Crowtrees Colliery, Quarrington Hill, County Durham

Archaeological Building Recording

Prepared for
The Crowtrees Heritage Group

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CROWTREES COLLIERY,
QUARRINGTON HILL,
COUNTY DURHAM

ARCHAEOLOGICAL BUILDING RECORDING

Summary

Archaeo-Environment Ltd (AE) were commissioned by the Crowtrees Heritage Group (CHG) to undertake an Archaeological Buildings Survey of the standing remains associated with the former Crowtrees colliery, now part of the Crowtrees Local Nature Reserve (NZ 33540 37720). These predominantly comprised a large stone and concrete structure at the south western end of the site, believed to be the remains of the former colliery winding-engine house, as well as a smaller masonry structure to the north east of the capped pit head. The building recording work followed on from a phase of Archaeological Documentary Assessment and Wide Area Survey undertaken by Archaeo-Environment earlier in the year (AE 2009a). This study looked at the origins and development of the colliery, as well as identifying any surviving features on the ground.

In many ways, the history of Crowtrees Colliery exemplifies the range of issues and factors influencing the development of the East Durham mining industry. It began as a relatively small landsale mine in the latter half of the 18th century, producing coal largely for local consumption, but its fortunes changed in the early 19th century when it was purchased by William Hedley. Hedley, a key figure in the development of locomotive transport, invested a large sum of money in constructing a new pit in the vale to the east of the Phase I colliery. An early painting of the site would indicate that this was a 'showcase' colliery. It featured a number of fine stone buildings and appears to have been 'planned' from the very beginning rather than growing up in a piecemeal fashion as many other mines in the region. However, the Phase II colliery was relatively short lived and had largely been demolished by the late 1860s. In 1866 the colliery was purchased by J.W. Morrison to provide coal for use at his nearby iron works in West Cornforth. This marked the final phase in the mine's history (Phase III). The surviving winding-engine base and associated structures, all date to this period.

Following the closure of the Phase II colliery Morrison sunk a new shaft to the south west which would allow him to transport coal directly down the Crow Trees line and from there to West Cornforth and his other local ventures. As such, the Phase III colliery was very different in form and function to Hedley's earlier venture. This colliery was intended as a 'workhorse' solely to provide coal to fire the huge furnaces at West Cornforth and not for shipment. This change of nature is reflected in the surviving Phase III buildings which appear far more utilitarian in construction than their predecessors as shown in the Crowtrees painting.

Today, only the engine platform survives of the original winding-engine house, the majority of the outer façade and the entirety of the roof structure having been lost. Originally, the engine house would have been much taller and the platform encased in rubble built outer shell. This can clearly be seen standing in earlier photographs of the site taken in by Don Wilcox in the 1970s, although only small fragments now survive in-situ above ground.

The monolithic engine platform is constructed of large masonry blocks interspersed with layers of shuttered concrete. This form of construction may have been used to absorb and redistribute some of the vibration from the engine which would have originally been mounted on top of the platform. Apertures to accommodate the massive iron bolts securing the engine can be found across the structure. The engine is likely to have been a single cylinder horizontal engine coupled directly onto a winding drum by a crank-arm which would have moved within the large slot to the north of the main platform. The associated headgear lay directly east of the surviving structure, located above the former pit head. The shaft head was capped in the 1960s, although the size of the structure can still be clearly discerned. To the east of the capped pit head stands the remains of a second stone structure. This rectangular platform is believed to be the base of a vertical pumping engine.

The standing building remains at Crowtrees are considered to be of regional, if not national, significance as a rare example of a 19th century winding-engine house and associated features. These iconic buildings, which were once so closely identified with coal production in the region, have now all but disappeared. Crowtrees is one of only five extant winding-engine houses in the North East and the only example listed outside a museum, the other surviving examples being preserved at Beamish and Woodhorn. The site is also of considerable significance in terms of its importance to the local community, many of whom remember when the mines were still in production, and a number of whom are ex-miners themselves. It provides a valuable link with this key phase in the region' s history and stands as a visual reminder of Durham's industrial past.

Acknowledgements

Archaeo-Environment Ltd would like to thank a number of people who have helped in the compilation of this report. Particular thanks are due to Joy Pounder for all her work in facilitating the project and to all the members of the Crowtrees Heritage Group for their continued support. Special thanks are due to Jennie Garrod and Gary Whitton of the DCC Countryside Team for organising and co-ordinating the clearance work and to all those volunteers who helped pull, cut and chop back the vegetation.

Thanks are also due to Claire Henderson, the DCC Assistant Archaeological Officer, for all of her work on the project, and to Debbie Anderson who initially supported the proposal and got the ball rolling. Finally, we are indebted to all those who commented and advised in light of the Phase I report, in particular Stafford Linsley whose site visit and follow up support has proved invaluable.

Report Author

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Survey and Illustration

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CROWTREES COLLIERY,
QUARRINGTON HILL,
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ARCHAEOLOGICAL BUILDING RECORDING

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CROWTREES COLLIERY, QUARRINGTON HILL, COUNTY DURHAM

ARCHAEOLOGICAL BUILDINGS RECORD

1.0 INTRODUCTION

Archaeo-Environment Ltd (AE) were commissioned by the Crowtrees Heritage Group (CHG) to undertake an Archaeological Buildings Survey of the standing remains associated with the former Crowtrees colliery, now part of the Crowtrees Local Nature Reserve (NZ 33540 37720) (Figure 1). These predominantly comprised a large stone and concrete structure at the south western end of the site (NZ 433153 537508), believed to be the remains of the former colliery winding-engine house, as well as a smaller masonry structure on the north east side of the capped pit head (Figure 2).

The building recording followed on from an Archaeological Documentary Assessment and Wide Area Survey undertaken by Archaeo-Environment earlier in the year (AE 2009a). This study looked at the origins and development of the colliery, as well as identifying any surviving features on the ground. Undoubtedly the most substantial extant element proved to be the former winding-engine house, now known locally today as 'the castle'. This rare and iconic building is closely identified with the former colliery and is considered to be of ***regional***, if not national, significance.

The following report aims to provide a detailed archaeological record of the winding-engine house remains and discusses how the structure functioned within the broader context of the former colliery. It also aims to assess the specific significance of the building, and re-evaluate the overall importance of the Crowtrees site in the light of any new information. Finally, it considers any factors which might potentially place the structure at risk, and makes broad recommendations for its future conservation and management.

The unique gazetteer number attributed to each feature in the earlier assessment report (AE 2009a) has been maintained throughout the following document. However, in the case of the two main structures (No. 23 and 24), separate context numbers have been allocated to provide for a more detailed structural analysis and record of the building.

Scope of work

The project was commissioned primarily to look at the remains of the large masonry structure, known locally as 'the castle' (No. 23) (Figure 2). This comprises the only upstanding building of any size which survives from the former Crowtrees colliery. A small topographic survey of the adjacent area was also undertaken in order to understand how this building worked in context. This was focused

on the immediate area of the pit head (now capped) (No. 24) and the adjoining small structure to the north east (Figure 2).

In advance of the recording work the structure was cleared of trees and shrubs. This work was kindly undertaken by Jennie Garrod and Gary Whitton of the DCC Countryside Team, helped by various local volunteers. In the process of clearing back the undergrowth other structures were identified, namely a concrete platform believed to have formerly housed a temporary winding-engine. Unfortunately, due to the limited time and budget of the project it was necessary to limit the scope of the project just to those features detailed above (Nos. 23 and 24). This meant that it was not possible to investigate the broader area surrounding the engine house, or the other features identified during the Phase I wide area survey. Future work on the site might look at extending the topographic survey, although this would necessitate considerably more vegetation clearance work. This would need to be discussed in detail with the DCC Countryside team to ensure that the requirements of the historical and natural environment are balanced.

A level 3 written, metric and photographic survey (according to English Heritage guidelines (EH 2006)) was undertaken of the former winding-engine remains and a topographic survey (at a scale of 1:500) was conducted of the immediate building curtilage including walls, large fallen stones, and the outline of the pit head.

2.0 METHODOLOGY

Documentary evidence

Considerable documentary research had already been completed as part of first phase of the project (AE 2009a) and this was used to inform the subsequent buildings survey. It had been suggested that the local industrial historian, Don Wilcox, had worked on an earlier survey of the building some time in the 1970s. An attempt was made to track any record of this in those papers deposited with the DCC Archaeology section following Mr. Wilcox's death. Unfortunately, this information is not currently audited so it is proved impossible to search within the time frame of the present project. DCC hope to catalogue the archive sometime in the near future. However, many of Mr Wlicox's photographic images have been catalogued on the Tommorrow's History website including three of Crowtrees [1] .

In addition to the earlier documentary work, new searches were undertaken online at the Durham Record Office, the NIMME, Durham University Special Collections (Palace Green) and Beamish for any information specific to Crowtrees, as well as more general references to similar colliery architecture. The timing of the project also coincided with a one day conference on Industrial Archaeology at the University of Newcastle (organised by Jane Webster, University of Newcastle) which was attended by a number of specialists including Marilyn Palmer (University of Leciester) and

[1] http://www.tomorrows-history.com/public_collections.php?colselect=45&searchresultsPage=5

Stafford Linsley (formerly University of Newcastle). The Crowtrees building was discussed at the conference and subsequently Stafford Linsley kindly visited the site and cast an expert eye over the standing remains.

Building Recording

The Crowtrees building is in a semi-ruinous state, although relatively stable. A full record of the building was made within the bounds of health and safety restrictions. This only restricted recording the top of the engine platform which was too high for photographs to be taken, although a number of bolt holes were surveyed.

The metric survey of the former winding-engine house (No. 23) and adjacent pit head structure (No. 24) was completed using a Leica TCR700 Reflectorless Total Station Theodolite (REDM), augmented by additional measurements taken by hand. A closed network of control stations was established around the complex prior to the commencement of the survey and all accuracy levels were within English Heritage guidelines (+/-5mm) according to the scale of final reproduction (EH 2000). All project drawings were produced in AutoCAD with structured layer control (EH 1999). Full digital data (DWG and DXF formats) is included in the site archive.

A 35mm SLR photographic record was made of the building and curtilage in both black and white print, and colour slide film, augmented by a digital record. All photographs were taken from vantage points as near parallel as possible to the front of the structure. Detailed shots of significant elements, including any potential engine fittings and joist slots, were also taken. A catalogue of photographs has been submitted with this report as part of the archive. Each photograph contained a graduated scale of appropriate dimensions, as well as north arrow and identification board where appropriate.

Topographic survey

A topographic survey was undertaken to enhance the buildings record. This was completed using a Leica TCR700 Total Station Theodolite to produce a base map which was later hachured on-site by hand.

3.0 BACKGROUND INFORMATION

Site Location

Quarrington Hill lies approximately 6.5 miles south-east of Durham city, in between Cassop and Coxhoe. The settlement is largely Victorian in date and is one of many colliery villages which grew up in the area following the expansion of the East Durham coalfield in the early 19th century. Quarrington Hill still retains much of its historic character, although in recent years some of the former terraces have been demolished and replaced by more modern development.

The surviving buildings are located on the south-western edge (NZ 433153 537508) of the former colliery site (Figure 2), which covers some 24-hectares at the northern end of the Crowtrees Local Nature Reserve (under the ownership of Durham County Council). The 40-hectare reserve lies on the north-west fringe of the village and extends south from Quarrington Quarry in the north, to the Coxhoe Bank Plantation in the south west.

Geology

The site lies on the western edge of the Durham Magnesian Limestone Plateau which runs along the eastern edge of the county. The carboniferous Coal Measures in this area are overlain by a sequence of sandstones, mudstones, dolomites and evaporites, all deposited during the Permian Period some 280 to 225 million years ago. The oldest of these is a sequence of sandstones known as the Yellow Sands which are clearly visible in the face of the quarried escapement on the northern edge the nature reserve. The underlying Carboniferous rocks, deposited between 345 and 280 million years ago, comprise a cyclical sequence of mudstones, siltstones, sandstones and coal which vary in depth and thickness across the area.

The unique sequence of Carboniferous Westphalian Coal Measures, overlain by the later Permian rocks, has had a marked significance on the historical development of coal mining in the east of the county. In contrast to the west of the region, where the exposed Coal Measures are relatively close to the surface, the concealed coal seams on the Magnesian Limestone Plateau can only be accessed by deep shaft mining. As a consequence, expansion of the East Durham coalfield, of which Crowtrees formed a part, did not really take off until the early 19th century when an increase in demand, as well as advances in mining technology and transportation, made extraction in these areas commercially viable.

Topography and Land Use

The Durham Magnesian Limestone Plateau Character Area (Natural England, 22.07.09) extends in a broad triangle south-westward from the North Sea coast, to the Wear river valley in the west, and the lowlands of the river Tees in the south. It is characterised by the striking west facing limestone escarpment and the gently undulating plateau, bounded to the east by the varied scenery of the coastal plain. The escarpment itself has been shaped by a number of minor streams as well as extensive quarrying in some areas, all of which have resulted in a series of irregular spurs and vales where broadleaved woodland and scrub thrive. Rough, species rich grasslands extends across the steeper uncultivated slopes.

The Crowtrees site sits at the base of the escarpment, sheltered on three sides by the steeply rising landform. To the north the exposed face of the Old Quarrington and Cold Knuckles quarry dominates much of the view. This was first opened in the 18th century although abandoned for a number of years and not extended on a massive scale until the early 20th century. The quarry is currently

owned by Tarmac who plan to extend the works sometime in the near future. This could potentially have an impact on the conservation and management of the Crowtrees colliery site.

