Report No: 2012R087

# Castle-an-Dinas Mine, St Columb Major, Cornwall

## Archaeological assessment

**Historic Environment Projects**

# Castle-an-Dinas Mine, St Columb Major, Cornwall

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| **Client** | **Mr and Mrs David Chambers** |
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**Acknowledgements**

This study was commissioned by Dean Benson of pdp Green Consulting, on behalf of the site owners, Mr and Mrs David Chambers. Work was carried out by Historic Environment Projects, Cornwall Council.

The historical research focussed on the publication of Castle-an-Dinas by Tony Brooks (2001), who also kindly edited the historical section of this report and provided the archive images for this report. Additional advice was also provided by Mr Chambers.

The Project Manager was Colin Buck. Nigel Thomas and Colin Buck wrote and produced this report.

The views and recommendations expressed in this report are those of Historic Environment Projects and are presented in good faith on the basis of professional judgement and on information currently available.

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**Cover illustration**

Castle-an-Dinas Mine painted by Jane Stanley (2011), reproduced by kind permission. The painting is from the north and shows mine buildings, headgear, etc. in the foreground and the aerial ropeway leading up and over the hillfort to the processing works on the south side.

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# Abbreviations

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|---|---|
| CaD | Castle-an-Dinas |
| EH | English Heritage |
| HER | Cornwall and the Isles of Scilly Historic Environment Record |
| HLS | Higher Level Stewardship |
| HEP | Historic Environment (Projects), Cornwall Council |
| MPP | Monuments Protection Plan |
| NE | Natural England |
| OS | Ordnance Survey |
| pdp | pdp Green Consulting Ltd. |
| SM | Scheduled Monument |
| SAC | Special Area of Conservation |
| SSSI | Special Site of Scientific Interest |
| WSI | Written Scheme of Investigation |

# 1 Summary

Castle-an-Dinas hill near St Columb Major is renowned for its prehistoric hillfort, and a Scheduled Monument (SM1006713). On the north and south slopes below the hillfort are the shafts, dumps and former buildings of Castle-an-Dinas Mine, which was worked for wolfram (tungsten) following a single narrow lode between 1916 and 1957, both sites are now owned by Mr and Mrs David Chambers. The mine was the principal wolfram working in Cornwall for this relatively rare metal. Following the mine's closure and the removal of the majority of the associated machinery, its remaining buildings have lain derelict, some have collapsed, and the workings have become covered in vegetation.

The former mine is subject to a Higher Level Stewardship agreement with Natural England (NE), who have funded this report and requested that both areas are included within the assessment. The principal aim is to undertake an assessment of the development, significance and survival of the structures and features at Castle-an-Dinas and to produce an archaeological record and building survey analysis of the site. The report will also assess a range of future management options (including conservation and the potential for HLS as a land/building management option). Recommendations have also been made for any other appropriate levels of investigation for each management option (either as part of the HLS scheme or other potential sources of grant funding).

Castle-an-Dinas mine, is the most significant 20th century wolfram mine in Cornwall if not south west England, and was the country's main tungsten producer for a number of years when in high demand (during world conflict years). Its buildings, many still preserved at both sites, were functional and represent a late but significant chapter of Cornish mining and the associated mining technologies used in Cornwall in the early to mid 20th century. The mine was recommended by consultants in the late 1990s to be assessed for Scheduling (MPP Step 4), as a nationally important site.

*To summarise, there appears to be three options. Options 1 and 3 can only be seen as short term and <u>may</u> provide funding for limited conservation to keep the site in its present character and significance. The second option, adaptive reuse, has longer term consequences for site preservation, but these may affect character and significance. The most appropriate options from a historical preservation view are 1 and 2. But the best long term sustainability option is 2 – a conflict of preservation and character interests.*

**Option 1**: HLS is an appropriate way forward for management of these structures, **if preservation** (and public access), is the preferred end use. However, this could only be a short term solution, as lack of use and damp would again affect the structures in time (unless a more adventurous public use could be determined). Given the undoubted significance of the site (its physical remains of extant buildings, its photographic record and detailed history), it is recommended that if this option is followed production of the main elements of a Conservation Management Plan should be undertaken to guide and inform (both the landowner and Planning officers) its short and long term use and provide ongoing management/maintenance principles for the south mine buildings.

**Option 2**: Non-HLS schemes for building preservation are likely to involve **adaptive reuse** funded by the site developer, although rigid guidelines for this to minimise impacts to the setting and character of the site would need to be acceptable to all parties. This option should necessitate production of an Impact Assessment report to inform the project developer and any other statutory or non-statutory agencies, of the impact of the site proposals on the identified significant site assets described in this report, as well as ways to mitigate or minimise those impacts.

**Option 3**: Castle-an-Dinas mine has already (in a 1998 county survey) been recommended to be assessed for Scheduling as a nationally important monument. Although an English Heritage (EH) site assessment has not taken place, a re-referral to EH may be appropriate, as a statutory designation may unlock funding for (albeit short term) site preservation as it would be a building at risk.

# 2 Introduction

## 2.1 Project background

Mr and Mrs David Chambers, owners of the former Castle-an-Dinas wolfram mine, sited on the north and south sides of the Iron Age hillfort, are subject to a Higher Level Stewardship (HLS) agreement with Natural England who have funded production of this report as part of a Historic and Archaeological Feature Protection option to consider the most appropriate management of the mine structures, which is the primary driver of this report. NE has also requested that both areas of the mine be included within the archaeological assessment, and have permitted site information relating to the hillfort (outside the HLS area), to be included in the report for site context.

Coincidentally, Mr and Mrs David Chambers sought pre-application advice regarding proposals to renovate and convert the remaining mine buildings on the south side of their property to residential use (Figs 1 and 2). As the proposals for the site could affect the setting of the Scheduled Monument (sited between the north and south mine sites), and could impact and change the character of these historic mine buildings (which were recommended for Scheduling by EH in 1998). A brief for the archaeological assessment and building recording (see Appendix 10.3) was issued by Dan Ratcliffe (13/07/2012), the local Historic Planning Advice Officer on behalf of Cornwall Council.

Historic Environment Projects (HEP), along with other archaeological contractors, were approached with a view to satisfying the HLS funding criteria and the subsequent planning brief and applying this methodology to both areas of the former mine. After producing an approved Written Scheme of Investigation (WSI - see Appendix 10.4), HEP was subsequently commissioned as the archaeological contractor on 13/09/2012 by Dean Benson of pdp Green Consulting.

## 2.2 Aims

The principal aim of the study is to undertake an assessment and understanding of the development, significance and survival of the structures and features of Castle-an-Dinas wolfram mine. In addition, the objectives are to create an archaeological record and building survey analysis of the site prior to potential alterations and impacts due to adaptive reuse.

The report will also be used to assess a range of future management options for the site (including conservation and the potential for HLS as a land/building management option). Recommendations will also be made for any other appropriate levels of investigation for each management option (either as part of the HLS scheme or other potential sources of grant funding).

## 2.3 Methods

### 2.3.1 Desk–based assessment

During the desktop assessment historical databases and archives were consulted in order to obtain information about the history of the site and the structures and features that were known to have existed on it. The main sources located and consulted are summarised as follows (refer to Section 8.0). Primary historical documents, maps, plans and other published material held by statutory and non statutory agencies (see Section 8.1):

- Historical documents, maps, plans and other published material held by Cornwall Records Office (see Section 8.1).
- Published and un-published material held by HEP and the site owner (see Section 8.1).
- Published histories of local industrial archaeology (see Section 8.2).

Documentary research and fieldwork have been slanted towards the industrial

development of the project area, with the majority of site management recommendations being applied to industrial sites. Nevertheless, sufficient background research has been undertaken to be able to summarise the pre-industrial history of the Iron Age hillfort within the project area (see Fig 2, Section 4.3).

### 2.3.2 Fieldwork

Detailed maps (produced from the Ordnance Survey Landline Digital Mapping) amalgamated with information derived from historic maps (including the 2nd edition 1:2500 Ordnance Survey map), as well as aerial photography and archive plans for use in the field, were used during the fieldwork element as well as other sources.

Archive photographs (primarily from Bullen 2003 and Brooks 2001), were also used to inform the field survey component of the project. Field recording was based on a mixture of photography (digital), annotated sketch and measured recording (as set out in the WSI, Thomas 2012, see Appendices 10.1 and 10.2).

### 2.3.3 Post-fieldwork

Following production of the archaeological assessment report, there may be a period of dialogue and consultation between Natural England (fund providers), the landowner, the project co-ordinator (pdp Green Consulting), and Cornwall Council Planning Advice, to discuss the report management recommendations for short/long-term significant feature/site preservation, the impact of future long-term management proposals and possible impact mitigation measures.

