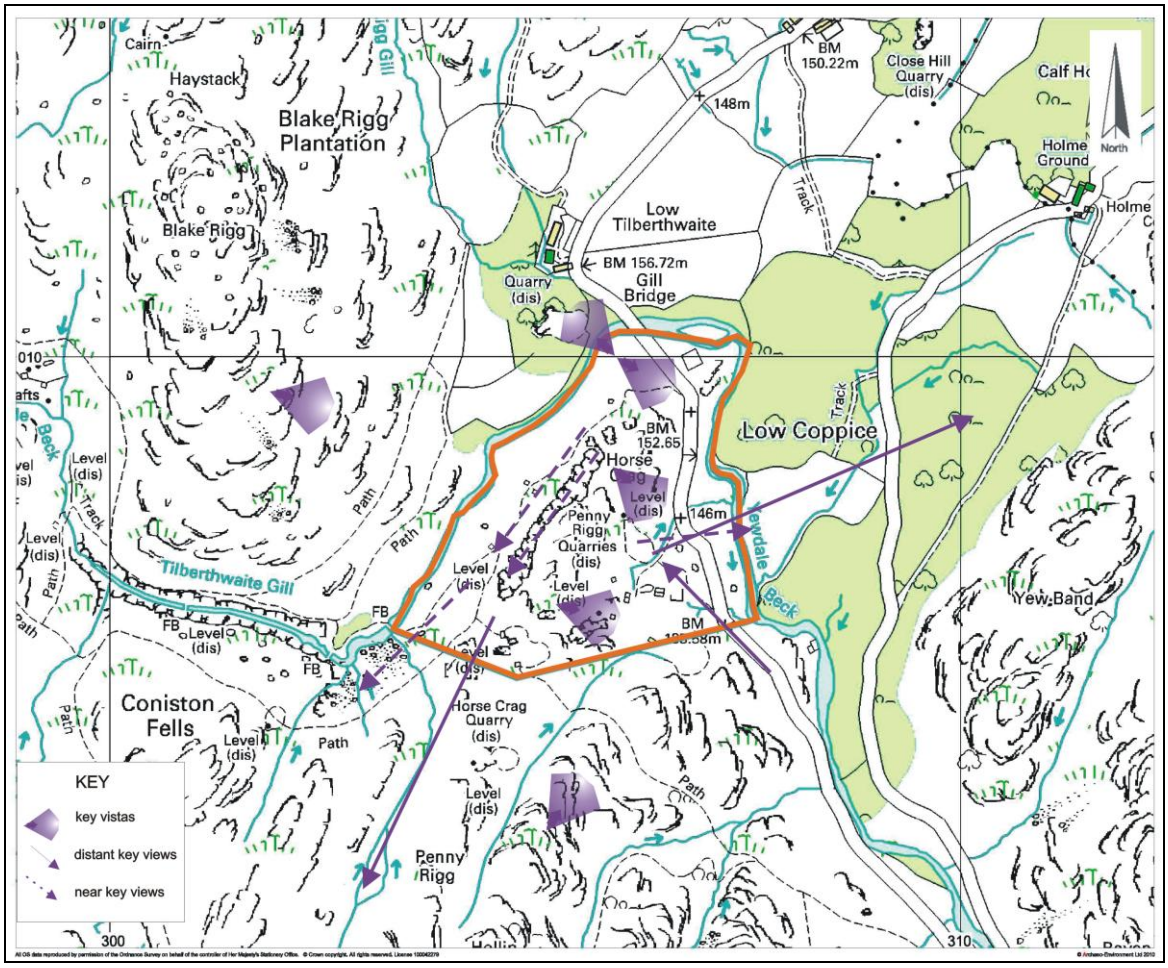


Figure 3: *some of the key views and visas within and around Penny Rigg.*

From the platform at the top of the steps leading up from the car park there are good long views and vistas out across the farmland to the east and the high ground to the north and west: the south is obscured by the brow of the hill. A little further south, over the crest of the hill, there are good views looking down onto the Copper Mill and beyond to the beck. Views to the site are best from a distance, particularly looking down from the surrounding high ground. However, there is also an important view coming up from the Coniston Road as the road bends slightly and the buildings suddenly loom up from the hillside.

Within the site views are limited to short glimpses along key features. There is a good view along the quarry from both ends, although that looking south-west from the northern end is possibly the most significant. There are also views following the course of the various roadways and tracks which carry

the eye in stages down the site. The mill itself lies in a small area of open ground so there are good views towards it in all directions, although from the north it remains largely invisible until you are over the brow of Horse Crag.

Plate 5: *one of the main vistas: looking out from the top of Horse Crag with the High Tilberthwaite and the valley farmland in the background.*

2.4 THE HISTORY AND ARCHAEOLOGY OF PENNY RIGG COPPER MILL AND QUARRY

The following section looks at the history and archaeology of the Penny Rigg mill and quarry. It is intended to provide a broad overview of the development of the site in order to place the surviving structures in context and help inform an assessment of significance. Those archaeological sites identified across the project area are detailed in the accompanying gazetteer (Appendix 1) and illustrated on Figure 4. Each site is referred to by its gazetteer ID number which is placed in brackets e.g. Closehead (1210). It should be noted that this is just a project identification number and not an HER number. At present the whole of the project area is covered by two HER entries – the Quarry and Mines (HER 18493) and the Copper Mill (HER 5608). However, one of the recommendations of the Plan is the expansion of the current HER entries to include some, if not all, of those features detailed in the accompanying gazetteer.

Prehistoric, Roman and Medieval copper mining and quarrying

Copper

Copper ores are found throughout the British Isles and are known to have been exploited from the Bronze Age (*c.* 2300 – 700BC) onwards. Recent research has identified a number of Bronze Age copper mines in southern Ireland, mid and north Wales and the English Midlands. Most of these are comparatively small opencast workings although there are examples (Great Orme, Gwynedd and Mount Gabriel, Cork) of underground operations. However, no prehistoric copper mines have yet been identified in Cumbria or northern England although recent metallurgical evidence would suggest that material was coming from these areas.[3]

Roman mineral extraction was concentrated on the lead and silver-lead deposits of the Mendip, north-east Wales, Derbyshire and the Central Pennines, as well as the gold deposits at Dolaucothi in Carmarthenshire. These operations are likely to have been under military control or licensed by the state. The only known examples of Roman period copper mining are at Llanymynech in the Welsh borders, Alderley Edge in Cheshire and, on the evidence of stamped copper ingots, Parys Mountain in Anglesey. No Roman period copper mines have been identified in Cumbria or northern England.

Lead and silver-lead continued to be the main non-ferrous ores exploited during the Middle Ages. There are few records of medieval copper mining and it is assumed that most copper was imported from continental Europe. No medieval copper mines have been identified in Cumbria but there is a 13th reference to a copper, lead and gold mine in the Derwent Fells near Keswick (Adams 1988, 26).

Slate

Slate has almost certainly been worked in the area since prehistoric times, although the earliest evidence of its use in this country dates to the Roman period. Slate roof tiles have been found at military sites like Segontium (Caernarfon) in Wales and within Cumbria at Hardknott fort in Eskdale, as well as in a domestic context at Whitley villa near Wroxeter. [4] However, it was by no means a widespread practice with terracotta roof tiles being more commonly used even in areas where local slate was plentiful.

It was not until the medieval period that the use of slate for roofs and floors became more widespread. It was used in the great castles built by Edward I (1272 – 1307) including Caernarvon, Conway and Carmarthen, as well as numerous ecclesiastical buildings like Calder Abbey. The first mention of slate in the documentary record of the area is a reference to a slate quarry at Sadgill, Longsleddale in 1283

[3] Citing online reference 'Seeking the origins of bronze tools by Paul Budd' > http://www.britarch.ac.uk/ba/ba36/ba36feat.html, accessed 10/09/10

[4] Citing online reference 'Wroxeter - Early History' > http://hch.shropshire-west.net/hanwood%20jigsaw/hhx%20A.Early%20History.htm and 'The History of slate' > http://www.slateroof.co.uk/Early_days.html, accessed 19/09/10

(Davies-Shiel & Marshall 1969, 154). However, it was not really until the late 17th century that the modern slate industry began.

The 16th and 17th centuries – the genesis of modern industry

Copper

During the 16th century England began to develop its native metals industries. This was due to a combination of wartime needs, expanding demand, and an over reliance on European imports. In the 1560s Sir William Cecil, Secretary of State, invited a group of leading German miners and entrepreneurs to expand and develop the British metal mining and smelting industries. The technologies and skills of the German engineers was renowned across Europe and by the late medieval period they were already using waterwheels to pump water from the mines, grind ore, run blast furnace bellows and operate forge hammers (Holland 1986, 16).

In 1563 Daniel Hechestetter Snr (sometimes Hochstetter), a master miner, was approached by the Crown to oversee the search, extraction and smelting of copper and other ores in Cumberland, Westmorland and Lancashire (Fleming 2002, 1). Hechstetter was an agent of the Haug Company, a successful consortium of merchants who had established links with London. Under the auspices of the newly formed 'Company of the Mines Royal', Hechstetter set about establishing a number of mines across the area, one of the largest and most successful of which was the Goldscope Mine in the Newland Valley. Ore from these mines was transported across the Fells by pack horse and brought to the new smelter on the Greta River at Brigham, near Keswick.

Initially copper mining formed an important part of the Mines Royal but by the early 1600s the company began to concentrate increasingly on more profitable lead mining operations. Further to this, by the middle of the 17th century cheap supplies of Swedish copper began to dominate the European metal markets. The net result was that by the end of the century the first wave of copper mining in this country had all but ceased with little production being conducted in either England or Wales.

Mining at Tilberthwaite during the Mines Royal Period

The date of the first operations at Tilberthwaite is not known, but ore was certainly being produced by the end of the 16th century. In 1599 a survey, led by Lord Scrope, was ordered by the Crown to evaluate the Mine's Royal operations. Although actually delayed till the following year by bad weather, the survey specifically mentions workings at both Tilberthwaite and Coniston Copper Mine to the west. Both of these mines were noted as being in poor production with dilapidated workings (Holland 1986, 24), a factor which points towards them having already been worked for sometime prior to this date. The Tilberthwaite mines (HER 3151) were located 0.5km north-west of Penny Rigg, at the head of Tilberthwaite Gill and there is no evidence of copper mining attributed to this period within the

project area. In fact the vein which was worked by the later mine was at Tilberthwaite, the 19th century miners having to tunnel deep under the gill to reach the vein.

The emergence of the Lakeland Quarries

The earliest documentary evidence of quarrying around Coniston Water comes from shipping records, parish registers and the accounts of contemporaries like Thomas Machell and the landowner Sir Daniel Fleming (Davies-Shiel & Marshall 1969, 155). These all show an increase and formalisation of the local slate industry by the last quarter of the 17th century. By 1688 slate was being exported from Piel Harbour, off the Furness Peninsula, and was probably boated there down Coniston Water. Several quarries are believed to have been operating around the lake by the early 18th century including Coniston, Gaitswater, Walna Scar, Tilberthwaite and Penny Rigg (*ibid*).

The increased demand for slate at this time may have been to do with the 'Great Rebuilding' which had reached northern England by the latter half of the 17th and early 18th century. In general terms this was a wave of architectural improvement and rebuilding which spread across the country from the south, on the back of growing economic stability and changes in the nature of tenancy and ownership. As a result, people began to invest more in the construction of their houses and sought better, longer lasting building materials. This was also a period when ideas of style and taste began to permeate down from the aristocracy to the rising yeoman and merchant classes. As such, the fine green slates of Lake District were in much demand for both flooring and roofing material.

The 18th century: a period of limited expansion

Copper

The Mines Royal Act, passed in 1689, ended the royal monopoly on metals and encouraged private investment in the mining industry. This subsequently led to a revival of copper mining in Devon and Cornwall, the rise of the copper smelting industry in South Wales, and the growth of the Bristol brass foundries. Copper mines also opened in the Midlands (Ecton, Staffordshire; Alderley Edge, Cheshire) and northern England, although these were never on the scale of the mines in the South West. The main use for copper at this time was in brass manufacture and copper sheathing for ships.

The principal 18th century copper mines in Cumbria were at Roughton Gill (Cadbeck), Goldscope (Newlands Valley) and Coniston. At Coniston, Charles Roe and his Macclesfield Copper Company had taken over operations in 1758 with the aim of reviving the fortunes of the abandoned mine. While at Tilberthwaite some small scale production continued - not all of it with the landowner's permission - but by the end of the century the mines were in a very poor state and prone to flooding (Adams 1988, 151). Despite this, the indications were that good reserves of copper remained present; the difficulty was in gaining the ore and successfully transporting it away from the poorly accessible site.

Slate

Slate production in Britain was limited geologically to five key districts - Argyllshire, the Lake District, Cornwall and Devon, south-west Wales and north-west Wales - all situated along the west coast. One of the main problems facing the emergent industry was transport. Slate by its nature was heavy, cumbersome and expensive to move and consequently the land sale of slate was very small. Transport by water was substantially cheaper and those slate producing areas which prospered were those with good access to sea-carriage. South Wales and Cornwall were the largest producers in the 18th century, with slate from the latter being exported as far as the Netherlands and Brittany. As might be expected, the Argyllshire quarries shipped along the western coast of Scotland, but even as early as 1737 there was a record of a cargo of Easdale slate being shipped as far as the London market. Meanwhile the Welsh quarries were shipping large quantities to Ireland. [5]

During the second half of the century production expanded rapidly, but was still relatively low compared to those figures reached in the 19th century. On the eve of the Napoleonic Wars the estimated total output of slate from British quarries amounted to only 45,000 tons. The land sale of slate remained negligible and the water sale, despite its accelerated rate of growth, was still quite low. Of the slate produced, 26,000 tons came from North Wales, 9,000 from Devon and Cornwall and only 6,000 tons from the Lake District. In general, slate production prospered better in the north whereas in the south thatch and tile still remained popular for the majority of vernacular housing and in Derbyshire and Yorkshire locally split limestone provided for a cheaper local alternative. [6]

Penny Rigg is known to have been one of the earliest quarries established in the Coniston area. By 1750 the site was already well established, and le Fleming was receiving considerable revenue in quarry royalties[7]. In January 1752 a stock take of the site recorded that 600 tons of slate, valued at £37 was cut and sitting on the quarry bank waiting processing and transportation (Cameron 1996, 131). However, it was not until the coming of the new century that slate production really began to escalate, and before that century ended the output of slate had reached over 600,000 tons.

[5] Citing online reference 'Historical aspects of the Welsh slate industry' > http://www.slateroof.co.uk/Slate_aristocracy.html, accessed 20/09/10

[6] [6] Citing online reference 'Historical aspects of the Welsh slate industry' > http://www.slateroof.co.uk/Slate_aristocracy.html, accessed 20/09/10

[7] De Fleming Estate Recods 'Papers regarding Coniston Slate Quarry' CRO - WD RY/BOX 21

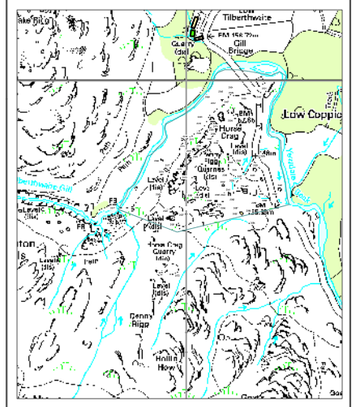
PENNY RIGG COPPER MILL CONSERVATION MANAGEMENT PLAN

SITE:	Penny Rigg Copper Mine

Title:

Figure 4 : Archaeological sites identified at Penny Rigg Copper Mill overlaid on 3rd Edition OS (Key to Gazetteer)

Notes:



North

Scale: 1:2000

100m

Key:

- Site Boundary
- Sites in Gazetteer

010

305

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044-51 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072

Horse Crag

Penny Rigg Quarries

Copper Mine (Disused)

Yewdale Beck

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The 19th century – the construction of Penny Rigg Mill and heyday of the quarries

Copper

Copper mining continued to be an important industry during the first half of the 19th century. Production remained centred on Cornwall and Devon, and to a lesser degree Anglesey, but there was also extensive copper prospection and mining throughout the British Isles and many of the smaller copper mines in Ireland, mid and north Wales and south-west Scotland date from this period. The 19th century also saw major advances in mining technology – high pressure steam pumping engines, compressed air drills, mechanised ore crushing and concentration - which allowed the exploitation of previously unworkable ore reserves. This was coupled with major changes in the capital organisation of the industry which favoured larger mines operating as joint stock companies.

The financial crisis of the 1860s, and the opening up of huge copper deposits in Chile, Australia and North America, caused a dramatic fall in world copper prices and many of the British mines were forced to close. A few mines continued but by the end of the century the British copper industry was all but dead.

The principal copper mines in Cumbria during this period were at Coniston, Roughton Gill, Goldscope and Greenburn. In addition, many of the smaller copper deposits at sites like Longlands, Glendaterra and Birkside Gill, were reworked during the first half of the century.

Taylor and Barratt and the Coniston Copper Mining Company

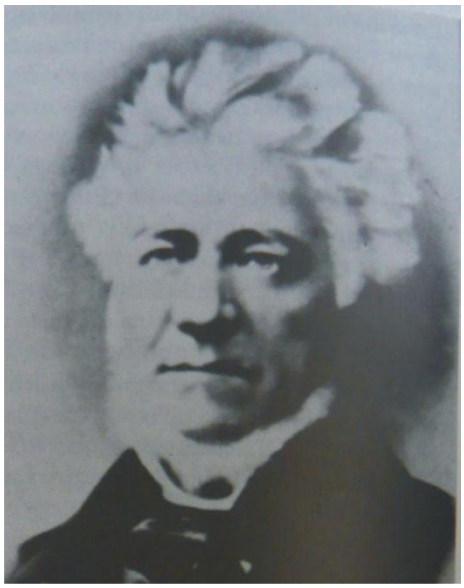


Figure 5: *John Barratt, mine manager at Coniston and subsequent mine owner*

On the 24th September 1824 John Taylor, who was acting as the resident agent at the lead mines in Grassington, took out a 21 year lease on the old Coniston Copper Mines; appointing John Barratt as mine's manager. Barratt (1793-1866) was a mining engineer from Devon whose father had worked at the Wheal Friendship (Mary Tavy) copper mine near Tavistock. Barratt and Taylor set about making radical improvements at Coniston, opening new levels to access the lode to the north of Great Cross-Cut and expanding works along both the Bonsor and Paddy End veins. They also introduced new technologies to all aspects of mining, from gaining the ore to processing and transportation. The result was that by the mid 19th century the mine was producing over 100 tons of ore per month and employing over 600 people in the extraction, and preparation of this valuable mineral.

The huge site was spread all across the Coppermine Valley, and featured 3 dressing mills and 13 waterwheels powering the various pumps, winches and crushers.

In 1850, with Coniston in profit, Barratt turned his attentions to the old Tilberthwaite mine. Taylor had resigned his involvement in the Company in 1841, selling his shares to Barratt in 1842 (Adams 1988, 147).[1] In August 1849 Barratt, and his partners Joseph Mason and James Hambleton, negotiated a new 30 year lease on Tilberthwaite to work the copper mine and the slate quarry (Holland 1986, 26). It was his intention to make the mine viable by driving a new tunnel – the Deep Adit or Horse Level (2039) -from High Tilberthwaite to intersect with the old workings at the top of Tilberthwaite Gill. The new adit was to come in below the group of veins at the head of the gill at an estimated depth of 525ft (125m) and was expected to reach the principal vein – the North Lode – in 7 years at an estimated cost of £3,000. In reality the enterprise took almost 10 years and cost much more than anticipated. Beset with problems, the tunnel covered over 3,240 ft (987m) but never managed to return Barratt's investment.

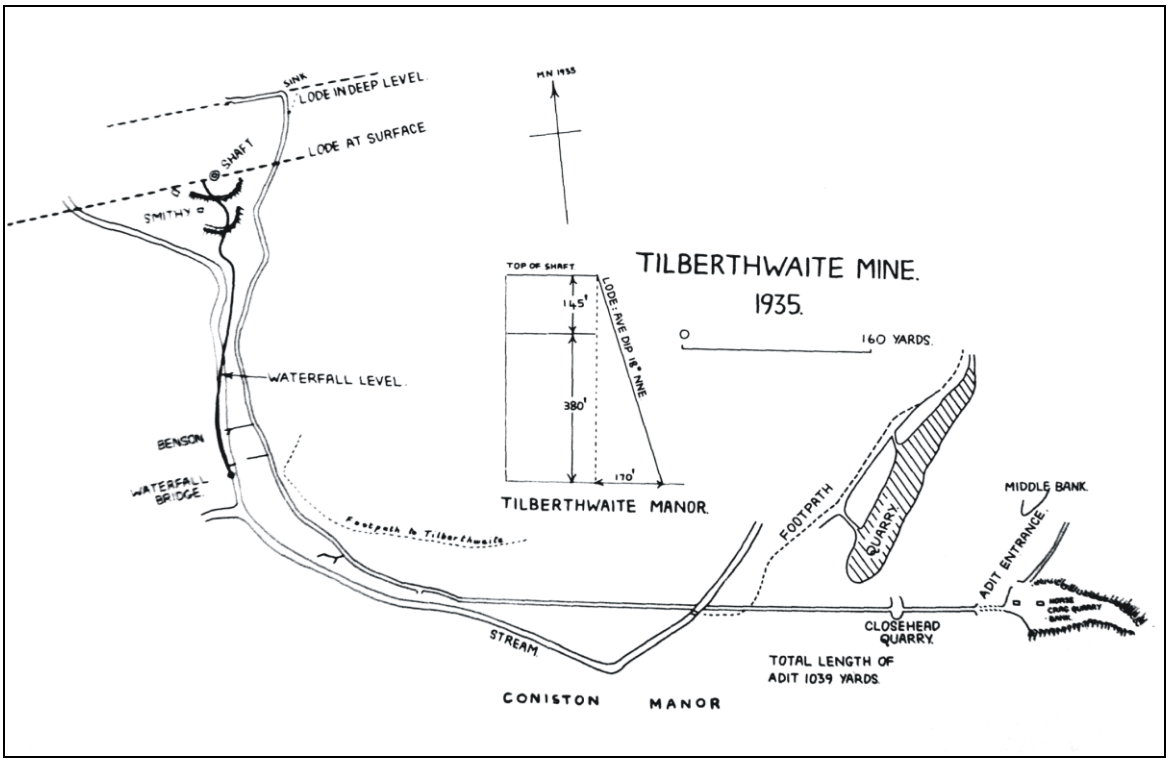


Figure 6: *the Horse Crag Level connecting Penny Rigg to Tilberthwaithe mine. Illustration from Adams showing the site c. 1935 but clearly shows the extent of Barratt's original tunnel (Adams 1988, 152).*

Constructing the tunnel

At this stage gunpowder would have still been used for blasting until the introduction of the more stable dynamite in 1877. Much of the tunnel would have been blasted using hand driven shot holes, leaving the tell-tale triangular holes of a hand driven jumper rather than the smooth boring

[1] Deeds held by the Coniston Local History Society > http://reqr.net/hh/deeds

of a mechanized drill (P Fleming. *pers. com*). Mechanised drilling was at its infancy at this stage and compressed-air rock drills were not introduced until the 1880s. There are smooth bored shot holes all around the entrance to the adit (2038) but these are largely associated with the opening of the later closehead in the 1930 (see Figure 6). Rock from the tunnels construction was almost certainly dumped on site, forming part of the earliest of the rid tips in the area. Such construction and quarrying debris differs significantly in colour from the mineral waste associated with the processing of the ore.

Despite the long-term failure of the tunnel, it did provide a solution to the flooding at Tilberthwaite, allowing water to flow down the adit to be discharged into the Yewdale Beck. It also solved the transportation issue, with tubs being transported by underground track all the way from the working lode to the Mill and then carted down to Coniston Water. To facilitate production, Barratt built a new crushing and dressing mill which covered an area from the adit entrance down to the banks of the beck; with each stage of processing moving ergonomically down the hillside.

Penny Rigg Mill

It is not clear when Penny Rigg Mill was constructed but it must have been after the Horse Crag Level was started. It does not appear on the first edition six inch Ordnance Survey map, published in 1850, although the drain leading from the adit is shown (Figure 7). It is likely that the mill was finished sometime soon after Horse Crag Level was completed in 1859. Today the mill survives in a semi-ruinous state, although many of the standing structures survive in a relatively good state of preservation.

The Copper Mill first appeared on the 1898 second edition Ordnance Survey map (Figure 8), although only a 6 inch version of this is available which does not show the buildings in any detail.[2] However, the map does show the basic outline of the complex, which is much as it appears today. By this stage the mine and the mill had already been closed for some time, and many of the original buildings had almost certainly been demolished or obscured by later quarry activity. Despite this, it is still possible to deduce a considerable amount about how the mill functioned[3] based on documentary, archaeological and cartographic evidence, although much still awaits discovery through a systematic and detailed survey of the site.

[2] Both Cumbria and Lancashire record offices were approach regarding a 25inch map but neither carried a copy of the map at this scale.

[3] Members of CATMHS and the Coniston Local History Society have already undertaken a great deal of survey using the third edition OS as a map base and we are indebted to them for providing a copy of this work for our use during field work.