Quarrington quarry is part of a long tradition of quarrying in the area, the Permian rocks providing an excellent source of sandstone, limestone, sand and gravels which have been extracted at least since the medieval period, and is reflected in the settlement name 'Quarrington'. The Crowtrees site itself is located in a former quarry marked as 'disused' on the 6 inch first edition Ordnance Survey (OS) map (Figure 3). However, this quarry does not appear on the earlier tithe maps of 1839 and may, therefore, have been opened to specifically provide materials for the construction of the Phase II colliery in the second quarter of the 19th century.

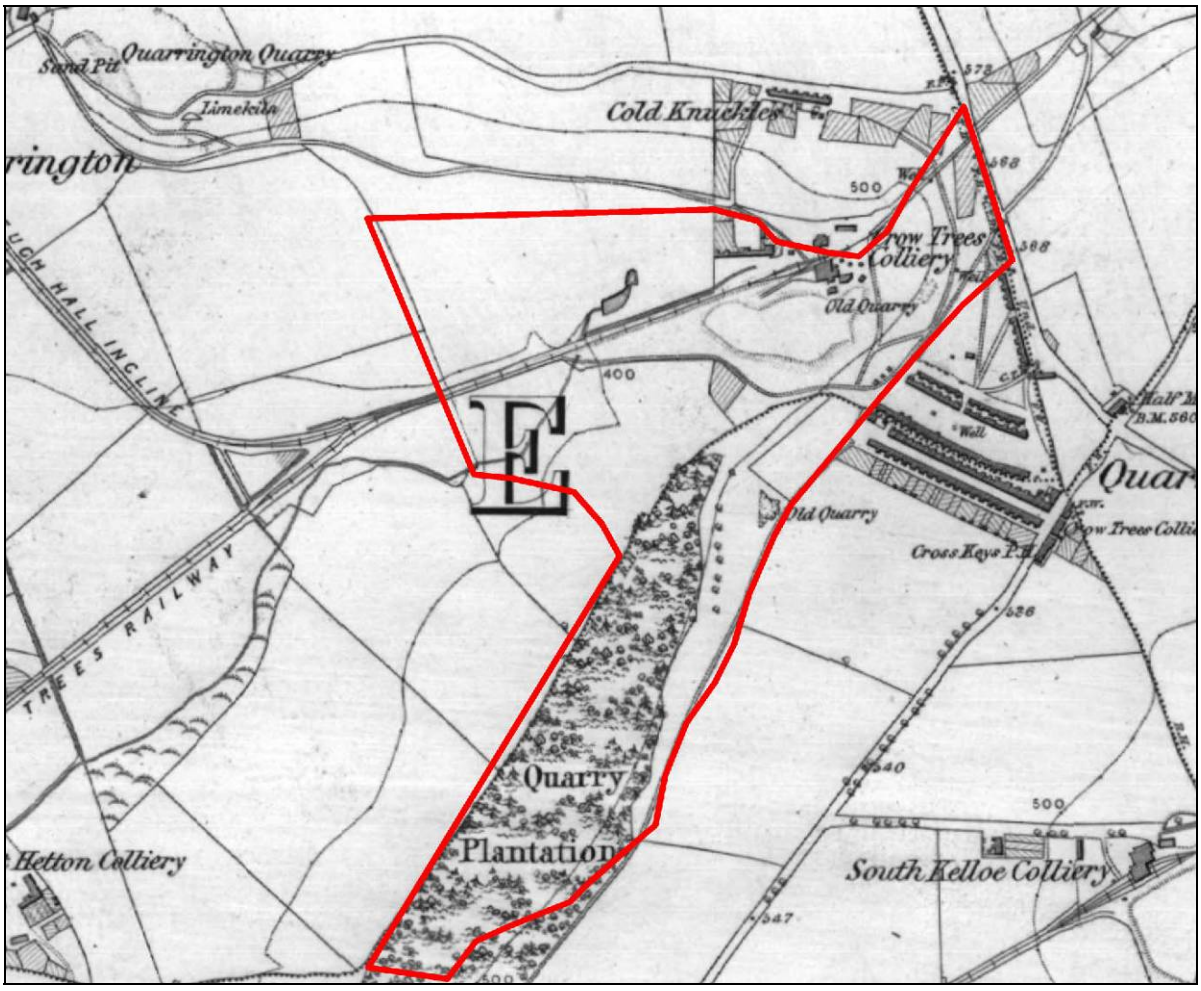


Figure 3: *6 inch first edition OS map (1860) showing the Phase II colliery built c. 1839. Note that the map shows no indication of the surviving winding-engine structure associated with the later Phase III site which was probably not constructed until the late 1860s.*

To the east of the colliery site lies Church Street which marks the western extent of the Quarrington Hill residential area; the main settlement lying to the south west. Late 19th century mapping of the area shows a row of workers cottages, serving the colliery, extending all along the north side of Church Street. Similar accommodation is shown on the site itself and on the high, level ground to the

south. Much of this housing was demolished in the latter half of the 20th century. The steep sides of the scarp, which forms the southern boundary of the site, once served as the village midden but today is populated by dense shrub and Hawthorn.

To the west lies the open expanse of the Magnesian Limestone Plateau which extends off into the distance. This relatively flat terrain has long been the favored location of transport routes into Durham. Today, the A1 can clearly be seen crossing the middle distance; as can the earlier turnpike (now the A177/B6291) which itself follows the course of the former Roman road to Sedgefield. Similarly, the advantages of the local topography were exploited when railway construction started in the early 19th century. New lines snaked across the plateau with numerous colliery sites developing in their wake. Crowtrees, built in 1839, was linked with the Clarence line at Coxhoe by a dedicated railway spur – the Crow Trees line. However, although industrial development may have been influenced by the landscape, it was not limited to it and by the latter half of the century a number of inclines had been constructed to move coal north east, across the rise of the scarp, to the newly established, and more economically attractive, West Hartlepool docks.

As well as the mining industry and its various by-products, such as brick and tile making, the good transport links and ready source of coal also saw the expansion of the iron making industry. In West Cornforth a huge foundry was established in the latter half of the 19th century which was to have a huge impact on the development of the local area with a number of pits, including Crowtrees, producing coal not for shipment but solely to support the expanding works.

Today very little of the Crowtrees Colliery site survives above ground apart from the prominent remains of the winding-engine house. However, building footings, house platforms, grassed over slag heaps and other features associated with the former mine can still be seen within the shrub and undergrowth. The majority of these have been documented in the site gazetteer accompanying the Phase I report (AE 2009a), although new features might be spied by the more vigilant visitor.

Designations

The site is currently not protected by any designations except as part of the Crowtrees Local Nature Reserve. The colliery site is recorded on the HER Nos. D6412, D963 and D3794, the latter being the winding-engine house; however, the HER does not afford any type of statutory protection.

Previous work

Apart from the work undertaken by Don Wilcox which is mentioned above, no other archaeological of architectural recording appears to have been undertaken at the site prior to the Assessment Report earlier this year (AE 2009a).

4.0 A BRIEF SUMMARY OF THE HISTORY OF CROWTREES COLLIERY

A detailed account of the history of Crowtrees Colliery can be read in the Phase I report (AE 2009a) and it is not intended to repeat that information here; however, a brief summary of the development of the site has been included to place the building within its immediate historical context.

In many ways, the history of Crowtrees Colliery exemplifies the range of issues and factors influencing the development of the East Durham mining industry. It began as a relatively small venture in the latter half of the 18th century, located close to the Crowtrees Toll House on the old Durham to Stockton turnpike road (the A177/B6291). This was the Phase I colliery - a landsale mine producing coal largely for local consumption. By the beginning of the 19th century Crowtrees was working the 3'6" and 4'10" seams at a depth of 16 and 25 fathoms, vending 4,000 chaldrons of coal per annum and employing 14 men (Bailey 1810, 10). At this time many believed that the Coal Measures did not extend east, underneath the limestone escarpment, or that if coal did exist here then it would prove too deep to mine successfully. However, new advances in mining technology began to provide solutions to problems of flooding and ventilation which had previously dogged the development of deep mines, and in 1823 the first deep pit, Hetton Lyon, was opened. The opening of Hetton Lyon was to have an enormous impact on the industrial development of the area, spearheading a massive expansion of the East Durham coalfield over the next fifty years.

In 1824, the year after the opening of Hetton Lyon, the engineer and mine viewer William Hedley purchased the Crowtrees royalty; this was to radically change the fortunes of the small colliery. Hedley, a key figure in the development of locomotive transport, recognised the huge financial potential in developing deep pits in tandem with a new railway transport network. As well as Crowtrees, Hedley also purchased the nearby West Hetton Pit, and possibly an existing mine at Heugh Hall (Mike Syers *pers.com*), with the intention of exporting coal along the newly constructed Clarence Railway to Port Clarence on the Tees, and from there to London and the rest of the world. However, within a few years the Phase I colliery proved uneconomical to run and with insufficient extraction to provide for the quantities of coal necessary to ship successfully. Despite the fact that by a further shaft had been sunk to access the 5/4 seam, a valuation of the pit undertaken in 1835 recommended that a new winning be sought with the intention of producing a higher, and more sustainable, yield (NEIMME 3410/FOR/1/15/96). Soon after this assessment it seems that Hedley decided to limit his losses on the Phase I colliery and invest in the opening of a new deep mine further to the east at Quarrington Hill.

The second Crowtrees colliery (Phase II) was a much larger affair; a deep mine sunk below the Permian rocks to work the 5/4 and Main seam. It was served by its own dedicated railway, the Crow Trees Railway, which joined with the Clarence line at Coxhoe. A painting of the colliery, believed to date to the mid 1840s, shows it to be of some considerable size with three headframes, each served by an associated winding-engine, and a separate pumping-engine house. Based on the painting and

the evidence of the first edition OS map (1857), it seems that Crowtrees Phase II was a 'planned' colliery from its conception and did not grow up in a piecemeal fashion like a number of other sites in the region. This assumption is corroborated by the complete absence of any reference to the colliery on the earlier tithe which, though published in 1839, was probably compiled in the first two decades of the century.

A planned colliery of this type would have required an enormous investment by Hedley not only in terms of sinking the shafts and the construction of the colliery buildings, but also the laying of the associated railway line. As such, Crowtrees Phase II was obviously a development of some status; an assumption borne out by the very existence of the commissioned painting as well as the apparent high quality of the buildings depicted. However, it seems that despite his investment, Hedley abandoned the mine soon after its completion. It is unclear why this was the case; it may have been because the venture proved too much of a financial drain, or possibly that even at this early stage there were problems which could potentially limit production. It is known that Hedley used the proceeds of the sale of Crowtrees, and the neighbouring West Hetton Colliery, to invest in mines at South Moor, Holmeside and Cragside (Archer 1882, 44), so maybe he just wanted to focus on those ventures closer to his home at Burnhopeside Hall.

Plate 1: *a painting of Crowtrees colliery by the artist J. Wood (c. 1840) held in the Beamish Museum collection. This painting clearly illustrates the high standard of the mine buildings, stone from which may have been used in the construction of the Phase III winding-engine house.*

Over the next few years Crowtrees was owned by a series of joint stock companies made up of some of the most influential men of the day. Many of these were directly involved in the cut-throat

battle which raged between the Clarence Railway Company, the Stockton and Darlington Railway and the Stockton & West Hartlepool Railway Company for control of the precious coal shipping trade. Finally, in 1866 the colliery was sold to J. W. Morrison who also owned the Rosedale and Ferryhill Iron Co. at West Cornforth. This was to mark the last major change in the collieries development and the construction of the Phase III colliery.

Morrison had first opened the West Cornforth Works in 1859 but within just twenty years it was producing between 4,000 and 5,000 tons of pig iron every year from 10 blast furnaces - two of which were the largest in the world. To feed the furnaces at Cornforth, as well as his other works at Burnmoor, Thornley, Murton and Stavely, Morrison needed a bountiful and reliable local supply of coal. In order to provide this he purchased several collieries in the area including Heugh Hall, Coxhoe, Hett and, of course Crowtrees.