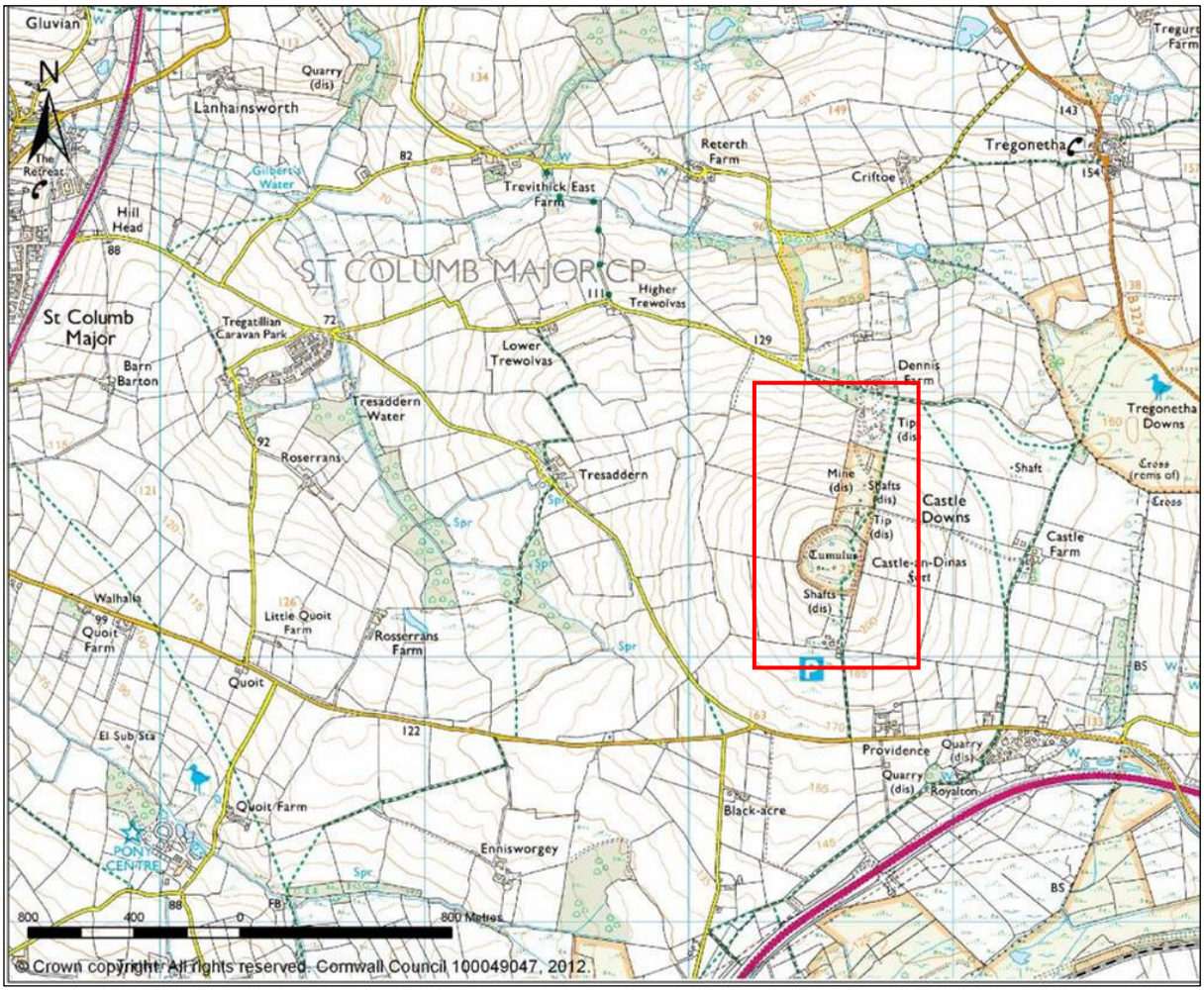


*Figure 1 Location map*

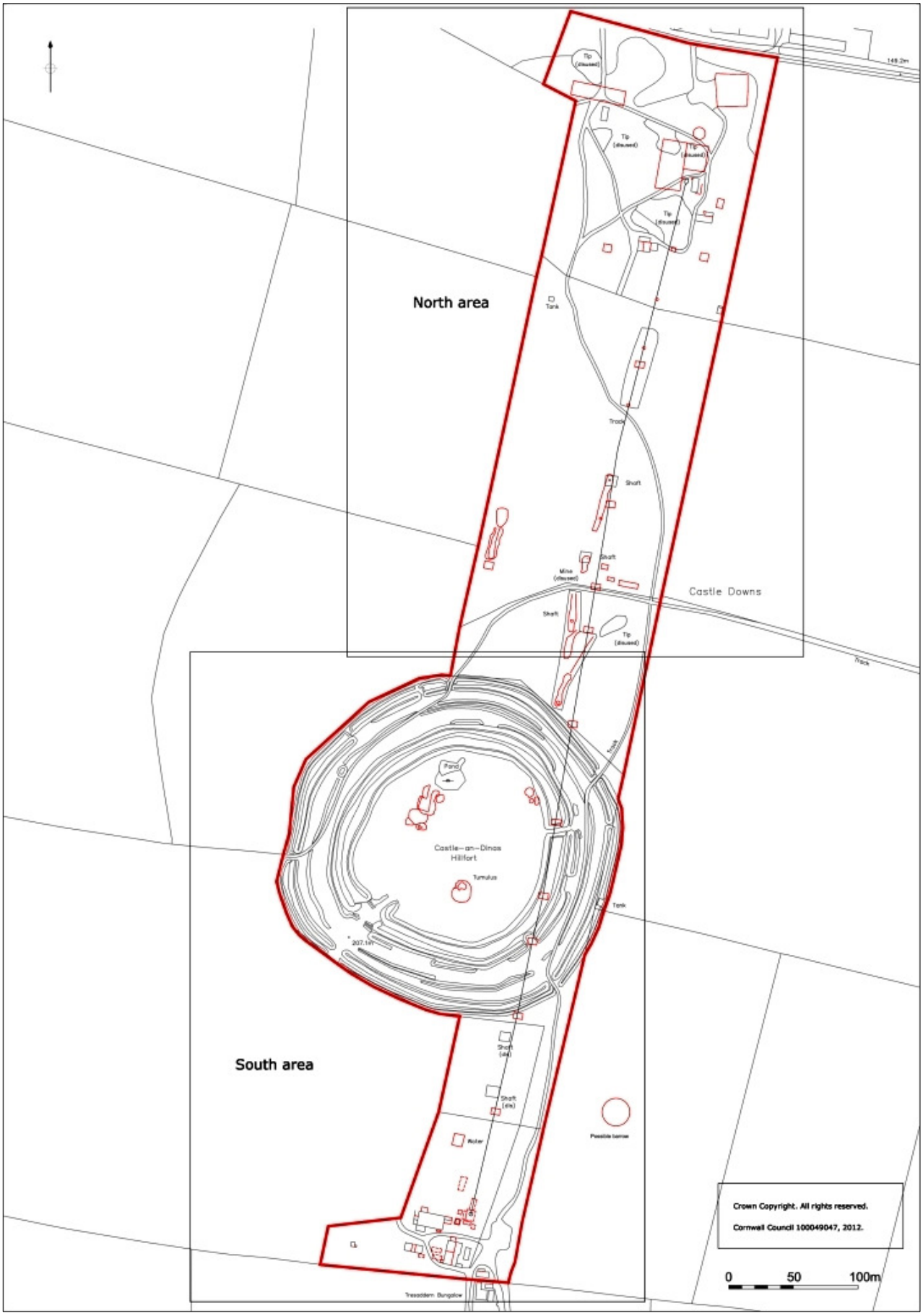


*Figure 2 Plan showing the north and south sites either side of Castle-an-Dinas hillfort*

# 3 Background

## 3.1 Location and setting

The multivallate hillfort of Castle-an-Dinas (centred SW 94546 62364), located to the east of St Columb Major in central Cornwall, encompasses over 7ha of land on the top of an oval hill and is widely considered as one of the '*most impressive in all Cornwall'* (Nankivell 1962, 8). Though formerly part of an extensive area of downland (Fig 3), the land around the fort was enclosed and agriculturally improved within the 20th century, leaving the fort (and narrow strips of land to north and south containing the mining remains), as a small fragment of rough ground in a swathe of improved pasture (see Figs 1, 2, 18, 19 and 22). Predominantly low-intensity agricultural use was in the ascendency until the early twentieth century, when the area's rich mineralogical resources were exploited, especially wolfram (Brooks 2001, iii).

Castle-an-Dinas wolfram mine had its first epicentre at the north site (SX 94692 62924), 500m north and downslope of the hillfort centre from 1916, whilst the south site (SX 94532 62057), 300m south and downslope of the hillfort centre from 1940. After the Second World War the mining activity ceased, but the buildings were left *in situ*. The landscape reverted back to pastoral agriculture. The general topography of the mine sites (as shown on Figs 1 and 22), is for each site to trend downwards from the granite mass hilltop (giving superb 360° views of the area), to the river tributary to the north and the wide valley of Goss Moor to the south.

Elevated at *c*.210m OD, within pastoral agricultural land, the sites overlook several steep river valleys running to the west, north and east, the hillfort and south site also looming over the flat wide basin of Goss Moor, a mix of marshy wetland and shrub; landscape remnants of vast 17$^{th}$ century streamworking operations to the south. The site is *c.*10km from the north coast of Cornwall, the closest major urban centres being Newquay to the west or Wadebridge to the north-east. The main arterial route through Cornwall, now marked by the A30, runs across Goss Moor from east to west, just over 1km to the south of Castle-an-Dinas.