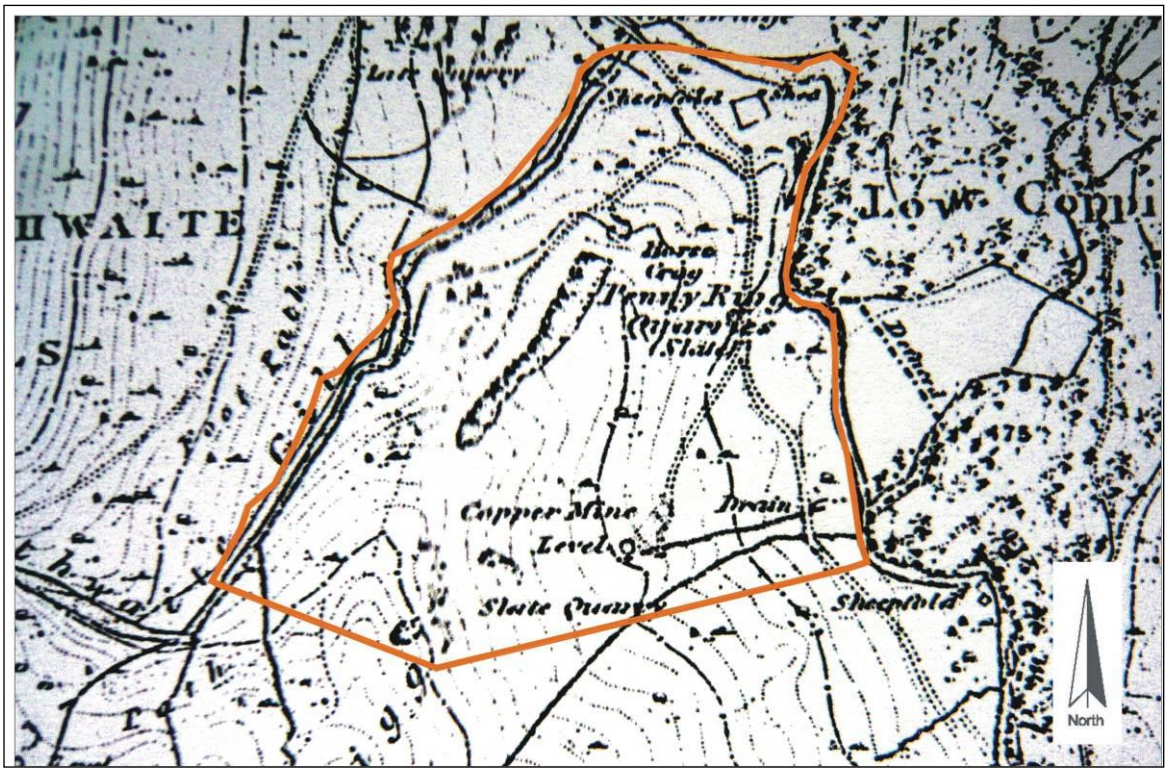


Figure 7: *first edition 6 inch OS map published in 1850. Horse Level is clearly shown and the associate drain leading from the adit to the Yewdale Beck but not the mill. Map was surveyed soon after the tunnel was begun in 1849 so the mill was probably constructed around the same time as the level was complete c. 1859.*

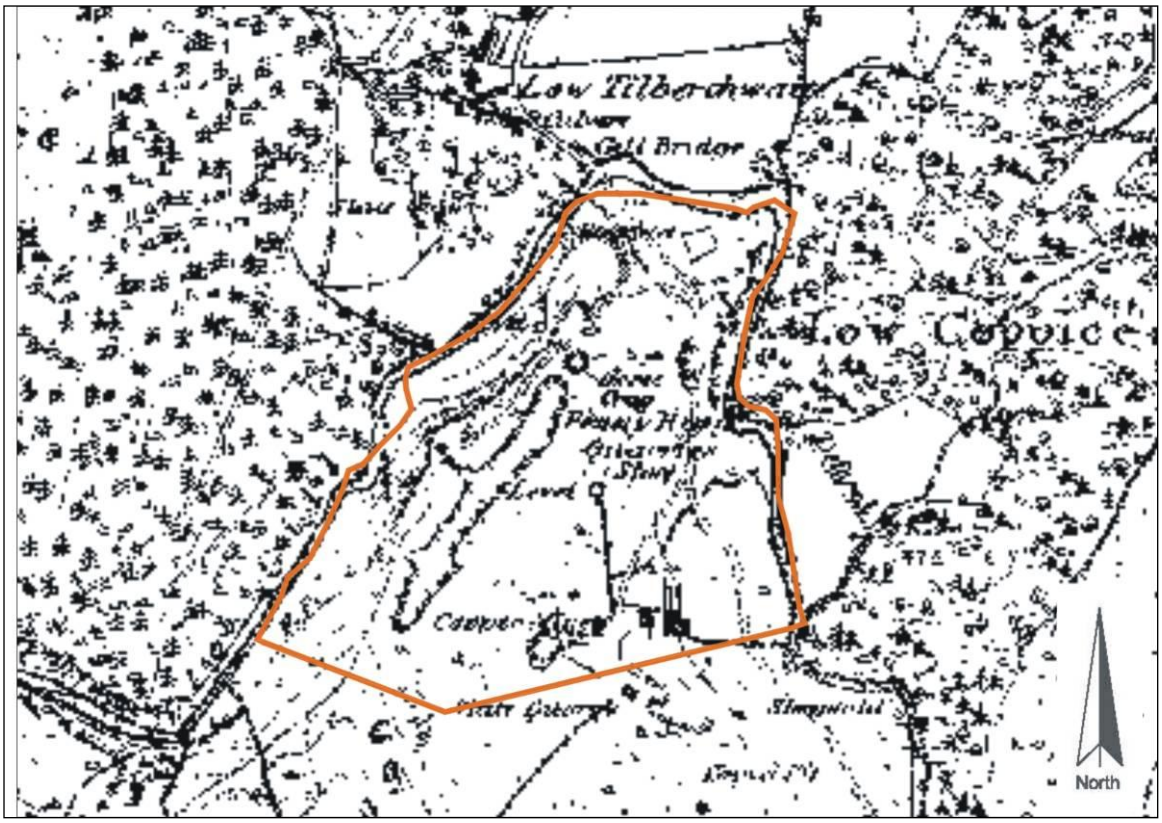


Figure 8: *second edition OS map published in 1898 shows the mill but by this stage both it and the mine had gone out of use and the quarry had expanded, using Horse Level as a closehead.*

Working the Mine and the Mill

Ore worked at Tilberthwaite was transported in tubs down the adit to Penny Rigg Mill. At the entrance to Horse Crag Level the loaded tubs would then have been transferred directly onto a surface tramway for transporting material around the processing area.

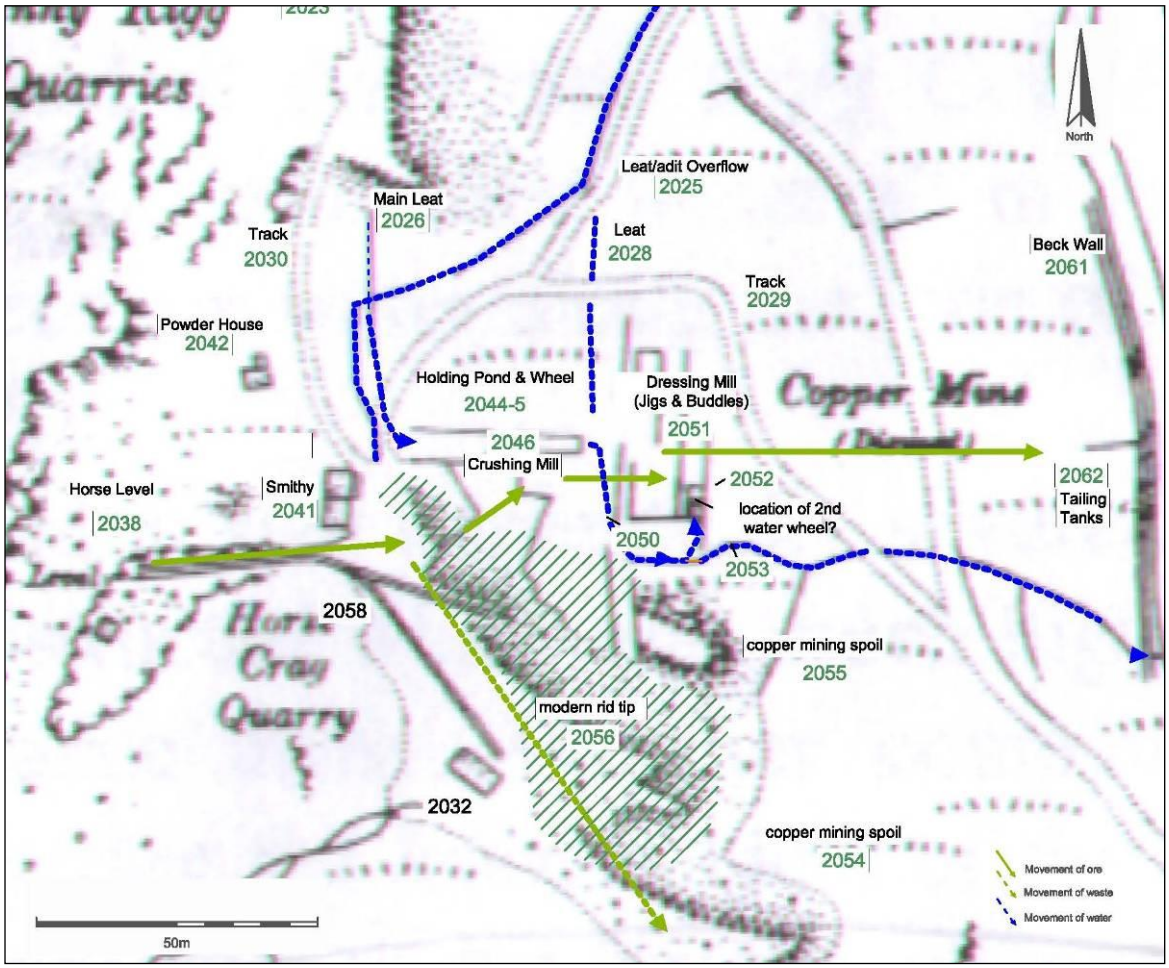


Figure 9: *features associated with Penny Rigg Mill, overlain on third edition OS map (1915)*

Close to the Level portal (2038) the mined material, or veinstuff, would have undergone preliminary storage and sorting to separate copper ore from waste rock. It was a common practice at the larger mines of this period for the veinstuff to be stored in stone, hopper-like ore bins or in store buildings known as copper sheds, but no evidence of these survives above ground at Penny Rigg. The material was then hand sorted to separate ore from waste and the ore sub-divided into three different grades: solid chalcopyrite ore, seconds or 'bouse', and finally the low-grade material. The high grade ore was sent to be broken down into thumbnail sized pieces by the mine 'maidens', women using a broad headed hammer or 'bucker' which was brought down on an iron plate. This was then sent straight for marketing. Bouse was 'cobbled' –broken up on anvils - and then sent onto the buckers, while low grade material was broken down into small pieces by the crushing mill.

None of the bucking or cobbing sheds remain visible above ground today but their foundations may lie under later spoil and rid tips. Such structures were possibly only temporary - just rudimentary structures built to provide shelter from the weather - and might have been moved around as the surrounding spoil tips grew too large to manage. Quite basic wooden structures are shown on old photographs of the Coniston Low Mill (Plate 10). These would leave very little sub-surface evidence apart from the cobbing floors, although stone buildings are known from other sites. The area of highest potential would be under the large central rid tip (2056). This is close to the mine entrance and therefore would be the most likely place for the location of bucking sheds. Surviving archaeological evidence of these activities might include stone ore bins and paved 'cobbing' floors.

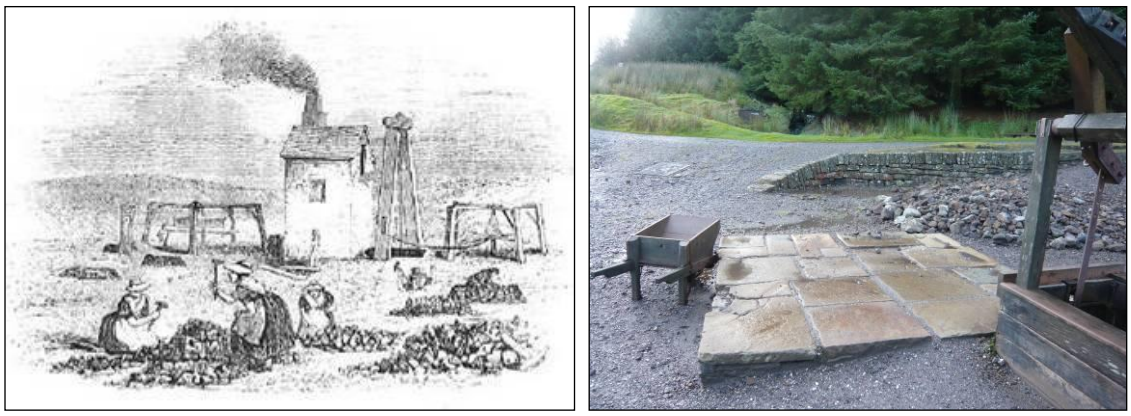


Figure 10 & Plate 6 : *mine maidens at a Cornish copper mine c. 1840 in Redding's 'Illustrated itinerary of Cornwall' and cobbing floor at Killhope – similar sub-surface remains could survive at Penny Rigg as evidence of the dressing process but these are likely to be under the present day quarry rid tips.*

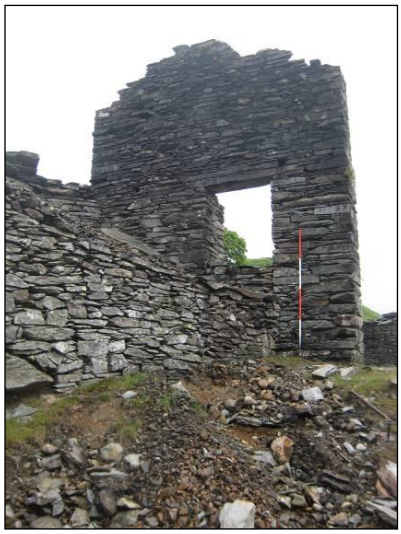
Waste material from the mine and the sorting process was dumped in a series of linear spoil tips at the southern end of the site. Most of these are now covered by later quarry waste but some do survive and should be conserved as an important element of the site's history. The mineral waste has a distinctive orange-yellow colour which is particularly apparent when seen in contrast with the grey slate rid. Two such heaps survive at the southern end of the site (2055 & 2054) and the flat top and regular sloping sides of 2054 would suggest that this was the product of end or side tipping tubs from straight off the tram or waggonway.

Once sorted, the ore was moved from the sheds to the Crushing Mill (2046); probably in wheel barrows. The processing plant was laid out in a series of terraces arranged down the hill slope to facilitate the movement of the mineral between processes. Sorted ore would have been taken into the Crushing Mill through the entrance in the south wall - the terracing meant that this would have led directly onto the top floor of the building – and was then loaded into a hopper which fed directly down into the crusher located in the room below. The crushing machinery was operated by a 32 feet diameter water wheel located to the north (2044).

Plate 7: *two types of spoil tip: on the left of the picture is the yellow-orange, mineral rich copper ore, while to the right dark grey slate rid. Unfortunately, the old mineral waste heap has become a popular route for mountain bikers, creating a scar on the face of the feature.*

The ore crusher is likely to have been based on John Taylor's 'Cornish Roll'; this was a set of double, smooth-faced crushing rollers supported in a wooden framework. The gap between the rollers was regulated by a pair of weights, usually stone, which were suspended from wooden shafts. Once the ore had been crushed it was put through a sizing trommel: a rotating cylindrical sieve. Material of the correct size fell through the trommel while coarser material passed through and was crushed again. A trommel is listed in the 1875 sale documentation associated with the mill. The Crushing Mill may also have contained a raff wheel, a revolving wheel with side buckets which returned the coarse material to the hopper on the floor above. The trommel and raff wheel would have been worked by the same water wheel which powered the crusher (2044). The floor of the Crushing Mill appears relatively undisturbed and may preserve archaeological evidence for fixtures and fittings associated with the layout of the crushing machinery.

The crushed ore was then taken to the Dressing Mill (2051), the long, rectangular building on the terrace below for further separation and concentration. The large size of the building suggests that this process was fully mechanised using jigs and buddles. Two high level openings in the south-west corner of the building probably represent hopper stances which fed crushed ore to a set of jigs positioned in the space below. Jigs were water-filled wooden boxes containing mechanised metal sieves. Ore was placed in the sieves and the sieving motion separated the lighter waste from the heavier copper ore. Jigging allowed ore down to about 1mm in size to be recovered.




Plates 8 & 9: *entrance to the upper floor of the crushing house still clearly preserved; ore was delivered via this directly to the upper floor of the crushing mill and then fed into the crusher below. And the wheel pit (2044) of the 32m diameter wheel which drove the crushing and stamping machinery – looking south from the holding pond (2045)*

Finer material, known as 'slimes', was treated in buddles. These were inclined wooden troughs. A pulp of slimes and water was fed into the trough and allowed to settle out. The heavier ore particles tended to concentrate near the top, mixed material known as 'middles' settled in the centre and the lighter waste or 'tails' moved to the bottom. The 'middles' were re-buddled to allow maximum recovery of ore. The northern end of the surviving building is divided into two narrow compartments and these probably mark the position of the former buddle frames. Both jigs and buddles had to be supplied with water and pit feature (2050) and water course (2028) may have been part of this process. The interior of the Dressing Mill is comparatively undisturbed and there is a high potential for the survival of intact archaeological deposits and features.

Plates 10: *Dressing floors at Bonsor Low Mill at Coniston Copper Mine – a rack of jigs is clearly visible in the foreground and buddles to the left. The crushers were in the buildings to the right, on the terraces, while the large building in the middle may have been a bucking shed.*

In the later 1875 sale records of the mill there was mention of a second, smaller water wheel measuring 12 feet in diameter (Holland 1986, 171). There is much debate about the location and

function of this wheel (A Cameron *pers. com*) but it is likely that it powered the jigs although there is little evidence surviving above ground as to its position. The leat from the primary wheel pit (2044) runs into an enigmatic sunken chamber (2050) and then appears to be culverted along the southern external face of the jig and buddle house. The wheel, therefore, was probably located in the structure at the south-eastern corner of the building. This structure suffered severe damage in the 2009/10 floods and interpretation remains problematic.

Plates 11 & 12: *the excavated washing floors at Killhope lead mine showing the 'slimes' in the foreground, hand-jigs in the distance and storage bins on the left. Archaeological evidence of this calibre could be preserved at Penny Rigg. Row of mechanised jigs at Killhope, powered by the water wheel which also served the crusher – a similar arrangement would have existed at Penny Rigg.*

The tails, or waste, from the buddling process was stored in slime ponds to prevent toxic residues polluting nearby streams. Two conjoined pits (2052) at the south-east corner of the jig and buddle house and raised pit (2053) may be examples of these settling ponds. The stratified sand deposits (2062) below the road probably relate to secondary slime ponds with beck-side wall (2061) designed to stop polluted material entering Yewdale Beck.

Water for the mill was originally brought along leat (2026) which formed part of a longer water course leading to a dam on Crook Beck opposite Wethlan Mine (32992 50053) (Holland 1981, 74-75). This fed into a finger shaped holding pond (2045) supplying the primary wheel (2044). Additional water was later provided when the Water Tunnel (2023) was driven though the hill to drain the flooded Penny Rigg Quarry. The large slate tip (2024) to the north of the copper mill is waste material from the excavation of this tunnel.

Other buildings associated with this phase are the smithy (2041) and possibly the powder house (2042), although this could be later. A mine and mill of this size would also have had an office building and possibly a manager's house but these have not as yet been located and may have been located in the southern section of the site which is now covered by slate waste.

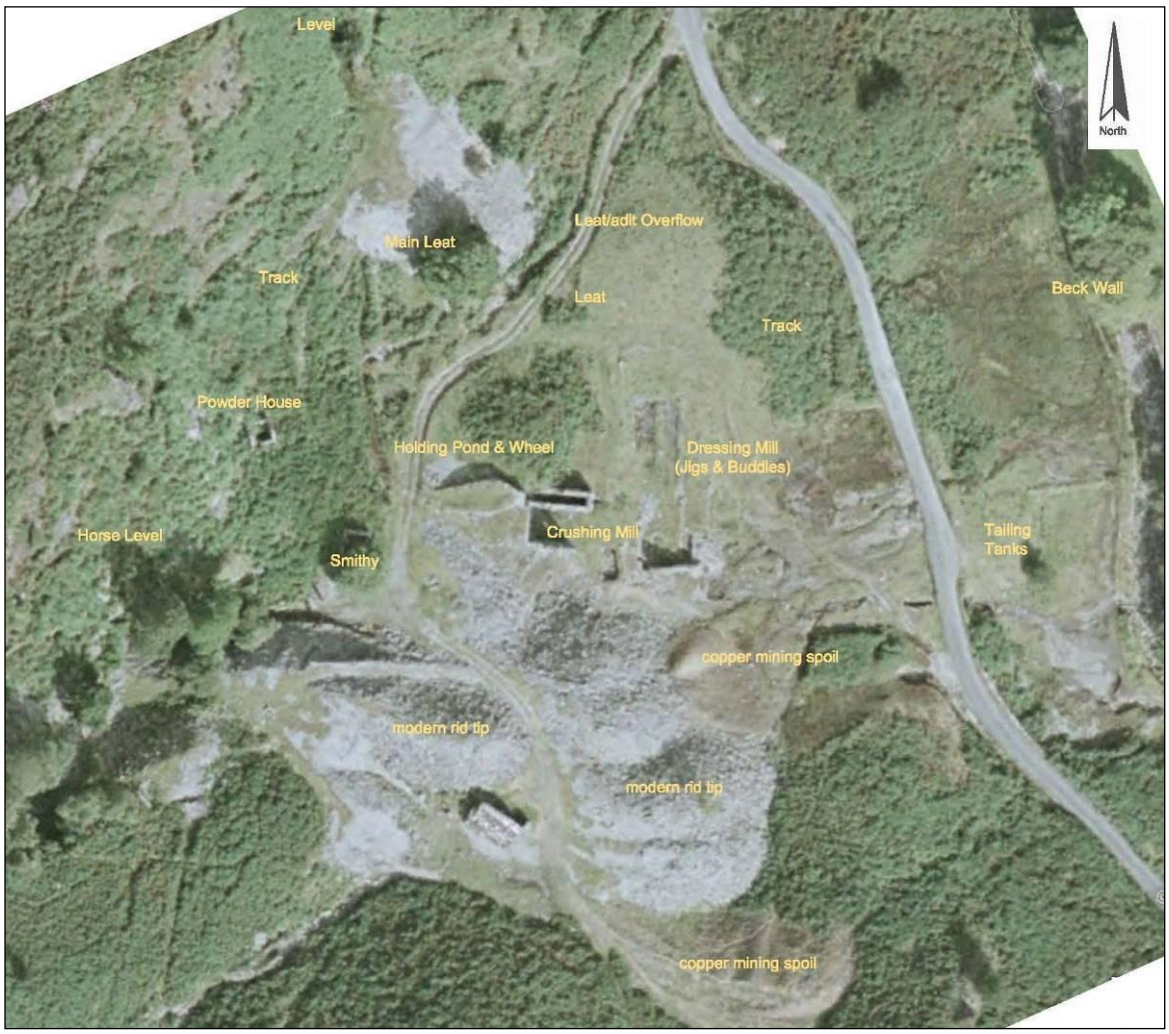


Figure 11: *modern aerial photograph (Google Earth) showing location of main features associated with the Penny Rigg Copper Mill – note tailing tanks on the west banks of the beck to the right of the picture*

Transportation

Ore was transported around the site by both surface waggonway and wheelbarrows or small cart. The latter would have been used to move material around the processing area, while the tubs would have taken larger material – waste and veinstuff - to the spoil tips or the dressing floors. The main tracks through the site (2025) and (2029) belong to this phase, although the path running parallel to the overflow is a later addition. However, little evidence of the former waggonway or tramways survives, except a few fragments of rail which may themselves relate to the later quarry.

Ore was not smelted on site but carted down to the company's copper depot at Coniston and from there transported by rail along the Furness railway which opened a route to Coniston in 1859 - the year Horse Crag Level was completed. Ore from Barratt's mines was by this time being sent to the Hafod Copper Works in Swansea owned by Messrs Wivian & Sons where it was used primarily in the coppering of ship's hulls (Davies-Shiel & Marshall 1969, 146).

The end of the copper works

Unfortunately, the production figures for Penny Rigg are included in those for Coniston so it is unclear what the mine's yield or workforce were (Holland 1986, 171). However, by 1864 Horse Crag Level had reached 3,000 feet (914m) in length, a feat probably only achieved by the introduction of new drilling technologies using a water blast pipe to drive pure air through zinc pipes or wooden ducts (Holland 1986, 144). In the same year Barratt, and his partners Mason and Cruso, renewed the lease for a further 21 years. But the tunnel was frequently beset by problems along its considerable length. Under the Tilberthwaite Gill it passed through soft sand and boulder clay and this was prone to collapse causing numerous roof falls. However, the mine did continue to operate for 15 years, but eventually in 1875 the tunnel's maintenance proved too costly and the venture was closed.

Other elements also contributed to the closure. The site had always been problematic in terms of ownership, the tunnel starting in the Le Fleming royalty but passing under Muncaster land for much of its course. This meant the additional expense of maintaining two royalties. By this date John Barratt had died, leaving the Coniston mines to his son, Francis, who in 1874 formed part of a consortium of share holders. But despite initial promising returns the company's mines began to fail (*ibid,* 171). The opening up of huge copper deposits in Chile, Australia and North America, had caused a dramatic fall in world copper prices and this, combined with the general financial crisis of the 1860s, saw mines across the country fall into liquidation. Tilberthwaite and Penny Rigg, along with the larger mines in the Coppermine Valley, were all sold at auction in 1875. At this stage the Coniston mines, including Tilberthwaite, raised about 100 tons of ore a month producing 1,373 tons of dressed ore in the year sale.

The record of the 1875 sale provides some indication of the size of the mill and the type of machine and buildings in operation. It is described as including a *'smithy, copper shed and dressing sheds. Two large wheels (12ft and 32 feet) powering a relatively new crushing plant with revolving screens (trommels), elevators, jigs and waggons'* - evidence for most of which can still be seen today (Holland 1986, 171).

A Brief Reprise

Both Coniston and Tilberthwaite were sold to Thomas Wynne of Staffordshire, one of H.M. Inspectors of Mines. In March 1883, Wynne authorised William Hellen to start clearing the Horse Crag tunnel of fallen debris. It was reported as being in a very poor state and in places liable to collapse without timber re-enforcement. Wynne had commissioned this work in the hope of selling the venture to a Mr Watson who had shown an interest in purchasing the mine but the sale proved unsuccessful – no doubt based on William Heller's rather damning report on its condition. However, the tunnel was successfully opened and remained so for a further three years until another roof collapse after which the tunnel was abandoned for nearly 40 years (Cameron 2010, 1).

Before the closure in 1886, a mine surveyor, Thomas Cook of Dalton-in-Furness, did make a preliminary inspection, reporting that although Tilberthwaite still had some potential the condition of the mine did not afford sufficient evidence to recommend purchase. Following the report Wynne was to write in a letter to a friend that 'the mines are such a dead weight on my hands, and it is a difficult matter to make ends meet' (Holland 1986, 202). Finally, he did manage to sell the mine to James Fleming in 1889. Fleming intended to reopen the tunnel and work the mine but was soon thwarted by discovering that of the 500 fathoms which constituted the mine, he owned only the first 130 fathoms under the terms of his lease, the rest lay in the Muncaster royalty which Wynne had rather deviously retained.

Despite this, Fleming pressed on with his plans, installing some new plant onsite in February 1889, but a stalemate had been reached. This situation was made worse by a further drop in copper prices which reached an all time low that year as competition from Chile brought about the collapse of the English market. Wynne had by this stage realised the potential of Penny Rigg quarry to recoup some of his losses and was working the site. But two years later, in 1891, he finally succeeded in selling his shares in the Coniston and Penny Rigg mines to Thomas Warsop. Warsop was an engineer and entrepreneur who had been employed at Coniston as a specialist in air-compressed drilling. In 1892 Warsop re-opened the Penny Rigg Quarry, and probably started work soon after at Horse Crag Quarry. This marked the end of the Copper Mill and in 1897 the site was dismantled and the large water wheel sold off as scrap for £3 (Holland 1986, 218).