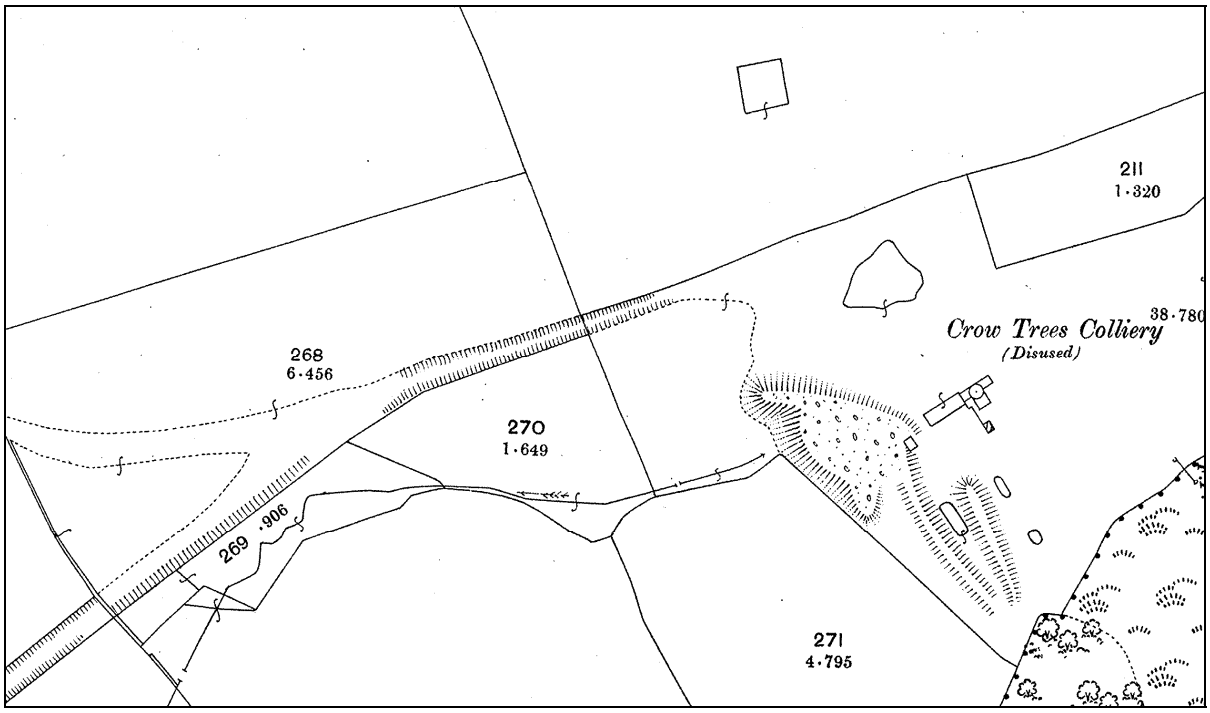


Figure 4: *extract from 25 inch second edition OS map showing detail of Phase III pit structures – the remains of the winding engine can be clearly seen. To the east lies the circular pit head, with the pumping-engine just beyond.*

It was J.W. Morrision who, almost certainly, was responsible for the closure of the Phase II colliery and sinking of a new shaft (Phase III) further down the slope to the south of the earlier pit. It is unclear why the earlier colliery was closed. There may have been issues with accessing the coal, or possibly the seam here was already exhausted by 1860. Whatever the reason, by the end of the century the second edition OS (dated 1898) shows only the buildings of the Phase III colliery and already these are noted as disused (Figure 4). No buildings or structures related to the earlier Phase

II site are shown at all except for the Crow Trees line. However, it is possible that the two pits did co-exist for a short period of time.

Morrison continued to control the majority of the mines along this section of the former Clarence line until a crash in the iron market saw the closure of the Rosedale and Ferryhill Iron Company in the late 1870s. Morrison was left with crippling debts and, maybe as a consequence, died soon after the closure of the works. The collapse of the iron industry brought about a temporary decline in coal production and this, as well as ownership and technical issues, contributed to the eventual closure of the Crowtrees pit in 1897. By this stage many of the surrounding pits had ceased production including Heugh Hall, West Hetton, Clarence Hetton, Bowburn, Cassop Vale, New Cassop and South Kelloe.

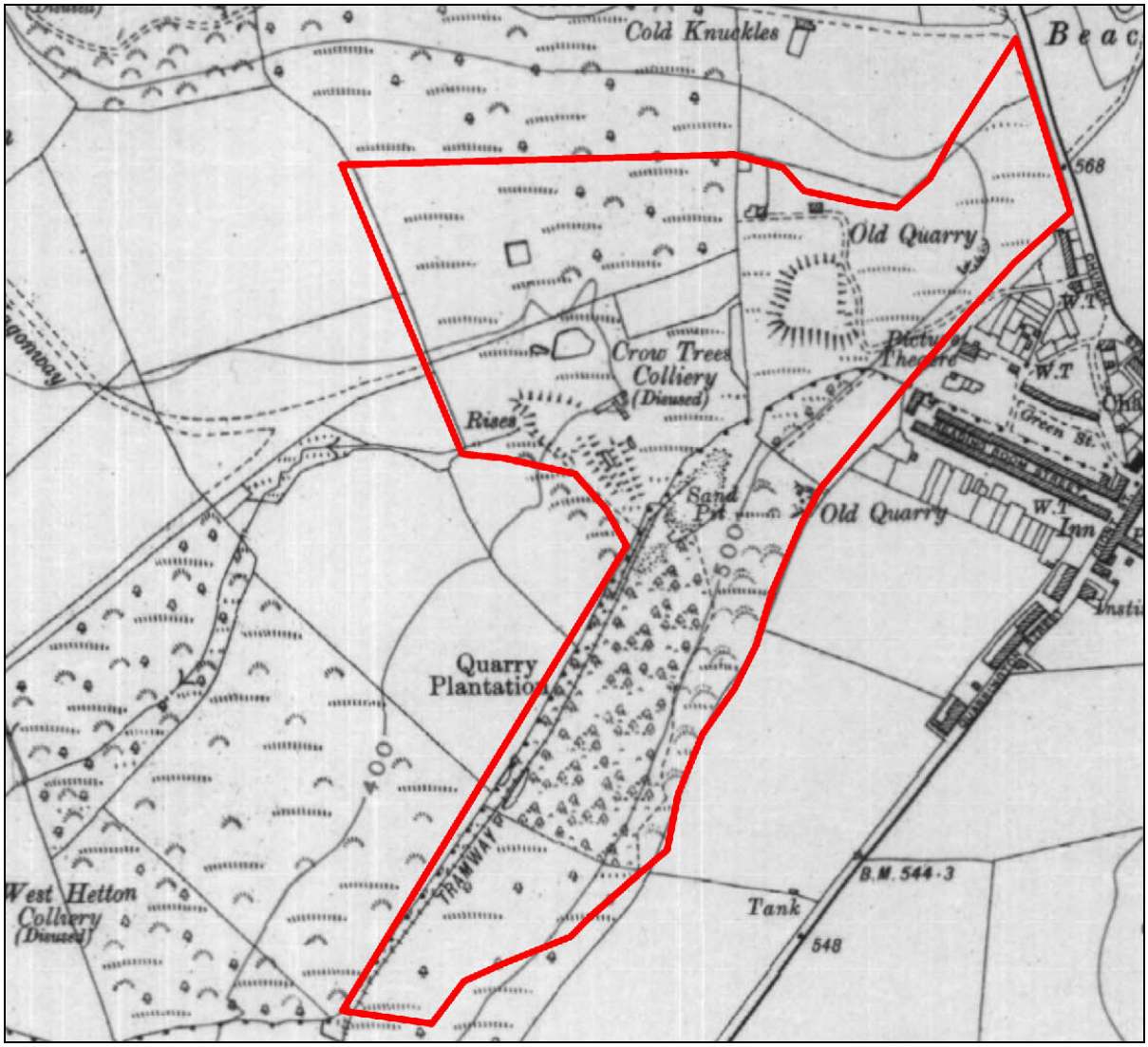


Figure 5: *extract from fourth edition 6 inch OS map (1939) shows only structures associated with the Phase III colliery still surviving, all buildings connected with the earlier Phase II (except a single house) have been demolished. However, the Heugh Hall incline and Crow Trees line are still visible to the right of the extract.*

The colliery seems to have fallen rapidly into decline. The second edition OS map (Figure 4) published just a year after its closure, shows only the Phase III winding-engine house and pit head surviving *in-situ*. Elsewhere on the site, some of the worker's housing associated with the earlier Phase II pit remained in use until the 1930 when they were finally demolished. However, the fourth edition map (Figure 5) published just forty years later (1939) shows that all other evidence of the original pit had disappeared, although the line of the Heugh Hall incline and Crow Trees Railway is still clearly depicted.

5.0 BUILDINGS DESCRIPTION

The surviving complex of structures is orientated north east to south west and measures 31.35m in total along its main axis. It comprises three separate elements: a) the winding-engine house; b) the capped pit head, and c) the east platform (pumping-engine base) (Plate 2).

Plate 2: *the winding-engine platform (100) with the capped-pit head (300) in front in the middle distance of the picture and the east platform (200) in the foreground*

The Winding Engine House (100)

The largest of these structures is the remains of the former winding-engine house (100), which is located at the western end of the complex. Today, only the engine platform survives of the original building, the majority of the outer façade and the entirety of the roof structure having been lost (Plate 3). The remaining structure comprises the monolithic, rectangular engine platform (150) which measures 14.50m along its long axis. The steam-winding engine and winding drum would have originally been housed on top of this platform. Eight bolt holes for securing the engine (101) are located on top of the eastern end of the platform.

Overall, the surviving structure is L-shaped in plan, with a slot for the crank arm and support plinth widening out the western end. Originally the building would have been rectangular, measuring 16.25m by 6.60m. The line of the former walls can still just be made out just above the grassed over debris at the base of the structure (Figure 6). At its eastern end the engine platform measures just over 3.00m at the base but steps up at intervals to a width of 2.50m at the top. At the western end, the engine platform is separated from a projecting stack structure (but not a chimney) (160) by a 1.00m wide slot (170); this was built to accommodate the motion of the crank arm driving the winding drum. The engine platform at this end is the same width as that at the eastern end, while the stack measures 5.40m along and 1.44m across. This means that the overall width of the surviving building at its western end is 5.60m at the base, stepping in to 4.25m at the top. However, it must be remembered that this is only the inner core of the structure and the overall building would have been somewhat wider (6.60m).

Plate 3: *South facing elevation (110) of the surviving engine platform (150) with remains of the building façade wall in front (112)*

The engine platform (150) survives to a height of 4.60m, although the north stack (160) is a little higher at 5.45m. Again, this is just what survives today but originally the building would have been much higher and included a roof. The roof is likely to have been a simple A-frame, or hipped structure like those shown in the painting of the earlier colliery (Plate 1). Around the base of the building the ground level has been raised quite considerably by deposits of fallen masonry and debris which has banked up against the structure and is now largely grassed over. A collection of large ashlars and roughly squared blocks can be seen scattered at the base of the building, particularly on the south side; these measure nearly a metre across in some cases.

The building is constructed of large masonry blocks interspersed with layers of shuttered concrete. This form of construction may have been used to absorb and redistribute some of the vibration from the engine mounted on top of the platform. The combined weight of the steam-engine and winding drum, coupled with the vibration caused by the machinery running at often 500 revolutions a minute, would place huge amounts of stress on the buildings foundations (RCAHMW 1994, 21). The courses of masonry blocks may have allowed for some degree of movement, being less rigid and prone to cracking than the concrete, whilst still providing structural support. The concrete used in the building is quite coarsely mixed, with large pieces of limestone rubble aggregate, some measuring 0.10m in diameter. The concrete would have been cast on site, the imprint of the timber planking frame still clearly visible on the surviving building. It was not reinforced, which might further account for the use of the masonry layers to provide some additional strength. Reinforced, or 'Ferro' concrete was not used extensively in British mines until the early part of the 20th century (*ibid,* 21).

The stone blocks used in the building are of some considerable size; one of the largest being over 1.50m long and nearly a metre wide. Many of these blocks are clearly re-used from another building, and given the degree of difficulty in transporting such huge blocks any great distance, coupled with the evidence of bolt holes and mouldings on some of the stones, it seems highly likely that these were from the Phase II colliery further to the north east. The quality of the dressing and tooling of some of the blocks indicates that these original buildings may have been of some status, further supporting the idea that the earlier colliery was very much a 'showcase' project.

Plate 4: *piece of re-used masonry built into engine platform - note the hole on the left hand face of the stone near the top; this may be for a fitting of some form or could be an indentation left by the brace used to lift and transport the block (112)*

The main body of the winding house comprises five key layers (Figure 7), although the base of the building is obscured by the raised ground level. Only the top of the bottom layer is exposed above ground, the structure then steps in 0.15m to the second tier which is constructed of large reused masonry blocks. These may have been quarried on-site, although it is unlikely that the local Magnesian limestone within the immediate vicinity of the colliery was of an adequate quality to produce such large blocks. Today the exposed natural stone on the site appears to laminate and wear quite badly but this might only be the condition of the overburden. If the local stone was not of suitable quality then the original Phase II colliery freestone may have been transported along the Crow Trees railway line from a nearby sandstone quarry. If this were the case then it would have necessitated the laying of the railway line before the construction of the colliery itself.

Immediately above the masonry block course is a layer of shuttered concrete, making the exposed base of the building 1.40m in height. The building then steps in, above which is another layer of shuttered concrete which measures 0.90m in height. There is then another step and a further layer of masonry bonded with concrete and rubble; this is just under 1.00m in height. The stones in this layer are a little smaller than those in the base layer, but are still fairly large re-used stone blocks. The final tier of the building is of concrete, and measures 0.64m in height. This would have probably been the main bedding for the steam-winding engine and features eight bolt holes, each measuring 0.10m in diameter.

Plates 5: *photograph of the winding-engine house taken by Don Wilcox in the 1970s (c. Durham County Council). The northern exterior façade wall is clearly shown as standing to some height.*

To the south of the main building lie the remains of a low rubble built wall (112), at a distance of 1.30m from the engine platform. It is constructed of fairly evenly coursed, roughly squared, limestone

rubble, with some larger squared and tooled blocks, and stands to a height of a little over 1.00m. This wall represents the vestigial remains of the outer façade of the engine house, with the intervening core space being filled with a limestone rubble and red brick (rough-moulded and measuring 0.06m x 0.11m x 0.23m). There is also some evidence of a similar structure on the north side of the building, although it does not survive as extensively above ground as it does to the south. However, photographs taken of the building in the 1970s by Don Wilcox show the outer façade wall standing to some height on this side of the building (Plate 5).