## 3.2 Designations

### 3.2.1 National

Castle-an-Dinas hillfort is a Scheduled Monument of national importance SM1006713 (PRN No. 21602). Its schedule boundary extends 1m outside the outer ditch.

Castle-an-Dinas Mine was recommended by English Heritage's Step 4 Industrial Monuments Protection Programme (1998) as being of 'potential national importance' (Minor metals: Tungsten: Option 1). Any EH recommendations for Scheduling are dependent on a site assessment, undertaken by a member of the MPP team, to confirm the national importance of the site and the appropriateness of Scheduling. This assessment has not, to date, taken place. Current policy (from a development context), given that the site has been identified as being potentially of national importance, is that this should guide its handling during the planning process with emphasis being on understanding the significance of the site and mitigating the application accordingly.

### 3.2.2 Regional/county

The entire project area (see Fig 2), is included within a large Area of Great Historic Value (27) encompassing Castle-an-Dinas, Belowda and Goss Moor (Ref 24 (2) (17) which was designated on 1$^{st}$ September 2007. Goss Moor is also a Site of Special Scientific Interest (SSSI) - soon to be a Special Area of Conservation (SAC). The project area is also included within a large Area of Great Scientific Value (14) (Ref R59 (1) (A) Policy 18. The hillfort and northern part of the site is also covered as a moorland designation Tregonetha Down (Ref. R40).

### 3.2.3 Local

There are no local designations (and none for either of the mine sites: north and south of the hillfort) within the study area.

## 3.3 Geology and Lodes

This area of Cornwall, the north-western corner of the St Austell district, includes the granite mass of Castle-an-Dinas and Belowda Beacon. Mainly of killas country, it also covers the northern and western fringe of the St Austell granite mass, the surface of which declines northwards beneath the killas at a low angle. Drainage northwards from the high ground gives rise to the extensive alluvial deposit of Goss or Tregoss Moor.

*'The alluvials are reported to have yielded much profit to tin streamers in the past, but few records of their nature or productivity have been preserved… The most important mine today is Castle-an-Dinas Wolfram mine, the deposits of which are anomalous in that high temperature minerals cassiterite, wolfram and lölingite or mispickel, associated with tourmaline, occur in a N-S lode of crosscourse trend; the granite of the hill, moreover, is clearly later than the lode…'* (Dines 1956, 521). The local geology includes altered killas intruded by a small granite mass (west side). The site includes *'A nearly vertical quartz-wolfram lode, trending N. 18°E., intersects an isolated hill rising 300ft or so above the surrounding country to over 700 ft Ordnance Datum'* (*op cit* 521)... on either side of the lode, over a breadth of a foot or so, the killas shows intense tourmalinization… The granite occurs as a boss or cupola forming a core to the hill (see Fig 6 a section of the mine)… *'The lode ranges from 1 to 6ft. wide but averages 3ft. and occasional branches leave it. It is constant in direction, verticality, and content, but southwards, so far as present development shows, it splits into two or three branches each about a foot wide but still carrying fair values. A few slides that cross it do not heave to any considerable extent, but, north of the granite, two roughly E-W. faults throw it, one 12 ft. right and the other 12 ft. left'* (*op cit,* 521)…

*'.. average recovery approaches 30lb. of wolfram … per ton of ore, which represents about 75% of the wolfram content of the lode. Dressing of the ore is simple and much of the wolfram is recovered as coarse concentrates from jigs and tables. The lölingite is removed by magnetic separator at South Crofty Mine, and the small, but variable amounts of cassiterite, ranging up to 3% of the concentrates, are also recovered there'* (*op cit,* 523).

As shown in Figure 6, at least 8 levels had been cut, the latter two focussing on the south side, accessed via South (New) Shaft. The extensive removal of this very narrow lode can be seen, its outcrops often going to surface (the recent collapse of the ground at Site 12 is testament to this). *'The lode had been productive for a length of nearly 1,800 ft. In the higher levels a few exceptionally rich patches helped to keep up the average value of about 30% wolfram has persisted in the deeper levels around South Shaft, although lölingite is present here in considerable amount' (op cit*, 525).

## 3.4 Landscape characterisation

The Historic Landscape Characterisation of the landscape around Castle-an-Dinas shows it to be an area of Recently Enclosed Land surrounded by Anciently Enclosed Land at a generally lower altitude. The Upland Rough Ground largely represents Goss Moor to the south of Castle-an-Dinas. The site of the hillfort was dominated by unenclosed scrub and moorland until enclosure in the post-medieval era (Herring 1996, Upland Rough Ground). It sits partially on an intrusive outcrop of granite into the slate bedrock, over 200m above ordnance datum. The north and south strips of the site until 1916 were of predominantly low-intensity agricultural use until the early twentieth century, when the area's rich mineralogical resources were exploited, especially wolfram, although the small quarry within the fort dates to the 1800s and partially destroyed the western barrow (Brooks 2001, 104).

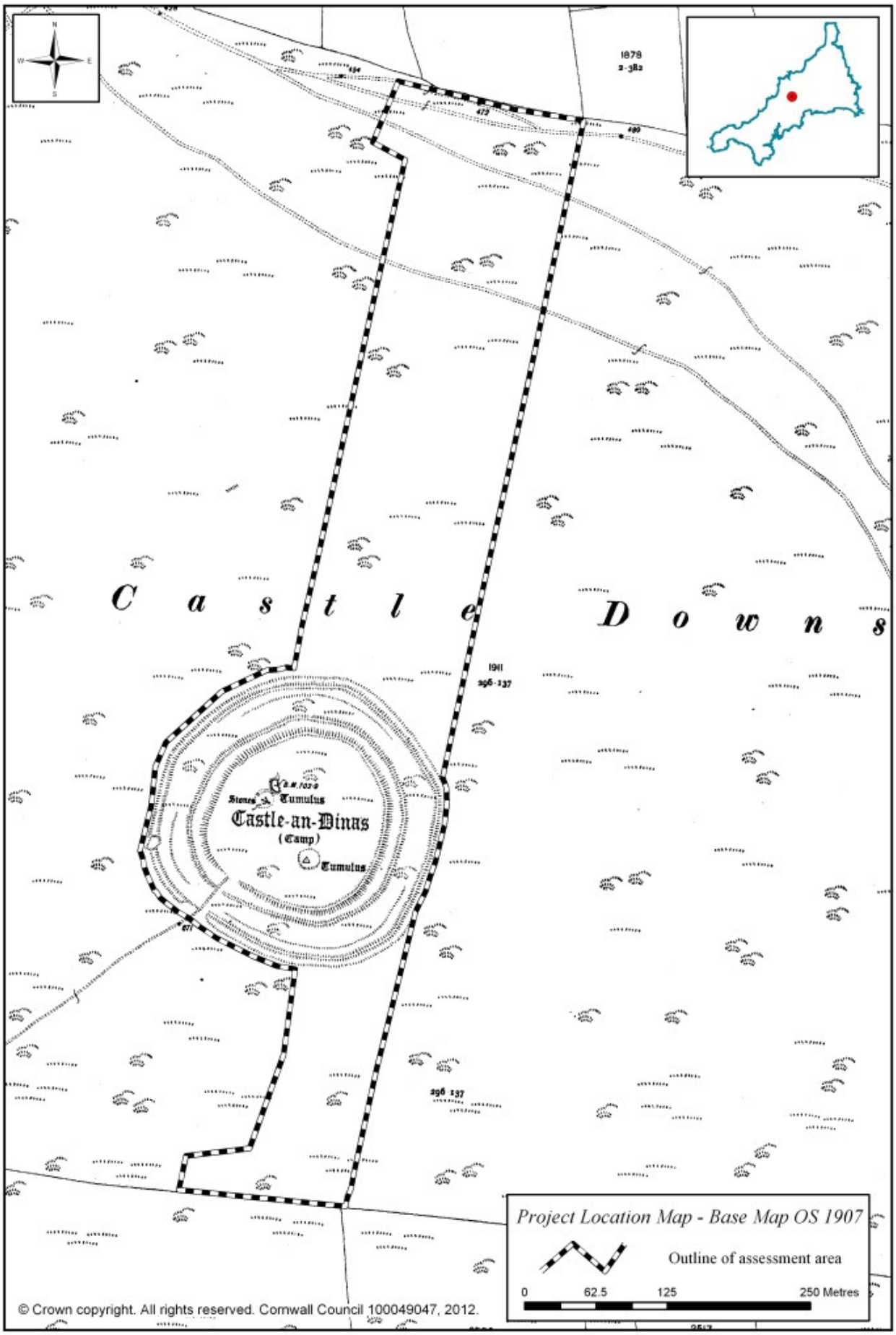


*Figure 3 1907 OS 25" map showing the study area*

The Cornwall County Council 2005-7 Landscape Character Study (Area 20) defines the site (both mine sites and the hillfort), as 'Mid Cornwall Moors'. This area is an open area of rough grazing with pastoral farmland on the surrounding slopes. The associated wetland and heathland flora and fauna found within this area is important locally and nationally. There are extensive views to higher land around and south to the china clay area. Tree cover is sparse on the higher ground but the sheltered slopes and lower land are well wooded.