Slate

Penny Rigg Quarry

In the late 18th and early 19th century the Penny Rigg Slate Quarry (2000), which lay to the north of the later Copper Mill, had continued to expand and by 1825 was some considerable size. An account of the quarry in J Corry's 'History of Lancaster', provides some insight into the nature of the operation:

"The township of Tilberthwaite, which extends to the northern boundary of the County, and is a very hilly tract, abounds with quarries of excellent blue slate. At Penny-Rigg quarry the slate is conveyed on trucks through a level drain into the side of the rock, at some height above the bottom of the pit. Each quarryman can raise nearly a ton per day, for which he is paid from 2s. 6d. to 3s. 6d. according to the quality of the slate. The rock splits into very thin light slate of a good blue colour, and the price is about 56s. per ton for the best. Sir Daniel Fleming, who is Lord of the Manor, is paid 3s 4d. per ton for the best slate, and 2s. for the seconds." (Corry 1825, 529)

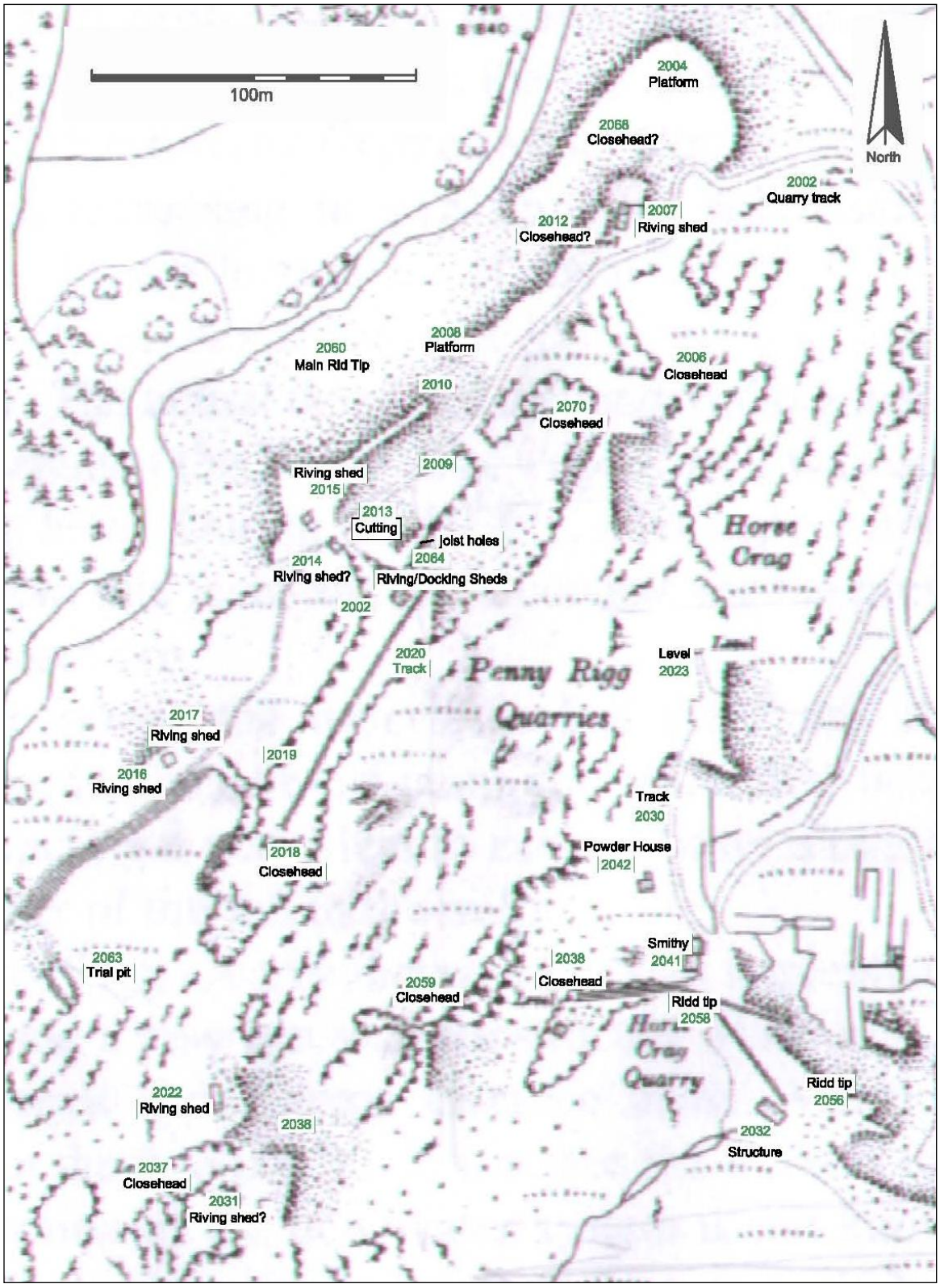


Figure 12: *key quarry features overlain onto third edition OS map (1915)*

The quarry is shown on the first edition OS map (Figure 7) and had already largely reached the full extent of the surface workings by this date, with the area covered by the quarry changing very little over the next century and a half. The only notable change between the first and second

edition OS maps (Figures 7 & 8) are the cuttings on the west side of the quarry which improved access as quarrying went deeper. Penny Rigg Quarry runs south-west to north-east and covers an area of approximately 0.5 hectares.

The fortunes of the 19th century quarry appear to have been the reverse of those of the Penny Rigg Mill and Copper Mine. In the early half of the century production seems to have been relatively buoyant as indicated by the Corry extract. By this stage two forms of quarrying were in operation: surface quarrying and sub-surface slate mining. Slate is found in veins between other types of rock and the angle of dipping of the vein determined the method of extraction used. Surface extraction had been undertaken for generations either in 'Open' quarries which follow the vein on the slope of a hillside (such as Brandy Crag at Coniston), or 'Pit' workings which were necessary when the vein dipped almost vertically, as was the case at Penny Rigg. With the introduction of gunpowder in the 18th century slate mining was introduced, this entailed the excavation of slate 'Closehead': levels driven into the rock to intercept the vein and then enlarged to remove the slate leaving pillars in place to hold up the roof.

Once Barratt began work on Horse Crag Level, quarry production at Penny Rigg appears to have largely ceased, or at least been reduced to a minimum. Quarry blasting may have been a risk to the underground tunneling and so had been terminated, although small scale extraction may have continued. It is certain that at least by 1870 the lower terraces of the quarry pit were completely flooded. At this stage Water Tunnel (2023) was driven through the rock to drain the quarry and provide a head of water to power the Mill wheel (2044).

Following the decline of the Copper Mill and Mine, the fortunes of the quarry once more began to rise. In 1897 Thomas Wynne re-opened Penny Rigg Quarry and began to invest heavily in its expansion as an alternative to his failing copper mines. During this period Horse Crag Quarry, on the site of the old mine was also opened.

Gaining the slate

Both surface and closehead mining was undertaken using a combination of blasting and hand picking. Tell tale shot holes can still be seen all over the quarry face, both the triangular holes of the hand-driven jumpers and the smooth bored holes of the mechanised drills. Originally made of iron and later of steel, a jumper was a slender rod with a chiseled end and was usually forged on site at the smithy. They were used to drill a hole in the rock to take a gunpowder charge. Later these were replaced by compressed air mechanical drills, but this was not until the 1880s. A jumper was found still *in-situ* on site (NY 30568 00088), at the north-eastern end of the quarry. The distribution of triangular to circular shot holes could potentially date the older sections of the quarry face, although there may have been considerable later activity, but there does seem to be a propensity of hand driven holes at the south-western end of the quarry.


Plates 13 & 14: *jumper found in-situ at Penny Rigg Quarry and the entrance to the closehead (2018)*

The surface slate was worked in terraces, rising up in two major increments from the lowest point at the north-eastern end of the quarry. The top level was the last to be worked, and this includes the entrance to the level (2018), or closehead, mentioned in the excerpt from Corry. This is now completely blocked after only a few metres and is extremely dangerous. The wooden lintel supporting the entrance is in a poor state of repair and liable to collapse. There were a number of other closeheads operating around the quarry. Although the phasing of these is not clear, one of the later ones may have been the shallow level at the north-eastern end of the site (2006) and a second small working begun at the northern end of the main quarry pit (2070). There was another level (2012) shown on the slope of the promontory on the third edition OS map (published in 1915) (Figure 12) but this has been completely blocked by quarry waste, although this might be linked with the remains of a possible adit found further down the slope (2068).

Plate 15: *view south-west down Penny Rigg Quarry (2000) showing the progression of the terraces, with the older works at the lowest level in the foreground. The various structures at the base of the quarry are riving and processing sheds.*

Processing the slate

Initially, the slate was cut into large blocks or 'clogs', this was then transported from the underground workings on trucks which Corry refers to in his article. These were then transported by a surface track to the docking and riving huts on the top terrace (2020). The path of this track (2020) leading from the entrance of the 'level drain' (2018) can still clearly be seen.

Plate 16: *path of the former track (2020) leading from the closehead (2020) in the distance, to the riving sheds on the tope level of the quarry*

The clogs were 'docked' or reduced in size with chisel and mallet, cutting across the grain, although after 1856 this process was replaced by sawing. Given their size, the transport of the large clogs would have been kept to a minimum and for this reason the docking huts were located within the centre of the quarry. There are a series of processing buildings on the upper and lower terraces, including the large square hut (2064) at the end of the adit track (2020) and later structures on the lower terrace (2065-67). In addition, there would have also been lifting gantries, saw pits, and working surfaces for the slate splitters. Two joist holes in the quarry face adjacent to building (2064) may be evidence of a lifting derrick of some form. Unfortunately, given the extent of later working in the quarry survival of some of the more ephemeral archaeological features might not be high but the more robust elements should be well preserved below the later debris.

The docked or sawn block was then 'rived', or split down the grain, and the resulting thin slates dressed to shape on a 'slate anvil' or point break iron, using a slate knife or 'whittle'. This may have been undertaken within the quarry but slate was also transported to the riving sheds located just to the west of the main quarry pit. There are a number of structures in this location all of which may have been riving sheds but the best preserved (2007) is at the north-eastern end, opposite the entrance to the small closehead (2006). This is a three, or possibly four, cell structure built of

local slate, with a rear wall still standing 1.50m high. Along the back wall is a stone bench, 0.30m wide, where the slate splitter would have sat and rested a slate block between his knees and rived the tile. Each cell measures approximately 2m across, although the third cell is smaller and has a curved wall. Buildings in this area were already in existence by 1850, and appear on first edition OS, although the current structure is later and is not shown until the 2nd edition map of 1898. There are other possible riving sheds located around entrances into the quarry pit, including (2015) which survives only as a building footprint, (2017) and (2016) at the south-western end of the site, and (2014) located close to the quarry entrance. The latter survives to quite a height, the rear wall standing 0.80m high and the doorway preserved in south-eastern wall. This might have been a riving hut or a dwelling, or both.


Plates 17 & 18: *well preserved riving shed (2007) at north-eastern end of quarry and riving shed or dwelling (2014) close to quarry entrance.*

Transport

Transportation had been a major factor limiting early quarry production. The size of clogs and even the weight of the processed slate would make moving material around the site problematic. Areas around the quarry are quite marshy, but the main access routes through the site seem relatively well drained. Good tracks and surface tramways would have been essential to the successful running of the site. The main quarry cart road looped around the bottom of the hill, rising up from the High Tilberthwaite Road to climb along the side of what is now the National Park's car park. It then levelled out and continued along the length of the quarry before petering out into a footpath at the south-western end. Today the road survives as a broad green track (2002). Along much of its length the track is a pack wall with revetment which would have kept the rid away from the course of the road and ensured the path remained unhindered. Presumably a horse drawn waggonway, or narrow gauge tramway, followed the line of this path, although no evidence survives above ground today. There is some indication on the north side of the track of a linear feature (2008) which runs parallel to the track, this could have housed a loading gantry or handling platform of some sort, or even the base of a water balance, an early form of crane.


Plates 19 & 20: *quarry road (2002) and platform adjacent to the road (2008) which was possibly a platform for a loading gantry of water balance.*

The management of waste and debris

One of the main problems faced by any quarry was the disposal of waste stone, or rid. It was not uncommon for up to 90% of rock to be disposed of as waste.[4] Most quarries dumped the rock over the nearest slope and Penny Rigg was no exception. This has created one of the most prominent features in the landscape today, the large quarry rid tip which extends all along the western side of the promontory (2060). This has obviously built up over a number of years, with numerous different phases of dumping. On the northern-eastern tip, above the car park, is a flat topped tip which features a square platform (2004), possibly marking where the tubs were tipped, or the location of a water balance. Successive phases of dumping would have required careful management to stabilise the tips and prevent slippage. Evidence of this can be seen across the site in the various revetments and pack walls designed to keep the rid in place. Today, the tip remains relatively stable despite its size, although there is some alarming evidence of subsidence above the car park.

Opposite the entrance to the upper terrace (2013) there is further evidence of tipping. A classic finger shaped rid tip is shown in this location on the third edition OS map. This features a central track along which the tubs would have been run before being end or side tipped, creating the spread of debris fanning out below. Later quarry activity has changed the shape of the rid tips today but they remain one of the most distinctive features of the site.

Horse Crag Quarry

The good slate around the entrance to the Horse Crag Level had been remarked upon prior to the sale of the copper mine in 1875 and there had been several approaches made for permission to work it (Holland 1986, 171). However, the lease on the Penny Rigg Mill still had 10 years to run and the new owner, Thomas Wynne, hoped to profitably run the copper mine or at least sell it as a going concern. Subsequently, Wynne did succeed in selling the mine to James Fleming who also hoped to bring the mine back into operation except he was thwarted by Wynne's retention of the

[4] Citing online reference @history of quarrying' - http://www.penmorfa.com/Slate/history.htm, accessed 22/09/10

Muncaster royalties. Therefore, Horse Crag quarry probably began some time towards the end of the century once the venture had been abandoned and the Mill finally sold off for scrap. The quarry does not appear on the first edition map of 1850 (Figure 7), but there is some indication of the beginning of works on the 2nd edition map of 1898 (Figure 8) and the third edition map shows the quarry fully established by 1915 (Figure 12).

Initially, Horse Crag was worked as a surface quarry, cutting into the hill slope immediately south-west of the mine level. Waste from the quarry was dumped on the large rid tip to the south (2056) which eventually extended over part of the area covered by the old Mill, possibly burying earlier features and buildings. Similar to the Penny Rigg, the Horse Quarry rid tips were built up over a number of years and a series of separate dumping phases can be determined. The 3rd edition OS map (Figure 12) shows a tramway leading from the mouth of the closehead to the top of the spoil tip for end tipping tubs directly onto the heap. Today, there survives evidence of subsequent trackways (2058) running to the top of the existing rid tip.

There are the remains of a number of small buildings around the quarry; although many of these are in quite a bad state of preservation (2035, 2031). The only building which survives to any height is the square building (2033) against the north face of the quarry but this is too small to be a riving shed and may have been a general store or quarry worker's cabin. The large rectangular building (2032) probably dates to this period and might be one of the best preserved structures from this phase of use. The function of the building is unknown but it could be a riving shed or some form of accommodation.

Given the overall absence of riving or docking sheds it is likely that the mill buildings may have been utilised in some way. The smaller wheel could even have been retained to drive a slate saw, although no evidence for this exists. The re-use of buildings could have an impact on the possible preservation of primary archaeological deposits and features associated with the mill.

Other Quarries

In addition to Horse Crag, there were a series of other smaller quarries in the area. To the west of Horse Crag, further up the hill slope there is a small closehead (2059). This does not appear on the 2nd edition OS map and probably dates to the first decade of the 20th century: it is clearly shown on the 1915 map. To the south-west of this there is another small closehead (2037) and surface quarry which is first shown on the 1850 first edition OS map. This is a well preserved group featuring a level entrance with rather impressive retaining walls, quite similar to that at the south-western end of Penny Rigg (2018). There is also a very well preserved riving shed adjacent. This is a rectangular stone building orientated north to south and divided into two main cells with a small third cell at the south-western end. It has a slab slate roof still *in-situ* and is enclosed by a curving south wall (again similar to (2007) at Penny Rigg). Each cell measures approximately 2m

across and features a rear stone cupboard. There is a second associated building on the opposite side of the level; this might be a workshop or smithy.


Plates 21 & 22: *smaller quarries in the area - very well preserved structure (2022) (probably a riving shed) adjacent to small closehead (2023).*

Further down the hill slope, and outside the immediate project area, there is another small quarry (2071) which appears on the first edition OS. This comprises both a pit and closehead quarry associated with a fairly large building measuring approximately 5m by 4m and with a gable end still standing to a height of 2.5m high. However, this structure is in a very poor state of repair and liable to collapse at any moment.

Worker's Housing

It is not immediately apparent where the quarrymen and their families lived. The nearest village is Coniston, nearly three miles south-west of the site. Presumably most of the quarrymen lived in the village walking to site each day. Together with the miners, must have made up a fair proportion of the population, particularly given the number of known quarries in the Coniston and Tilberthwaite area. However, some of the men would have almost certainly lived on site but there are none of the slate barracks which are commonly associated with sites in Wales. A number of the buildings still surviving on site could have been living accommodation, in particular (2014) which might include a hearth although this could also be a forge or smithy. Some of the multi-celled riving sheds may have been both dwellings and workshops.

Generally, quarrymen were a distinctive breed with there own communities, codes of behaviour and dress. It is interesting to speculate on how this group interacted with the remaining miners at Coniston. Further historical study might reveal a great deal about these two groups of workers, who may have worked together cheek by jowl at Penny Rigg in the mid 19th century.

The 20th century – a final flurry of industry

Copper

Between 1912 and 1913 there was a brief reprieve for Tilberthwaite mine when it was worked by

the Central Chile Copper Company, and later in 1917 by the Langdale Silver Lead and Copper Company (Adams 1988, 151). Following the First World War, the Greenburn and Tilberthwaite Mining Company re-opened the mine in 1924. The company was headed by the mining engineer Oscar Gnosspelius, who together with his mine manager John 'Willie' Shaw, made a valiant attempt to bring Coniston and Tilberthwaite back into successful production. The old Horse Crag Level was once more cleared by Joe Shaw and Billy Gibson Snr amongst others and re-timbered. In fact the tunnel was extended at the Tilberthwaite end to a depth 600ft and a ladder way cut to the surface where it was sealed with a trap door (Cameron 2010, 2). However, the output of the mine never justified the re-instatement of the mill and instead the ore was hand dressed and sent by cart to Coniston (Holland 1986). By 1930 the tunnel had once more been blocked by a roof collapse and this was to finally mark the end of the Horse Crag Level in terms of copper mining.

'' There is a popular local story told about Major John Hext, one of John Barratt's descendants, who as a child decided to explore the mine. He walked the full length of the tunnel, alone, with torches and waterproofs and then started to climb the Tilberthwaite ladder-way. After an exhausting climb he reached the top but found he was unable to push the trap door upwards. After a major struggle, and no doubt a moment's panic, he eventually managed to release the bolts, force open the door and climb out onto the fell side, to his great relief. He then had to run all the way down-track to the road to avoid being late for tea."

(A Cameron 2010, 2)

Slate

In 1993, with his plans to re-open the copper mine failing, Oscar Gnosspelius turned his attentions instead to the good slate to be had at Horse Crag. Gnosspelius had spent a year working as an engineer in a quarry in Sweden so understood what was necessary to run a successful venture. It was decided that John W. Shaw, working with several local workmen, would open up a closehead off of the old adit, as well as working the surface quarry at the entrance (Figure 6). This was a relatively small affair, although later a paraffin engined air-compressor was mounted on an iron wheel chassis to enable the drilling of shot holes. Fittings associated with this compressor can still be seen around the Level entrance. The quarry operated until 1938 when Shaw finally retired. The Greenburn and Tilberthwaite Mining Company went into liquidation four years later in 1842. More recently, in 1989, George Tarr obtained planning permission to re-open the quarry and start working the closehead. He worked the mine for 10 years but eventually abandoned the venture in 2000 to concentrate on other commitments.

Plate 23: *Splitting slate at Horse Crag Quarry - John W. Shaw in the background (from Holland 1986, 529)*

Current use

Despite the closure of the mine and quarry, interest in Penny Rigg and Tilberthwaite continued. Coniston Water and the surrounding area became a popular holiday and tourist destination after the Second World War and during the 1960s and 70s pot holing and mine exploration began to grow as a popular pastime. In 1979, a group of experience enthusiasts formed the Cumbria Amenity Trust Mining History Society (CATMHS) and embarked on a long term programme of surveying and recording the mines across the Coniston and Tilberthwaite Fells, both below and above ground. This work continues today and is an unparalleled resource regarding all aspects of Tilberthwaite's development and history.

Over the past two years there has been a concerted effort by members of the society to once more clear a route through the Horse Crag Level to Tilberthwaite. Sterling progress had been made in this work and after numerous weekends spent labouring away the first stage was almost complete but the winter floods in 2009/10 wrecked all of the team's efforts, washing slate debris cleared from the tunnel right back in again. The whole exercise had to be started again from scratch. To date, operations have been going well and the team is close to achieving their goal again. In addition to the underground exploration, Alastair Cameron and Don Borthwick have undertaken a considerable amount of surface recording work.

The Penny Rigg quarry is now a popular site for climbers. A number of routes have been bolted around the quarry and there are nearly 50 routes in total across the site which range from Hard Severe to E6. However, there are a number of easier climbers which make the site a popular venue for schools and outward bound groups.[5]

[5] Citing online reference > http://www.discoverthelakes.co.uk/tilberthwaite-quarry-i501.html, accessed 28/09/10

Gaps in Our Understanding of the History and Archaeology

The early growth of the quarry - *Penny Rigg Quarry was already well established by 1825 but there is little known about the early history of the site. A study of the Le Fleming estate papers (if they exist) might provide further information, and this in turn may promote a wider understanding of the genesis of quarrying in the area.*

How the Mill worked *– the description in the previous section has been based on a preliminary field and documentary survey but there are a number of questions which remain unanswered: Where was the initial ore sorting undertaken? What type of crusher was operating? How were the* ***jigs and buddles arranged? Were there waggonways or tramways on site? Where did they run?***

How exactly did the water management system work? *A more detailed programme of documentary, topographic and buildings survey work - possibly with some targeted excavation - has the potential to answer some of these questions and reveal much more about how the mill functioned, including those who worked on the site and details of production.*

The history of the Penny Rigg and Horse Crag Quarry *– The history of the quarry in the late 18th century is another area which would benefit from further study, including the inter-relationship between the quarry and the mine. Did production at the quarry cease during the years the mine when the mill was in operation?*

Phasing of the quarry *– The sequence of the quarry's development is not clear – in particular the succession of quarried terraces and closeheads.*

Form and function of the quarry buildings *– it remains unclear what the function was of the various buildings around the site. A number may have been riving sheds but there would have also been store rooms, workshops, accommodation etc. though these have not been indentified. A more detailed buildings record –including documentary research - and a comparative study of structures at other quarries might provide a greater understanding. Other aspects of how the quarry ran would also benefit from further investigation.*

Lives of the quarrymen *– it is unclear where the quarrymen lived. Did some live on site? Further historical material (including census data) might reveal who worked at the site as well as information about rates of pay, conditions etc.*

Previous Archaeological and Historical Research

Apart from the work undertaken by CATMHS there has been no archaeological or historic research undertaken at the site.

2.6 THE ECOLOGY AND GEOLOGY OF THE SITE

Geology

The geology of the area has had paramount influence on the history and ecology of the site. The ancient volcanic activity in this part of the Lake District has resulted in exposure on the surface,

and underground, of valuable minerals and metals which have been extracted at least since the 16th century. The archaeology and ecology we see today is partially derived from this exploitation.

The volcanic activity and resulting mineralogy of the area has a value in its own right, although not designated for its geological interests like the nearby Coniston Copper Mines which is a Site of Special Scientific Interest (SSSI). Despite this, there are still geological features associated with Penny Rigg that are of interest to geologists.

The Tilberthwaite Gill SSSI, which partially crosses into the site, is not designated for its geology *per se* but it has enabled the designated plant communities to evolve in this environment. The gill is a deep cut ravine, carved through the rocks of the Borrowdale volcanic series to reveal tuffs of both acid and basic composition and this in turn has created the habitat for an impressive array of plant communities.

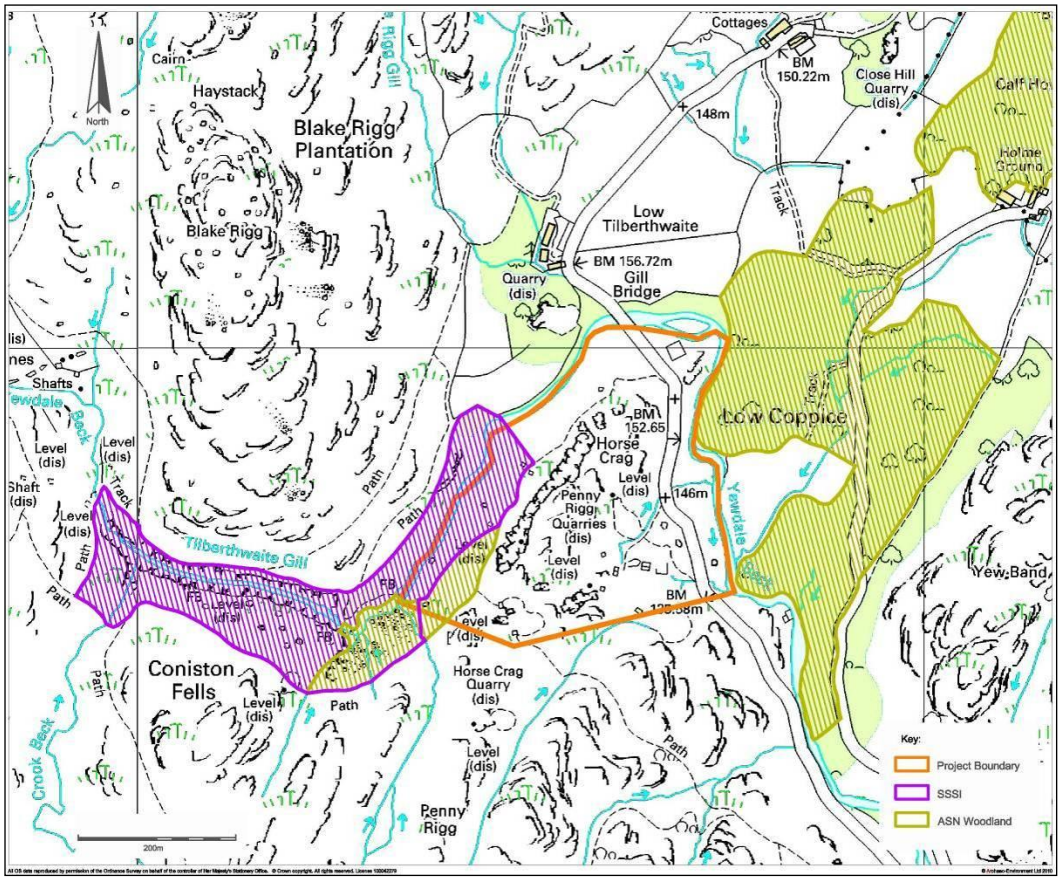


Figure 13: *Ecological designations associated with Penny Rigg Copper Mill and Quarry.*

Ecology

The present flora and fauna of Penny Rigg clearly reflects the combined industrial and agriculture history which has dominated the site for at least five centuries. Prior to the development of the mines, the native post glacial vegetation would have comprised Atlantic dry upland heath with pockets of blanket bog and other mire habitats. The extent of grazing on the site throughout

history would determine the amount of woodland and scrub at any one time, but the presence of a Ancient Semi Natural Woodland (ASNW) just at the top of the site, and the presence of woodland plant species throughout the site, suggests that woodlands hung on in this area a lot longer than at nearby Coniston. Indeed the valley sides, characteristic of this site, are likely to have been managed for woodland resource and even charcoal for much of the later post glacial history. Grazing itself, although clearly impacting on the present day ecology of the site, is not as heavy as elsewhere on the fells.