A short cross wall at the western end of the building (113) may be a later addition following the collapse of the outer shell of the engine house. There is some local memory of a stone and red brick wall surrounding the structure in the last fifty years and there are fragments of such a wall littered around the building.

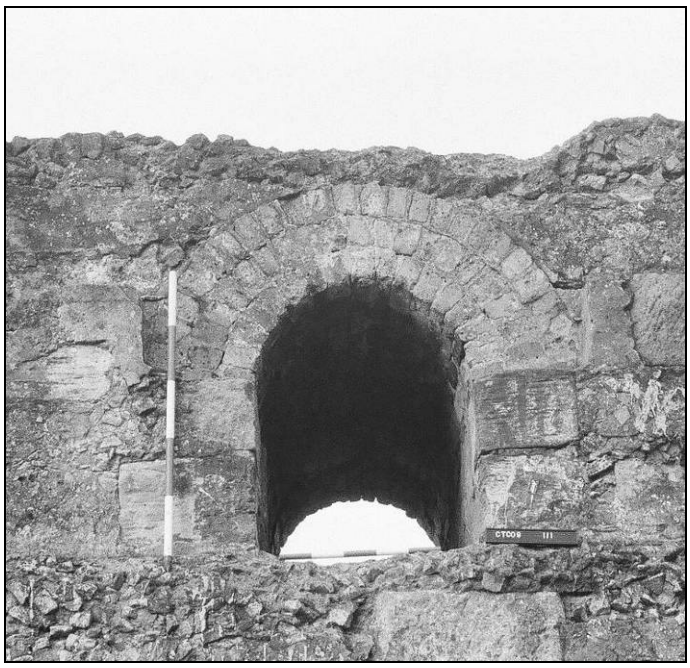
Directly abutting the engine platform at the eastern end is a rectangular, stepped structure (180) which appears to form an integral part of the main building. It measures 5.60m by 2.20m, and drops down in a series of four steep steps to the area of the capped pit. At its highest point, where it abuts the engine platform, this structure is just under 2.00m high, dropping to just 0.30m immediately west of the pit head. The structure is largely masked by rubble but appears to include a 0.60 x 0.40m slot (182) on the northern side at the base, and features two large wooden beams at the top which extend into the main engine platform. The two beams (181) are set 1.20m apart and each measures 0.20m across and is 0.20m thick, with approximately 1.00m exposed from the face of the building. A horizontal beam-slot (183), possibly a sole plate slot, also runs across the front of the main engine platform at the same height. These features may all be associated with pit headframe, tying the structure into the winding-engine house.

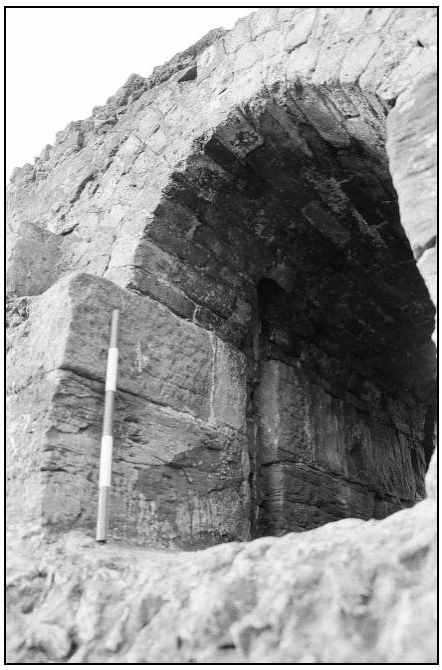
The South Facing Elevation (110)

This elevation overlooks one of the main routes through the nature reserve and is today the most public face of the building, and hence the most susceptible to graffiti. It is one of the building's long elevations and clearly illustrates its construction (Plate 3). In particular, the huge blocks of stone which make up the base layer of the building stand out. A number of these reused stones feature bolt holes, although some of these could be Lewis holes associated with their transportation.

One of the most prominent features of the southern elevation is the brick headed arch at the eastern end (111). The arch aperture measures 0.20m across and stands to a height of 1.00m. It runs through the whole width of the building (2.70m) at the height of the second tier (2.50m). The arch is framed by sandstone blocks and features three tiers of red, rubbed-brick voussoirs. The wall surrounds on each side step in to form a plinth which could be a support for a platform or bearing. However, there is no indication of wear anywhere on feature and this, together with it location, would argue against it housing any type of bearing or drive shaft. On the inner face of the arch there are

two shallow slots running up into the concrete above; these connect with two of the eight bolt holes identified on top of the engine platform. The exact function of the arch remains unclear at present.





Plates 6 & 7: *brick headed arch (111). The second photographs shows the detail of the slot on the arch soffit which links with the bolt holes at the top of the engine platform*

The West Facing Elevation (120)

This is the main short elevation seen by the public and overlooks a popular walker's routes out to the large ponds to the north. The elevation clearly shows the relationship of the engine platform to the other structures which make up the building, namely the crank arm slot (170) and the adjacent concrete stack (160).

The crank arm slot (170) measures 1.00m wide and starts at a height of 2.40m above the present ground level, extending 2.20m to the top of the engine platform. At the base of the feature there is a small area of repaired masonry (121) but there are no other associated features such as mounting or bearing holes which would suggest that this was ever a void for a wheel or beam of any sort. The main function of the slot was to provide for the movement of the crank arm attached to the adjacent horizontal steam engine. The crank arm would drive the revolutions of the winding drum.

The rectangular supporting stack (160) to the north of the crank arm slot survives to a height 0.60m above that of the engine platform. It is constructed largely of shuttered concrete, although some masonry blocks are used on the lower levels. It rises in a series of stepped tiers which correspond to those of the main engine platform and the two features are obviously integrated and built at the same time.

Plate 8: *West facing elevation of winding-engine base showing engine platform (150) to the right, crank arm slot (170) and stack (160) to right.*

The North Facing Elevation (130)

This is the second long elevation and is formed of two parts - the engine platform (150) and the concrete stack (160). At the base of the stack are a line of four rectangular apertures (131), each measuring 0.5m across and 0.70m high. These start at a height of 0.70m above the present ground surface. These features extend south, back into the body of the building, for various lengths. The two outer features (131a, 131d) are 1.00m in depth and a single bolt hole is visible on the soffit (approx. 0.10m in diameter), set 0.80m back from the wall face. The central two features (131b and 131c) extend further into the building to a depth of just over 3.00m. Both feature a set of double bolt holes (each 0.10m in diameter) on the soffit, set 0.50m from the wall face. These features were designed to provide access to the bolts, or rods, which would have secured the engine and associated machinery to the platform above. The weight and vibration of the machinery would have necessitated fittings of such a large size to run down through the building and be capped off at the level of the apertures (Linsley *pers.com*). The bolts may have needed to be checked and replaced at intervals and so could not be sealed permanently within the building, access would have also been needed to remove and service any parts of the engine located above. There is another set of access holes on the pumping-engine base and there may be others concealed below the level of the present ground surface.

Visible on the face of the main engine platform is the north side of the arched aperture (132) seen on the south facing elevation (111). The feature varies slightly on this side of the building as there

appears to be the vestigial remains of some structure just visible as scars on the wall surface (133). This seems to be the remains of a canopy, formerly supported by two partitions. To the west of the arch is a square aperture (134), which measures 0.40m across, and is braced on both sides by shaped sandstone. This feature sits just below the shallow parapet created by the top tier of the engine platform and is most likely a joist hole for a beam supporting a structure to the north.

Plate 9: *North facing elevation (130) of winding-engine base showing bolt access apertures (131) in the cement stack (160)*

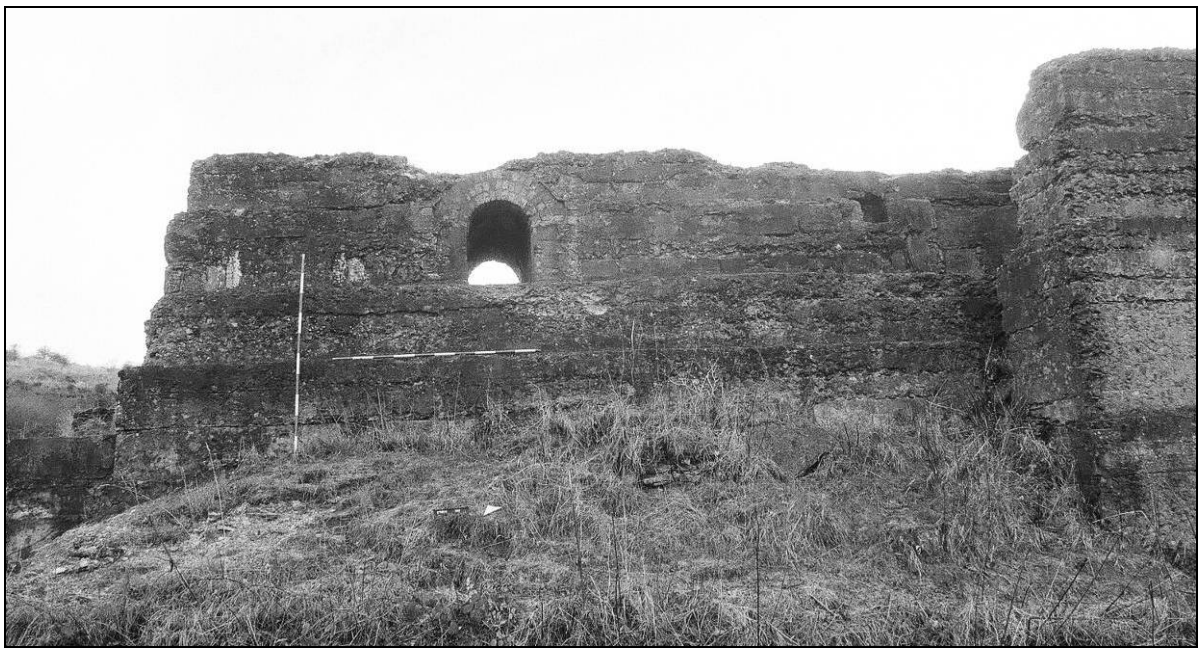


Plate 10: *North facing elevation (130) of winding-engine base showing arch (132) and joist hole (134)*

Based on the evidence of the surviving building footprint, it seems highly probable that the space immediately north of the engine platform was once enclosed, making the overall building rectangular in plan. It is unclear what this space would have been used for, but it might have included a framework supporting the winding drum, with possibly the boiler located below at ground level. However, more often the boiler was housed outside the main engine house because of the danger of explosions.

Clearance of the soil and surface debris to the north of the surviving structure, and a small targeted excavation, might reveal evidence of the original form and a function of this key area. One clue might be the fragment of walling (135) just visible in the bank below the main structure. The stonework here seems to be curved and could form part of a circular feature like a flue or chimney, although far too little survives above ground to be certain.

The East Facing Elevation (140)

This elevation comprised the stepped structure to the east of the engine platform (180), as well as the void created by the crank arm slot (170) and the adjacent concrete stack (170). The stepped structure (180) is slightly offset to the north and is not directly central to the engine platform; this is consistent with the building originally being rectangular. Located at the top of the stepped structure (180) are the two wooden beams (181) and beam slot (183) detailed above. Just below the two beams is another bolt access aperture (184) which is partially buried.

Plate 11: *East facing elevation (140) of winding-engine base showing structure (180), probably the base support of the headframe*

The Capped Pit Head (300)

Capped in the 1960s, nothing survives above ground of the pit head, although the dimensions of the feature can be estimated as measuring 5.00m north east to south west. The mound of earth just to the south of the pit head (Figure 6) could have been associated with the capping or might be a later deposit associated with the demolition of the modern wall which was known to have enclosed the area.

Just to the north of the capped head is a concrete platform which is believed to have formerly provided hard standing for a mobile winding-engine brought in to access the shaft when it was associated with East Hetton (Jones *pers.comm*). No trace of the former headframe survives apart from those elements incorporated into the adjacent winding-engine house base (180).

The East Platform (200)

At the eastern end of the complex is the remains of a low, rectangular platform which measures 5.80m north east to south west and 3.60m across. The core of the structure is an outcrop of the natural Magnesian limestone which has been faced with re-used ashlars and roughly squared blocks. The platform survives to a height of 1.80m at the eastern end, and 0.90m at the west end where it adjoins the pit head. This difference in height appears to have been part of the original design of the building, although this cannot be confirmed absolutely. Clearance of soils and debris from the top of the structure might establish its original form and discern if any bolt holes or fitting survive; evidence for these can be deduced from the surviving bolt-hole apertures (201) on the north face.

Plate 12: *East platform (200) showing north face (110) with bolt access apertures (211) just visible*

The two apertures are of a similar dimension to those found on the winding engine house (131 and 184) and probably served the same function. They can be seen, located just above ground level on the north side of the structure. However, the features on the east platform are largely obscured and further clearance would be required to confirm their function.

Just to the east of the two apertures is a large block of stone which appears to feature a linear indentation running vertically along its face (212). This could be a reused fragment from one of the original colliery buildings, or may be serving some purpose *in-situ*. Again, further excavation would be needed to confirm this.

6.0 DISCUSSION – THE BUILDING IN ITS CONTEXT

There is little doubt that the large standing structure (100) surviving at Crowtrees is the remains of the Phase III colliery winding-engine house. The winding-engine would have been one of the most important and prominent buildings associated with a colliery site, and possibly, together with the headframe, the most iconic. The complex wooden lattice of the headframe, topped by one or two pulley wheels, and connected to the monumental engine house by the perpetual movement of the winder, would have once been a common feature of the local skyline. Today almost nothing remains of these great edifices, the counties numerous collieries having disappeared from the landscape virtually overnight.