The northern part of this character area features the Iron Age hillfort of Castle-an-Dinas. Castle-an-Dinas is one of the largest and best preserved Iron Age hillforts in Cornwall, incorporating further Early Bronze Age barrows within its multiple banks and ditches; it is possible that there was an earlier prehistoric enclosure underneath the hillfort. *'The re-routing of the A30* (north of the original route) *which crosses south of the project area has significantly damaged an extensive and well-preserved medieval strip-field system… Much of the area has a scatter of industrial and residential development and infrastructure'* (Herring 1996, Upland Rough Ground).

The north and south foothills of the Castle-an-Dinas promontory suffered from the whims of wolfram exploitation in the first half of the 20th century, with shafts dug into, and an aerial ropeway constructed over the earthworks, whilst mine buildings were constructed at two sites (see Fig 2). After the Second World War the mining activity ceased and the location has reverted back to pastoral agriculture. The landscape today presents as mainly treeless rough pastoral grazing amongst long linear sections of fencing where the lode outcrops at surface through openworks, adits and mine shafts.

# 4 Historical background

## 4.1 Historical development of wolfram mining in Cornwall

By the turn of the 20th century, Cornwall's mining industry was struggling to survive from a combination of low tin market share values and worked out lodes. The main future lay in working deeper lodes. However, a localised resurgence from 1905 in tin mining saw new companies amalgamating to form (in the west) Grenville United in 1906, Geevor Tin Mines in 1911, Botallack, and in the east Phoenix United, a total across Cornwall of approximately 30 mines. The First World War created additional demands, and by its end there were eight large tin mines operating in Cornwall; East Pool and Agar, Dolcoath, South Crofty, Grenville United, Geevor, Tincroft, Tresavean, Levant and Basset Mines Ltd (which closed in late 1918). Combined, these employed 3,471 men and produced 4,525 tons in 1918 (Barton 1967, 256).

This period also witnessed an increasing interest in tungsten, previously discarded as a contaminant. *'Tungsten is a relatively rare element .. occurring as a compound and never as a native metal… The commercial sources of tungsten are the minerals Scheelite and Wolframite…'* (Brooks 2001, 1). Tungsten was not in demand until technological advances in the early years of the 20th century, when tungsten alloys were developed for high speed steels and drills. Also by 1910 tungsten filaments in electric lamps and its use in electrical contacts became common.

The main feature of tungsten production has been its response to high demand; mainly associated with periods of military conflict: the First World War (1914-1918), the Second World War (1939-1945), and the Korean War (1950-1953). During the post-First World War economic depression, world demand for tungsten production severely waned. However, it picked up in the 1930s as countries began to re-arm, peaking in the mid 1940s. *'Once again the wartime tungsten boom was followed by a severe drop in demand and production. This time, however, the trough was of shorter duration, initially because of the … decision of the US Government in 1946 to stockpile tungsten, and demand later strengthened as a result of the Korean War'* (*op cit*, 3).

*'Tungsten occurs in south-west England and in Cumbria, with south-west England being by far the most important area. Most of the production prior to 1930 was a by-product of*

*tin mining* (South Crofty, Tincroft and East Pool). *From 1930 to 1957 the United Kingdom production largely reflected the output of Castle-an-Dinas. On closure of the mine in 1957 UK production to all intents and purposes ceased'* (*op cit*, 3).

## 4.2 Castle-an-Dinas Mine

Tony Brooks (*op cit*) in his book *'Castle-an-Dinas 1916-1957',* describes in detail the history and development of the mine. Rather than duplicate text, the methodology of using a timeline has been used to illustrate the history, fortunes and failures of this mine. A variety of publications have been used to compile this history (see references in Section 8), but the main source was provided by Tony Brooks' (2001) excellent book. For site inventory numbers refer to Figures 23 (south site) and 30 (north site).

Note: The pre 20th century background does not include any sites later worked by Castle-an-Dinas Mine. The sites described worked east/west lodes north/south of the hill.

**Pre 1800** Goss Moor to the south and to a lesser extent, the valley of the River Menalhyl (Lanherne), to the north and east of the hill contained alluvial deposits of tin that had been streamed from the medieval period. Hamilton Jenkin notes (1964, Vol. IX, 25) *'Two such lodes were specifically referred to in Carnsewe's notes of c 1580, 'one in the north side of Castell Dennyse and one other greate loade before John Merryfeldes doure''*. Hamilton Jenkin goes on to describe the latter site as being of stanniferous elvan which had been worked from the southern foot of Castle-an-Dinas for a distance of two miles to the east. Later Carew (1602) in his Survey of Cornwall commented that Goss Moor was the largest tinworks in Cornwall.

**1819** The two mines described above appear to have been unsuccessfully re-worked as Wheal Trewolvas on the north side and Old Castle-an-Dinas mine (SX 94340 61399) restarted in 1851, on the south side of the hill (Hamilton Jenkin, 1964, 25-27).

**1860s to 1901** The same east west lode was reworked for a short period from Great Royalton, a little to the east (SX 94988 61548) of the earlier site. The recorded outputs for both sites are in 1859, 42 tons of black tin, 1868-71 and 1899 to 1901, 93 tons of black tin (Dines 1956, 528).

**1912-13** Mr WE Cox (an old mining engineer) obtained a lease from the Duchy of Cornwall to start searching for a wolfram lode on the northern slopes of Castle-an-Dinas Hill. The 1907 OS map shows that the land was still unenclosed heathland (Fig 3). Mr Cox had found wolfram earlier in streamworks further north of the hill. Costeaning and trial pits (initially on the north side of the hillfort banks – Site 24), eventually proved a north south lode going under the hill (not the expected east-west course).

**1915** By July the lode had been proved at the top of the north side of the hill, and a prospect shaft cut (possibly Sites 23 or 26), to a depth of 45 feet exposing a 3 foot wide lode. Cox's Level (Sites 23 to 26), was the primary shallow level cut on this mine (following the lode outcrop down from surface).

**1916** Continued development of the mine was beyond the resources of the few men who had worked on the site thus far, under the management of Mr Cox. A limited company, **Great Western Ores Ltd**, with a nominal capital of £15,000 was formed to develop and fund the mine.

**1917** No 1 Level (Adit portal at Site 32), and its shaft (Site 33), was cut to aid deeper development of the adit. Josiah Paull, previous manager of South Crofty [also Gunnislake Clitters (Buck 1998), and Hingston Downs Mine (Buck 2005)], a mining engineer of some repute, was employed in a consulting capacity. Plans for a new mill sited lower down the site (north side), were made to process and dress the ore using new and second hand items from other mines in the west of Cornwall. These included a 56 HP Tangye Gas engine (Site 45), an Edgar Allen jaw crusher, two crushing rolls, a

Frue vanner, two Jigs, a pump (to supply water to the mill from the river to the north), a sand/slimes table and other items (all within the Mill at Site 47). Underground development work continued with 12 men being contracted to drive levels from No 1 level shaft (Site 35), and construction of the new mill foundations (July). It is interesting that even at this early date, prospecting started on the south side of the hill. North Shaft (Site 40) was cut in May.

**1918** By this date Top adit (from No 1 Level) was continuing south under the hillfort (and accessed by at least four shafts – one of which is within the fort itself at its north east corner – Site 21). This connected (at its northern end with Bottom Adit, from No 2 Level), sited further to the north, which allowed the ore to be trammed directly from the workings to the new mill, which was working from the end of January. In May, **South Crofty Mine** purchased Castle-an-Dinas mine and the Great Western Ores company (as capital had run out). The mine was held on lease for 21 years (5% royalty) from September 29th 1916 as granted by the Duchy. By this date '*There is a small office* (Site 31)*, miners' changing house and blacksmiths' shop* (both Site 27)*. Crushing started at the end of January 1918 and up to 400 tons have been treated for a yield of approximately 10 tons of wolfram… 17 men were employed on surface and 16 underground'* (Brooks 2001, 27). By the end of the year Josiah Paull's report to the shareholders noted that underground development had continued, but 2,700 out of the 3,500 tons crushed was ore from development work (at 29.76lbs of wolfram per ton). The wolfram recovered was 46 tons 10 cwt with a value of £8,800.

**1919** In the first half of the year the fall in the price of wolfram seriously affected the mine's viability (when the Governments control of the sale of wolfram was removed at the end of April, the price plummeted). The mill was stopped in early September, with underground development work only continuing. At this time 14 men were employed on surface and 18 underground. The mill machinery was kept in working order, in case of an upturn in wolfram market prices.