The influence of mining and quarrying on the ecology of site is clear. The Penny Rigg Quarry itself is a huge cavernous rocky feature ideal for plants and animals to exploit. Elsewhere on the site, industrial disturbance, new structures, changes in drainage and the creation of cavernous mines and spoil heaps, have all had a great effect on the wildlife in the area.

Plate 24: *Looking north along the steep sided valley of the Yewdale beck. Characteristic acid grassland and remnant heath and in the foreground a highly diverse natural flush*

Although the natural heath communities still retain an element of dry heath in some parts of the site, much has been replaced with acid grasslands, often dominated by bracken. Woodland elements survive where grazing cannot reach, especially on the inaccessible ridges and rocky areas caused by both the natural geology of the site as well as man-made features. The result is a highly modified, but interesting, flora and fauna, some of which are now permanent features while others are transient as the communities, gradually revert to their original character as time goes by. Unlike Coniston Copper Mine, the steep sided Tilberthwaite Gill provides a dominant natural habitat which is inaccessible to stock and displays one of the richest floras of any gill within the South Cumbria area.

Tilberthwaite Gill Site of Special Scientific Interest

The Tilberthwaite SSSI lies partly within the boundary of the site. It is designated for its Inland Rock U17 *Luzula sylvatica-Geum rivale* community (Tall herb ledge vegetation- Hydrophilous tall-herb fringe communities of the plains and of the montane to alpine levels). The list of 'Operations Liable to Damage' (OLD's) the site and the 'Conservation Objectives' cited by Natural England are included in Appendix 6. Currently the site is assessed as being in favourable condition.

The area of SSSI within the Penny Rigg site includes the designated community, acid grassland with a partly native woodland cover and a spoil heap.

Plate 25: *looking down into the beautiful Tilberthwaite Gill SSSI. This photograph shows the acid grassland and tree over (partly non native larches). The inaccessible ledges of the ravine provide excellent habitat for interesting communities.*

Woodland habitats

A small part of the site, at the extreme western corner, is classified as Ancient Semi Natural Woodland (ASNW). There is still remnant woodland in this area comprising mainly shrubby juniper, ash, rowan, birch and willow. There is, however, no sign of any regeneration of this woodland and the understorey is composed of abundant stands of bracken. Unlike at Coniston, the evidence at Penny Rigg suggests that in relatively recent times the woodland was more widespread throughout, as a woodland flora of wood sorrel, foxglove and Herb-Robert is still apparent under bracken outside this ASNW area.


Plates 26 & 27: *The remnant woodland within the Ancient Semi Natural Woodland site. Bracken dominates the ground flora. Lichens have become established on this stone and there are likely to be other examples on the site. A specialist would be needed to identify any rare metaliferous species.*

Rare lichen communities

Rare lichen communities are a feature of highly metalliferous rocks and open ground. They are often able to exploit habitats poisonous to other species. There is no available information about the lichen communities at Penny Rigg, but based on a comparison with Coniston Copper Mines, the mineral nature of the mines and resulting deposits would point to a high potential for the existence of rare lichen communities being present.

Plate 28: *Entrance to mine on the south side of Penny Rigg quarry, excellent bat hibernation potential.*

Bats

The semi-ruinous buildings, level entrances and closeheads potentially make the site a haven for bats; this includes the opportunities for hibernacula within the mines themselves as well as roosting and hibernation opportunities in some of the structures and buildings. An existing basic

bat survey previously carried out (1995) would clarify this, but it was not seen during the report production period. Most of the mines and enclosed structures or buildings with enclosed recesses are likely to be classified as high risk for bat disturbance should work be undertaken to restore or modify these in any way.

Calaminarian Grasslands

Calaminarian grasslands occur on soils that have high levels of heavy metals, such as lead, zinc, chromium and copper, which are toxic to most plant species. They typically occur on artificial sites associated with past mining activities like Penny Rigg.

Calaminarian grassland habitat is best identified by an examination of the Bryophytes and lichens. There was little evidence of the classical OV37 higher plant indicator species which are generally found on the spoil of lead mines (eg Alpine pennycress *(Thlaspi caerulescens),* Spring sandwort *(Minuata verna),* Thrift *(Ameria maritime)).* However, some species of this community were present, either occasionally or commonly, across the site. These include Northern rock cress *(Arabis petraeae),* Flea sedge *(Carex pulicaris),* Eyebright *(Euphrasia spp),* Lesser clubmoss *(Seliginella selaginoides),* and wild thyme *(Thymus polytrichus).* Copper concentrates tend to be characterised by poorly grown stands of heather *(Calluna vulgaris)* and bent *(Agrostis capillaris)* and the former was abundant throughout the site. All these species, however, can also be found on acid grassland and rock communities.

Plates 29 & 30 *One of the less vegetated spoil heaps to the south east of the site only a few mosses and plants (here fox glove and herb-Robert) have colonised. This rid tipp has vegetated completely – possibly an indication of the later slate mining activities.*

Without further identification of the lower plants and lichens, which is beyond the scope of this survey, the predominant associations can be described as early pioneer communities on skeletal substrates often associated with quarries and other 'brownfield' land. These vary enormously depending on the age of deposits, the composition of the deposits and the coarseness of the deposits.

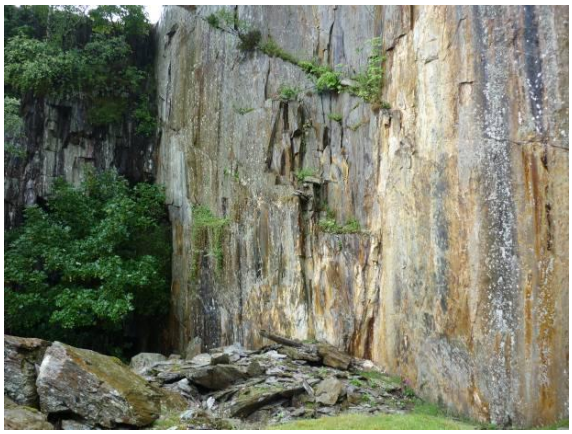
In some cases there has been little or no colonisation of the deposits by species other than lichens, even on spoil heaps which have been *in situ* for a long time. This is apparent, for instance, on parts of the spoil heap immediately adjacent to the car park at Penny Rigg. Highly toxic and unstable deposits are likely to remain bare of vegetation, or sparsely vegetated, with ruderal species such as lichens, bryophytes, ferns - especially the locally abundant Parsley fern *(Cryptogramma crispa)* - suppressed heather *(Calluna vulgaris),* Herb-Robert *(Geranium robertianum),* English Stonecrop *(Sedum anglicum)* and other acid tolerant plant species. Where initial or established plant communities have developed, however, local conditions have provided for a variety of species associations. Some are species rich, such as that developing on top of the spoil heap above the car park and some of those to the south east of the site. Plant species such as Heath bedstraw *(Galium saxatili),* Heath pearlwort *(Sagina subulata),* Mouse-ear- hawkweed *(Pilosella officinarum),* Sheeps sorrel *(Rumex acetosella)* and Wild thyme *(Thymus polytrichus)* are ubiquitous as well as many, often diminutive, versions of grasses such as Sheeps fescue *(Festuca ovina)* Sweet vernal grass *(Anthoxathum oderatum)* and Bent *(Agrostis spp)* and many types of mosses and lichens. Others, such as those with courser deposits, show much less diversity and a more direct reversion to acid grassland, and indeed at Penny Rigg some spoil heaps have revegetated completely to form grassland. The later influence of slate quarrying may have covered the original mineral deposits in these cases. Where course deposits dominate, species characteristic of open stony habitats such as lesser clubmoss *(Selaginella selaginoides)* and parsley fern *(Cryptogramma crispa)* are prevalent.

Plates 31 & 32: *Carline thistle growing on a well vegetated spoil heap and Butterwort - a common plant in the man-made and natural mires*

The industrial heritage, combined with natural features, has also created a characteristic range of wetland habitats. In some cases these have resulted from depressions created by past industrial activity, such as the wash floors and slime pits leading down to the river to the south-east of the site. The wetland communities created are dependent on the surrounding environment, with strong acid influences apparent. The various leats are rich in rushes, sedges, and mosses and plant species such as sundews *(Drosera spp.)* and butterwort *(Pinguicula vulgaris),* have become established. It is possible that some of the more acid bogs were influenced by past industrial

processes (acid extraction of metals, for instance) but generally there is little to distinguish them from the natural flushes and bogs of the open moor.

Bryophyte rich seepage habitats are particularly common at Penny Rigg and occur at the base of some of the structures as well as within the Level entrances.

Plates 33 & 34: *a large diversity of moss and liverworts on this seepage community, and Macro ledges supporting tall plants and trees*

Chasmophytic Vegetation

Chasmophytic Vegetation are plant communities that colonise the cracks and fissures of rock faces. The natural chasmophytic vegetation at the site has been significantly supplemented by man-made features associated with the cave entrances, quarried rock faces, exposed rock outcrops and built structures at the site. These range from a macro scale (trees and shrubs on large ledges) to the micro scale (mosses and plants on small fissures).

Trees and shrubs which have survived grazing on inaccessible rock ledges are a feature on both natural and man-made ledges and are particularly frequent around Penny Rigg Quarry where shrubs such as juniper, hawthorn, broom and holly, and plants such as heather *(Calluna vulgaris),* foxglove *(Digitalis purpurea)* mint *(Mentha spp)*, have colonised any space available.

Within the wet Level entrances, or in the caverns of the closeheads, where seepage habitats occur, abundant mosses, liverworts, and many ferns survive (e.g. male and broad buckler ferns *(Dryopteris spp.),* lemon scented fern *(Oreopteris limbosperma),* hard fern *(Blechnum spicant),* maidenhair spleenwort *(Asplenium trichomanes).* In addition plants such as Hawksbeards *(Crepis spp.)*, Mint *(Mentha spp.),* St Johns wort *(Hypericum spp.)* and many others hang on to the fissures and cracks. These are exceptionally attractive habitats.

All these macro and micro habitats will support other wildlife in particular invertebrates and birds.


Plates 35 & 36: *Superb micro habitats within this Level entrance at Penny Rigg and exposed river shingles adjacent to the Yewdale Beck*

Exposed River sediments

In recent years the conservation value of exposed riverine sediments has begun to be recognised, particularly for invertebrates. They can support rare species especially beetles *(Coleoptera Spp)* and may also support bird species such as the yellow wagtail and common sandpiper. These are important, largely natural, habitats within the river corridor but are vulnerable to disturbance and damage from a number of activities.

The river sediments at Penny Rigg, particularly adjacent to the Yewdale Beck, may be important due to the potential influence of metaliferous material and interaction of the *in-situ* deposits with the flooding river shingles which, in effect, creates additional habitat for the characteristic river shingle species.

Natural Moorland Habitats

The natural moorland habitats (mostly heather dominated dry heath and blanket mire) which, alongside woodlands, would have been the main features in a post glacial landscape have been highly modified by industrial activity and by grazing animals. The fabric of the site is now composed mainly of bracken dominated acid grasslands. Except where industry has disturbed the ground beyond repair, there is potential to restore this habitat. The barriers to such regeneration (grazing and bracken invasion) could, in theory, be lifted but the implications of this to other habitats which are considered to be of higher priority would make this an inadvisable course of action.

Other protected species

Other protected species at this site may include breeding birds and reptiles (especially adders).

Gaps in Our Understanding of the Ecology

Understanding the geology *- as there is little available information about the specific geology of this site, there is an opportunity for further research and possibly survey. Investigations into British*

Geological Society (BGS) sources may reveal further information. There are clearly opportunities for interpretation of the geology of the site to the wider public.

The lichen communities *- It is recognised that the survey of lichens on mineral rich sites such as this are underworked. Studies into this site could reveal much about the behaviour of lichens in this sort of habitat. Furthermore, additional survey could reveal the most sensitive lichen areas which should be undisturbed. The site should be assessed by a specialist lichenologist in order to examine the potential for rare lichen species.*

Bats and other protected species *- Bat surveys, and surveys for other protected species, would be a pre-requisite for any development or restoration at high risk sites like this. A search via the Tullie House biological records centre in Carlisle may reveal records already in existence for the site.*

Rare Invertebrate Communities *- Rare river shingle invertebrate communities may be found by additional survey along the shingles of both the Yewdale Beck and the Tilberthwaite gill.*

Grasslands and wetlands *- The interpretation of grasslands and wetlands within industrial landscapes, including on metaliferous spoil is difficult. Further survey by a lichenologist and a bryologist would allow a better understanding of the post-industrial habitats at this site. This is also the case with Chasmophytic vegetation. These habitats are often inaccessible and difficult to survey. A fuller survey, especially of closehead and Level entrances, seepage, fissures and ledges may reveal specialised and rare species.*

2.7 THE COMMUNITY AND THE MINES

There are a number of communities within the immediate vicinity of the mines, the largest of which is Coniston village with a population in the region of 1860, but others include Bowmanstead, Hawkshead Hill and Tover, all located along the valley bottom. The majority of these settlements have been influenced in some way by the development of the mines and quarries in the area, and there remains amongst the residents a strong interest in their industrial heritage.

Penny Rigg lies within the Lake District National Park which attracts some 8 million visitors each year.[6] Many of these come for the beautiful scenery and the peace and quite offered by the region, but increasingly there is more demand for outdoor activity holidays including mountain biking, hiking, kayaking, climbing, orienteering, as well as more specialist activities such as cave and mine exploration. The landscape around Consiton and Tilberthwaite offers many of these activities and is a particular favourite with walkers who come to climb Coniston Old Man, as well

[6] Citing online reference 'The Lake District National Park – Tourism' > http://www.lakedistrict.gov.uk/index/learning/posters/poster7_tourists.htm, accessed 31/08/10

as boat users on Coniston Water. There are a large range of tourist attractions within the immediate vicinity, most notably Ruskin's house at Brantwood and the Ruskin Museum in the village, as well as the Beatrix Potter estate at Monk Coniston. People are also drawn to the area because of its associations with Donald Campbell who was killed trying to regain the water speed record on Lake Coniston in 1967.

In order to understand more about the use of Penny Rigg Copper Mill by the community a questionnaire covering various aspects of the site was sent out to individuals and groups identified as having an interest in the future development and management of the site. This predominately comprised those listed in the 'stakeholder' section, but forms were made more widely available to the general public at the Coniston TIC and the Ruskin Museum. Nevertheless, the survey can really only be said to reflect the views of a small percentage of the community. Attempts were made to reach a broader range of people but all those who responded were all already familiar with the site and the vast majority were from the local area. This could potentially introduce a bias which might be said to skew the results. A broader consultation would be needed to provide a more rounded understanding of potential new users, but the current study does provides a good picture of the issues and concerns affecting those who currently enjoy the site.

It should be noted that the questionnaire sent out covered both Coniston Copper Mines and Penny Rigg Copper Mill. A total of 19 questionnaires were completed, as well as 3 more general letters outlining issues and concerns. The majority of people who responded completed the sections on both sites, but a small percentage (15%) left the Penny Rigg questions blank. Overall, those questioned wrote less about Penny Rigg than Coniston, but that might only be expected given that the latter is a much larger and more public site. The following analysis is based on a summary of information from the questionnaires.

The number of visits made, distance travelled and reason for visit.

The majority of those who responded to the questionnaire were frequent users of the site, with 37% visiting a number of times each year and 31% visiting at least two or three times. However, only 10% would class themselves as regular users, i.e. those who visit the site more than once a month. This is contrast with 54% who were regular users at Coniston, with 40% visiting the site more than once a month.

The majority of those who responded lived quite close to the site, 54% coming from within 10 miles of Coniston and the rest coming from Cumbria, with only 1 person responding from outside the county. Most of those surveyed visited the site for a broad range of reasons, 53% of those questioned came to visit the Copper Mill and Quarry, and the same number also came for exercise and to enjoy a good walk. A further 37% cited the natural environment as a reason for their visit and 10% came to have a picnic and a day out with the family. As might be expected given the nature of the survey group, a large number came to take part in underground mine

exploration (42%), although this figure was slightly lower figure than the 54% recorded for Coniston. Finally, 2 of those questioned (10%) came specifically to climb.

Plate 37: *memorial bench along Tilberthwaite Gill. This path remains popular with walkers and mine explorers alike and is obviously a cherished landscape which means a great deal to a number of people.*

What makes the site important?

A series of possible options was provided to assess what made the site important. All but 2 people 'strongly agreed' that the archaeology and history of the Copper Mill and Quarry was significant, with a further 53% commenting on the importance of the below ground 'mining' archaeology (although 1 person also strongly disagreed). All the other aspects cited received a fairly even response, with the majority of those questioned either agreeing or strongly agreeing. In terms of the importance of the wildness of the landscape, 32% 'strongly agreed' while 21% 'agreed' with the statement and the others did not comment. 'Access to great walks' received a similar response with an even distribution (26%) between those agreeing and strongly agreeing, as did the importance of the site as a potential educational resource (37%). Flora and fauna were also seen as significant with 26% of those questioned strongly agreeing and 37% agreeing.

> *"An interesting quarry to show en route to the group (Tilberthwaite). Show the groups the mine entrances and spoil. Discuss the dangers! Access. How far workers walked to get to work. Age of workers – life expectancy."*
>
> Response to questionnaire – Andy Stubbs, Coniston

At the end of this section people were encourage to add any other aspects which made the site important to them, most people left this blank but those that did comment remarked on the interesting standing remains, the peaceful nature of the site and its educational potential.

Issues facing the mines

The final two questions on the survey were aimed at establishing a general feel for how people would like to see the site managed and improved in the future. As might be expected, these two questions produced the greatest variety and depth of response. The largest threat to the site was seen as being the condition of the standing remains, with 63% strongly agreeing with this statement and a further 11% agreeing. Interpretation and information was also a keen issue with 63% seeing this as a problem. Threats to setting and views, vandalism and litter, and flood damage were all seen as problems receiving a uniform response. Other issues were more divided between those who did and did not see them as a concern. In particular, opinion over footpaths and routes were split equally (26%) between those wanting improvement and those wanting things left alone. The response regarding health and safety was even more divided with 37% of people seeing the current coverage as poor, and 32% seeing the measures in place as good.

Those questioned were then asked to prioritise three key improvements to be made across the site. All those who responded listed;

1) the need for the stabilisation and maintenance of the archaeological and standing structures, and
2) the need for better interpretation and information on both the Copper Mill and Quarry.

There was no real agreement on a third issue but responses included:

- the need for better water management to prevent flooding;
- protection of the landscape by better paths, although this was equally matched by the call for fewer paths to let walkers 'discover' the site on their own;
- removal of obscuring vegetation;
- more guided walks;
- the site should be Scheduled;
- further historic investigation;
- stop trail bike access, and
- preserve the peace and obscurity of the place

'' The Mill site is one of the best preserved, may it long remain so"

Response to questionnaire – Derek Cutmore, Lindal

Gaps in Our Understanding of the Community Value

The potential market – *little is known about those who do not currently use the site and what would attract them to visit. This of course should not be to the detriment of current users and*

would need to be carefully balanced, but as yet the broader demands of the area are not understood.

***The educational potential** – associated with the above would be a better understanding of the educational potential of the mill and quarry. The site would seem to offer a broad range of possibilities in accordance with Key Stage 2, 3 and 4 curriculum topics including local history, the natural environment, scientific discovery, geology, industrialisation and technological and economic change. Local schools in the area were asked to contribute to the plan but failed to do so, possibly because of the timing of the project during the summer holidays. This aspect might need revisiting, particularly with regards improvements to site interpretation and presentation.*

3.0 DEFINING SIGNIFICANCE

Background

The following section looks at just what it is that contributes to the unique site significance of the Penny Rigg Copper Mill and Quarry based on the information gathered in the 'Understanding the site' section. The national significance of the quarry has already been noted by the English Heritage Monument Protection Programme (MMP) review which noted the site as being of 'clear national importance, for which statutory protection will normally be appropriate' although it is not as yet a designated site. Neither does this recognise the importance of the Copper Mill which is arguably the most complete and best preserved example outside the South West. However, such assessments are rather broad based assessment and looks across the whole country without addressing the nuances of each specific site which are essential when considering future management. Any historic site has its own unique cultural significance derived from a wide range of varying values and perspectives encompassing not just the physical fabric of the site but also its setting, use, history, ecology, traditions, local distinctiveness and community value (Kerr 1966, 4). Therefore, the successful management of a site is based on protecting these various elements, foreseeing any potential conflicts of interest within them, and minimising any potential threats arising in the future.

'Most places are significant for more than one reason. Anyone who manages such an asset will need to understand all its values because most management problems are the result of competition between different values'

HLF 2005, 11

This assessment of significance includes an overall evaluation of the whole mill, mine and quarry complex according to guidance set out in Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (English Heritage, 2008). This focuses on four high level themes:

- **Evidential Values** - the potential capacity of a site to yield primary evidence about past human activity (building design, extent of survival, etc).
- **Historical Values** - the potential of the site to offer a connection between the present and the past through association with people, events and aspects of life.
- **Aesthetic Values** - the potential for people to derive sensory and intellectual stimulation from a place, through design, art, character and setting.
- **Community Values** - The potential for a site to hold meaning for people to relate to it or whose collective experience or memory it holds (often closely related to Historical and Aesthetic values).
- **Ecological Values** In addition, there will also be a consideration of the importance of the natural environment in terms of diversity, habitat and research potential.

Within these five broad headings various site specific criteria and themes will be explored and evaluated, although there is considerable overlap between each of the groups. In order to help the formation of a positive conservation and management strategy each of the criteria have been ranked (Clark 1999, 149; Kerr 1996, 19). However, the intention is not to devalue certain aspects of the site and it should not be assumed that an element designated as being of SOME or MARGINAL significance should be regarded as expendable, but only as less significant than other aspects of the site. It should also be stressed that significance may be modified as new changes are implemented and perceptions of the site alter. A review of significance should, therefore, not be seen as a single exercise but something to be regularly re-evaluated.

Ranking of Significance

Exceptional: aspects of the site considered as seminal to the evidential, historic, aesthetic or communal value of the site, the alteration or development of which would destroy or significantly compromise the integrity of the site. This category may be determined by the date, rarity, completeness, duration, setting or the representative quality of the element discussed.

Considerable: aspects that help to define the evidential, historic, aesthetic or communal value of the site, without which the character and understanding of place would be diminished but not destroyed.

Some: aspects which may contribute to, or complement, the evidential, historic, aesthetic or communal value of the site but are not intrinsic to it, and in some circumstances may be intrusive, and the removal or alteration of which may have a degree of impact on the understanding and interpretation of the place.

Marginal: **those** aspects which have only a minor connection with the evidential, historic, aesthetic or communal value of the site and could be considered intrusive, the removal or alteration of which could have a limited affect on the understanding of place.

In some cases, especially in the case of evidential and historic factors, the criteria affecting significance may vary spatially across the site. To clarify this, the individual significance of the key site components will also be assessed and ranked. However, again it should be stressed that this is intended to allow for informed management decisions and it does not mean that if, for example, Horse Crag Quarry is given a lower ranking than Penny Rigg Quarry that it is necessarily intrinsically less valuable, but just possibly less sensitive to change.

3.1 OVERALL SITE SIGNIFICANCE

The Penny Rigg Copper Mill has **exceptional** significance as a single phase, medium sized, ore dressing and processing plant associated with Tilberthwaite Copper Mine, one of the oldest copper mines in the region. It belongs to an important group of Cumbrian mines, which together comprise the largest concentration of copper mines outside of Devon and Cornwall. The most significant mine in the group is the large, multi-phase site at Coniston, but below this there are three comparable sites – Tilberthwaite, Goldscope and Greenburn. Goldscope, in the Newlands Valley, and Tilberthwaite both date from at least the 16th century and continued to operate until the late 19th - early 20th century, while Greenburn is a single-phase, late 19th century site. There are also smaller copper workings in the group, including Long Work and Dale Head in the Newlands Valley, the Hay Gill and Carrock End mines in the Caldbeck Fells and the Seathwaite Tarn mine in the Coniston Fells. Significant quantities of copper were also raised at Roughtongill in the Caldbeck Fells; although this mine is better known as a lead producer. In addition, there were a number of insignificant or unproductive copper trials in Buttermere and Borrowdale, many of which are listed by Adams (Adams 1988).

The mill at Penny Rigg is associated with the final major phase of operations at Tilberthwaite and is considered to be of **exceptional** significance as part of this overall complex; although at some distance spatially from the main site. In many ways the significance of Tilberthwaite parallels that of Coniston, although the mine itself is on a much smaller scale and was never as successful. Indeed, part of the importance of the site is the close ties it has with Coniston; the two sites being under the same ownership for much of their use. Like Coniston, Tilberthwaite remained in almost continual operation from the late 16th until the early 20th century, and as such its history marks the broader development of mineral mining across the region. In addition, when seen together with Penny Rigg Mill, the mine can be said to preserve all the principal features of an integrated mining operation, providing physical evidence of the full extractive process from underground mining to the production of the final copper concentrate.


Plate 38 & 39: *Penny Rigg Copper Mill, one of the best preserved single phase mills in the country*

Well preserved copper mills of this size and period are comparatively rare in England, and the best parallels to Penny Rigg are found elsewhere in the Lake District. The Upper and Low Mills at the Coniston mines contain many of the features which can be seen at Penny Rigg but these were much larger, multi-phase operations and the archaeological remains are considerably more complex. The nearby Greenburn copper mine on the north flank of Wetherlam is of a similar size but is more complete than Penny Rigg. It is also a slightly later operation as shown by its use of more complex ore recovery techniques such as acid leaching (a system which only starts to be employed in British metal mining towards the end of the 19th century). Penny Rigg by contrast is perhaps a better example of a typical mid 19th century mill. There were a number of contemporary copper mills elsewhere in Cumbria (for example Roughtongill, Redgill and Goldscope) but few standing structures survive today at these sites.