Crowtrees Phase III was a mid to late 19th century colliery and quite different in scale and form from its predecessor (Phase II) further up the vale to the north east. The Phase II colliery had been a 'showcase' seasale colliery designed from the outset with the intention of producing high yields of coal for transportation by railway to Port Clarence on the Tees, and later the new port at West Hartlepool, for shipment down the coast to London and out across the world. The painting of Crowtrees (Plate 1) held in the Beamish collection, although possibly painted with a little artistic licence, shows a 'planned' colliery with a number of fine Georgian engine houses, brick built chimneys and wooden headframes, all served by a dedicated railway. However, based on the documentary evidence, it seems that Crowtrees Phase II never lived up to its owner, William Hedley's hopes and within just forty years or so the whole complex had been demolished and replaced by a much smaller, utilitarian concern (Phase III).

The Phase III colliery was constructed predominantly to serve the needs of the nearby Rosedale and Ferryhill Iron Foundries at West Cornforth. As such it was more of a 'workhorse' pit than the earlier colliery and it is likely that the associated buildings would have been much more utilitarian in design. Unfortunately, all that survives today is the core of the winding-engine house so we have little idea of what the structure would have looked like from the outside before its decline, although based on the

surviving fragment of the façade wall (112) we do know that it was a rubble-built construction, which incorporated some larger blocks, probably from the earlier colliery.

Based on the second edition historical map published in 1898 it seems that the Phase III colliery was a very small venture, working only one shaft which was probably divided below ground by brattices, although a second shaft would have been required by law to provide for alternative egress in the case of emergencies. This followed the passing of the 1865 Mines Act introduced after the Hartley Pit disaster of 1862 when over 204 men lost their lives when the single shaft became blocked by a collapsed engine arm. There is no surviving documentary or landscape evidence of the location of the second pit, but it seems likely that at least one, if not more of the earlier Phase II shafts would have remained in use.

Requirements of a Standard Colliery

The primary above ground structures necessary for any colliery of this date would have been: the headframe, winding-engine house, pumping-engine, coal screens, workshops, engineering sheds and stables. The majority of these structures would have once been found at Crowtrees Phase III, although given the size and nature of the pit some of these might have been quite limited. Unfortunately, by the time the second edition OS map was published the colliery had already closed and only the main structures are shown as still being extant.

The headframe would have included one, or possibly two, pulley wheels or sheaves which by the mid 19th century would have been located directly over the pit head. The lattice of the frame would have been constructed of wood, steel headframes not being introduced until the early 20th century. The pit head itself would have been surrounded by pit banks which formed the shaft top, as well as platforms on which the extracted coal would have been tipped into waggons or screens (RCAHMW 1994, 13). Mechanised coal screening, rather than hand sorting, became increasingly more widespread towards the end of the 19th century. Coal was sorted into various sizes for sale but given that the Crowtrees coal was being sent directly to the iron works, and not for more general shipping, it might not have been screened. Immediately adjacent to the headframe, and integrated with it at the base, was the winding-engine house.

The Winding-Engine House

Good winding equipment was essential to the success of a colliery as it was responsible for the transportation of men, coal, and machinery from the surface to the coal face. Any failure in the winding gear could delay production and seriously compromise the success of the colliery. In the early days of mining, coal had been transported up from the coal face manually, usually by women. The women were required to carry the coal in baskets on their backs up the ladders of a shaft, or along the steep incline of a drift mine. Later, simple mechanised forms were introduced. The windlass was a geared wheel driven by a number of men which would haul coals to the surface, and

this idea was later adapted into the horse-engine or winding gin; both were widely in use during the 17th and early 18th centuries.

By the latter half of the 18th century, Thomas Newcomen's beam engines were being widely used in coal production for pumping water from mines, but the single-acting pistons of these machines could not easily be adapted to provide for the rotational motion needed for winding. In 1784 James Watt installed the first successful condensing rotary double-acting engine which could be applied directly to a drum shaft for winding coal, although still reliant upon a beam for power transferral (Hayes 200, 16).

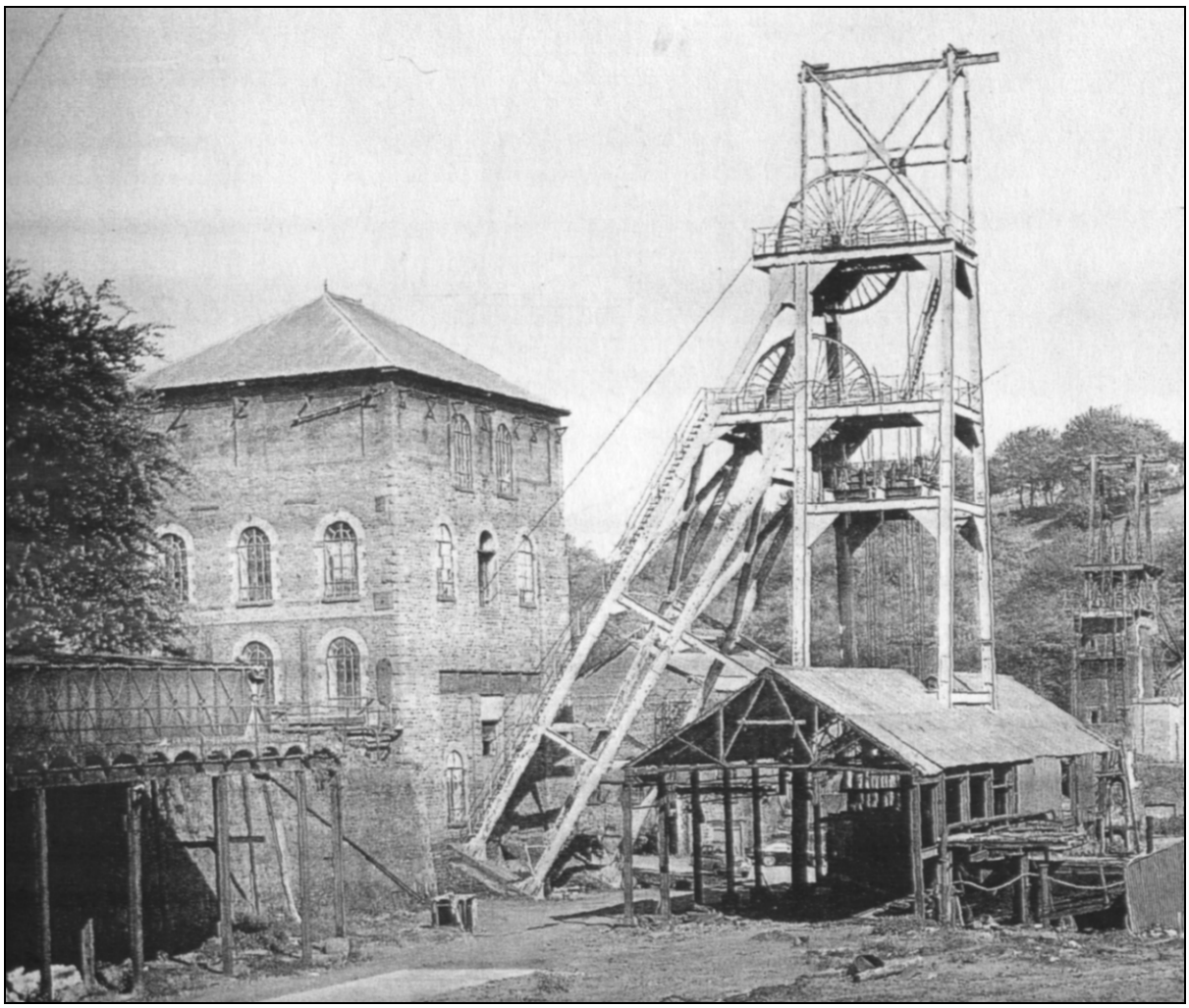


Plate 13: *19th century winding-engine house and headframe at Tirpentwys in Wales. The engine here was a vertical winder, so the building is taller than Crowtrees would have been but it does show the relationship of the various elements of the pit head.*

In 1800, Watt's patent expired leaving the path open for the free manufacture and development of the rotary engines. At this time Richard Trevithick was developing a small high-pressure non-condensing engine which dispensed with the need for a beam. This engine, the forerunner of the later locomotive, had a wide range of applications, not least for powering colliery winding gear.

However, the Trevithick engine proved too small to drive the winders necessary to access the deep shaft collieries which were being sunk across the East Durham coalfields. More successful was Phineas Crowther's patented vertical steam cylinder engine which drove an overhead crankshaft. Crowther was based in Newcastle and his engine, patented in 1800, became popular throughout the north-east. It proved to be relatively fast running and able to handle the large tonnage of coal being generated by the Durham and Northumberland coal fields. The 60 and 40 horse power winding-engines detailed in Phase I/II colliery assets report of 1837 (AE 2009a, 22) may have been of this type.

From the 1850s the vertical winding-engines were largely being replaced by horizontally mounted engines. This was the type of engine which would have been installed at Crowtree Phase III. Typically an installation would involve a pair of engines coupled directly onto a winding drum, one on each side, with their cranks offset so that both engines could not be on the centre of a stroke at the same time and so unable to start. Connected to the crankshaft would have been an indicator which showed the position of the cages in the shaft to guard against under or over winding. Alongside the engines would have been a lever for the reversing gear and one working a valve regulating steam to the engine, as well as a pedal for braking the drum (RCAHMW 1994, 70). Based on the size and width of the surviving platform (2.50m), the Crowtrees engine was smaller than that detailed above and was most probably a single-cylinder horizontal engine, or a tandem compound engine.

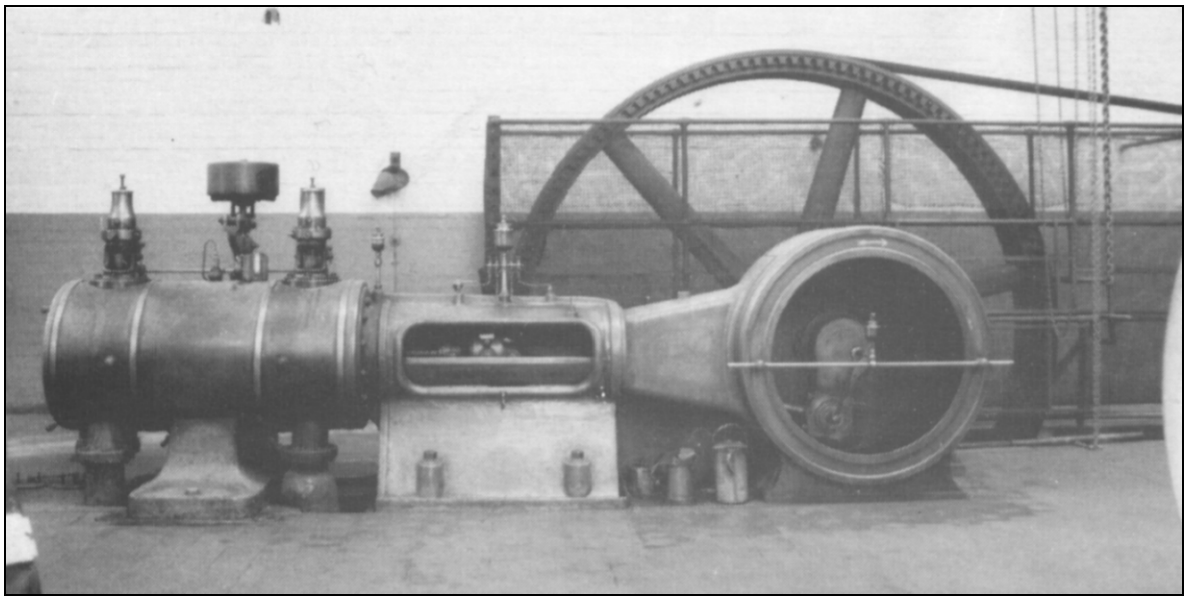


Plate 14: *Single-cylinder horizontal engine similar to that which may have been installed at Crowtrees, although this engine has drop valves and a controlled trip gear to drive a generator*

In the early 19th century, Arthur Woolf had observed that when steam was exhausted from one cylinder it still had some power left in it, so he designed a second larger, low-pressure, cylinder which could still push a piston with the reduced force. The use of this more efficient engine, known as a compound engine, became standard in the latter half of the century. There were two main types of

design based on this principle – the cross compound and tandem compound engine. The former vented steam from the cylinder on one side of the engine to the other, but the tandem compound engine had one cylinder placed behind the other and connected by a long piston rod.

Single cylinder engines are generally earlier in design as the double-cylinders required quite high pressures to operate successfully; engines capable of such high steam pressures were not widely available until later. Based on the date of the Phase III colliery it seems likely that the Crowtrees engine was a single cylinder engine, although the platform might conceivably be large enough to accommodate a tandem compound engine. Whatever the type of the engine, it would have driven a crankshaft which ran along the north side of the building, its action being accommodated by the 1.00m wide slot adjacent to the engine platform. The crankshaft would have been attached to the winding drum in the place of the usual engine flywheel. The iron ropes used for winding ran around the drum.