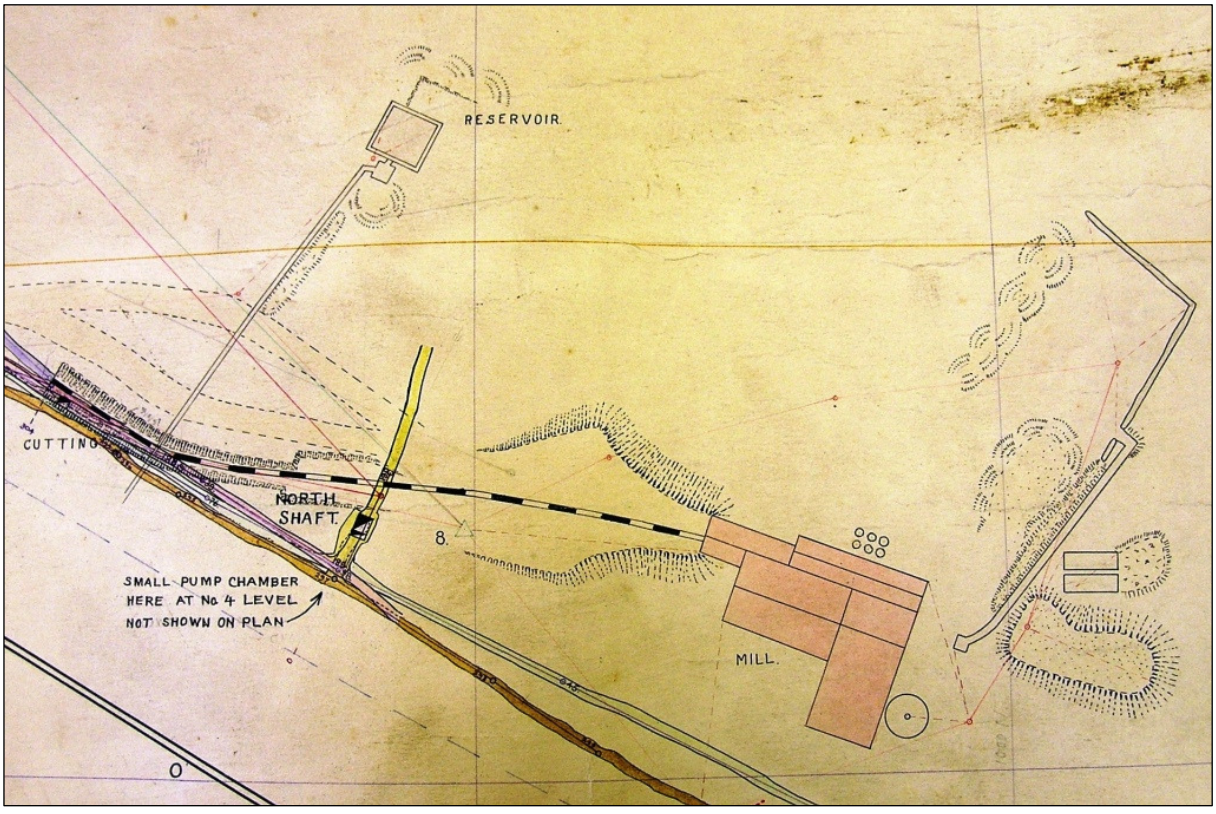


*Figure 4 Plan of the Mill complex (Reproduced with permission of the CRO, MRO 15156)*

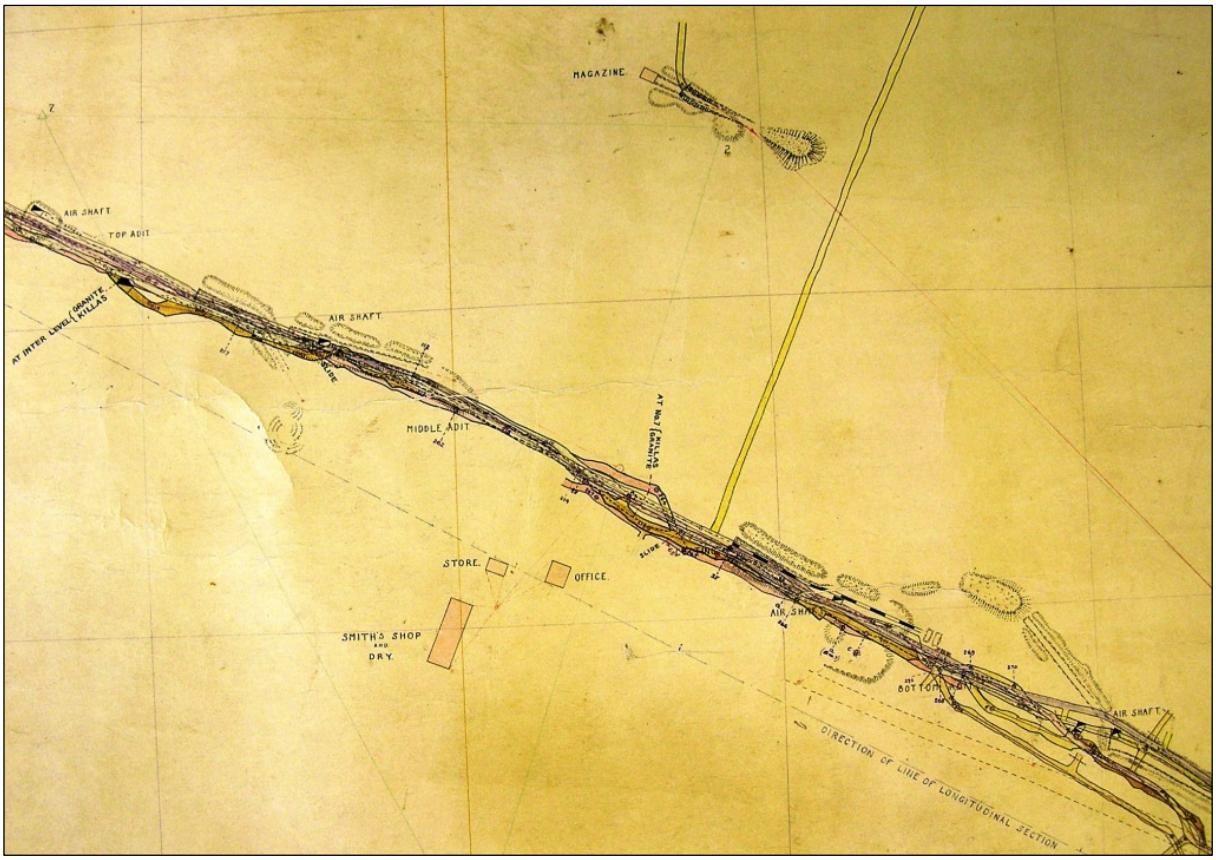


*Figure 5 Plan of Cox's Level (Top Adit) and mine buildings (Reproduced with permission of the CRO, MRO 15156)*

**1920** *'Underground work continued, and a further 582 ft of development was accomplished on the wolfram lode. No 1 level was extended 283 ft and No 2 level 239 ft. On surface 3 men were employed with 11 underground … the average grade of the lode was about 20lbs per ton'* (*op cit*, 29). In December all work was suspended and the mine mothballed due to the low price of wolfram (which had fallen from 60 shillings (s) a unit to approximately 13s). A lengthy period of closure ensued, although the machinery was maintained. Luckily for this mine (due to its topography and lode orientation), its adits and levels freely drained, thus pumps were not necessary.

**1929** By the middle of the year the wolfram price had begun to recover and a contract agreed to supply 200 tons of wolfram at 32s per unit. At the end of the year Josiah Paull aged 60 retired as manager of South Crofty, his son taking over responsibilities.

**1932** Mining and milling continued until January when the wolfram price fell (to below 20s), again making the operation un-economic and forcing closure.

**1933** Development work resumed in July when miners were employed to fulfil a large contract. This was the start of the main operating period for this mine; re-ignited when national demand through a sustained period of re-armament and then subsequently increased throughout the duration of the Second World War.

**1934** *'In 1934 it was recognised that the possible ore reserves above No 2 level were limited and that the mine had to be deepened… To achieve this a deep drainage level (No 4 level) was started in the valley some 1450 ft to the north of the mill and about 15 ft above the river level in the valley'* (*op cit*, 32). Figure 6, a north-south section of the mine has been reproduced from Brooks (2001, fig ii). This shows the final mine development below ground level and all the shafts and working levels.