There are no examples of comparable mills outside the Lake District. No mill remains of this size or period at the Alderley Edge copper mines, Cheshire or at the Ecton mines, Staffordshire. Although there are a number of surviving examples of mid 19th century copper processing mills in Cornwall and Devon these sites are technologically quite different from Penny Rigg, especially in the widespread application of steam to power the dressing floors. Unlike the Lake District, the copper mills in the South West were also involved in the production of secondary products such as arsenic.

The best parallels for Penny Rigg Mill can be found at some of the small, single period copper mines in north Wales such as Cwm Ciprwth, Cwmdwyfor, Lliwedd and Hafod-y-Porth in Snowdonia which were all worked in the 1850s and 60s and have well preserved remains of water-powered crushing and dressing mills (Bick 1982). Like Penny Rigg, the relative isolation of these mines has contributed to their preservation.

The basic technology for processing copper ores is very similar to that used with lead ores and there are a large number of surviving lead mines, with associated small mills, which are comparable to Penny Rigg. Parallels can be drawn with known sites in the north and mid

Pennines where extensive use of water power was made. In addition to the excavated and reconstructed site at Killhope, Co. Durham (Cranstone 1986) there are a number of other mills more comparable in size to Penny Rigg, and which also contain water powered crushing and dressing mills; examples in North Yorkshire include the Dolly Level and Low, or Plate, Level dressing floors in Swaledale, North Yorkshire (Gill 2004) and the Bolton Gill dressing floors, Grassington Moor (Palmer and Neverson 1989). The best examples of small water powered lead dressing mills are in Wales. The mid Wales mills have been studied and recorded by the late David Bick - for instance the mill and crusher houses at Cowarch Mine, Dinas Mawddwy (Bick 1978, 20). The sites in North East Wales - for instance Bryntail, Llanidloes or Nantiago, Llangurig - have been the subject of a recent survey by the Clwyd-Powys Archaeological Trust (Jones et al 2004). Similar comparative surveys have yet to be undertaken in Northern England.

The largest producers of slate in Britain was North and Mid Wales where three huge mechanised quarries dominated the market - Penrhyn Quarry, Bethesda, Dinorwic quarry, Llanberis and Oakeley Quarry, Blaenau Ffestiniog. Overall, Wales produced nearly 60% of the country's total slate output in the late 19th with the Lake District only accounting for 13% of the market.

There are 33 slate quarries recorded for Cumbria on the National Monuments Record (NMR) but this does not include the numerous smaller sites scattered across the region which are not registered on the database. A brief glance at the first and second edition OS maps shows a huge number of sites in operation in the 19th century, and Cameron identifies 18 working sites in the Tilberthwaite area alone (Cameron 1996, 132). One of the largest and most complete historic quarries is at Honister where slate was cut from the late 19th to the late 20th century. The complex at Honister features extensive evidence of quarrying from a number of different phases of use including inclined planes, packhorse tracks, lorry roads, dressing sheds and bothies. The site now forms one of the regions key visitor attractions. Other quarries in the Cumbria noted as being of national importance in terms of their heritage significance include Hodge Close, Coniston Old Man, Stockdalebank (Longsleddale), Wrengill and Threlkeld.[7]

Penny Rigg and Horse Crag form part of the Tilberthwaite quarry group seen as being of national, and therefore, **exceptional** significance due to the comprehensive nature of the surviving archaeological material. This includes adits, closeheads, riving sheds, workshops, rid tips, tramway, working faces and access tracks. Many of these features are well preserved and the site has the potential to 'tell the story' of slate extraction from the quarry face through to the preparation of split slate for transport. However, a certain amount of work still needs to be undertaken to provide a better understanding of the development and the function of some of the surviving structures.

[7] English heritage MPP quarries report citing online reference > http://www.cumbria-industries.org.uk/quarrying.htm, accessed various

All three major forms of quarrying are represented on site – surface, pit and slate mining. The quarry has a long history of use dating back at least to the late 18th century and continuing right up to more modern times. In addition, the operation of these two industries within a short distance of each other is also of considerable importance, demonstrating the geological, historical and economic juxtaposition of the local copper and slate industries. This has implication with regards the understanding of the industrial development of the region, as well as in exploring the social history of Coniston and how the miners and quarrymen co-existed. The quarry is also important as historic evidence of a 'living' industry, quarrying still being very much an element in the economy of the region. This contributes to the site's educational potential and provides a link between the industrial landscapes of the past and those of the present.

Other factors contributing to the overall importance of the site include the **exceptional** significance of the geology of Penny Rigg, particularly in understanding the volcanic activity and resulting mineralogy of the region and how this has influenced the development of the extraction industry. The flora and fauna of the area is similarly of **exceptional** significance, particularly along the Tilberthwaite Gill where the site forms part of the SSSI and the various pockets of ASN Woodland which extend into, or border, the site.

In terms of its setting, Penny Rigg is significant for its strong 'sense of place'. This goes beyond the purely historic and archaeological remains to evoke a very strong aesthetic and emotional response prompted by the juxtaposition of decay and re-growth. Such subjective responses are very difficult to quantify and evaluate but it is apparent that there is a strong attachment to the site amongst regular users, although perhaps it does not stir the same levels of enthusiasm as Coniston. Nevertheless, Penny Rigg is not the poor relative but has a unique and of intrinsic value of its own and actually has a much broader general appeal. Not least, because access to the site is much easier than at Coniston, with good car parking close by. This makes it more popular with families and youth groups. The site is also more compact and focused than Coniston, although considerably less complex, and overall the preservation is better.

Summary of factors contributing to the overall EXCEPTIONAL significance of the site	
Penny Rigg Copper Mill is an intrinsic part of the Tilberthwaite Mine complex.	EXCEPTIONAL
Significance of Tilberthwaite as part of the group of Cumbrian Copper mines - the largest collection of mines outside Devon and Cornwall.	EXCEPTIONAL
Overall importance of the Cumbrian copper mines to the development of the modern world and global industry.	EXCEPTIONAL
Within the Cumbrian group, Tilberthwaite is one of the more comprehensive examples, alongside Greenburn and Goldscope mines	EXCEPTIONAL

Penny Rigg Mill is an exceptional example of a single phase mid 19th century mill with very little later development (though possibly buildings re-used by quarry). One of the best in the country	EXCEPTIONAL
The mill (as opposed to mine) forms part of the Lakeland group of copper mills - better preserved than Coniston, and single phase; Greenburn is later and little evidence survives at Goldscope.	EXCEPTIONAL
The whole process of copper making from gaining the ore to preparation of the final copper concentrate is evident at Tilberthwaite/ Penny Rigg.	EXCEPTIONAL
Significance of Penny Rigg and Horse Crag as one of a group of important 18th and 19th century slate quarries in Cumbria.	EXCEPTIONAL
Levels of preservation and the comprehensive nature of the quarrying evidence at Penny Rigg and Horse Crag	EXCEPTIONAL
The ecological importance of the site as reflected in its SSSI designation and identification of ASN Woodland.	EXCEPTIONAL
The juxtaposition of the copper and slate industries, illustrating how two major forces in the Lakeland economy where driven by the unique geology of the area.	EXCEPTIONAL
Educational potential with regards geology, ecology, history, economics, art and outdoor activities.	CONSIDERABLE
The site is very important to the local community and has good access.	CONSIDERABLE
The site creates a cherished and valued 'sense of place'.	CONSIDERABLE
The quarry is a historic link with operating quarries in the region – part of the living industrial landscape.	CONSIDERABLE
There are some important views and vistas across the landscape from the top of Horse Crag	SOME

3.2 EVIDENTIAL VALUES

Preservation on the site is very good in places, and there has already been some research undertaken on both the above and below ground remains. However, there is considerable potential for more information to be uncovered in terms of the form and function of the mill and quarry, the various related structures, and more general data on the lives of the people who lived and worked on the site.

There are four different areas where material evidence at Penny Rigg can be found:

1) **Above ground standing remains** – these have been the primary focus of the first section of the Plan and include buildings associated with the mill, mine and quarry including Level entrances, riving sheds, ancillary buildings, tramways, workshops, mill buildings, platforms, settling tanks and leats. These remains are considered to be of **exceptional** significance as discussed below.

2) **Sub-surface archaeological remains** – little is known about the preservation of the below ground archaeology associated with the site as no excavation has taken place. However, considering the mill is thought to be largely single phase, and has remained relatively undisturbed since the 1880s, then there is potential for the preservation of structures and deposits to be good. Survival of evidence associated with the quarry is unlikely to be as well preserved as there has been considerable disturbance in these areas. Sub-surface remains are, therefore, considered to be of **considerable** significance although levels of preservation will vary across the site.

3) **Below ground mining activity** – this varies from the sub-surface, more 'traditional', archaeological remains and deals instead with the specialised field of mining archaeology. Currently only members of CATMHS have undertaken any below ground investigation and recording related to both the copper mine and slate closeheads. The underground workings are considered to be of **exceptional** significance although a more detailed consideration of this area is beyond the remit of the Plan.

4) **Artefact Collections** – there is the potential for the discovery of artefactual evidence from both surface and below ground investigation. Currently there are no collections associated with the site. Any finds identified during mine exploration work by CATMHS have sometimes been passed to the Ruskin museum (but with no formal agreement on ownership or storage), although current CATMHS policy is to leave finds *in situ* (Matheson pers comm.).

The above are all important in terms of expanding our knowledge of mining and quarrying at Penny Rigg and Horse Crag but this Plan primarily deals with just the first form - the above ground evidence - and to some extent the potential for the survival of sub-surface archaeological remains. What is immediately apparent from a consideration of the surviving material evidence is the good preservation of the standing remains, and the comprehensive nature of the evidential material.

The Copper Mill and Mine

The major components of the Mill and Mine – Horse Crag Level (2038), spoil tips (2054-55), smithy (2041), powder house (2042), water wheel pit (2044), water courses (2025-28), trackways (2029-30), crushing house (2046) and ore dressing mill (2051) – all survive as prominent features or standing structures in the landscape. Most are in a good state of preservation, although many are considered to be at immediate risk. The extent of the surviving evidence is of **exceptional** significance and makes this one of the most important copper mill sites in the country. In addition, there is considerable potential for the survival of *in-situ* sub-surface archaeological remains associated with the dressing mill, washing floors and settling ponds. Other features such as the mine office, ore storage buildings and bucking/cobbing sheds may also survive beneath later slate waste tips and could be recovered through archaeological excavation; although removal of the rid would be quite some undertaking.

In general, the material evidence of the 19th century mill and mine are considered to be of **exceptional** significance because they form an integrated unit illustrating all processes of production from gaining the ore to processing the mineral ready for shipment to the smelter. All of these processes take place in a relatively small area, moving down the site in sequence from the adit entrance to the banks of the beck. As such, the site has considerable educational potential to convey how a 19th century copper mine worked in a focused and easily accessible area. Although Coniston offers a broader range of material it is spread out over a large area, whereas Penny Rigg is quite small, making it more immediate and easier to visualise and navigate around.


Plate 40 & 41: *slate quarry buildings – the overall the preservation of these buildings is quite considerable, especially down the slope from the main Penny Rigg Quarry. These two buildings (2022) and (2031) lie on the south-east slope of Horse Crag. The first (2022) even has the slate slab roof preserved over the end cell.*

The Quarries

The slate workings at Horse Crag and Penny Rigg quarries include evidence of all forms of slate production – surface, pit and slate mining – all together on one site. Based on a preliminary assessment, there appears to be a sequence of development showing a progression from the 18th century terraces of Penny Rigg to the 19th century closeheads and later re-worked adit and surface quarry at Horse Crag. Associated with both sites are riving sheds (2007, 2031, 2064), rid tips (2060, 2056, 2058), ancillary buildings (2014, 2008), closehead levels (2018, 2006,2059), tramways (2020) and trackways (2002) which, as with the copper mining, show the progression of extraction from working the slate clods at the face to reducing to splitting the slate for shipment. There is some potential for the survival of sub-surface remains, although there has been considerable later disturbance on the site.

Overall, preservation in the quarries is quite good but variable. The better preserved examples (2022, 2031, 2037) seem to be away from the main thoroughfare, on the south-eastern slope of Horse Crag, above the copper mine.

Summary of factors contributing to the EVIDENTIAL value of the site	
General	
The group value of the site – the comprehensive nature of the evidence, for both copper mining and slate quarrying within one small area.	EXCEPTIONAL
The good preservation of much of the standing archaeology	EXCEPTIONAL
The Copper Mine and Mill	
The comprehensive nature of the evidence from mining the ore to processing the mineral ready for smelting, all aspects are represented.	EXCEPTIONAL
The mill is single phase so presents a clear picture of operations in the mid 19th century without later additions.	EXCEPTIONAL
One of the best examples of a single phase water driven (as opposed to steam) mineral mill in the country.	EXCEPTIONAL
The potential survival of undisturbed sub-surface archaeological deposits and features.	CONSIDERABLE
Arrangement of the mill is sequenced down the hill, and the compact nature of the site, means it has considerable potential to interpret the material evidence for the more general public.	CONSIDERABLE
Potential survival of archaeological remains under the spoil tips	SOME
The Quarries	
The comprehensive nature of the evidence which includes all processes from working the quarry face to splitting the slate for transportation.	EXCEPTIONAL
The range of the evidence, including all forms of quarrying – surface, pit and mining and arranged around the site at different places which will be useful for site interpretation.	EXCEPTIONAL
Overall preservation of the standing structures is good, but varies considerably across the site.	CONSIDERABLE
Variety of the standing structures, although further research is necessary to explore the function of each of the surviving buildings	CONSIDERABLE
The potential survival of undisturbed sub-surface archaeological deposits and features.	SOME

3.3 HISTORICAL VALUES

Much of the history of Tilberthwaite mine is interwoven with that of Coniston and a considerable body of research has already been undertaken in this field by the likes of W.G. Collingwood (1910, 1912), E Holland (1981,1986) and most recently, Peter Fleming (2007), amongst others. Much research into the specific history of Penny Rigg has been undertaken over the past four years by Alistair Cameron (Cameron 1996, 2010) and members of the Coniston Local History Group (CLHG) and CATMHS. A considerable amount is known about the mill in terms of

ownership, although details of levels of production and the workforce etc. are a little more elusive and largely tied up with Coniston.

Information on the quarry is less readily available, largely because the copper mine was the focus of operations in the 19th century. A preliminary survey of the readily available information has been undertaken (with help from CLHG and CATMHS) as part of the preparation of this Plan but a more detailed study of primary source material including: the Le Fleming estate records at the Cumbria Record Office (CRO WD RY/BOX 21); records relating to Tibberthwaite Mine in the County Records Office in Whitehaven; any later archives held by Rydal Estates; company records of 'Warsop Companies' (late 19th operations under Thomas Warsop), as well as any data held at the National Stone Centre[8] would be recommended, maybe as part of a more detailed buildings and topographic survey. Therefore, at present the historical value of the site in terms of significance is relatively poor, although with considerable potential.

One of the most important historic aspects of the site is the potential to compare the lives of the quarry men with those of the miners working the copper mines. At one stage, in the mid 19th century, the two groups may have been working closely together and it would be interesting to explore their interaction.

In addition to the documentary material there are important historic figures associated with the site which contribute to its historical value. One of the most significant connections is with Arthur Ransome, author of 'Swallows and Amazons' who was a great friend of Oscar Gnosspelius and spent a great deal of time with him discussing 'gosson, veins, reef, pyrites and what not' when he was writing his book 'Pigeon Post' which was published in 1936 (Holland 1986, 279). The book is dedicated to the engineer and Gnosspelius is believed to have been the model for the character of Timothy 'Squashie Hat' who appears in the book. Ransome recorded a visit made to Horse Crag Closehead in 1935 during which he met up with 'Slater Bob' another character who was in his books and who was almost certainly based on John W. Shaw. Ransome described the area around Tilberthwaite Gill as interesting from a mining perspective but a strenuous hike which caused him considerable internal pain!

Other important historic figures associated with the site include Oscar Gnossepelius himself who was a renowned civil engineer and an early aviator, designing the first seaplane - the Gnosspelius No. 2 - in 1912. He married Barbara Collingwood, the daughter of the historian, artist and writer, W.G. Collingwood. Collingwood conducted considerable research into the 16th century records of the Mines Royal activities, publishing key articles on the topic. In 1901 he founded the Ruskin Museum.

[8] http://www.quarrying.org/archives/nationalstonecentre.html

Of course there is also John Barratt who was the instigator of many advances in mining methods and technologies and who, together with John Taylor, was responsible for turning around the failing fortunes of the Coniston and Tilberthwaite mines. Thomas Warsop is another key figure associated with both the mine and quarry. He was a gifted inventor, introducing compressed air for mechanised drilling at Coniston and charging holes for blasting and other purposes with explosives, but his research saw him also experimenting with a huge range of other devices including: vacuum cleaning carpets by compressed air; a patented fly catcher; a railway rail lifter; a trouser stretcher; a self-acting weighing machine; an improved flash boiler; a reversible screw propeller and a simple automatic railway coupling. Thomas erected many large air compressing and rock drilling plants both at home and abroad, including one in which air was conveyed over 8000 feet[9] and was one of the founders of Warsop Companies.

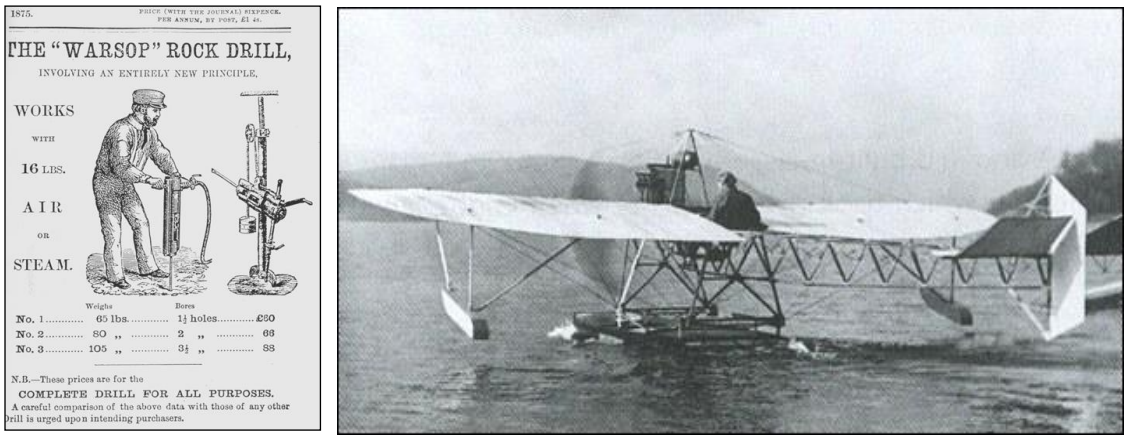


Figure 14 and Plate 42: *Warsop's compressed air 'Rock Drill' and the first seaplane, the Gnossepelius No.2*

The site is also connected with the contemporary artist and sculptor Andrew Goldsworthy, whose installation – sheep fold- stands on the banks of the Yewdale Beck.

Summary of factors contributing to the HISTORICAL value of the site	
Good historic information on the ownership of the mine and the opening of the Horse Crag Level tunnel as well as the subsequent development of the site.	CONSIDERABLE
Good level of social history about the site derived from census data etc.	CONSIDERABLE
Good opportunity to explore the interaction between quarrymen and miners.	CONSIDERABLE
Association with Arthur Ransome.	CONSIDERABLE
Association with Oscar Gnosspelius and J.W.Shaw	CONSIDERABLE
Associations with John Barrett and Thomas Warsop.	CONSIDERABLE

[9] Citing online reference 'The History of Warsop and its Machines' > http://domain928502.sites.fasthosts.com/pdf_files/history/warsop_fairport_history.pdf, accessed 13/09/10

Documentary evidence relating to the quarry (although considerable potential for future research).	SOME
The secondary evidence covering the site (with Tilberthwaite), particularly the work of Collingwood, Holland, Fleming and Cameron.	SOME
Associations with the artist Andrew Golsdworthy	SOME
Association with Collingwood	MARGINAL

3.4 AESTHETIC VALUES

Penny Rigg is located on the edge of the fells, at a dividing point between the wild, blasted landscape of the fells and the pastoral farmland of the valley bottom. As such it is a landscape of transition and this is reflected across the site. To the north the landscape is quite barren, with the huge expanse of the rid tip dominating the area, and to the north-west the ground rises steeply towards the open fell, although this always remains in the distance and is not an ever present force as it is at Coniston. On the southern side of the site the picture is slightly different and, although still very much an industrial landscape, it overlooks the more fertile farmland across the beck. As such, the industrial and the agricultural are brought together and serve as a visual reminder of the forces which have formed the area over the past 400 years.

Plate 43: *there is a strong sense of exploration and discovery at Penny Rigg, buildings are partially hidden by the bracken and there always seems something new to see beyond the next bend of the twisting track. In the distance can be seen the farmland of the valley floor.*

The other predominant factor contributing to the aesthetic value of the site is that the landform of the crag means that there are no clear views around it except from the top. As such, it is very easy to become disorientated. This makes the visitor feel that they are on an expedition, and there is a great sense of discovery on encountering the various standing structures scattered across the landscape. The paths across the site contribute to this. They are in quite good condition but are not imposing so that, again, they convey the feeling of following a little known trail. Even the main

path through the quarry twists and turns so that there is always something new to discover beyond the next bend.

The overall size of the Penny Rigg quarry pit is also quite an important factor and is a dominant feature on the landscape. Although relatively small in comparison with modern quarries, the fact that this is a pit, rather than surface quarry, seems to add to its general impact. The worked faces seem looming and imposing when viewed from below and sheer and vertiginous from above.

Plate 44: *view looking down into the quarry – the size of the quarry pit and its impact on those visiting the site is of considerable significance to the aesthetic value of the site.*

"Because it has been left as you find it from years ago. A natural find – real 'Time Team' archaeological find. The young kids enjoy that natural find 'feel'. I worry a visitor centre approach detracts from the enjoyment of just stumbling across"

Response to questionnaire by Andy Stubbs, Coniston

The movement of water around the site is another prominent feature, in particular the changing character of the Yewdale as it rushes through the Gill and then meanders around the crag to the east. The passage of water through the leats and down from the adit is also a key feature of the mill site.

Although the natural attractions of the site have no doubt inspired many amateur artists, the only professional with a direct association with the site is Andrew Goldsworthy. A British sculptor, living in Scotland, Goldsworthy produces site-specific sculpture and land art situated in natural and urban settings. He has designed the installation which forms part of the re-constructed sheep fold on the banks of the beck (2001). His art relies on the use of natural objects to create sculptures

which draw out the character of their environment. The slate in the sheep fold perfectly reflects this concept and creates an interesting and attractive piece of art which does draw a number of people to the site each year.

Plate 45: *Andrew Goldsworthy's sheep fold (2001)*

Summary of factors contributing to the AESTHETIC value of the site	
The transition between the wild landscape of the fells and the pastoral farmland of the valley bottom.	EXCEPTIONAL
The sense of exploration and the 'discovery' of archaeology amongst the wild landscape.	EXCEPTIONAL
Size and depth of Penny Rigg Quarry pit.	CONSIDERABLE
Views out across the landscape from the top of Horse Crag	CONSIDERABLE
The Andrew Goldsworthy sculpture	CONSIDERABLE
Movement of water around and across the site	SOME

3.4 COMMUNALVALUES

The site is of considerable communal value to those who already use it regularly, and there is the potential to extend this to new users without detracting from the historic character of the site or its 'sense of place'. In particular the educational and interpretative values of the site could be improved to appeal to a wider audience and enhance the experience for existing users. Currently, the site is very popular with walkers on their way up to Tilberthwaite High Fell, and with mine exploration groups who visit the site specifically or on the way to Tilberthwaite mine. The quarry is also used regularly by climbers of all ages, but particularly youth groups.

Plate 46: *a school's group enjoying a day in the sun, traversing a bolted route at Penny Rigg Quarry*

The contribution of the site to regional tourism is relatively low and it is not considered to be either desirable, or viable, to promote it as key tourist attraction, although it does have **exceptional** significance as a small visitor site. What is important about Penny Rigg is that it appeals to a broad audience, probably more so than a site like Coniston Coppermine. One of the biggest advantages Penny Rigg has over Coniston is easy access. Visitors can drive to the site and there is good off road parking close by. This makes the site more attractive to short stay visitors who come for a bit of fresh air and exercise, or those who want to come for a quick look at the mill. It also has an appeal for families who can come for a picnic without having to hike some distance to the site. Although the mill or rid tips of the quarry might not be the most attractive location for this, the banks of the beck, next to the sheep fold, do have some merit. The sheep fold itself attracts a number of visitors each year who come specifically to see the Andrew Goldsworthy sculpture

The educational potential of Penny Rigg has the potential to be of **exceptional** significance but is currently under exploited. There is the opportunity here for further enhancement without necessarily disturbing the heritage character, or 'sense of place', of the site. As an educational resource the site touches upon a number of subjects within the curriculum ranging from history (including local history), geology, ecology, economics and geography to more esoteric subjects such as art and English. Similarly, the site is an important resource for adult education with opportunities for local history, geology, archaeology and art. Associated with this is the interpretative value of the site, although currently underdeveloped and virtually non-existent.

Summary of factors contributing to the COMMUNITY value of the site

Significance of the site in terms of recreational mine exploration.	EXCEPTIONAL
Significance as a potential educational resource for all ages	EXCEPTIONAL
Significance of the site to walkers and hikers.	EXCEPTIONAL
Significance of the site as a climbing venue	CONSIDERABLE
Significance of the site for short stay visitors	CONSIDERABLE
Significance in promoting health and exercise.	CONSIDERABLE
Significance in terms of tourism potential	SOME
Current significance of site interpretation	MARGINAL

3.5 ECOLOGICAL AND GEOLOGICAL VALUES

The **exceptional** significance of the Yewdale Beck has already been recognised in the designation of the flora as an SSSI. This recognises the extremely rare plant communities associated with the gorged out rock ledges of both acid and base-rich substrates as well as the acid grassland and areas of stabilising quarry spoil which are within the boundary of the SSSI. Although these communities are all set out within the citation – it is the U17 *Luzula sylvatica-Geum rivale* tall-herb community vegetation found on the rock ledges and dependant on the moist riverine environment which is the notified feature and which is the feature of **exceptional** significance.

The bat habitats created at the site by the buildings, quarries and mines entrances are also of **considerable** significance and this is confirmed in the bat survey of 1995. Bats are highly protected and any destruction or disturbance of their habitat is illegal. These nocturnal and hibernating species will need to be carefully considered in any archaeological maintenance or conservation proposals.

The geology of the site is of considerable significance having had enormous influence on the environmental and historical legacy of this site. The exposed geological features, as well as the *in-situ* deposits and spoil heaps, potentially form the basis of an exceptionally significant feature of the site.

The potential for rare lichen communities may also be of considerable significance and directly influenced by the underlying geology, although this needs to be assessed by a specialist. This could potentially include a community of lichens which can survive on metalliferous substrates.