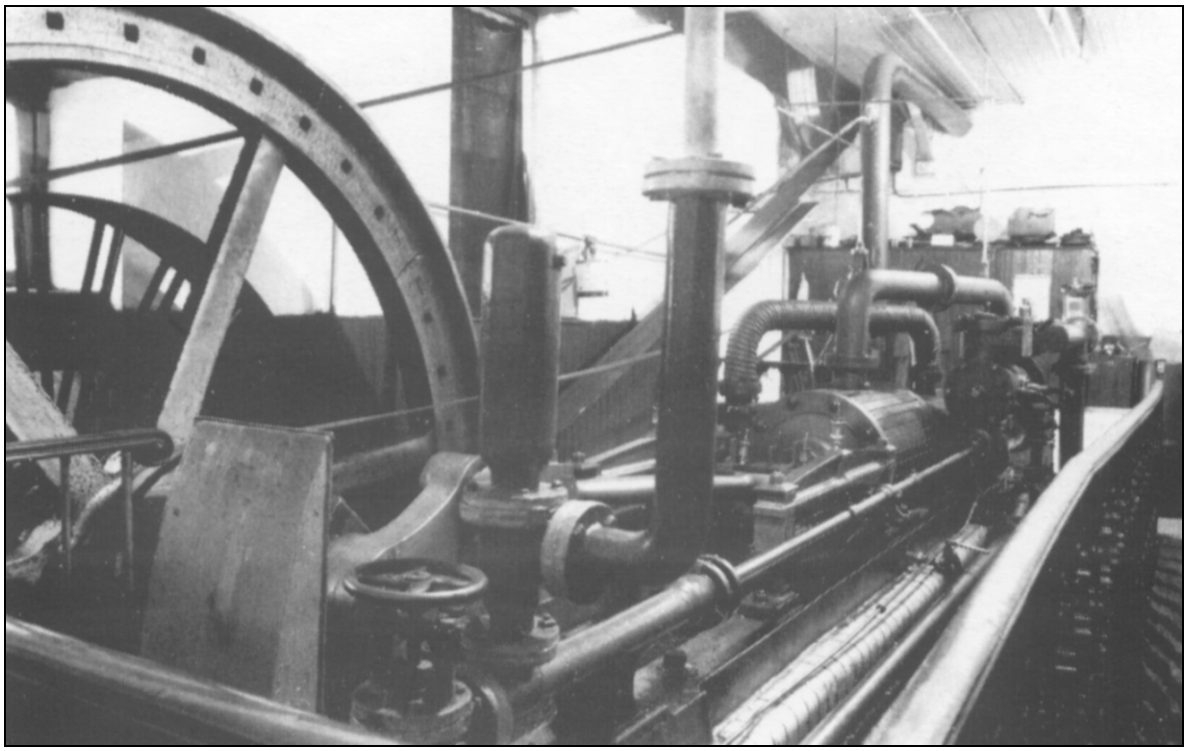


Plate 15: *Horizontal tandem compound engine, this is the other form which may have been used at Crowtrees; this one is being used at a textile mill to power machinery at a textile mill*

The early coal mines used ordinary hemp-rope or iron-chains for winding but neither of these proved suitable for fast winding or heavy loads. By the 1840s iron-wire ropes had been introduced from the Prussian collieries, these could carry much heavier loads for longer periods and were soon widely used. They remained the main form of cabling until later replaced by steel-wire ropes. The first iron-wire ropes were flat and coiled in on themselves, but these were later replaced by round ropes which wound on and off the drum. The ropes had originally been used to haul wicker baskets which had to be filled from the tubs below ground. In December 1834 the first cages were installed at South Hetton, this meant that filled tubs could be raised directly to the surface. A similar system was used

at Crowtrees Phase II where Hedley had built both a surface and underground railway to convey chaldrons both to and from the shaft. A similar system would have remained in use during the latter phase of the colliery's development for raising both coal and men to the surface. The bottom of each tub was fitted with rails which connected directly with the railway, so speeding up the efficiency of transfer.

Other Key Buildings

At Crowtrees, while the winding house would have been the largest of the surface buildings, it would have been surrounded by a number of smaller adjacent structures. Power from the winding-engine might have been harness to run other facilities around the pit including various workshops servicing the site. Larger collieries (including the Phase II site) would have had a huge range of workshops, foundries, fitting shops, sawmills and engineering works, but given the size and function of the Phase III colliery it is unlikely to have had such diverse facilities.

Closely allied to the winding-engine house would have been the boiler house and associated chimney, providing steam for the engine. This would have been located near, but not necessarily within, the engine house structure. Early boilers were notoriously temperamental and could be highly dangerous and destructive. We know that at Crowtrees Phase II there was a large boiler explosion in December 1850 which killed two men and blasted debris up to 200 yards away. This was followed in April 1856 by a second explosion which killed William Barry, a 23 year old fireman (AE 2009a, 39). There is no surviving evidence of where the Crowtrees Phase III boiler house was located, although Mrs Ticehurst, a local resident who lived on the site until the 1930s, does remember a chimney being located to the south of the surviving winding-engine house. There is a small square building shown in this location on the 1898 second edition OS map, and it is likely that this was the associated boiler house, particularly given that it lies just north of a reservoir or pond. A nearby source of water was a pre-requisite for a boiler house to both provide water and drainage.

The large ponds which lie to the north of the present structure did not form part of the colliery but were recently created as part of the local nature reserve. There are no ponds shown in this area in the earlier historic mapping, although the first edition does show a large water source to the north east (Gaz No. 32) which was linked with West Hetton Colliery. However, the base of the vale was probably always quite boggy, making drainage an issue. A brick-lined, square pond or cistern, 170m to the north of the Phase II colliery (Gaz No. 31) is shown on the second edition OS map (1898), but not on the earlier edition map (1860). However, this is not believed to be associated with the later phase colliery but probably related to drainage of the nearby Quarrington Quarry which was expanding during the latter half of the 19th century. The brick-lined tunnel, which forms part of the structure, leads down from the north in the direction of the quarry, with no obvious outlet to the south to the mine. Water filtering off from the quarry may have been pumped and collected here to avoid flooding the works further below, or this feature may have been added after the closure of the Phase III pit.

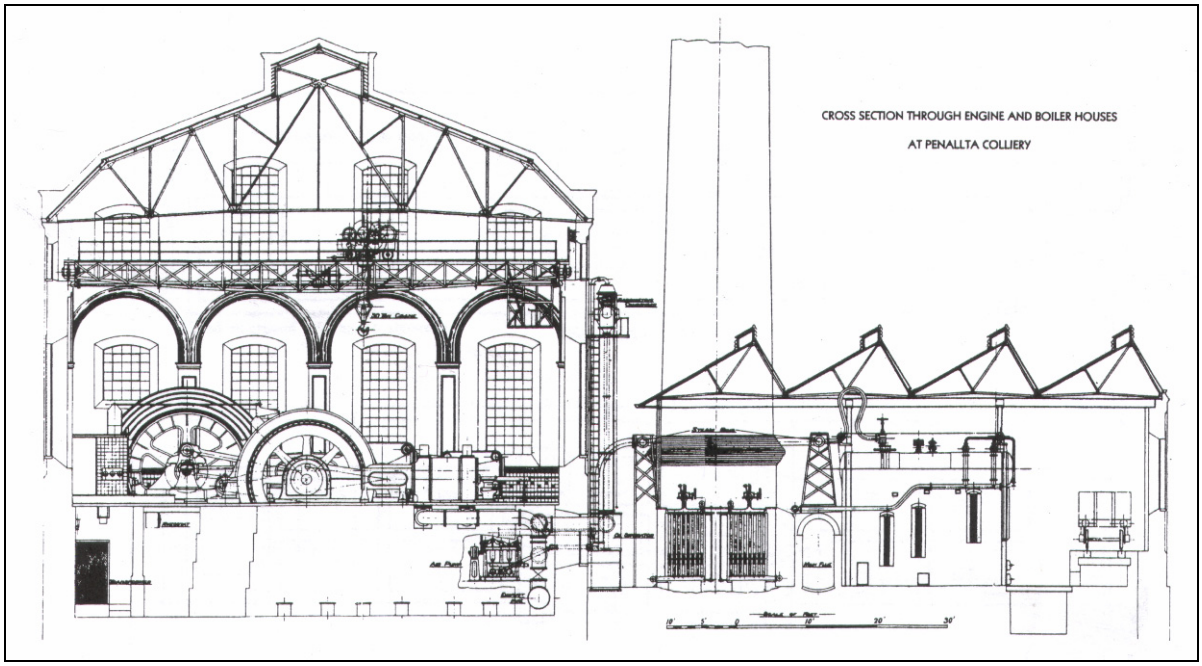


Plate 16: *cross section of an early 20th century engine house with boiler house attached. This is a larger building than that at Crowtrees but provides an illustration of how the interior of the engine house was arranged. The horizontal engine rests on a substantial concrete platform such as that preserved on site (100) with bolt access apertures shown at ground level.*

The Pumping Engine

Below ground flooding was a continual problem in all mines. Initially, this had been one of the key issues limiting the opening of the deeper pits, but by the early 19th century advances in technology had made water pumping and drainage at depth possible. Given the location of the Phase III pit at the base of the vale, drainage would have always been an issue. Although above ground hydrology does not necessarily reflect that below ground, water permeating through from the surface through cracks and fissures in the limestone, as well as below ground watercourses, would have made flooding a continuous risk.

The importance of dewatering made it one of the first processes to be mechanised with the introduction of steam power. Thomas Newcomen's atmospheric condensing pumping-engine was first employed at a colliery near Dudley Castle in 1712. This single-action beam engine, with the piston directly attached to the pump rod, was to become a feature of collieries across the country for the next 200 years. Later modifications to the design enabled a rotary motion which was then re-converted to a reciprocating up and down action, but without the danger of the piston drawing in air, or the breaking of a rod, both of which could cause untold damage. The new engines were faster and more efficient than the non-rotative engines. The Crowtrees pumping-engine was likely to be a vertical engine based on this design, located on the surviving platform (200) east of the pit head. Access vents, for the fastening and adjustment of bolts securing the machinery, can be seen on the northern side of the structure. These are similar in design to those on the winding-engine house (131).

The power necessary for pumping was much less than that required by the winder and would require a much smaller engine in size and capacity. Often by the second half of the 19th century, the operations of pumping and winding had been combined in a single large engine house, but at Crowtrees they appear to have remained separate. Water from the pump would have probably been vented into the reservoir serving the main boiler house. A single boiler house could have served both engines, or the pumping engine may have had its own dedicated boiler.

Plate 17: *photograph by Don Wilcox showing pump spears from Crowtrees Colliery used as a fence rail (not found during 2009 survey). These timber spears were joined together to form a linkage to transfer power from the steam engine to a pump at the bottom of the shaft (c. Durham District Council).*

Mine Ventilation

No other substantial structures associated with the former colliery survive above ground, although there is some indication of other remains hidden in the surrounding undergrowth. Key aspects of the working mine left still to discover would include any features associated with the ventilation of the deep pit. Alongside flooding, the dangers of poor ventilation and foul air were one of the primary risks associated with mining. Insufficient oxygen, the threat of explosion and noxious gases, all combined to make underground conditions hazardous. As such, some form of mine ventilation would have been an important part of the colliery complex. Early forms of mine ventilation relied on changes in the temperature to naturally draw air through the underground workings. A fire, or furnace, was lit at the bottom of one shaft (upcast) to induce a flow of fresh air down the other shaft (downcast). However, foul air, which could be laden with flammable gases, was drawn into the furnaces; this was potentially dangerous and carried a high risk of explosion. By the early 19th century the risk was

partially addressed by furnaces being arranged to take sufficient fresh air for combustion and only discharged hot gases directly into the upcast shaft to heat the air column.

This type of ventilation system leaves very little evidence above ground, which the majority of the process contained at a sub-surface level; the only above ground evidence being the upcast shaft. Sometime the upcast would be a dedicated ventilation chimney, but more commonly it would have been a working shaft providing emergency egress as well as ventilation. At Crowtrees it seems highly likely that the Phase III colliery would have used at least one, and possibly more, of the former Phase II shafts to fulfil both these functions. If this were the case then presumably the headgear and winder from one of the earlier shafts must have remained in use. Alternatively, a new upcast shaft and associated headframe may have been located close to the known pit head, with the surviving winding-engine structure surviving both. However, there is no evidence of a second shaft on the second edition map.

Towards the middle of the 19th century mechanical means of ventilation were being explored, but the only successful device to be employed was a centrifugal fan invented by the Frenchman Guibal in 1862. These were gradually introduced into British collieries towards the end of the century, and in many cases were massive installations with fans measuring up to 15m in diameter. However, these were not in widespread use until after the construction of the Phase III pit, and it is unlikely that one would have been installed on the site.

Transport

In terms of transport, the rail and tram-handling network which existed on the site from the Phase II colliery would have partially remained in used throughout the final phase. The incline to the east which connected with the West Hartlepool line via Thornley, was closed down as coal was no longer being produced for shipment. Instead, coal extracted from the mine would have been transported directly along the Crow Trees line to Coxhoe, and from there to the iron works at West Cornforth.

Despite the reliance on mechanised transport most collieries kept a certain number of horses for general haulage and similar tasks. These were in addition to the below ground pit ponies. Stabling for these horses would have been above ground, and evidence of these might still survive on site. However, the majority of the colliery stabling would have been below ground.