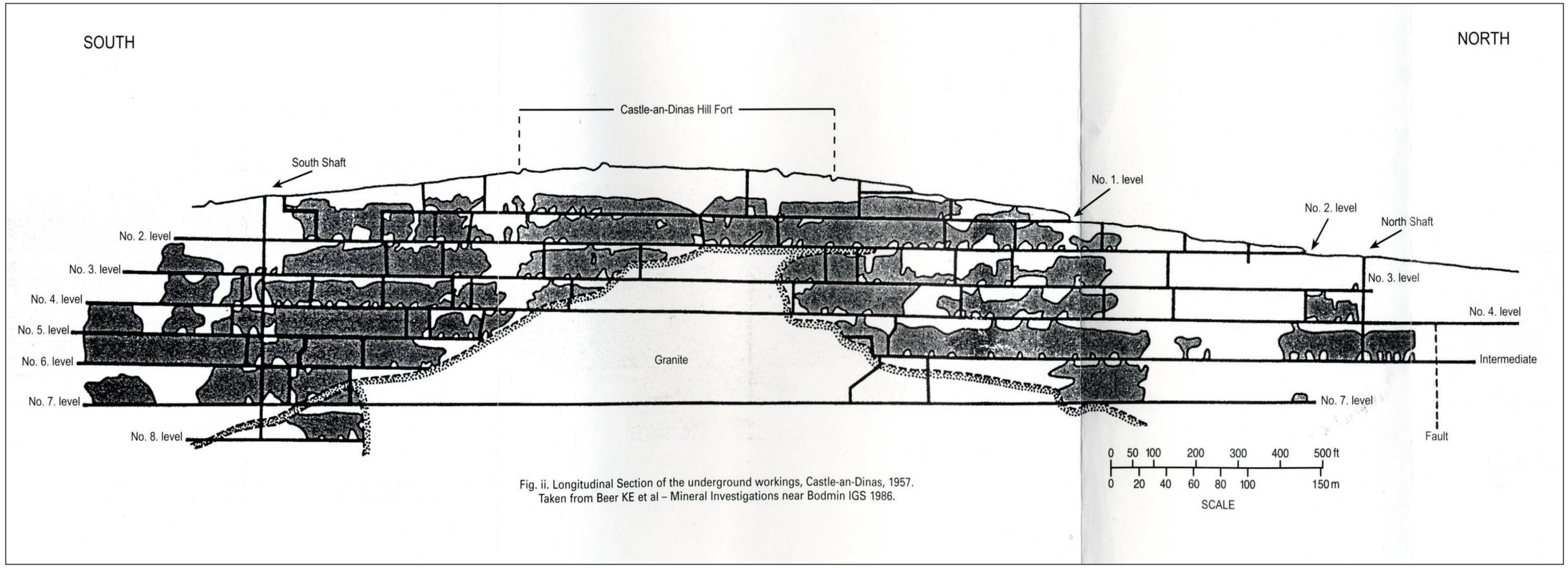


Fig. ii. Longitudinal Section of the underground workings, Castle-an-Dinas, 1957.
Taken from Beer KE et al – Mineral Investigations near Bodmin IGS 1986.

*Figure 6 Section of Castle-an-Dinas Mine (reproduced with permission from Brooks 2001, Plate VII)*

**1935** By the middle of the year, No 2 level was beyond the centre of the hill. In the following year the levels of Nos 2 to 4 were continued southwards under the hill with varying success – often meeting the granite massif (see Fig 6). The 4th level (or drainage adit) was driven this year, as well as North Shaft (to hoist from the 3rd and 4th levels). But to work the known continuation of the lode on the south side of the hillfort these levels had to be continued through the granite.

**1937** Compressed air rock drills were finally introduced to continue development of the levels through the granite. A Holman T13S compressor was installed into a new building just to the east of the Mill. The main levels were driven on contract to a dimension of 7ft (height) by 5 ft (width). No 2 level trammed ore directly to the mill, whilst the lower levels trammed ore to (probably) North Shaft (Site 40 see Fig 30). *'The ore was dumped into a bin and thence trammed into the mill via the rail track from No 2 level which passed alongside the bin. Waste was trammed across a gantry and tipped on a waste dump'* (*op cit* 38). Attempts were made to locate other parallel lodes, but they were not successful.

**1939** By this time the surface buildings at the north site also included a Miner's dry (change house – Site 27), a small office (Site 31), store (Site 30), magazine (Site 28.1), Carpenter's shop (an extension of the mill – Site 47) and a Blacksmith's shop (possibly Site 39). During the 1930s, the mine made regular but small profits. However, to continue operating the mine needed to discover more ore. Figure 7 shows the north shaft core site with Mill and buildings (early 1940), whilst Figure 8 shows a contrasting view of the site today.

**1940** *'By the beginning of 1940, the development on No 4 level had been extended southwards for practically the full length of the ore deposit as exposed in the upper levels and, reserves of stoping ground were nearly exhausted'* (*op ci*t, 45). A diamond drilling programme was undertaken to discover other adjacent or lower ore bodies. This proved that there were no parallel lodes within the distance drilled, that the wolfram was sited close to the granite and that positively the lode in the killas below No 4 level should contain payable ore. By this date the mine was only working a single shift and producing only about 2 tons of wolfram per month. The average number of men employed this year was 45 underground and 30 on surface.

**1941** More investment was needed if the mine was to continue operations. At this time the market demand and price for wolfram was high (given the world situation). A variety of options were considered, but the sinking of a new shaft on the south side of the hill (south of the shallow granite and close to the lode), to exploit a better ore prospect in depth, was adopted. At South Shaft (Site 8), Deep adit was 215 ft. from surface, and it was planned to sink the shaft to a depth of 400 ft. In early November, to speed up shaft sinking, it was decided to excavate from deep adit upwards reducing the need for surface buildings to be constructed first. The initial shaft raise was holed to surface on Christmas Eve. Figure 9 shows the abandoned mine plan (MRO 15156) section of South Shaft down to No 7 Level, although it did finally extend another level lower.

**1942** Following purchase of the compressor (Site 7) to use during pumping and sinking the shaft, compressed air rock drills were used thereafter (and due to the rock being harder at South Shaft). A Holman de-rated Holman T.60.S two stage vertical compressor requiring 80hp to run it (at 580rpm instead of 720rpm), was purchased (see Fig 10), and for the pumping plant in the shaft, about 50hp was required. As time was important it was decided to install two Ruston Hornsby horizontal diesel engines, one for the pump another for the compressor (see Fig 11). However, the engine shafts were configured so that the compressor engine could also be used to work the pump. *'A small petrol engine driven compressor was provided for charging the starter air bottles for the engines. All this machinery was housed in a concrete block building 66 ft long by 35 ft wide* (Site 7) *erected to the* (south) *west of the shaft'* (*op cit*, 51).

*Figure 7 North Shaft complex in early 1940s (Reproduced with permission of Tony Brooks)*

*Figure 8 North Shaft complex in 2012. (Later) Diesel Mill engine house (Site 45) in foreground, Miners' Dry (Site 43) in background (© CC HE Projects)*

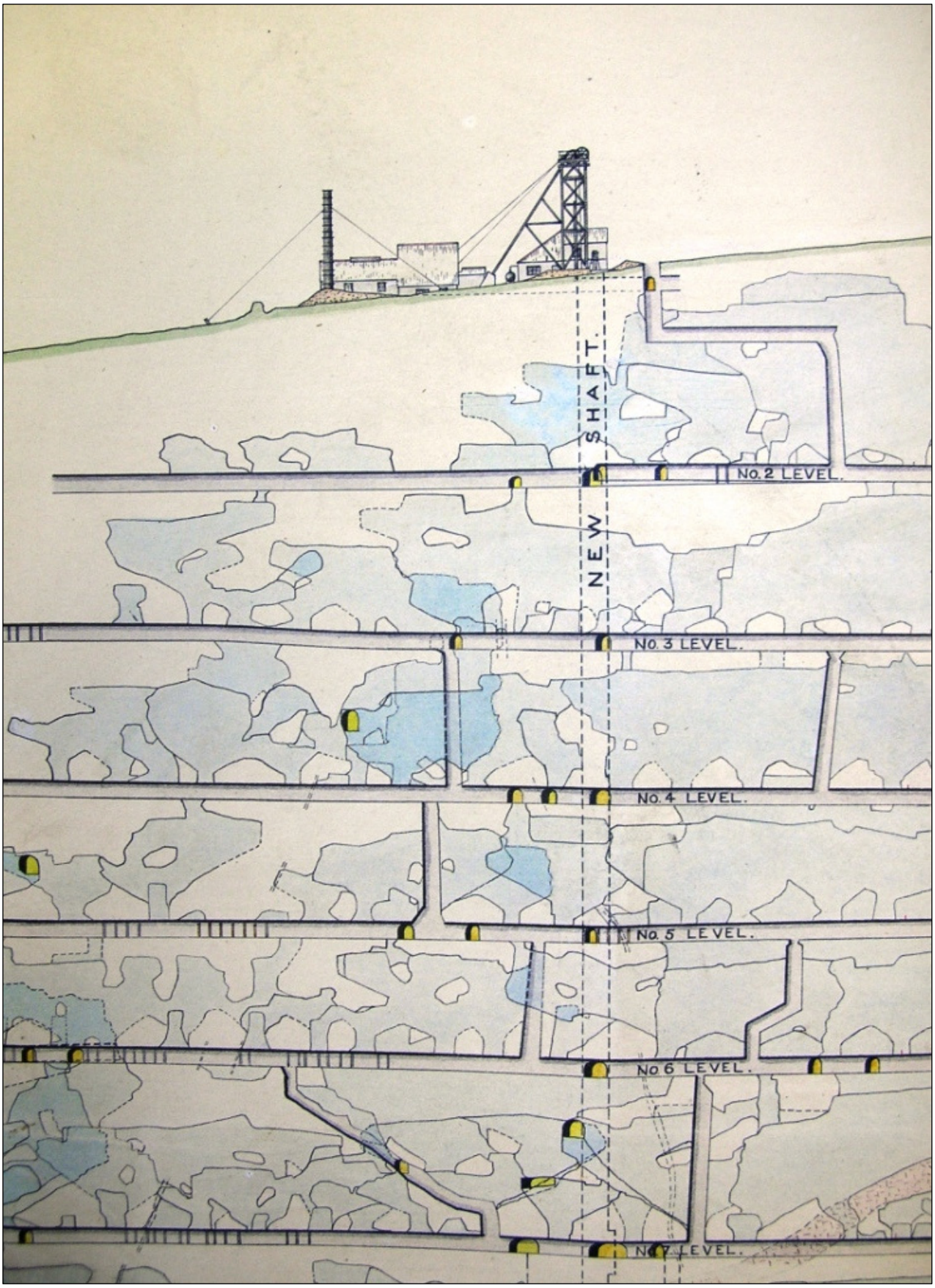


*Figure 9 Section of South Shaft and the mine complex (Reproduced with permission of the CRO, MRO 15156)*