The post industrial habitats associated with the mine workings and structures are of considerable significance, and on further investigation may well reveal exciting and rare species assemblages that could raise the ecological profile of the site. The chasmophytic vegetation, partly due to mining operations, are also of considerable significance and exceptionally attractive in places. Although common in the Lake District, the interaction of industrial remains and metalliferous substrates extend the possibilities of rare and diverse habitats.

The presence of the designated area of Ancient Semi Natural Woodland (ASNW) site is of **considerable** significance. The site represents a remnant of the woodlands that would once have been ubiquitous in this area and likely to have been more widespread throughout the site until the quarrying operations disturbed the natural vegetation.

Natural moorland and woodlands habitats in the Lake District have often been degraded as a result of farming and leisure activities. In many areas attempts to restore these are being carried out. In this case, however, there is a danger that trees and shrubs may damage the fragile deposits and building remains and undermine some of the more unique habitats.

Without further investigation the presence of protected species other than bats at the site or rare invertebrate communities on the river shingles, cannot be confirmed. Any planning application, however, would be likely to need an ecological assessment and if any are found this would raise the significance value of the species concerned.

Summary of factors contributing to the ECOLOGICAL value of the site	
Significance of the Tilberthwaite Gill SSSI to the site	CONSIDERABLE
Importance of protecting bats	EXCEPTIONAL
Significance of the geology at the site	CONSIDERABLE
Significance of the Rare Lichen Communities	SOME
Interesting and potentially rare post industrial habitats at the site	CONSIDERABLE
Extensive opportunities for diverse Chasmophytic vegetation	CONSIDERABLE
Importance of the ANSW site to the area	CONSIDERABLE
Significance of exposed river sediments	SOME

3.6 SIGNIFICANCE BY AREA

Those values contributing to the significance do vary spatially across the site, particularly with regard historic and evidential significance. The following section summarises significance by zone, as illustrated in figure 15. It is based on the current values as well as potential *i.e.* the current communal value of some areas is poor but this would improve with better interpretation. This means that significance will, of course, vary in response to any changes and developments in the future.

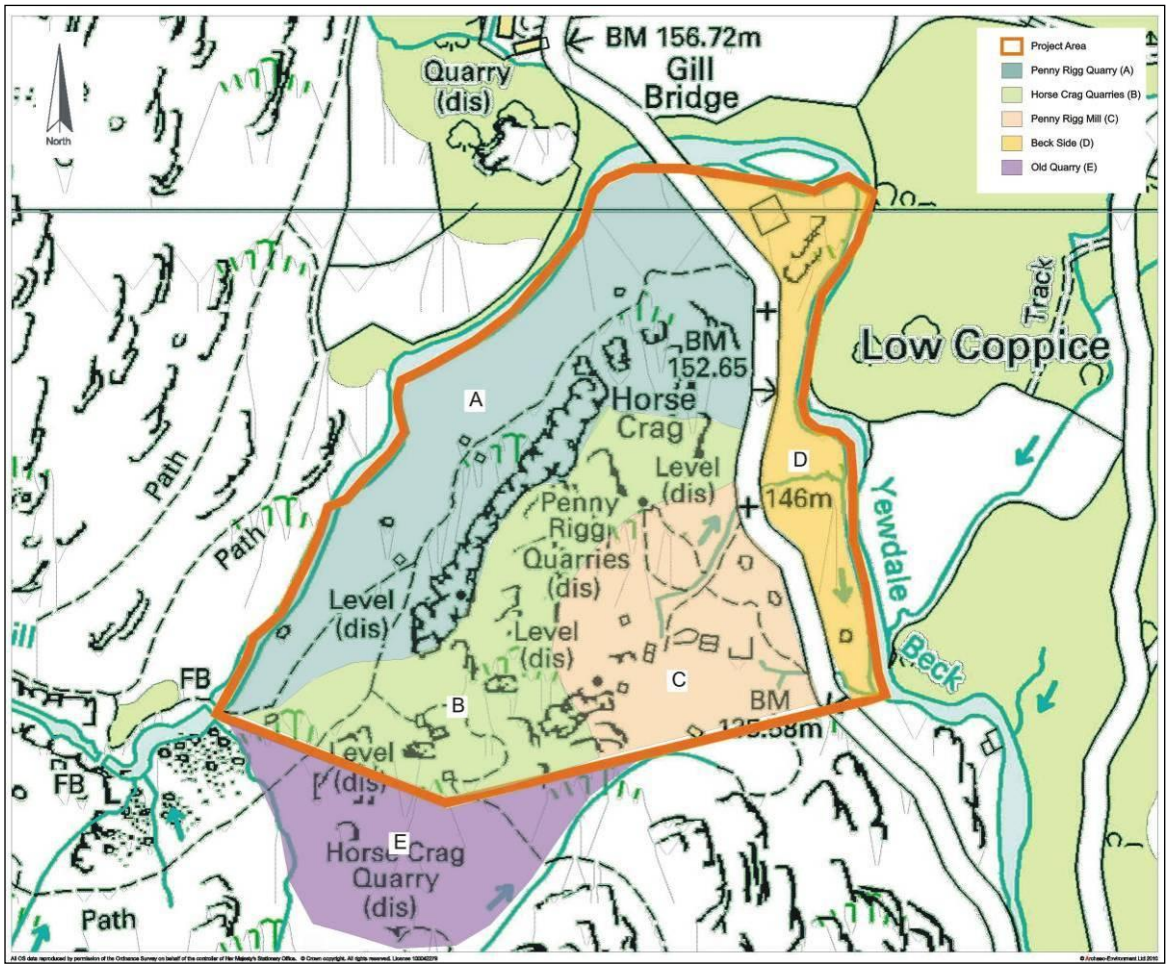


Figure 15: *Penny Rigg Copper Mill zones of significance.*

Penny Rigg Quarry (A)

Penny Rigg Quarry is overall of **exceptional** significance. In terms of evidential value it is of exceptional significance as the main quarry site, dating back at least to the late 18th century. It features evidence of all main processes from working faces and closeheads to riving sheds, rid tips and trackways. Historically it is slightly less significant as only an outline of the site's development is traced, although there is considerable potential here for further research. Aesthetically the depth of the quarry is quite striking and it is a dominant feature of the landscape. There are important views along the quarry pit and from the top of Horse Crag out across the hinterland. As a community resource it is exceptionally significant as a venue for climbers and also has considerable potential for interpretation and education. Ecologically this zone is of exceptional significance as it includes the Tilberthwaite Gill SSSI and features a number of levels and quarries which may be used by bats or other protected species. There is a lot of potential for discovery of things of considerable significance such as rare lichen communities and interesting post industrial habitats and geological features.

Horse Crag Quarries (B)

Horse Crag Quarries are overall of **considerable** significance. In terms of evidential value the area is of exceptional significance and includes some of the best preserved quarry buildings on the site. The area includes Horse Crag Quarry itself as well as a number of small closeheads up on the hill behind (in between the Mill and Penny Rigg Quarry). Horse Crag is important as the only surface quarry on the site (although quite small) and the closeheads are very good examples of this form of quarrying. Historically the site is of considerable significance because of the close connection with Oscar Gnossepelius, J.W. Shaw and Arthur Ransome. Aesthetically, it is of considerable significance for views out across the Mill and the strong sense of discovery which permeates this area, with hidden levels and buildings peeking out of the bracken. As a community resource the preservation of the archaeological material has some significance as part of the overall story of the site. Ecologically the area is of considerable potential significance due to the location of levels and crevices which may be used by bats, the presence of the ASNW, possible rare lichen communities, post industrial habitats, chasmophytic vegetation and geological features.

Penny Rigg Mill (C)

Penny Rigg Mill is considered to be of overall **exceptional** significance. Evidentially it is exceptionally important as one of the best preserved example of a single phase, mid 19th century copper mill in the country. It is also significant because of the comprehensive nature of the material all focused within one small area. Historically it is significant for its associations with John Barratt and mining at Tilberthwaite in the 19th century, as well as later connections with Thomas Warsop. Aesthetically the decaying buildings add to the site's 'sense of place' but views from within this area are limited. In terms of community value this is one of the most important areas of the site and is of exceptional significance. It has considerable potential as an educational resource, partly as it is small, focused and has good access. It is also an important site for local mining enthusiasts who are working hard to restore the Horse Crag Level. Ecologically the area is of exceptional significance due to the location of the level and building crevices which may be used by bats and of considerable importance because of the possibility of rare lichen communities post industrial habitats, chasmophytic vegetation and geological features.

Beck Side (D)

The Beck Side area is considered to be of overall **considerable** significance. Evidentially, the remains of the settling ponds and wall on the banks of the beck, below the Mill, are of considerable importance and represent the final stage in the ore dressing process. Historically, the area is only of marginal importance but aesthetically it is significant because of the Andrew Goldsworthy sculpture and the views along the beck. The grassy banks of the beck offer a good place for a picnic and a walk and, therefore, are of some community significance. Ecologically the site is of considerable significance because of the possibility of rare lichen communities, post industrial habitats, chasmophytic vegetation and geological features. It is also of some

significance due to the potential presence of riverine invertebrate communities on the shingle.

Old Quarry (E)

The Old Quarry is considered to be overall of **considerable** significance. Evidentially the remains of the closehead, old surface quarry, rid tips and buildings are of exceptional importance. The building is extensive and survives to a significant height, although at immediate risk of collapse. Historically the site appears on the first edition OS map and is one of the older quarries in the area; probably contemporary with the first phase of Penny Rigg. Aesthetically, this area of the site is quite wild, rising up towards the higher ground, and makes an important contrast with the landscape around the Mill. The interpretative potential of this small quarry makes it of some community significance and ecologically the site may be of considerable significance due to the likelihood of protected species being present and the post industrial habitat, and geological interest. There is also at least one highly diverse wet flush which is of some importance.

"Mining site out of the way and it is so interesting. Very peaceful"

Response to questionnaire by Mr. P. Timewell, Barrow-in-Furness

Plate 47: *entrance to the closehead (2018) in Penny Rigg Quarry – the levels of preservation on the site, across a wide range of features, is very high.*

Significance by zone	Evidential	Historical	Aesthetic	Community	Ecological
Penny Rigg Quarry (A)	EXCEPTIONAL	CONSIDERABLE	EXCEPTIONAL	EXCEPTIONAL	CONSIDERABLE
Horse Crag Quarries (B)	EXCEPTIONAL	CONSIDERABLE	CONSIDERABLE	SOME	EXCEPTIONAL
Penny Rigg Mill (C)	EXCEPTIONAL	CONSIDERABLE	SOME	EXCEPTIONAL	CONSIDERABLE
Beck Bank (D)	CONSIDERABLE	MARGINAL	SOME	SOME	CONSIDERABLE
Old Quarry (E)	EXCEPTIONAL	SOME	CONSIDERABLE	SOME	CONSIDERABLE

4.0 PROTECTING SIGNIFICANCE - RISK, ISSUES, OPPORTUNITIES AND POLICIES

Protecting the significance of the mines

Those elements and values which contribute to Penny Rigg's unique cultural significance are under a number of real and potential threats. The following section looks at the various risks and issues which may threaten the future of the site, as well as identifying and exploring opportunities for enhancement and improvement. At the end of the discussion on each set of related issues there are a series of policies aimed to mitigate or limit the potential threat. This aims to provide a clear and practical way forward and help form a long-term management plan which will protect and enhance the Mill, Mine and Quarry as a heritage asset for the future.

It starts with a general section, highlighting '*a vision'* for the future of the site as well as a series of broad based conservation principles. It then goes on to look at those specific threats and issues identified through fieldwork and consultation with the various stakeholders. Given the nature of the risks and opportunities there may be some degree of reiteration across sections.

4.1 GENERAL AIMS AND CONCERNS

The Vision

A vision for Penny Rigg Mill and Quarries

Penny Rigg Mill and Quarries will continue to be a key surviving example of the important industrial history of the Lake District. The site will provide a stimulating educational experience celebrating the role played by copper mining and quarrying in the industrial history of the region. It will compliment existing industrial sites in the area, including Coniston and Tilberthwaite, and provide opportunities for exercise and health, the enjoyment of a 'secret landscape' and wildlife appreciation for all. Penny Rigg will be an asset to the Lake District National Park, the landowner, local community and all other users, and contribute to the cultural and economic growth of the region.

The vision will be achieved through active conservation, good management and sensitive tourism strategies, with the aim of preserving, balancing and enhancing all aspects of the site's cultural significance. The various stakeholders need to work together to ensure the future of the site as a valuable heritage and leisure asset while ensuring the protection of the historic fabric and strong 'sense of place'.

Adopting the Plan

The success of the Plan is dependent on the agreement and understanding of all the major

stakeholders - Rydal Estates as the landowner, LDNPA, English Heritage, Natural England, and the various mine exploration societies and outdoor centres which use the site. Adoption of the Plan must also include appropriate financial provision to implement policies, and a suitable timetable for assessment and review. Significance should only be changed after an appropriate 'research and review' period and not on the basis of future management expediency.

Statutory Requirements

Penny Rigg is not a Scheduled Monument and as such the archaeology is not afforded any legislative protection. A Scheduled Monument is protected from demolition, destruction and damage, and altering the site in any way must have prior written consent from the Secretary of State. Despite the Tilberthwaite quarries being noted as being of national importance in the MPP quarry review, neither these, nor the Mill, have been Scheduled. Further the substantial remains of the Gill Head mine which was worked between the 17th and 19th centuries and has substantial documentary evidence associated with it, could also be considered for scheduling, but would require additional research (Matheson pers com). It is recommended that a new application be made to English Heritage for spot scheduling based on the 'Overall Significance' section of this Plan which stresses the **national** importance of the site based on a wide variety of criteria including those advocated by the MPP - survival, potential, diversity, amenity value, documentation and group value. The area proposed for inclusion would be the project area plus an extension to the south to cover the old quarry (Figure 16).

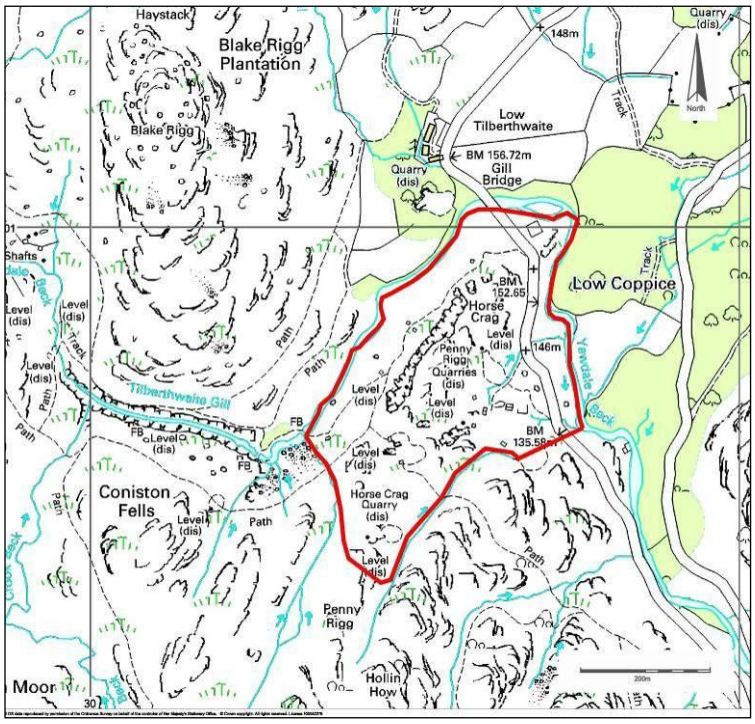


Figure 16: *proposed Scheduled Monument Area*

The site is afforded some degree of protection under local planning law. Planning Policy Statement 5 (PPS5, 2010) states that the Local Planning Authority (LPA) - the Lake District

National Park Authority - must take into account:

> *-The desirability of sustaining and enhancing the significance of heritage assets and of utilising their positive role in place-shaping; and*
>
> *-The positive contribution that conservation of heritage assets and the historic environment generally can make to the establishment and maintenance of sustainable communities and economic vitality (PPS5, HE7.4, 7)*

when assessing any planning proposals. Although not designated Penny Rigg is still covered under PPS5 Policy HE8 which deals with non Scheduled monuments and states that:

> *The effect of an application on the significance of such a heritage asset or its setting is a material consideration in determining the application (PPS5 HE8, 8).*

this would include any developments within the vicinity of the site which could impact upon the setting of the Mill or Quarries. Setting in this context is defined as:

'*The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral' (PPS5 2010,15).*

As such, setting does not necessarily have to relate spatially to the site but might be any element which affects our understanding of the heritage asset. This might have an implication on any future proposals within the wider area.

Site of Special Scientific Interest

The ecology of part of the site is protected as a SSSI; this is intended to give legal protection to *'the best sites for wildlife and geology in England'*. Sites are administered by Natural England who are responsible for the identification, protection and conservation of SSSIs under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000).[10] Natural England will need to be contacted before any operations, within the boundary of the SSSI (or outside the boundary if affecting the integrity of the interest features of the site) are undertaken. Operations Liable to Damage (OLDS) (Appendix 6) the site would include any form of spraying, drainage works, planting or changes in grazing regimes. Such work will require consent, assent or advice from Natural England or the relevant competent authority under the CROW Act. The

[10] Further information on SSSIs can be found on the natural England website http://www.naturalengland.org.uk/ourwork/conservation/designatedareas/sssi/designation.aspx

Environment Agency may also need to be consulted depending on the nature of works.

Non-Statutory Guidance

As part of the Lake District National Park, the Penny Rigg Mill site operates under the statutory objectives of the Parks Authority to:

- *conserve and enhance the natural beauty, wildlife and cultural heritage of National Parks, and*
- *promote opportunities for the understanding and enjoyment of the special qualities of the National Parks by the public.*

A new National Park management plan (2010-2015) has been published - 'The Partnership Plan'[11] – central to which are the concepts of sustainable development, the promotion of world class visitor attractions, the conservation of the natural environment and involvement with local communities. Any management strategies and conservation policies at Penny Rigg should aim to support and enhance these overarching aims.

POLICY G1: ADOPTING THE PLAN

All the main stakeholders should agree on, and adopt, the Plan as the basis for future management strategies and key guidance in assessing any proposed changes. An appropriate timetable for amendment should be established and no statement of significance changed except after appropriate research and review.

POLICY G2: STATUTORY CONTROLS

All stakeholders should ensure that any maintenance or development work undertaken on, or in the vicinity of, the mines is in strict accordance with planning policy (and any revision or amendments to those policies). No work should be undertaken without consultation with the appropriate authorities and the provision of the necessary consents.

4.2 PHYSICAL CONDITION: PROTECTING THE MATERIAL EVIDENCE.

The condition of the standing remains

The majority of the structures on the site have been abandoned for over 100 years are in a semi-ruinous state. As with a number of industrial sites, this is part of their intrinsic character – the juxtaposition of decay, the wildness of the landscape and re-assertion of nature – as such any maintenance plan needs to strike a balance between preservation and attrition. However, it is important to conserve the monument for future generations but the guiding priniciple should be

[11] Citing online reference 'Lake District National Park –Management Plan and Actions' > http://www.lakedistrict.gov.uk/index/caringfor/partnership/ldnppmanagementplan.htm, accessed 05/09/10

stabilisation rather than any form of extensive re-construction. Where a feature is in danger of being lost completely – such as the gable of structure (2072) - and/or where such a loss would damage the understanding or physical condition of the wider site, then re-construction might be considered. Of course, such work should only be undertaken under the auspices of the the relevant specialists and with permission of the landowner.

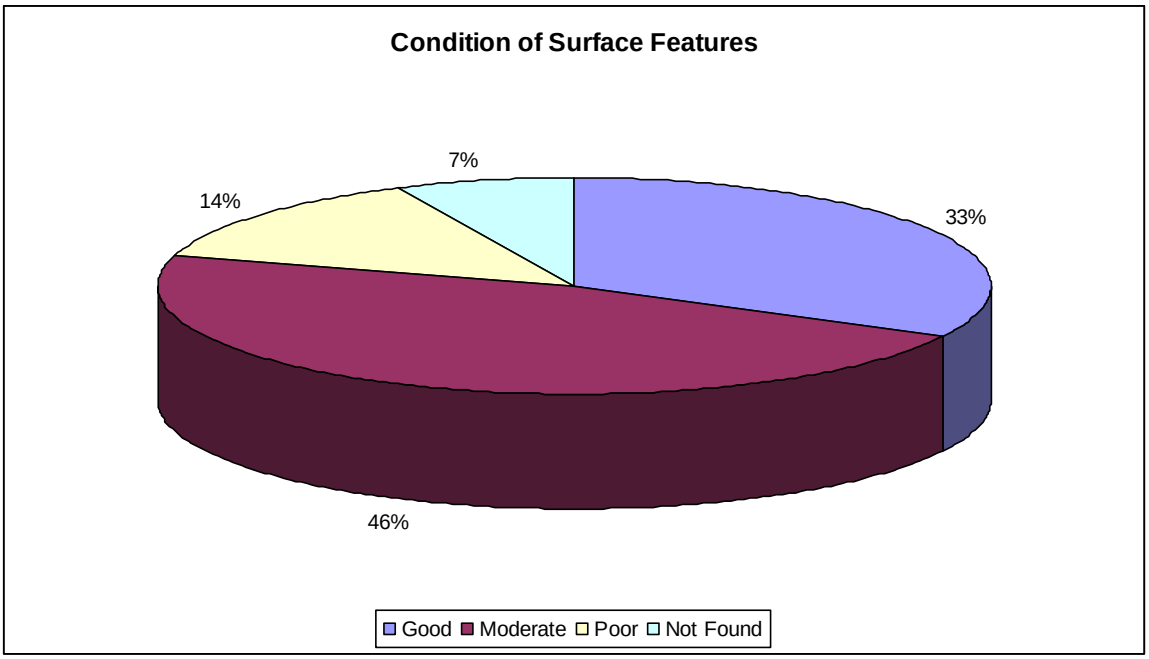


Figure 17: *overall condition of the key features identified across the site as detailed in the gazetteer.*

A full structural survey of the Penny Rigg was not commissioned as part of this project but a preliminary, visual inspection of structures was made during visits to the site in May 2010. These observations are included on a site-by-site basis in the gazetteer (Appendix 1) and summarise in Appendix 4. However, the elements at greatest risk are those highlighted in the table below. In the majority of cases the condition of most of the features is relatively stable and only affected only by the slow rate of natural attrition expected of any site exposed to the elements. However in some cases, man-made threats and environmental factors are contributing to an increased rate of deterioration. These will be discussed in the section below.

Table 2: *standing features considered to be at greatest risk*

Name	Condition Issues	Notes/Recommendations
Quarry Structure (2016)	Building in a good condition but slowly deteriorating.	Structural survey and periodic monitoring recommended. Archaeological survey of extant structures
Quarry Closehead (2018)	The pack walls along the approach to the closehead entrance are good but will need stabilising. The biggest issue is the	Structural survey recommended and advice sought (from

	condition of the timber lintel which is rotten and in danger of imminent collapse and in-filling	CATMHS or structural engineer) about the best way to re-instate the timber supports and stabilise the entrance.
Quarry Structure (2032)	Building in moderate condition but currently occupied so an 'as is' survey is needed to monitor for any further deterioration. Window lintel is cracked and stone work above slumping. The Building has modern roof and chimney etc added by recent occupants. It is unclear what immediate and long-term impact this is having on the building	Structural and archaeological survey of extant structures recommended. The condition of the structure should then be periodically monitored. Keeping the building in use may be helping to preserve it but there is also the potential for further damage if ill-informed alterations are made. More information is needed on the current use and then future status should be discussed with Rydal estates
Smithy (2041)	Mature tree growing out from hearth. Tree is undermining building but removal might cause more damage.	This is an important building in terms of both the quarry and mill but is under serious threat. Uprooting the tree would cause untold damage, but cutting the tree at the base and poisoning is recommended, although care would need to be taken that the tree *could* be felled without causing even more damage to the structure. However, the tree is a strong feature in the immediate landscape and also has the potential to provide natural habitat. Advice would, therefore, need to be sought from Natural England and there might also be some user objections to its removal.
Quarry Building (2041)	Building survives as low foundations only and is built on old rid tip. Not in immediate danger but deteriorating.	Should be recorded and monitored for any further decline.
Copper Mill (2044 – 2053) including wheel pit (2044), holding pond (2045) crushing mill	Although overall in a good/moderate condition some features are in need of stabilisation. The wheel pit (2044) is substantially complete but some of the coping stones are missing and this is letting water permeate the stonework.	As the primary heritage assets, and of exceptional importance to the significance of the site, the stabilisation of the copper mill should be a high priority. A structural assessment should be undertaken

(2046) and dressing mill (2051).	The stonework has partially collapsed at the NW and SE corners and there is a structural crack in the centre of the east face. The north and south faces of the holding pond (2045) are in good condition but the east face is partially collapsed and there is a danger that the stone facing will fall into wheel pit below. The wall head and door lintel of the south gable of the crushing mill (2046) is in need of attention. The Dressing Mill (2051) is in need of **URGENT** attention - damaged door lintel, massive structural crack in south wall and unstable wall heads. This structure suffered considerable damage during the winter floods.	and a plan for remedial action put in place. In advance of consolidation, an archaeological buildings survey of the whole mill complex is recommended as a permanent record. A certain amount of deterioration is expected over time but a survey will allow any escalating changes to be monitored, warning of any more serious problems of subsidence and loss of structural integrity and act as a baseline for any subsequent conservation work.
Beck Side Wall and Tailings (2061-2)	Cut by recent storm gullies in the area of the tailings ponds and wall core now exposed to erosion and further damage. There is severe risk of further erosion in this area and the possibility of heavy metal pollution if tailings material is carried down Yewdale Beck in future flood episodes. Chemical sampling and assessment may be required.	Structural assessment and consolidation. Preservation by record as a minimum. The Environment Agency should be informed and appropriate action taken as a matter of urgency.
Quarry Building (2072)	Building in very poor condition. The slate roof has collapsed in and undermined the gable wall making it lean alarmingly. The debris from surrounding rid tip is also slipping into the interior and damaging what remains of the walls. Needs immediate attention.	Structural assessment needed as a matter of urgency. Building should also be archaeologically recorded in case of any further deterioration (Risk Assessment will need to be undertaken in advance to determine risk from collapse). Gable will probably need to be dismantled and reconstructed.

It is recommended that a structural engineer or conservation architect undertake a full survey of those features identified in the table above and a more general review of those features identified as being in a 'moderate' condition (Appendix 4). The surveyors report will provide the necessary information to develop a full maintenance programme and act as a baseline statement for the implementation of future period conditions reviews (either quinquennial or less).