Given the date and size of the colliery it is unlikely that there would have been many of the buildings associated with later movements in miner's welfare. Pithead baths for instance were not introduced until the 1920s and would not be expected at Crowtrees which was closed long before this. There seems to have been no dedicated onsite colliery housing, with the majority of miners living in nearby Quarrington Hill, or in those houses associated with the Phase II site. Similarly the local school and chapels were all located at either Quarrington or Cassop.

7.0 SIGNIFICANCE

The Crowtrees colliery standing building remains are considered to be of **regional**, if not national, significance as a rare example of a 19th century winding-engine house and associated features. Crowtrees is one of only three winding engines, listed on the Durham HER, as still surviving out of the huge number which once spread across the county's landscape. The other two surviving structures are both at Beamish (D779, D3235), making Crowtrees the only surviving winding-engine house in the county outside a museum. There are two unspecified engine houses recorded at Butterknowle (D788 and D9104), but it is unclear if these are winding houses.

Across the county in Northumberland the situation is only a little better with four engine houses still standing at Scremerston (N15007), Rothley with Hollinghill (N17192), Fallowfield (N20894) and Pegswood (N17192). The only specific references to winding-engine houses are those preserved at Woodhorn (N11669, N14928). All these structure, except Rothley, are listed grade II buildings. There are no engine houses recorded on the Tyne and Wear HER except for a 20th century hydraulic engine house at Elswick (T4902). Nationwide the picture is similar, with only 8 specific winding-engine structures recorded on the NMR, although there are 106 records altogether which have some reference to winding gear.

Given the importance of mining to the historic and cultural development of the county it is quite shocking that, only 20 years after the widespread closure of the pits, so little of the associated cultural heritage survives standing. The Crowtrees building is also important within the immediate context of the development of the colliery itself which is considered to be of exceptional importance in our understanding of the expansion of the deep mines of the East Durham concealed coalfield. The site clearly illustrates the interconnection of the various elements stimulating the industries growth in the early 19th century including: the increase in shipping demand; development of transport network; the rise of financial investment, and advances in mining technologies.

The Crowtrees winding-engine house is also of considerable significance in terms of its importance to the local community, many of whom remember when the mines were still in production, and a number of whom are ex-miners themselves. The site provides a valuable link with this key phase in the region's history and stands as a visual reminder of Durham's industrial past. As such it is a valuable educational resource, although more work is necessary to exploit this to its full potential. The standing remains are also of note as part of the Crowtrees Local Nature Reserve, providing both habitat and an interesting focal point for visitors and walkers.

The following table attempts to explore these various facets in a slightly more rigorous manner and uses criteria based on that used for monument scheduling by English Heritage. The grading system is based on 1 being of greatest significance, and 3 being of lowest. However, just because an aspect or feature may be graded as of low significance it should not be seen as expendable.

Table 1: *Crowtrees Assessment of Significance*

Criteria	Evaluation	Grade
Period	The standing building remains all date to the second half of the 19th century (although incorporating some earlier material) and are a rare example of surviving colliery structures from this date in the county, and across the north-east as a whole.	1
Rarity	Only 2 other extant winding-engine houses are recorded on the Durham HER and both of these are in Beamish Museum. The only other specific winding-engine houses recorded in the north-east region are those at Woodhorn. This makes Crowtrees the only standing structure outside a museum, and the only structure not listed. Nationwide only 8 specific examples of similar buildings are recorded on the NMR, although there are 106 entries related to more general 'winding gear'.	1
Documentary	While there is considerable documentary material available on the Phase II colliery there appears to be very little material specifically related to the Phase III site. Further research into the Rosedale and Ferryhill Iron Works, and its owner J.W. Morrison, may prove valuable.	3
Group value	The winding-engine house and pumping-engine platform, together with the earthwork remains marking the pit head, are an important group associated with the Phase III colliery site development. It is this group which survives on the earliest cartographic evidence we have of the site – the second edition 1898 OS map. The group represents key elements of the working colliery and provide an understanding of how the various processes in coal production operated on the site. The broader colliery site is significant as part of the industrial landscape of the area, and one of a group of deep mines which developed in the early 19th century, and which were all linked together by the Clarence Railway (and its later rivals). Within the bounds of the project area the surviving features form an important group which tells the story of the progression of use across the site from the earlier Phase II pit to the later Phase III colliery further down the vale.	1
Historical	The remaining buildings are of exceptional historic interest as one of a very few surviving examples of late 19th century colliery building in the country. Crowtrees is also important to our understanding of how a late Victorian mine operated, and the type of technology employed.	1
Diversity	The site is not particularly diverse, however, it does illustrate two of the most important elements of a colliery layout – namely the winding mechanism transporting coal, men and machinery both to and from the coal face, as well as dewatering of the below ground workings. In the broader area there is also evidence of transportation and worker's	2

	housing.	
Survival/ Condition	Only the inner core of the winding-engine house survives and the building has lost perhaps 40% of its overall structure. However, what does survive is stable and in good condition.	2
Community/ Educational Potential	The site has considerable potential as a community resource working as part of the Crowtrees Local Nature Reserve. The existence of this project, and the foundation of the CHG, is evidence of the already considerable local interest in the site. In terms of its educational potential it has an immediate visual impact which is missing at other colliery sites – it is the only surviving colliery structure outside Beamish or Woodhorn. However, some thought needs to be put into how best to display the buildings to make them publically accessible but protect their condition from any potential risks such as vandalism. A management strategy is needed to promote educational and community engagement while balancing the needs of conservation.	1/ 2

8.0 RESEARCH POTENTIAL

The following section assesses the research potential of the development area based on 'Shared Visions' the North-East Regional Research Framework for the Historic Environment (Petts & Gerrard *et al* 2006).

Table 2: *Research potential*

Research Aim	Discussion
Post Medieval: PMviii: Industrial intensification 1790-1830 **Modern** MOi: Industry	The winding-engine house and associated remains are of potential importance in our understanding of how a late 19th century mine functioned, and Crowtrees is one of the few pieces where such physical evidence survives extant. In particular, the Phase III site is an example of a dedicated 'service' mine providing coal specifically for the needs of the West Cornforth Iron Works and further research into the company could reveal a lot about the operation and interconnection of late Victorian conglomerates like the Morrison Ironworks and its various related industries.

9.0 MANAGEMENT ISSUES

> *The survival rate of the large intricate functional structures of the coal industry has not been good. Many structures could not be turned easily to new uses, and some, like headframes, were delicate forms, and unlike the masonry blast furnaces of the earlier iron industry, which survive in large numbers, were easy to demolish. Combined with the demand for renewal and reclamation of sites, this factor meant that few examples, even of quite recent collieries, survive today*
>
> RCAHMW 1994, 9

There are a range of issues associated with the management of a standing industrial building, some of which are shared by all archaeological sites, but some of which are specific. Interest in the preservation of Britain's industrial heritage has increased in recent years, but unfortunately in the case of our colliery buildings, this has come too late and so very little physically survives today of this important chapter in the county's past. The Crowtrees winding-engine house is an extremely rare reminder of this historic legacy and requires a sound management strategy in place to ensure its protection for the future. Potentially there are a number of risks and issues which could effect the site, these might include:

Protecting the site against vandalism – in particular there is the issue of whether the building remains clear of vegetation as it currently is following the recording project, or whether the undergrowth should be allowed to grow back to offer some protection from vandals. There is an argument that by promoting the importance of the building as part of the community's heritage it would better deter vandals who would grow to see the structure as contributing to 'their' historic identity rather than as a random object; however, this might be rather optimistic.

Funding future maintenance – who pays for any maintenance work, particularly if clearance is a long term option, as well as money to respond to immediate crisis like graffiti and acts of vandalism.

Monitoring the condition of the standing building - an assessment of the condition of the building will need to be made on a fairly regular basis and a strategy for dealing with condition issues put into place.

Promoting the educational potential of the building – how to enhance the building for educational purposes and engage with the local community?

Protecting the public - by their nature, industrial sites can be dangerous and Crowtrees is no exception. Given that there is open public access to the site, a detailed health and safety audit needs to be undertaken, especially around the former pit head.

Identifying those responsible for maintenance etc - possibly one of the greatest dangers to any industrial site is who is responsible for its upkeep. While there will be specific legal responsibilities in terms of ownership this is more a case of knowing who does what and who to talk to.

Statutory protection – at the moment the site is not designated and as such not offered any statutory protection. It is not seen as being in immediate danger, being part of the Local Nature Reserve, but circumstances can change and some form of legal protection should be considered. Most of the other surviving engine houses in the country are listed buildings (grade II) which should be considered as a minimum protection. However, given the rarity of the standing structures, and the overall significance of the site to the development of the regions industrial past, it is felt that there would be a good case for pursuing Scheduled Monument status.

10.0 RECOMMENDATIONS

The following is a list of recommendations for how to progress further work on the Phase III colliery buildings. These suggestions are for further community study and involvement but do not deal with those management issues discussed above.

(i) **Further documentary research** – further research might be undertaken specifically tracking down the company records of the Rosedale and Ferryhill Iron Company which, as yet, have prove elusive. These might provide details of the Phase III colliery construction, as well as information on its day-to-day running.

(ii) **Further work on the social history of the mining community**– this report, and the preceding assessment, has very much focused on the Crowtrees colliery site itself but has not looked at the broader aspects of the Quarrington Hill community. This might be an area which the CHG would want to expand in future projects, possibly looking at census data, personal accounts, photographs etc. to write a village history.

(iii) **Community excavation** - funding might be pursued to undertake a small, targeted community excavation, possibly around the base of the winding-engine house, to explore the north side of the building as well as the pumping-engine platform.

(v) **Extension of the walk-over survey** – the CHG might look at extending the survey work by the clearance of more vegetation. Such a programme would need to be worked out in unison with the DCC Countryside Team but might include a different targeted area each year which could be stripped back, recorded, and then allowed to revert back to a natural state.

9.0 CONCLUSION

In November 2009 Archaeo-Environment Ltd undertook an Archaeological Buildings Survey of the standing remains associated with the former Crowtrees colliery, now part of the Crowtrees Local Nature Reserve (NZ 33540 37720). These predominantly comprised a large stone and concrete structure at the south western end of the site, believed to be the remains of the former colliery winding-engine house, as well as a smaller masonry structure to the north east of the capped pit head. The building recording work followed on from a phase of Archaeological Documentary Assessment and Wide Area Survey undertaken by Archaeo-Environment earlier in the year (AE 2009a). This study looked at the origins and development of the colliery, as well as identifying any surviving features on the ground.

In many ways, the history of Crowtrees Colliery exemplifies the range of issues and factors influencing the development of the East Durham mining industry. It began as a relatively small landsale mine in the latter half of the 18th century, producing coal largely for local consumption, but its fortunes changed in the early 19th century when it was purchased by William Hedley. Hedley, a key figure in the development of locomotive transport, invested a large sum of money in constructing a new pit in the vale to the east of the Phase I colliery. An early painting of the site would indicate that this was a 'showcase' colliery. It featured a number of fine stone buildings and appears to have been 'planned' from the very beginning rather than growing up in a piecemeal fashion as many other mines in the region. However, the Phase II colliery was relatively short lived and had largely been demolished by the late 1860s. In 1866 the colliery was purchased by J.W. Morrison to provide coal for use at his nearby iron works in West Cornforth. This marked the final phase in the mine's history (Phase III). The surviving winding-engine base and associated structures, all date to this period.

Following the closure of the Phase II colliery Morrison sunk a new shaft to the south west which would allow him to transport coal directly down the Crow Trees line and from there to West Cornforth and his other local ventures. As such, the Phase III colliery was very different in form and function to Hedley's earlier venture. This colliery was intended as a 'workhorse' solely to provide coal to fire the huge furnaces at West Cornforth and not for shipment. This change of nature is reflected in the surviving Phase III buildings which appear far more utilitarian in construction than their predecessors as shown in the Crowtrees painting.

Today, only the engine platform survives of the original winding-engine house, the majority of the outer façade and the entirety of the roof structure having been lost. Originally, the engine house would have been much taller and the platform encased in rubble built outer shell. This can clearly be seen standing in earlier photographs of the site taken in by Don Wilcox in the 1970s, although only small fragments now survive in-situ above ground.

The monolithic engine platform is constructed of large masonry blocks interspersed with layers of shuttered concrete. This form of construction may have been used to absorb and redistribute some of the vibration from the engine which would have originally been mounted on top of the platform. Apertures to accommodate the massive iron bolts securing the engine can be found across the structure. The engine is likely to have been a single cylinder horizontal engine coupled directly onto a winding drum by a crank-arm which would have moved within the large slot to the north of the main platform. The associated headgear lay directly east of the surviving structure, located above the former pit head. The shaft head was capped in the 1960s, although the size of the structure can still be clearly discerned. To the east of the capped pit head stands the remains of a second stone structure. This rectangular platform is believed to be the base of a vertical pumping engine.

The standing building remains at Crowtrees are considered to be of regional, if not national, significance as a rare example of a 19th century winding-engine house and associated features. These iconic buildings, which were once so closely identified with coal production in the region, have now all but disappeared. Crowtrees is one of only five extant winding-engine houses in the North East and the only example listed outside a museum, the other surviving examples being preserved at Beamish and Woodhorn. The site is also of considerable significance in terms of its importance to the local community, many of whom remember when the mines were still in production, and a number of whom are ex-miners themselves. It provides a valuable link with this key phase in the region's history and stands as a visual reminder of Durham's industrial past.