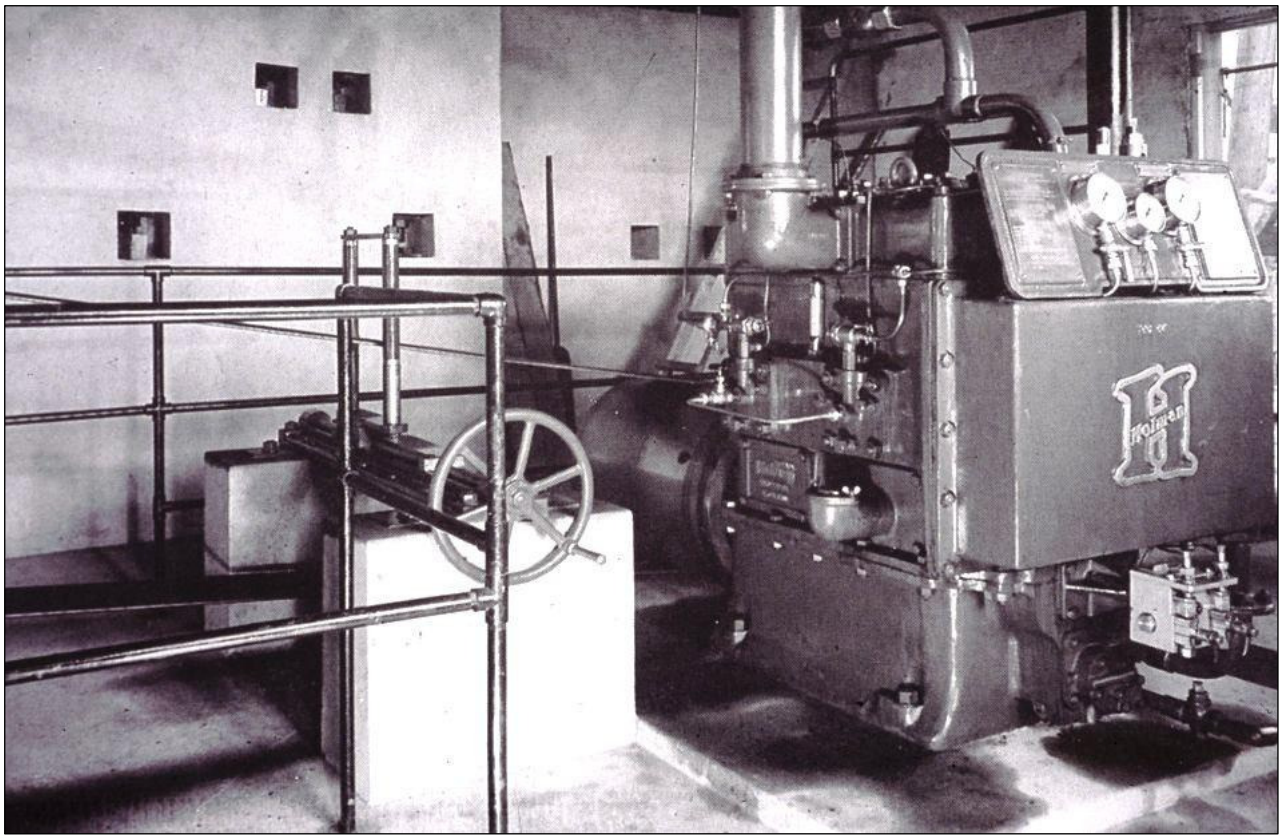


*Figure 10 Image of the Holman's compressor engine (T60S) (Brooks 2001, plate 10, 49) (Reproduced with permission of Tony Brooks)*

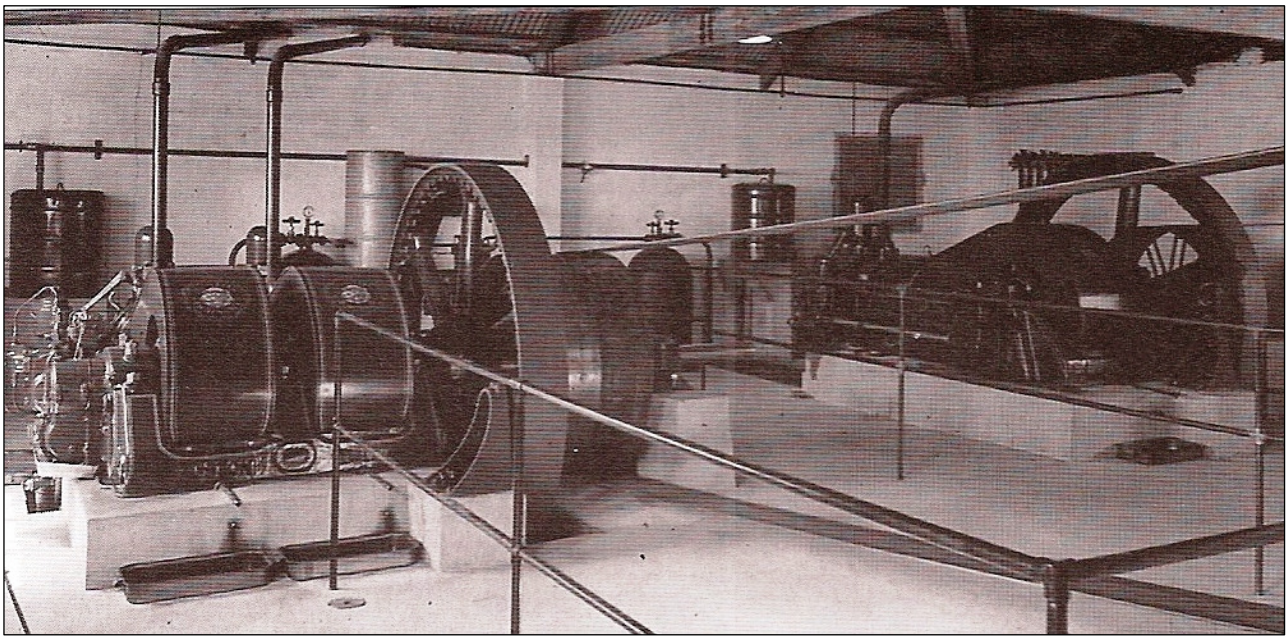

*Figure 11 Image of Ruston and Hornsby horizontal diesel engines (Reproduced with permission of Tony Brooks)*