Plates 48 & 49: *severe cracking in the wall of the (2051) and leaning gable wall in danger of imminent collapse on building (2072) at the old quarry (2071).*

General Conservation Principles

The degree of preservation across the site varies but any consolidation or stabilisation work must take account of the unique significance as identified in section 2. Any work undertaken, either in terms of maintenance or to enhance the communal value of the mine (i.e. improvement to interpretation) should abide by established built heritage conversation guidelines (SPAB, Pickard 1996, 152- 171).

CONSERVATION PRINCIPLES

The following guidelines should be applied to any management decisions regarding changes to the historic fabric of the Copper mines:

i. ***Minimum intervention*** *– no repair work should encroach on the original fabric of the site in a manner which would diminish the authenticity of the structure.*

ii. ***Reversible change*** *– anything new that is introduced to the site should be reversible wherever possible, leaving little or no impact on the underlying structure. Repairs and alteration work should not prevent the future re-evaluation of the structure.*

iii. ***Repairs*** *– the purpose of repairs is to contain the process of decay but any work undertaken must maintain the integrity of the structure and respect its character and that of the broader setting.*

iv. ***Like-for-like*** *– repairs should be carried out using traditional techniques and re-used or salvaged material where possible. Priority should be given to repairing what is there rather than replacing with new fabric.*

vi. ***Detail*** *– particular emphasis should be placed on design detail with regards material, location, method of fixing, etc. All detail should enhance and complement the historic integrity of the mines.*

vii. ***Research*** *– no repair work should be undertaken without adequate research and recording of the existing structure. Any removal of fabric, structure or spaces should be adequately recorded*

according to appropriate guidelines.

viii. ***Removal of material*** *–should only be undertaken where it is shown that it plays no significant role in the cumulative historic interest of the site.*

ix. ***Reconstruction*** *– priority should always be given to restoration over reconstruction. Reconstruction should only be undertaken where indisputable historic and pictorial evidence is available.*

Erosion

Given the exposed nature of Penny Rigg there is a general problem with erosion across the site, although good ground cover does help to stabilise many areas, particularly the bigger rid tips. The majority of the larger tips are stable at their core but there is a shift of looser surface material and some edge cracking. Of particular concern is the north-eastern edge of the Penny Rigg Quarry rid tip (2060), just above the car park. There are signs here of cracking and shifting and it is recommended that a structural engineer assess this as a matter of urgency. All of other tips seem stable but given the volume of some of the material it would be prudent to have the engineer check all tips within the main area of public use; especially given last year's heavy rains. In general, erosion on the north side of the site, around Penny Rigg Quarry, seems more of an issue, largely because this area is more exposed to the elements. The main problem on the southern side of the site is from flooding.

Plates 50 & 51: *crack along the north-eastern edge of the main rid tip at Penny Rigg Quarry and bracken growth surrounding the powder magazine (2042) and weakening the stonework over time.*

Footfall Erosion

In general, much of the erosion is caused by the weather or by flooding and there does not appear to be a significant problem from footfall, although this may change should visitor numbers increase in the future. The footpaths are generally in good condition, the only exception being the track (2030) leading from the Tilberthwaite Road to Horse Crag Level. This was washed away in

the winter floods and has been reinstated by member of CATMHS but the aggregate is quite loose and needs to be monitored.

Bracken

Bracken potentially obscures archaeological sites, making them harder to interpret and more vulnerable to accidental damage. The root systems can also cause extensive damage to buried archaeological remains and low-lying extant features. Bracken is a particular problem in zones B (Horse Crag Quarries) and E (The Old Quarry) (Figure 15). There are a number of structures in these are that are in danger of bracken damage, including (20220, (2031), (2042) and (2043). The bracken is infiltrating the stonework in these buildings and loosening the joints. A programme of target bracken clearance would therefore be recommended. It is also a problem with regards to the leats (2025 & 2026) as it damages the retaining walls and obscuring the path of these features. None of these sites are within the SSSI or area of ASNW but Natural England and the Environment Agency will need to be consulted before any clearance work is undertaken. The only really effective measure of control would be chemical spraying; cutting or trampling would have less ecological impact but this method has little long term efficacy unless carried out annually for at least five years. All clearance work would also potentially impact upon the ferns growing in the area which have been identified as being of ecological significance.

Grazing

Current grazing regimes do not cause any measurable impact on the archaeology of the site. There is some sheep grazing on the upland but this is largely concentrated away from the archaeology. However, the LDNPA should be consulted regarding any changes in grazing regimes, and the introduction of feeders, water troughs or pens on the site should be avoided.

Possibly the greatest threat to the cultural heritage is the use of quad bikes for stock herding. There was no evidence of this observed during the field survey but the commoners and landowner should be aware that such use can cause considerable damage to the archaeological remains. Where possible, quad bike use should be restricted to existing roads and pathways.

Flooding

Increased rainfall and snow melts raise the risk of flooding at certain times of year. This has an impact on the features associated with the Copper Mill on the southern side of the site. Horse Crag Level was designed as an adit so it is no surprise that after heavy rainfull water rushes through from Tilberthwaite mines. In addition, water also cascades down the beck to the west of the site. As long as the various leats are maintained across the area then most years this is not a problem, however in November 2010 heavy rainfall resulted in a leat above the track to Horse Level being breached; this resulted in water flowing directly on to the track and material was also deposited on the public road. This is likely to recur unless the leat is repaired (Matheson pers comm.). The damage needs to be recorded and repair works undertaken. The winter of 2009/10

also brought exceptional levels of flooding which have caused considerable damage to some of the mill structures, in particular the terrace walling (2047) where the base has been undercut by water flow, and the western end of the Dressing Mill (2051). Damage caused by the floods need to be rectified and the mill structure stabilised (see table of sites at risk) but more extensive flood alleviation work is considered unnecessary given the infrequency of such an occurrence. However this should be monitored annually.

During last year's flood, all of the work that CATMHS had undertaken to clear the adit was washed straight back into the tunnel. The methods being used for the current excavation should avoid this problem happening in the future but it is not clear whether this will have a marked impact on drainage. It is not anticipated that it will but it should be monitored nevertheless. It is also essential that the leats are well maintained, especially the leat overflow (2024). If the existing water management systems consistently prove to be inadequate then it may prove necessary to construct a drain to divert any run off water away from the site. This should of course only be undertaken after discussion with the LDNPA archaeologist and ecologist.


Plates 52 & 53: *flood damage winter 2009/10 – damage to Dressing Mill (2051) and erosion along the Yewdale beck, potential washing contaminated soil into the river.*

One issue of considerable concern is the erosion of the Yewdale Beck at the south-eastern end of the site. The course of the beck has changed following the rains but this has not had a marked impact on the archaeology except in this area where the Beck Wall (2061) has been damaged and the Tailing Ponds (2062) eroded by hill wash. Heavy metals may have been washed into the beck and this would require immediate attention both to assess the environmental impact and to ensure that pollution is not still occurring. Recommendations need to be sought from the Environment Agency how best to mitigate this problem.

Emergency Maintenance

Although there is probably little that can be done to protect against such occurrences as floods of 2009/10, there should be measures put in place to meet any unforeseen threats to the site from

man-made or natural sources. This type of damage is not covered by the general maintenance programme and would potentially require the availability of emergency resources, both physical (in terms of man-power and equipment) and financial in order to limit impact and prevent further deterioration.

Self Seeding Trees

There are a number of self seeding trees which have grown up in fissures in the quarry face. These are becoming an increasing problem in terms of health and safety, and a potential threat to the archaeology. In terms of safety, root action can bring about rock falls, as has happened along the southern wall of the top quarry terrace (Plate 55). Such falls are obviously unpredictable and could be hazardous especially for climbers as roots may permeate deep into the rocks and not be obvious from the outside. The trees themselves could also fall, although most appear to be tightly anchored by roots growing into the rock face. The tree above the quarry cutting (2013) and that above the shallow closehead (2006) are seen as being particular problems. Other trees are a direct threat to the archaeology, particularly the mature specimen growing out of the hearth in the middle of the smithy (2041). There are other trees growing on top of rid tips and other features, and while most of these smaller trees are not now a problem they will be in the future if allowed to continue.

Plates 54 - 56: *self seeded trees growing around Penny Rigg Quarry, the first in the wall of cutting (2013) the second on the north on the top terrace has caused a rock fall and the third above the closehead (2006) threatens to collapse the level entrance in the future.*

Consideration should be given to cutting down some of the larger trees and leaving just the dead stumps. However, this would have a considerable impact on both the ecology and the setting of the site. The trees clinging onto the quarry edge, dwarfed by the enormous size of the rock face, are one of the natural attractions of the site. Careful consideration should be given to the large trees which might pose a danger and advice sought from a structural engineer or arboriculturalist

but favour should be given to their retention. Smaller trees should be managed to prevent them becoming an issue in the future. Natural England will need to be consulted before the removal of any trees to assess the environmental impact if this affects the SSSI.

Vandalism and litter

There is little wanton vandalism on site, although CATMHS members have reported that people have been removing the coping stones from the wheel housing (2044) and throwing them into the wheel pit. However, there is inadvertent vandalism in the use of trail bikes which are causing considerable damage to the spoil and rid tips. In particular this is damaging (2054 and 2055) the two mineral waste tips associated with the copper mine rather than the later quarry. These features are an important part of the site's heritage and must be protected. Preventing the use of these bikes on the site will be difficult to enforce. Signs at the car park might help and possible laying out alternative routes to direct the bikes off of sensitive areas of the site. Existing tracks though the spoil tips should be removed and maybe large rocks placed on the line of the old path to prevent re-use until the waste has resettled.

Litter is currently not seen as a major issue but this could change if visitor numbers increase.

Plates 57 & 58: *quarry building re-used as bothy (2032) note damage to window lintel and trail bike scars on the side of mineral waste tip (2055)*

Reuse of historic buildings

Rydal estates lease out one of the Penny Rigg quarry buildings (2032) as temporary accommodation. This is only used infrequently as a bothy and a wood burner has been put in and the building roofed over with tarpaulin which is weighted down with rocks. Overall this building is in good condition but it does have a cracked window lintel and the stone work above slumping as a result. The concern is that there is the potential for further damage to be done to this historic structure and the roof is also a bit of an eyesore, although it does serve to keep the water out of the stone work. The condition of the feature should be monitored and an archaeological survey is recommended (as part of the mill survey) which will act as a baseline to monitor any further decline.

If the buildings were to acquire a designated status then any such changes in use or alterations to the structure would be carefully controlled.

Damage caused by site maintenance work

Given that the site is part of a working landscape there is the potential for general maintenance work to be undertaken which could potentially damage the asset, this might include drainage, clearance, erection of gates, fencing, ditch cutting and building repairs etc. Currently, apart from the bothy, this has not been an issue but there is the potential for it to be so in the future. It is recommended that as a responsible owner, Rydal Estates continues to work with the LDNPA archaeologist to help protect this important and interesting heritage asset. Maintenance work could also potentially have an impact on the ecology of the site, particularly in the SSSI and ASNW areas and guidance must be sought from Natural England in advance of any work in these.

Bolted climbing routes

There are over 50 climbing routes at Penny Rigg Quarry, the majority of which are bolted. At present the impact caused by these are largely ecological with the climbers potentially disturbing sensitive habitat. However, this needs to be balanced with the considerable community value they add to the site. As such, existing routes should be left but no new routes added without discussion with the LDNPA archaeologist and ecologist, and with Natural England to ensure that no bats or flora are disturbed.

Threats to below ground archaeology

Many of those threats detailed above apply to both surface and sub-surface archaeology. Given the level of prolonged use, considerable disturbance, and the thin soil coverage in the area of Penny Rigg quarry, potential archaeological preservation here is thought to be low. However, around the Copper Mill preservation has the potential to be quite good, although there may have been some re-use of the area when Horse Crag Quarry was in operation. There are no real issues beyond those listed above that are seen as a threat to the below ground archaeology. But the likelihood of preserved deposits should be kept in mind with regards the future management of the site.

Sale of slate rid for aggregate

Approaches have been made to remove some of the waste slate for sale as aggregate. In some areas this might be acceptable although the impact on the visual and cultural setting – and structural stability of the site - would need to be evaluated carefully. Removal of waste from around the Penny Rigg Quarry is not considered to be appropriate as this material is intrinsic to the development of the 18th and 19th century quarry and important to its understanding and setting. The same is true of all the other quarry tips except (2056), the large rid tip associated with

the last phase of quarry use in the 1880s (and probably early 20th century). This tip overlies the earlier mineral ore spoil tip (2055) and may possibly conceal evidence of buildings and features associated with the Copper Mill, including the bucking/cobbing sheds. An argument can therefore be put forward that the removal of this feature would enhance the heritage value of the site. Of course, it would also remove an element linked to the quarries development (contravening Policy HI1) but aspects of this phase in the site's history are represented elsewhere. Another consideration would be any potential damage to the site caused by the removal of the waste material both to the standing structures and sub-surface deposits of the Mill and to any potential features concealed by the tip. There would also be ecological concerns regarding the implications for site drainage. An environmental impact assessment would, therefore need to be undertaken before any such plans were approved and early consultation should be sought with the LDNPA archaeologist and ecologist and Natural England.

Climate Change

The recent increase in rainfall, and subsequent frequency of flooding, has been linked by some authorities with climate change. At present Penny Rigg Mill and Quarry are not perceived as being in any direct threat from climate change but this may alter in the future as if the pattern of rainfall continues to increase and is an aspect that needs to be monitored

Policies to protect the physical condition of the site

In response to those risks and issues outlined above the following policies are proposed to guide the future management of the mine complex.

POLICY PC1: PRODUCTION OF A MAINTENANCE PROGRAMME

With further advice from a structural engineer (and arboriculturalist), and based on those issues raised in the Plan, a long term maintenance programme should be agreed and adopted by all relevant stakeholders. This should include proposals for appropriate funding and culpability to ensure the successful implementation such a plan.

POLICY PC2: CONDITIONS REVIEW

A periodic (quinquennial) programme of conditions monitoring should be agreed upon. This will include the monitoring of erosion, bracken and footfall damage as well as those issues outlined in the maintenance plan. A more frequent annual review might be considered for some features (this could potentially be undertaken by volunteers).

POLICY PC3: PROVISION FOR EMERGENCY REPAIRS

A response programme for emergency situations should be put in place. This will aim to secure funds and appropriate resources to deal with unforeseen man-made or natural situations like the winter flooding of 2009/10. This should not be left to the general maintenance budget as

unanticipated expenditure may put at risk the provision for more minor on-going repairs. Natural England should be part any emergency planning discussions.

POLICY PC4: STOCK MANAGEMENT

The LDNPA (Ecology and Archaeology) should be consulted in advance of any major changes to stock grazing regimes to prevent damage to the ecology or archaeology of the site. Quad bike use should be kept to establish paths and access routes. LDNPA Archaeologist to make commoners and land owner aware of particularly sensitive archaeological areas.

POLICY PC5: VANDALISM AND LITTER

Levels of vandalism, trial bike use and litter dropping will be monitored and suitable measures put in place should the issue become a problems. Trail bike use will be prohibited within the environs of the site.

POLICY PC6: BOLTED CLIMBING ROUTES

No new bolted routes should be introduced without consultation with the LDNPA archaeologist and ecologist and Natural England.

POLICY PC7: CLIMATE CHANGE

The site will be monitored for any indication of impacts from global warning and any necessary measures discussed and put in place to secure the preservation of the monument.

4.3 HERITAGE IDENTITY: PRESERVING THE HISTORIC EVIDENCE

The ever changing nature of the Copper Mill and Quarry

The Quarry has undergone a huge number of changes and modifications during its 250 year history and each of these has contributed to the unique history of the site and needs to be understood and protected. It is necessary to preserve and enhance each of these different elements and not try to restore the works back to a specific phase or period. However, the Mill is slightly different because part of the exceptional significance of this is that it is single phase.

Threats to the artefactual evidence

Some artefacts remain *in-situ*, predominantly iron fittings as well as some timber fixtures. These elements add to an understanding of how the Quarry and Mill worked and are part of the on site experience and, therefore, should remain where they are although this does place them at some risk from attrition and theft. However, to place such fittings in a museum collection would detract from their significance by divorcing them from their context – in effect making them lumps of iron. This is not, of course, the case for all surface finds and items like the iron jumper should be collected and sent to the Ruskin Museum. If something new is discovered, either above or below ground, then it should be reported to the LDNPA archaeologist. The Ruskin Museum curator

should also be contacted as they currently house the largest collection of industrial artefacts in the area as part of the Coniston Collection (largely donated by CATMHS). However, any finds do legally belong to the landowner (unless Treasure Trove, which seems unlikely). A formal agreement needs to be made between the museum, the landowner and parties undertaking research such as CATMHS with regards to the future storage, conservation and display of artefacts.

Potential loss of documentary material

Much of the documentary material related to the site is available at publicly accessible archives but some remains in private hands. A valuable resource was recently lost when many of John Barratt's original mine ledgers and cost books passed into the hands of a private collector following the auction of material from the Hext estate earlier this year[12], although some were purchased by CATMHS. Luckily, in this case many of the documents had already been scanned (with the owner's permission) but in future such important material could be lost. The grand-daughter of WG Collingwood, and daughter of Oscar Gnosspelius, Janet Gnosspelius, has died recently and she was known to have been the family historian, curator and archivist. It is highly likely that her estate will contain important material related to the Mill and Horse Crag Quarry and the Ruskin Museum has already made approaches to the family to secure the archive for the public but it is possible that, like the Hext documents, they will go to auction (V Slowe *pers. com.*).

A procedure for an emergency purchase fund to respond to cases like the Hext sale is recommended. This might simply take the form of 'Friends of Coniston (and Penny Rigg)' who could be contacted in such an event, as well as a maintaining a mailing list of potential contributors. Application for existing national funding would also form part of this strategy including the Heritage Lottery Fund and the Heritage Memorial Fund.

""I learned a lot about mining and its technology there'

Response to question on what makes the site important to you – Mr P. Timewell

Policies to Protect the Heritage Identity of the Site

POLICY HI1: RESPECTING THE HISTORICAL DEVELOPMENT OF THE QUARRY

All elements of the quarry's rich and varied past must be appreciated and there should be no attempt made to return the site back to a specific historic period. All care should be taken to preserve and retain the historic fabric of the Quarry including any later adaptations to changes in form or function.

[12] Citing online reference 'Tennants Auctioneers – the Hext Sale' > http://www.tennants.co.uk/About-Us/News/News-Articles/The-Hext-Sale.aspx, accessed 07/09/10

POLICY HI2: PROTECTING THE COMPREHENSIVE NATURE OF THE EVIDENCE

All areas of the site – including the various quarries and the Mill - should be considered as part of the overall complex although certain areas may be less significant than others. The setting, function, and historic relationship between each of these industries remains key to the site's significance and each will be protected and enhanced with no imbalance introduced.

POLICY HI3: PRESERVATION OF FIXTURES AND FITTINGS

The stakeholders will agree procedures for reporting and conserving any fixtures, fittings and finds (including those found during mine exploration).

4.4 SETTING: PRESERVING THE INDUSTRIAL LANDSCAPE

Existing Setting issues

The setting of Penny Rigg is of exceptional significance to the cultural heritage of the site. A number of those issues affecting the physical condition of the site also apply to setting including:

- **Inappropriate use of Historic Buildings** – the use of the quarry building (2032) as a bothy is a bit of an eyesore, potentially detrimental to the structure and may require planning consent.
- **Damaged caused by site maintenance work** – the introduction of fencing, new paths, access tracks and drainage ditches could all damage the setting of the site.
- **Grazing** – changes in grazing regimes could potentially impact upon setting, and
- **Self seeded trees**– are a complicated issue which can be said to both contribute positively to setting but also potentially threaten it.
- **Bolted climbing routes** – the addition of new routes could potentially harm setting if too many are introduced within a small area.
- **Removal of ridd tips** – the potential removal of later spoil tips

Plate 59: *setting: the twisting paths, rocky enclaves and tree cover make Penny Rigg able to absorb greater visitor numbers without impacting the open views and landscapes of Coniston.*

Potential Setting Issues

Any new development either in, or within the vicinity, of the Penny Rigg Copper Mill valley could potentially have an impact on the setting of the heritage asset (PPS5 HE8, 10). In such cases a monument's setting is not bound spatially by the views and features within or in the vicinity of the site but would include any element which might affect our understanding of the heritage asset. This might include:

- Other industrial sites (mines, quarries, mills, smelters, foundries etc)
- Transport routes (the railway, copper sheds, quays on the lake, packhorse routes)
- Pattern of settlements (Coniston village and the outlying hamlets and villages with links to the mines, including upland settlement)
- Hydrology (becks, leats, damns etc providing power not just to Coniston but as a network operating across the landscape)
- Built heritage (form, design, materials of the buildings within the wider regional context)
- Social/economic implications (Development of community including worker's housing, schools, churches, workers education, etc)

Plans for any development should be discussed well in advance with the LDNPA archaeologist.

Increased Use

An increase in the number of people using the site may pose a considerable threat to the setting. At the moment, the secluded and peaceful quality of the site is an important element of Penny Rigg's character but attracting more visitors could detract from this. Balancing any improvement in

the tourist and educational significance of the site with the preservation of the current cultural setting will be a challenge, although Penny Rigg is less sensitive than Coniston, and is able to absorb greater visitor numbers without impact because of its topography.

Policies to Protect the Setting of the Site

POLICY S1: ADDRESSING SETTING ISSUES

No factor shall adversely impact the setting of the site. The introduction of any new element which might adversely affect setting should be discussed in advance with the LDNPA (archaeology and ecology) - this includes tree planting, erection of new structures, conversion of existing structures, tracks, paths and extraction.

POLICY S2: LIMITING THE IMPACT OF VISITOR NUMBERS ON THE SITE

The significance of the cultural setting of the site must always be considered in balance with any plans to increase visitor numbers and enhance interpretation.

4.5 USER REQUIREMENTS: MANAGING THE EXPECTATION OF EXISTING AND POTENTIAL USERS

Many people use Penny Rigg for a variety of reasons, and each of these have different requirements and expectations, some of which could potentially bring them into conflict with other groups. The table below summarises the main groups and there key interests and potential conflicts

Table 3: Current User Requirements and Potential Conflicts

User	Requirements	Potential Conflicts
Rydal estates (Landowners)	Public liability (Health and Safety threats minimised) Relations with common grazing tenants maintained Site Maintenance Potential sale of aggregate Lease on Bothy	Potential conflict between H & S requirements and setting/Conservation/climbers/Mine explorers. More people on site increases H&S concern. Maintenance work could come into conflict with archaeology and ecology Any development could bring estate into conflict with EN and the LDNPA
Commoners	Stock grazing Vehicle access to manage stock	Changes to grazing regimes could cause conflicts with ecology/archaeology

		Quad bike use could threaten archaeology.
Climber/Outdoor Activities Groups societies	Road access and car parking Bolted Routes	Large numbers of cars could be an issue with other users. Bolted routes may come in conflict with setting, ecology and archaeology.
Lake District National Park, English Heritage & Natural England	To protect and curate the archaeology, geology and ecology of the site and ensure legislative and planning requirements are met. To conserve and enhance the natural beauty, wildlife and cultural heritage of the Tilberthwaite area. To promote opportunities for the understanding and enjoyment of the site To ensure the successful future management of the site.	Potential conflict with landowner Potential conflict with climbers (minimal)
Mine Exploration societies	Road access and car parking Good public access on site Advice and support with regards excavation and conservation.	Potential conflict with landowner (though existing relationship good) Large numbers of cars could be an issue with other users.
Walkers	Road access and car parking Good public access across the site Further information on the site	Potential conflict with landowners regarding access (though not been a problem in the past). Large numbers of cars could be an issue with other users.

Good Communication

Any potential conflicts are perceived to be relatively minimal, however, the failure to meet the requirements of key users, and subsequent issues arising from this, would be one of the greatest risks to the future conservation and management of the site. Given the small number of parties involved in the day-to day use and/or running of the site a steering group is not really appropriate. However, every effort should be made to ensure that good communication is maintained between the LDNPA, Rydal Estates, Commoners, CATMHS and Outdoor Activities Groups. Ideally, an online forum should be established (maybe on the LDNPA website) where any plans for site could be discussed. This might also serve to promote public awareness of the site. Any major issues which cannot be resolved or discussed in this manner might require an extraordinary meeting of the stakeholders to be called. In many cases any conflict is often because users are simply unsure of the correct procedure and/or where there are areas of sensitive archaeology/ecology.

This Plan should go a considerable way to alleviating this and might be used as a springboard for further discussions.

Encouraging new users

One of the primary aims of the LDNPA is to promote opportunities for the understanding and enjoyment of the site, enhancing its potential as an educational and community resource. The site is currently used by a fair number of people, predominantly walkers, climbers and those involved with mine exploration, but the numbers are not considerable. Although the results of the questionnaire were somewhat skewed by the distribution area, most of those currently using the site lived in Coniston or Cumbria. There is the potential to attract a small number of new visitors and to appeal to a wider audience – family audiences for example - but this would need to be balanced with the current cultural significance of the site (including health and safety issues).

In the table below are some potential new users which could be targeted and a consideration of the potential threat they may pose to the existing significance of the site.

Table 4: Potential users

User	Requirements	Potential Conflicts
Schools and colleges	Road access and car parking Mini bus/coach access? Good public access across the site Further information on the site. More information on the geology and ecology of the site. Toilets?	Large numbers of cars could be an issue with other users. Increased facilities might have an impact on setting Increase in numbers could threaten isolated character of site. Increase in health & safety concerns
Families (picnickers) visiting or staying in Coniston and the area.	Road access and car parking Good public access across the site Further information on the site Toilet facilities?	Large numbers of cars could be an issue with other users. Increase in facilities on site could detract from historic character

There are not perceived to be any great issues with encouraging these new user groups. Both existing and potential users would all benefit from improvements to on site presentation and interpretation.

Plate 60: *good access and car parking make Penny Rigg a good site for a variety of visitors.*

Policies to Help Meet User Expectations

POLICY U1: ENSURING THE NEEDS OF EXISTING USERS

A collaborative approach is needed to ensure that all key users (stakeholders) are involved in the long-term management of the site. As such, good communication will be maintained between the key stakeholders to guide all decision-making and resolve any existing or potential conflicts.

POLICY U2: ENSURING THE NEEDS OF THE BROADER COMMUNITY

An online public forum will be made available to encourage comments from the more general community on any key issues.

POLICY U3: ATTRACTING NEW USERS

Measures will be explored to attract new users to the site without compromising the cultural significance of either the mill or quarry and Penny Rigg's unique 'sense of place'.

POLICY U4: IMPROVING CONTACTS WITH SCHOOLS AND COLLEGES

In accordance with Policy U3, links with local schools and colleges will be extended to promote the educational value of the site. There will be consultation with teachers regarding input into future interpretation plans.

4.6 ACCESS: GETTING THERE AND MOVING AROUND

Road Access

There is good road access and car parking facilities at the site. One issue which may need to be monitored is parking on the verge close to the Mill. This might have health & safety implications for pedestrians and road users if it increases but presents no threat to the archaeology.