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1857 First edition 25" OS map sheet XXVII. 15/16

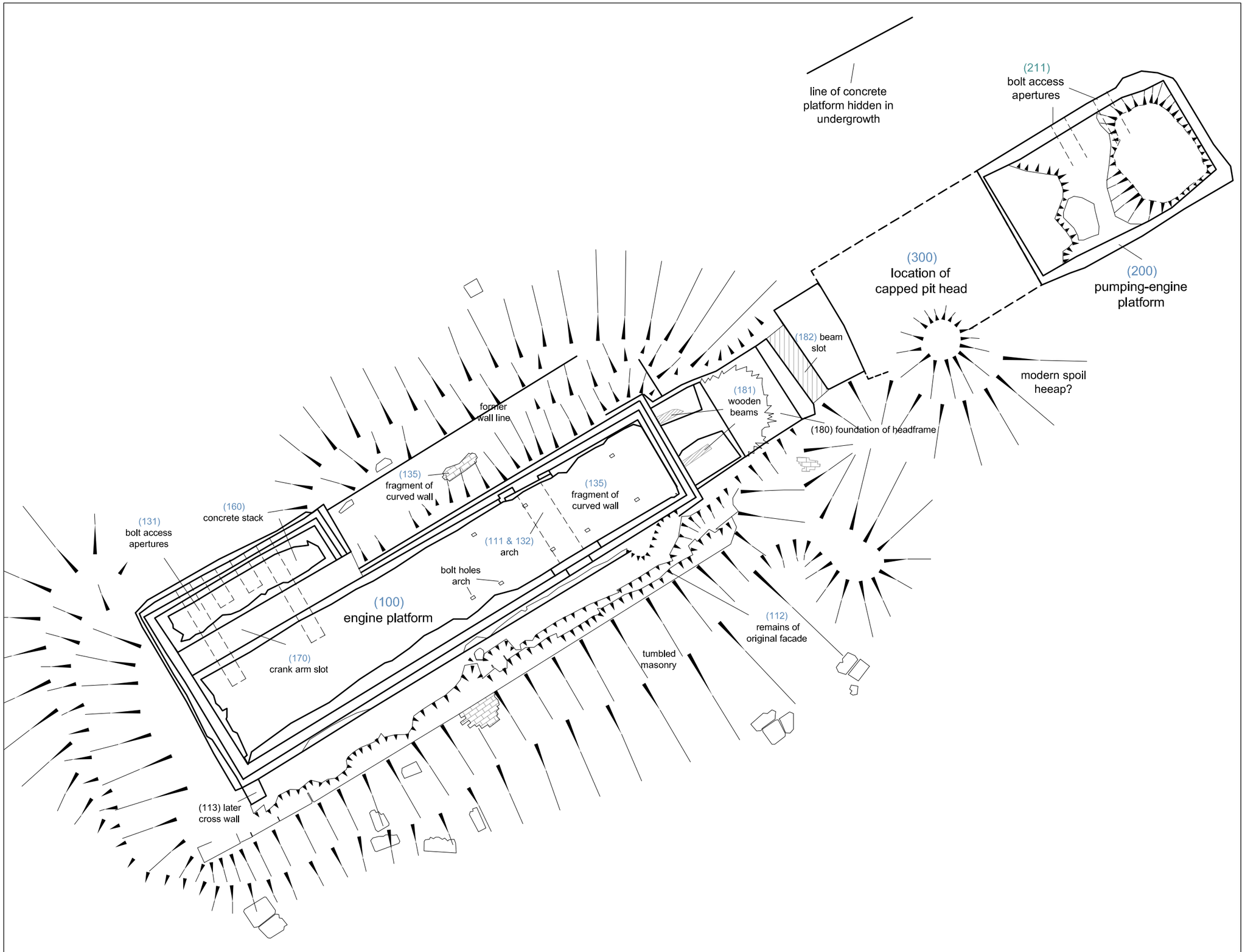
1860 Second edition 6" OS map XXVII.15/16

1895 Second edition 25" OS map XXVII.15/16

1898 Second edition 6" OS map XXVII.15/16

1919 Third edition 25" OS map XXVII.15/16

1939 Fourth edition 6" OS map XXVII.15/16



CROWTREES COLLIERY QUARRINGTON HILL COUNTY DURHAM

SITE:	Crowtrees Colliery

Title:

Figure 6: Plan of Winding-Engine House and Associated Structures

Notes:

North

Scale:

0 5m

scale 1:100

Key:

(201) context number

interior features

fragments of brick wall

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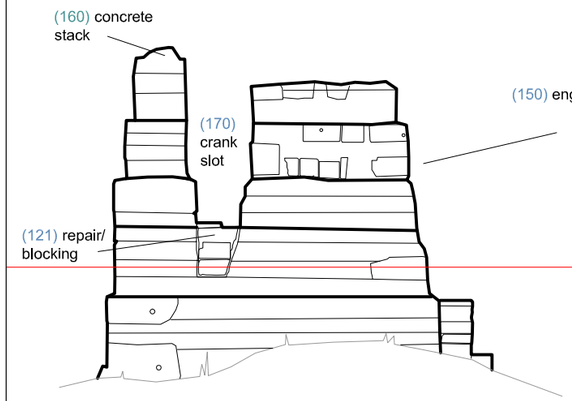
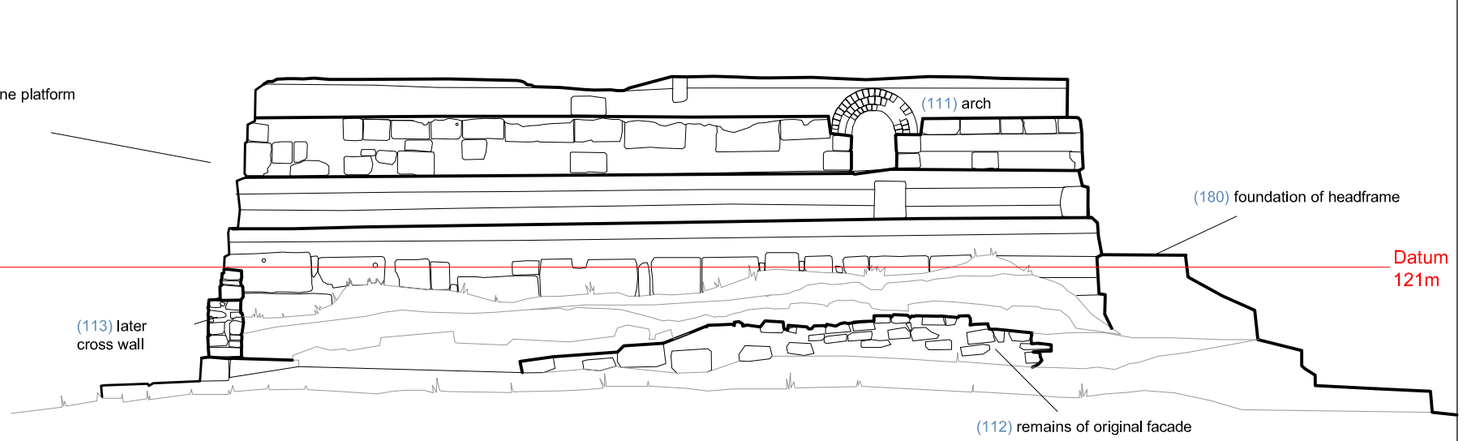
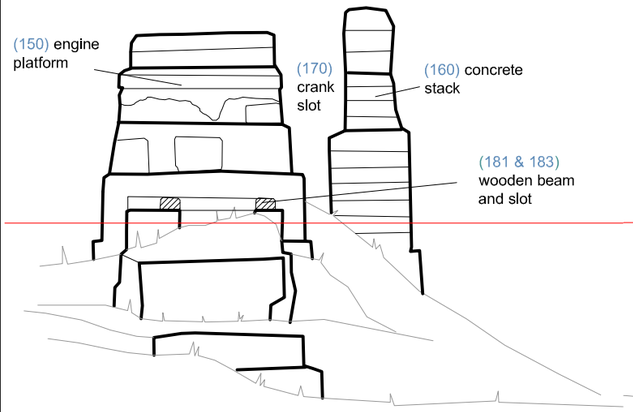


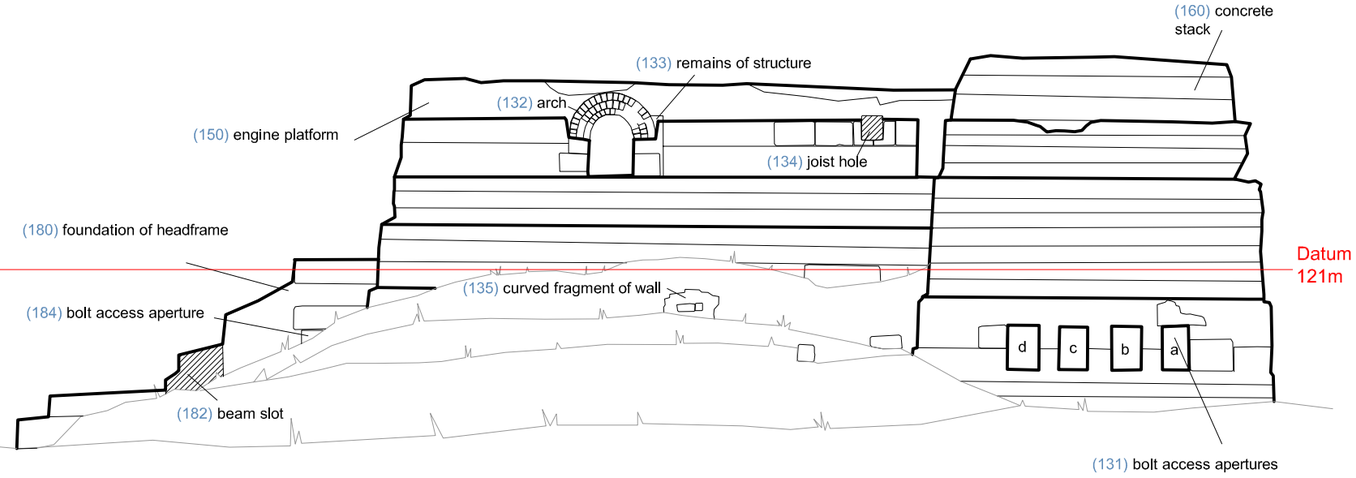
West Facing Elevation (120)



South Facing Elevation (110)



East Facing Elevation (140)



North Facing Elevation (130)

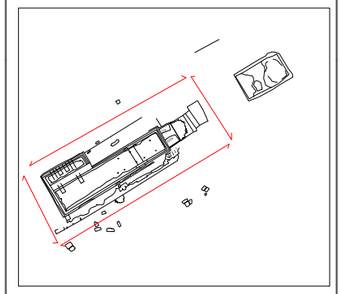
CROWTREES COLLIERY QUARRINGTON HILL COUNTY DURHAM

SITE: Crowtrees Colliery

Title:

Figure 7: Winding-Engine House Elevations

Notes:



North

Scale:

0 5m

scale 1:100

Key:

(111) context number

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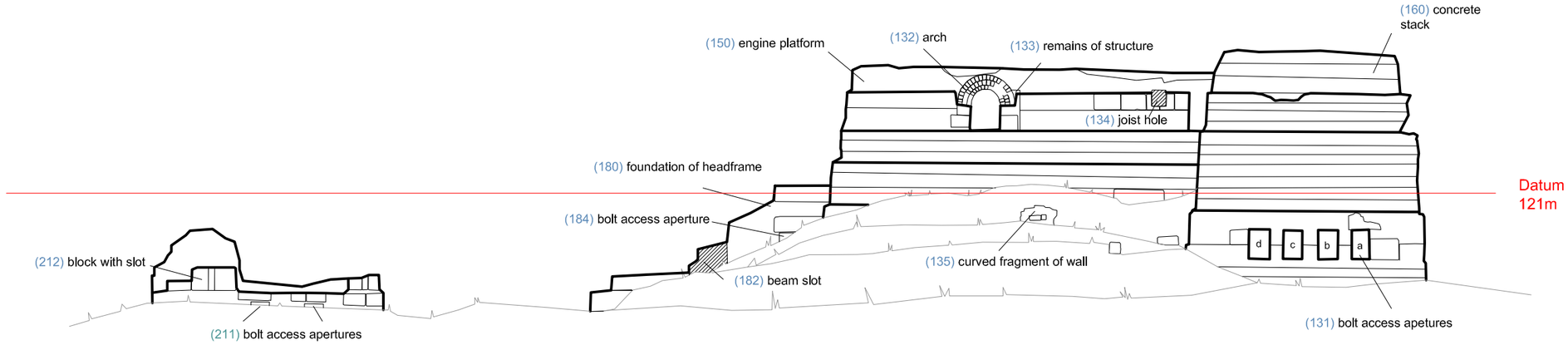


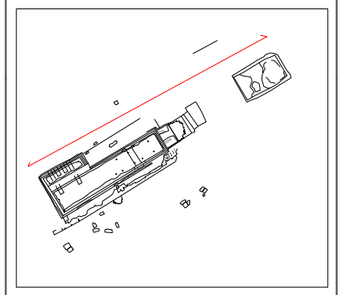
CROWTREES COLLIERY QUARRINGTON HILL COUNTY DURHAM

SITE:	Crowtrees Colliery

Title:

Figure 8: Profile/Elevation of Whole Complex (North Facing)

Notes:



North

Scale:

0 5m

scale 1:100

Key:

(201) context number

– – – blocking/change of build

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