Access around the site

The tracks and footpaths around the site are generally good. There is not perceived to be a general problem with footpath erosion, except in those areas around the Copper Mill affected by the winter floods. The tracks in this area would benefit from improvement and should be annually reviewed to assess deterioration over the winter. No additional tracks are recommended.

Public Access

There is good public access across the site.

Health and Safety

Given the nature of the site, H & S and public liability is a continual problem. Old mines and closeheads can obviously be dangerous places as can quarries. There are minimum safety provisions in place and the main areas for concern would be: Horse Crag Level (2039) because it is in such an accessible area; the Penny Rigg closehead (2018) because of its condition, and the approaches to the quarry pit from the south because of the depth of the pit and unstable edges. The other closeheads in the area would also be a concern. However, to put in H & S measures to mitigate against these dangers would seriously detract from the cultural significance of the place. It is recommended that the Horse Crag Level be gated but with CATMHS and MOLES members given easy access (maybe a contact number on the online forum); the gate also being set far enough down the tunnel as not to been seen from the outside and to a design suitable for bat entry. The other closeheads should be reviewed. However, there has to be an element of user responsibility recognised by anyone who visits and enjoys our National Parks and upland landscapes. The public are made aware of the dangers by a sign at the entrance to the car park but maybe an additional sign could be erected close to the track leading into the Copper Mill. However there is some resistance to over-signage and consultation has suggested that if an interpretation panel were to be placed in this vicinity it could incorporate a safety warning.

CATMHS, the Ruskin Museum and other parties have also all been very good in stressing the message that 'no below ground exploration should be undertaken' in all the mining literature relating to the area. This safety message, and more general advice, should also be made available online on the LDNPA webpage, especially regarding advice for teachers and outdoor activity groups etc.[13] although it is the responsibility of organised groups to provide their own risk assessments.

[13] A simple online search on 'Health & Safety advice in the Lake District National Park' produced little relevant information of even a general nature.

Disabled Access

Under Compliance with the Disability Discrimination Act 1995 (DDA) reasonable provision should be made to provide disabled access to heritage assets; however given the nature of the terrain, physical access to the site is very limited. Even though the road to the site and car park is good, paths around the Mill are very uneven and the steps up to the quarry are steep for those with impaired mobility. Consideration should be given to this when looking at improving onsite interpretation, with maybe a sign in the car park for those without access onto the site. Other innovative approaches should also be considered including interactive website via discrete webcams and online tours and information.

Intellectual Access

CATMHS and the CLHG has done a great deal to promote public interest in the social and industrial history of the mines in the Coniston area (including Tilberthwaite), producing articles, guided walks, online contributions, websites and a dedicated CD-Rom. This provides a great platform from which to explore further opportunities to enhance and attract people to visit Penny Rigg.

Policies to Protect and Promote Access to the Site

POLICY A1: ROAD ACCESS AND CAR PARKS

Maintain good car park and safe road access.

POLICY A2: FOOTPATHS

The conditions of the current footpaths around the site should be maintained but no new paths established.

POLICY A3: ACCESS AROUND THE SITE

The level of public access around the site will be maintained.

POLICY A4: HEALTH AND SAFETY

Health & Safety provision will be regularly reviewed (annually) and made to find an appropriate way to combine safety requirements without compromising either the historic fabric of the mill/mine and quarry or the character of the site.

POLICY A5: DISABLED ACCESS

All relevant stakeholders will work together to ensure that disabled people have all reasonable access to the site, including the consideration of more innovative measures to extend the user experience.

POLICY A6: INTELLECTUAL ACCESS

Every effort will be made to promote the intellectual access to the Copper Mill and Quarry as an online educational resource including establishing links with schools and colleges and existing community web sites. On site information should also be a priority, although considerations must also be given to the type of displays suitable given the constraints of the environment.

4.7 IMPROVING THE INTERPRETATION AND PRESENTATION OF THE MINES

Increasing the educational and tourism value of the mines

Penny Rigg has considerable potential as an education resource in a number of different areas for both children and adults, including on site and online access. Ways to enhance the educational potential of the site without impacting its significance would include:

Guided walks

Some guided walks around the area are already undertaken by the National Park Ranger (Tony Hill) amongst others. However more directed 'Quarry and Mine' walks might be considered as a more regular event (maybe monthly). This could be organised either through the LDNPA as part of their list of events, or the Ruskin Museum or CATMHS (assuming volunteers to lead could be found). During term time tours could be run aimed specifically at schools and designed to tie in with key curriculum studies. To achieve this successfully, teachers would need to be consulted in order to produce relevant source material to facilitate a continuation of course work back in the classroom.

Although quite small in its own right, there is the opportunity for Penny Rigg to link in with any improvement to interpretation planned for Coniston and a consideration of the site should be included in any future proposals. The Mill, together with Tilberthwaite mines, is an important part of the 'story of Coniston Copper' and there is an opportunity to promote the site as part of a wider appreciation of the region's industrial history, maybe as part of an 'Industrial trail' linking together not only copper sites but quarries, iron, coal and even timber production sites, either from a local or Park wide perspective. This could be linked in with online resources for walking and cycling tours etc.

Improving onsite interpretation

Improving interpretation on site would benefit both existing and new users. This could take two forms: physical and virtual. Both options have the capacity to highlight the physical dangers of the site and to encourage good care and considerate use. In terms of physical displays, panels might be considered at key points around the site. The design of these must take into account the cultural significance of the site and blend in with the natural environment. A muted material like

slate might be an option. Vandalism is not a huge problem on site but any signage would undoubtedly be prone to abuse and this has to be kept in mind when designing any panels, as well as the extremes of the weather in this area. Where the signs are erected would also need careful thought, and to maximise potential they would need to follow an arranged course around the site, telling the story of the Mine, Mill and Quarry.

A second, and preferred option, would be no signage but a downloadable tour of the site which gives a commentary of its history. This would be accompanied by a map and route - all available online. This has considerable potential to engage the visitor through weaving facts with a fictional narrative illustrating the social and industrial history of the site, and at the same time preserves the site's 'sense of discover'. The 'tour' could also be easily updated and would have no physical impact on the site, although there would still need to be discrete numbers and information points. However, it might exclude those visitors who do not have access to the appropriate equipment, and a combination of signs and virtual tours might be considered.

In addition to promoting the social and industrial history of the mines it is also important to remember the ecological and geological significance of the site. There are clearly opportunities for promotion of the geology, flora and fauna of the site to a wider audience. This should be undertaken in co-operation with Natural England due to the sensitivity of the SSSI area.

The Ruskin Museum remains committed to supporting the Coppermines and Penny Rigg projects as they develop, as we view both sites as integral to a full understanding of Coniston, and the development of the local community. (Vicky Slowe, Curator, Ruskin Museum)

Toilets

Currently there are no provisions for toilets on site. Given the size of the site it is probable that most visitors will be short stay, or else walkers who do not really expect facilities to be provided. Demand might increase if the site becomes more popular with families and school parties and the potential requirement for toilet facilities should be kept under review.

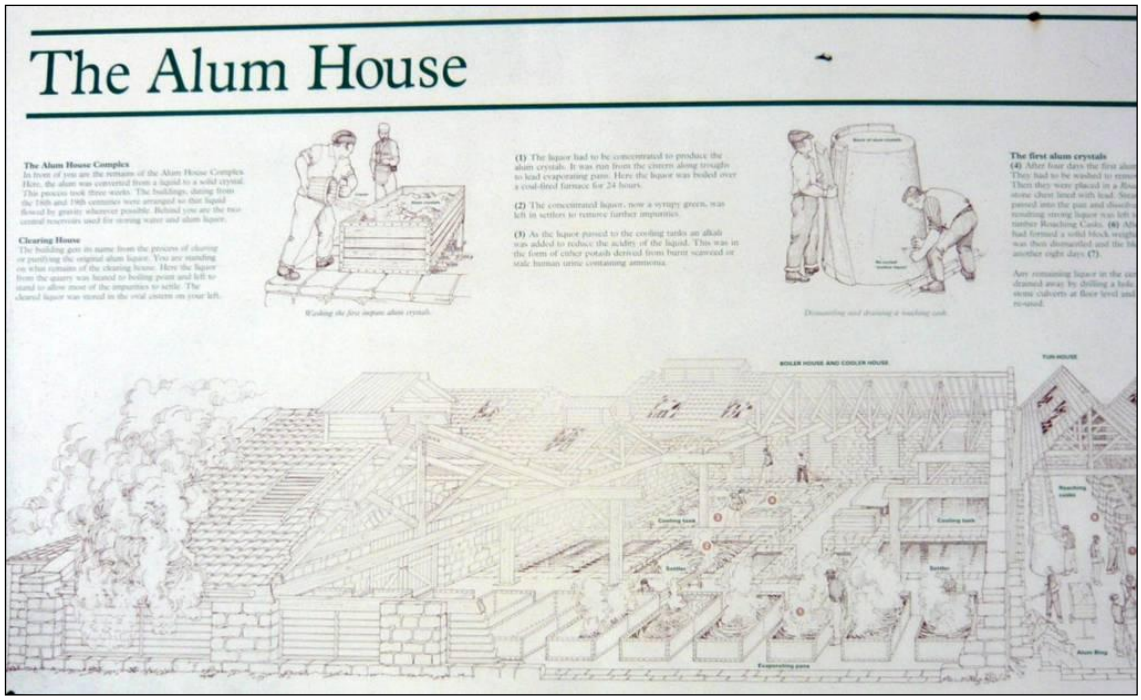


Plate 61: *example of signage from a comparable early industrial site – the Alum works at Ravenscar. This panel, produced by the National Trust includes graphics and text to illustrate how the various processes of production took place around the site.*

Policies to Improve Interpretation and Presentation

POLICY I1: IMPROVING SITE INTERPRETATION

Steps will be taken to improve site interpretation (both on site and online) to enhance the educational value of the Archaeology, Geology and Ecology of the site.

4.8 ECOLOGY AND GEOLOGY: PROTECTING THE NATURAL ENVIRONMENT OF THE SITE

It is essential that Tilberthwaite Gill SSSI remains in favourable condition. The management criteria which will ensure this are contained within the Conservation Objectives (appended) (Appendix 5). The site is protected under the Wildlife and Countryside Act 1981(as amended). Natural England will need to be contacted before any operations within the boundary of the SSSI (or outside the boundary if affecting the integrity of the interest features of the site) are undertaken. Any Operations Liable to Damage (Appendix 6) the SSSI (Appendix 6) will need to be assessed by Natural England under the CROW Act to ensure no significant damage will occur to the features for which the site is designated. Planning policy also states that maintenance, and where possible enhancement of the ecological interest features should be made in both the strategic and day-to-day management of the site.

The types of management which are likely to significantly affect the site include changes of grazing management, introduction of plant or animal species (including trees), changes to the

level of recreational use including hiking, gill scrambling and climbing and disturbance to the integral or adjacent deposits, spoil heaps, veins, mines and underground passages.

Bats

Bats are highly protected under European law under regulation 41 of the Conservation of Habitats and Species Regulations 2010. Works undertaken to restore or modify structures - mines (especially entrances) and buildings (derelict or otherwise) - should be preceded by a survey by a licensed bat ecologist to assess risk. This is a requirement under planning permission regulations, but even where planning permissions are not required it is illegal to disturb or harm bats and they should be considered in detail with mitigation.

Any measures to block shafts or levels for health and safety reasons should always take the welfare of bats into consideration and be structured to allow free entry and exit. Any existing barriers should be assessed for accessibility to bats and remedial measures taken if necessary.

Lichens

Any operations, including the restoration of buildings and structures, may inadvertently affect protected lichens or rare lichen communities. Operations should be preceded by a survey carried out by a specialist lichenologist. Important lichens can be present on derelict buildings, *in-situ* deposits, and on geological features where copper and other heavy metals may be present, as well as structures which may have used materials from these veins. Potentially protected lichens will be present at the site.

Post Industrial Habitats

Post industrial habitats are very important for their interesting and possible rare communities. Spoil tips should remain free of vegetation and remain exposed if required. There may however be conflicts with archaeological needs to stabilise the deposits (especially those liable to flooding and subsidence). Any requirements to stabilise deposits within the Tilberthwaite Gill SSSI, by engineering or vegetative means, would need to have consent under SSSI regulations. If outside the SSSI it is also recommended that an ecological assessment is undertaken to avoid inadvertent damage to protected lichens. On top of this, the needs of the vegetative communities described above should be discussed with Natural England and lichenologists prior to work being undertaken.

Inland Rock Habitat

This includes Chasmophytic vegetation, Calaminarian grassland and early pioneer communities on skeletal substrates and is a priority BAP habitat. The main threats to their condition are: unsuitable grazing management (overgrazing and undergrazing); lack of suitable management leading to the development of scrub and woodland in place of open habitats; recreational pressure of walkers and climbers causing damage to fragile vegetation communities, and atmospheric

pollution. Clearly future changes of management of this site should consider the effects to this habitat. In addition, the use of Penny Rigg quarry for climbing should be assessed and managed. There is potential for the activity to damage rare Chasmophytic vegetation.

River Habitats

Any fluvial restraining plans should take account of the possibility of the sites supporting rare invertebrates and should be preceded by a thorough invertebrate survey.

Restoration Work

Where planning permission is not required for any development or restoration work taking place within the SSSI, the ecological features are still protected under the Wildlife and Countryside Act 1981 (as amended), therefore, the owner of the site must apply directly to Natural England for consent for any operations liable to damage the site.

All developments or restoration projects carried out on the site will need to take into account all habitats and species which are protected and provide mitigation plans. A full explanation of regulations and licensing and the implication for planners, owners and other competent authorities can be found at www.naturalengland.org.uk

Ancient Semi Natural Woodland

There is an opportunity to support Forestry Commission targets on ASNW sites by recreating high quality woodland. This may include further planting or fencing to allow for regeneration. A reduction in the extent of bracken would help regeneration but any control of bracken would have to be carefully undertaken to avoid damage to other ferns.

The area of this ASNW is devoid of surface archaeological remains so restoration into woodland might be appropriate. Throughout the remainder of this site the extensive archaeological remains and geological requirements mean that woodland planting is not appropriate. This also applies to the inappropriate tree planting which has occurred by the car park. There has also been a great deal of tree regeneration (both native and non native species have seeded into inaccessible ledges and areas within and around the quarries and mine entrances). Despite the benefits to ecology from these tree habitats a risk assessment should be carried out to determine if any should be removed (in certain cases a felling licence will be required from the Forestry Commission).

Policies to Protect the Natural Environment

POLICY E1 PROTECTING THE GEOLOGY ON THE SITE

Plans for the protection of geological features will be integrated into any maintenance, interpretation and access plans for the site and close communication maintained between the LDNPA ecologist/geologist and Natural England's geological team. Surveys may be required prior to obtaining planning permission so this should be allowed for in future timescales.

POLICY E2 PROTECTING THE ECOLOGY OF THE SITE

Plans for the protection of protected species and important plant and animal communities will be integrated into any maintenance, interpretation and access plans for the site and close communication maintained between the LDNPA ecologist and Natural England.

Any proposed restoration schemes or developments will take full account of statutory obligations with regard to the SSSI and planning policy guidance, including allowing good time for appropriate surveys.

POLICY E3 PROVISION FOR EMERGENCY SITUATIONS

A response programme for emergency situations should be put into place and Natural England should be part of the emergency planning discussions.

4.9 FURTHER RESEARCH: IMPROVING OUR UNDERSTANDING

In a number of areas there remain gaps in our knowledge which have been highlighted at the end of each appropriate section in the 'Understanding' chapter. These cover a broad range of issues some of which will require further research and survey. There are no policies associated with this section although a series of recommendations are made.

Gaps in our Understanding of the archaeology and history

Detailed Building and Topographic Survey

It is recommended that further survey should be undertaken to record both the Quarry and the Copper Mill. This would provide a permanent record of the site and act as a baseline survey for conditions monitoring and management. It is recommended that a combined buildings and topographic survey be undertaken at the Copper Mill as a matter of priority including plans, elevations and earthworks. An urgent survey is also required at the Old Quarry (2071-72). A topographic survey is further recommended for Penny Rigg Quarry, with targeted full building record at sites like the riving shed (2007).

Documentary Research

As part of a more detailed site survey, further research should be conducted into the documentary evidence associated with the site including cartographic evidence (estate maps), estate records, census data, trade directories, mining records and national resources like the National Stone Archive and BGS.

Targeted Excavation

In terms of understanding the archaeology, it is recommended that further work be undertaken to within the confines of the Copper Mill in order to assess the extent and levels of preservation in this area and understand more about the use and function of the building. Areas considered to be of particularly high archaeological potential include: the Dressing Mill (2051), Crushing Mill (2046) and the Tailing Ponds (2062) down by the beck.

Expansion of the Historic Environment Record (HER)

Currently the Mill (5608) and Quarry (18493) are recorded as just two sites on the LDNPA HER. It is recommended that this be expanded to include those sites listed in the gazetteer (or at least the key sites). This would provide for a more comprehensive record of the resource for future research and management.

The North West England Research Framework (NWERF)

In terms of expanding a broader understanding of the archaeology of the region, work at Penny Rigg should aim to explore those research aims discussed in the NWERF (Brennand 2007). The site has the potential to inform a number of areas discussed in the Post-Medieval and Industrial and Modern sections of the agenda including: settlement and land-use; technology and production, trade and exchange.

Gaps in our Understanding of the Ecology

Bat Survey

Natural England have also suggested that they would be keen to explore opportunities for surveying bats within the unusual environment offered by the mine. Bat surveys would also be a prerequisite for any planning permission for development or restoration at high risk sites in this area. An initial data search via Tullie House Record Centre may reveal existing records of bat species found at this site.

Other surveys

Further studies into the lichens on site is recommended, this could reveal much about the behaviour of lichens in this sort of habitat as well as the most sensitive areas which should be undisturbed. Surveys by a lichenologist and bryophytologist would allow for a better interpretation

to fully appreciate the significance of these habitats at this site. This is also the case with Chasmophytic vegetation. A fuller survey, especially of mine entrance, seepage, fissures and ledges however may reveal specialised and rare species. Furthermore a survey of shingle areas and adjacent *in-situ* deposits may identify rare assemblages of invertebrates

4.10 OWNERSHIP AND FUNDING: WHO IS RESPONSIBLE FOR WHAT

Issues relating to ownership and responsibility are potentially a risk to the future management of the site. The majority of these generally arise from miscommunication or a lack of clarity in terms of responsibility. Maintaining good communication between the LDNPA, Natural England, Rydal Estates and mining amenity and outdoor activity groups should mean that those issues identified above can be dealt with and that any future problems can be solved swiftly.

In addition, while the preservation of the historic and cultural significance of the site should remain at the heart of any management strategy, outside pressures and demands can begin to influence and affect decisions. Every attempt should be made to minimise this and raise awareness of the unique values of the Copper Mill, Mine and Quarry.

Funding maintenance and improvements is a perennial problem but failure to secure appropriate funding could place the future of the site at risk. In particular, funding needs to be generated to undertake any essential maintenance work necessary to stabilise those structures identified as being of high risk. Agri-environmental funding, under a High Level Stewardship scheme, has already been identified as one source of possible long term funding. The Tilberthwaite Fells are one of those areas already identified by Natural England as a target area and this Plan has shown that Penny Rigg would qualify in terms of a number off those key themes set out under the Natural England ' North West: Higher Level Stewardship Theme Statement'.

HLS funding may contribute to undertaking some of the recommended capital works including the stabilisation and conservation of those buildings identified as being at risk (Historical and Archaeological Feature Protection HAP – up to 100% of costs, or Restoration of Historic Buildings HTB – up to 80% of costs) and possibly funding for wetland management.

Other forms of national funding, including Heritage Lottery Funding[14] (Heritage Grants, Your Heritage Grants and Young Roots Funds) and the National Heritage Memorial Fund[15] might be pursued to provide for improvements to interpretation (either physical or intellectual). As well as

[14] Citing online reference 'Heritage Lottery Funding' > http://www.hlf.org.uk/HowToApply/programmes/Pages/programmes.asp, accessed on 22/09/10

[15] Citing online reference 'The National Heritage Memorial Fund > http://search.hlf.org.uk/nhmfweb/aboutthenhmf, accessed 22/09/10

other NGOs like the Charles Hayward Foundation Heritage & Conservation Programme.[16]

POLICY OF1: MAINTAINING GOOD COMMUNICATION

Communication between key stakeholders should be maintained and improved where necessary; methods should be explored to ensure this.

POLICY OF 2: SIMPLIFYING PROCEDURE

The LDNPA will attempt to ensure that the various applications and procedures necessary in the management of the site are simple and straightforward, and will ensure that there is advice on hand where necessary.

POLICY OF3: INFORMED MANAGEMENT

All decision-makers, at all levels, need to be made aware of the significance, risks and issues discussed in this Plan and any subsequent updates.

POLICY OF4: FUNDING STRATEGY

A short and long term funding strategy needs to be explored to safeguard against any risk to the maintenance of the site and provide for improvement to site interpretation and outreach.

4.11 REVIEW OF POLICIES

In considering potential risks and issues to the future significance of the site it is important to remember that these will not remain static but will reflect changes in use and condition over time. As such, any policies should not be seen as 'set in stone' but will need to be flexible and adaptable to meet the changing needs of the site. These should be reassessed at regular intervals and suitable policies added or amended as appropriate.

[16] Citing online reference 'Charles Hayward Foundation' > http://www.charleshaywardfoundation.org.uk/, accessed 22/09/10

5.0. MANAGING THE FUTURE: MANAGEMENT AND MAINTENANCE PLAN

Priority is based on: 1 = urgent due to health and safety or the structural stability of the site; 2 = within 5 years; 3 within 10 years

Plan no.	Task	How	Priority	Notes
Maintaining and Protecting the asset				
1	Assessment should be made of pollution from tailing ponds into the beck	LDNPA together with the Environment Agency should test for possible pollution and take immediate remedial action.	1	
2	Application made to English Heritage to Schedule the site	Application made based on the criteria discussed in the Significance section of the Plan.	1	If initial discussions seem unfavourable then perhaps options to list the mill should be pursued, although its condition might make this unlikely.
3	Commission a specialist structural survey of the mines (above ground).	This will focus on those structures identified as being of greatest risk but might include other areas of the site dependant on available funding. Assessment should also include stability of rid and waste spoil tips and self seeded trees.	1	Survey should result in an itemised and costed list of short and long term repairs, prioritised according to urgency. Particular attention paid to stability of rid and waste spoil tips and potential threat of self seeded trees.
4	Review Health & Safety requirements	H&S consideration should be assessed as part of the review by the structural engineer and appropriate measures taken.	1	In particular any threats from unstable masonry, unsafe trees and entrance to underground workings.

5	Action repairs list	Based on the results of the structural survey all actions should be taken to stabilise the site. This should primarily focus on any major structural requirements, but also any minor repair work which might prevent further decline	1	Minor repair work should not be undertaken until a structural survey is complete in order to avoid having to repeat work should more extensive repairs prove necessary. The appropriate ecological surveys (bats, lichen, newts etc) will need to be undertaken in advance of any remedial work.
6	Commission and undertake buildings and topographic survey of Mill, Old Quarry Building (2072)	Commission an archaeological survey of the Mill to include elevation and plan drawings of the buildings and a hachured topographic survey of the surrounding area. Survey should include further documentary research.	1	Survey should be undertaken prior to any stabilisation work and will inform a consolidation programme. Quarry building (2072) included because it is at immediate risk of collapse. Should include a community/outreach element
7	Commission and undertake buildings and topographic survey of Penny Rigg and Horse Crag Quarries	Commission an archaeological survey of the Mill to include a hachured topographic survey and target buildings recording of key standing structures. Survey should include further documentary research.	2	Although less of a priority than the Mill, this survey should be undertaken prior to any stabilisation work and will inform a consolidation programme. Should include a community/outreach element
8	Establish Emergency action fund and procedures	Establish a strategy to deal with emergency repair requirements as a result of flooding or other unforeseen damage. This should identify suitable resource to make the structure stable,	2	Funding for this work should be separate from that allocated for maintenance work so that emergency repairs are not a drain on the more long-term maintenance needs of the site.

		and undertake repair work; and allocate funds immediately available to cover this.		
9	Establish an on-going timetable of monitoring to assess the condition of the site	Set up a quinquennial inspection programme to review the condition of the site and assess the success and suitability of repairs.	2	Timetable should be set up at the same time as the maintenance plan but first review not scheduled until later. An intermediate review may be necessary in the short term to gauge the success of initial repairs and assess the 'settling down' of the site.
10	Dealing with Trial Bikes	Signs should be erected prohibiting trail bikes. Any existing damage should be rectified and provision taken to prevent the area being used in the future	2	Re-sculpting of the old mineral heaps (would need consultation with Natural England).

Plan no.	Task	How	Priority	Notes
Responsibility for managing and protecting the Archaeology and Ecology of the site				
11	Explore ways to improve communication between stakeholders.	Produce a list of concrete improvements that can be made to increase good communication, might include online forum.	1	Improvements in communication might include plans for regular emails or telephone communications as well as online information like a contacts list.
12	Funding Strategy	Formulation of a funding strategy to secure money to manage the long-term future of the site, including the	1	A range of funding bodies might be approached including HLF and Natural England's Higher Level Stewardship awards

		commissioning of surveys and improvements to interpretation.		
13	Define procedures	Those procedures associated with the management of the archaeology and the SSSI site should be clarified and all stakeholders made aware of ramifications. An online 'information pack' should be set up providing details of procedures, forms and contact numbers and made available to all stakeholders.	2	

Plan no.	Task	How	Priority	Notes
Reaching new users and Improving Interpretation				
14	Improve onsite presentation	Commission designer to produce both onsite and online interpretation material.	2	This would follow on from any information resulting from the more in depth surveys. Thought should be given to where information could be hosted online but initially might be the LDNPA website. Funds should be raised to commission: 1. A short walk around the site (Graphics) 2. Information board to accompany the walk (in a suitable material)

				3. An MP3 narrative to accompany the walk. This might provide a pilot scheme for the larger Coniston site. Could maybe include Tilberthwaite as well.

Plan no.	Task	How	Priority	Notes
Promoting the Natural Environment				
15	Promoting the natural environment	The importance of the site as SSSI should be embraced and fed into any improvements to Interpretation and onsite displays.	2	

Plan no.	Task	How	Priority	Notes
Further research and recording				
16	Expand HER	All of the key sites in the gazetteer should be added to the LDNPA HER.	2	
17	Excavation	A programme of integrated excavation and survey should be undertaken to explore those areas associated with the site where preservation is thought to be good.	3	Must be conducted under the auspices of the LDNPA and English Heritage. And should respond to those research aims proposed in the NWERA. Could involve a community project.
18	Understanding the natural	Further Bat and Lichen surveys		

	environment	undertaken under the guidance of Natural England.		

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Cartographic material

1851 Six inch First Edition Ordnance Survey Map

1890 Six inch Second Edition Ordnance Survey Map

1919 Six inch Third Edition Ordnance Survey Map