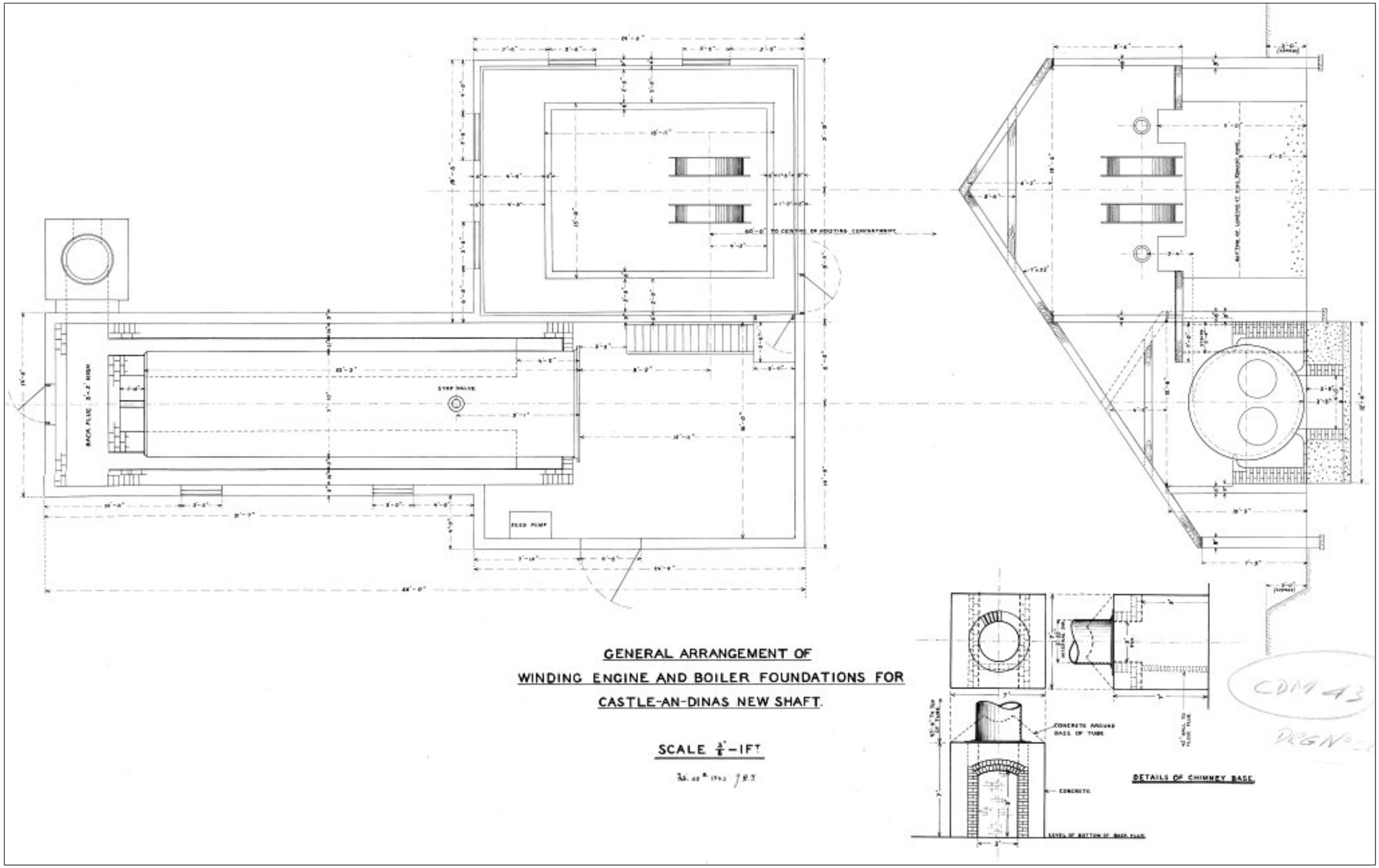


*Figure 12 Original construction plan for the Winding engine and boiler house foundations (Sites 3.1 and 3.2 respectively) (Reproduced with kind permission of Mr Chambers)*

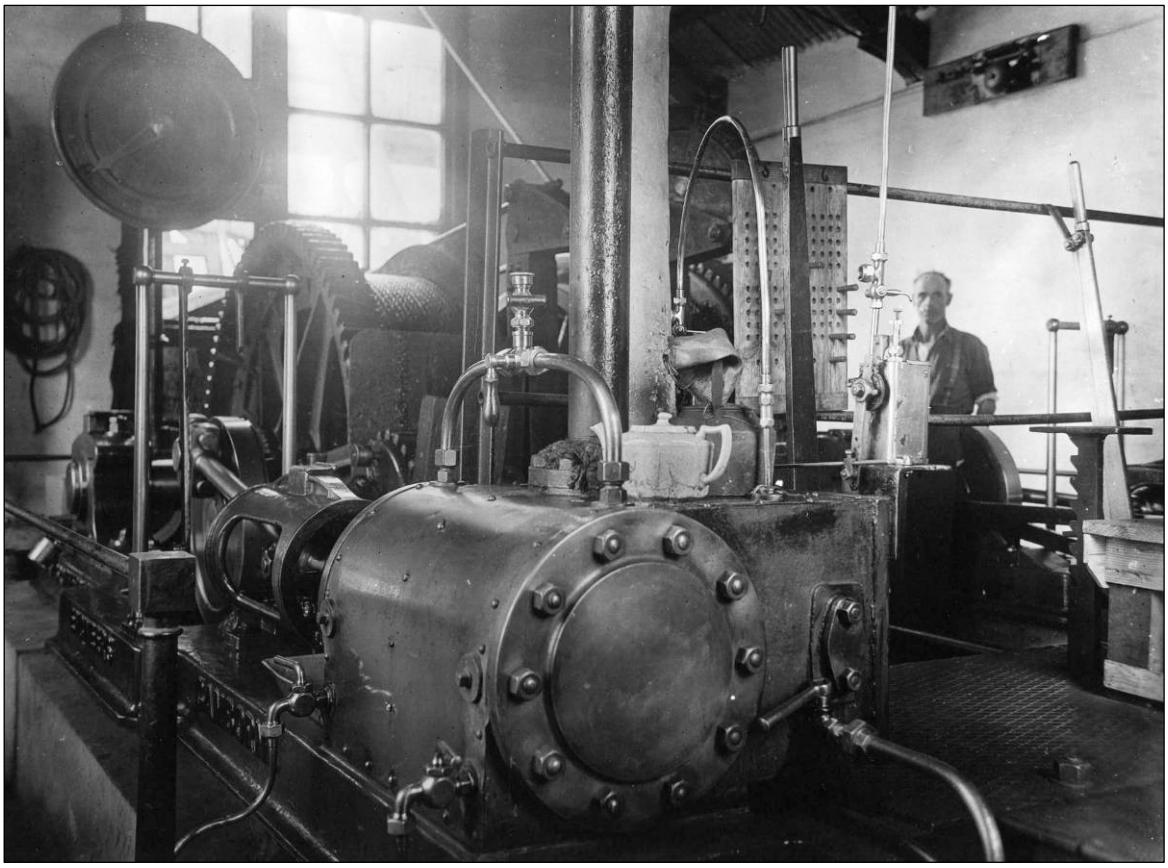

*Figure 13 Image of the horizontal cylinder steam winding engine (Reproduced with permission of Tony Brooks)*

*Figure 14 Internal view of the winding engine house (Site 3.1) © CC HE Projects*

A second hand horizontal cylinder steam winder was purchased from King Edward Mine in 1942. An original proposed construction plan of the building for the winding engine and boiler house is reproduced in Figure 12, although this was not the final layout (see Site 3 inventory description). The winding engine was purchased new in 1906 and had 10 inch by 15 inch slide valve cylinders and 5ft. diameter drums (Buck 2012 and Fig 13, a photograph taken in 1945 in the engine room). By way of contrast, Figure 14 is an internal photograph of the same building taken in 2012. A second hand Lancashire boiler from South Crofty Mine was installed. This was 7ft. 10in. diameter and 32ft. long. All of these buildings were built of concrete block with asbestos roof sheeting. The chimney for the boiler was detached from the building and built of bolted sections of old Cornish boiler tubes.

Given a shortage of finished surface equipment and a reduced labour force due to the War effort, it was not until September that the winding and air compression plant was operational and the shaft sinking (to full size), could be resumed.

**1943** By February the shaft had reached to a depth of 140ft. below adit, water ingress had slowed the process down, requiring the purchase of two Pulsometer steam pumps. However, a third (larger) pump was later purchased as more water entered the shaft at its base. In addition (at lower depths), the steam from the Lancashire boiler was not sufficient for all the pumps (and as an auxiliary back-up), one of the (now) unused locomotive boilers at North Shaft (Site 41.3), was repaired, transported and re-erected next to the South Shaft boiler house (Site 4), and coupled to the main boiler. Electric power *'at 100 volts was supplied by a steam driven 2.5 kw DC Robey Electromotors generator installed in the corner of the oil engine house … The shaft reached its final depth of 218 ft below adit a little less than a year after sinking had started; the bottom station being cut 200 ft. below adit'*. (*op cit*, 57). The generator was located at Site 7.1.

The diesel engine was connected via gearing to a flat rod which then connected to a twin set of (opposing) balance bobs (Site 7.4), working 10in. twin pump rods. The pumps in South Shaft pumped the water up to No 4 level, which then were laundered along No 4 level to the north side adit portal. *'When hoisting ore the cage was raised in the headgear to an elevated platform 18 ft above collar level. At this point the wagon was run out of the cage on to a straight track… The gantry led to the top of a concrete 60 ton capacity ore bin* (Site 9)*… The gantry extended on the far side of the ore bin and carried the tramroad out to the waste rock dump'* (*op cit*, 62). Figure 15 shows (left to right) the steel chimney (Site 3.3), the ore bin (and gantry - Site 9), the aerial ropeway steam engine room (Site 10), the aerial ropeway (Site 11 and terminus Site 11.1), the South Shaft headframe (Site 8), the balance bob(s) (Site 7.4) and the Diesel engine and compressor House (Site 7). By way of contrast, Figure 16 shows the site today.

The mechanism of an aerial ropeway (Site 11) was used to transport the ore from South Shaft to the mill on the other side of Castle-an-Dinas hill. A steam driven engine (second hand 11 HP Marshall vertical single cylinder, slide valve, non condensing engine - Site 10) powered endless wire rope carried loaded 'buckets' (capacity of 10 tons/hour) via overhead pylons (Sites 11.2 – 11.11), 2,700 foot up the hill, over the Iron Age hillfort and down to the mill beyond North Shaft (Fig 19). At the North Shaft site, a new unloading station and ore bin was built to receive the ore (Site 11.12), sited west of the Compressor House. A year later a new diesel Mill Engine House (Site 45) was constructed (Fig 17) on the site of the earlier compressor house.

**1944** Underground development resumed with Nos 5, 6 and 7 levels being driven north and south of South Shaft, but was relatively disappointing in terms of ore produced. In addition, a shortage of labour across Cornwall at this time also affected operations.

**1946** Figure 18, the 1946 aerial photograph, shows the development of the north site at this date. The extent of waste dumping is evident. Unfortunately, the image of the south site is not clear.

*Figure 15 Image of the South Shaft complex from the north (Reproduced with permission of Tony Brooks)*

*Figure 16 South Shaft complex in 2012. The ore-bin, shaft headgear and chimney have all gone (© CC, HE Projects)*

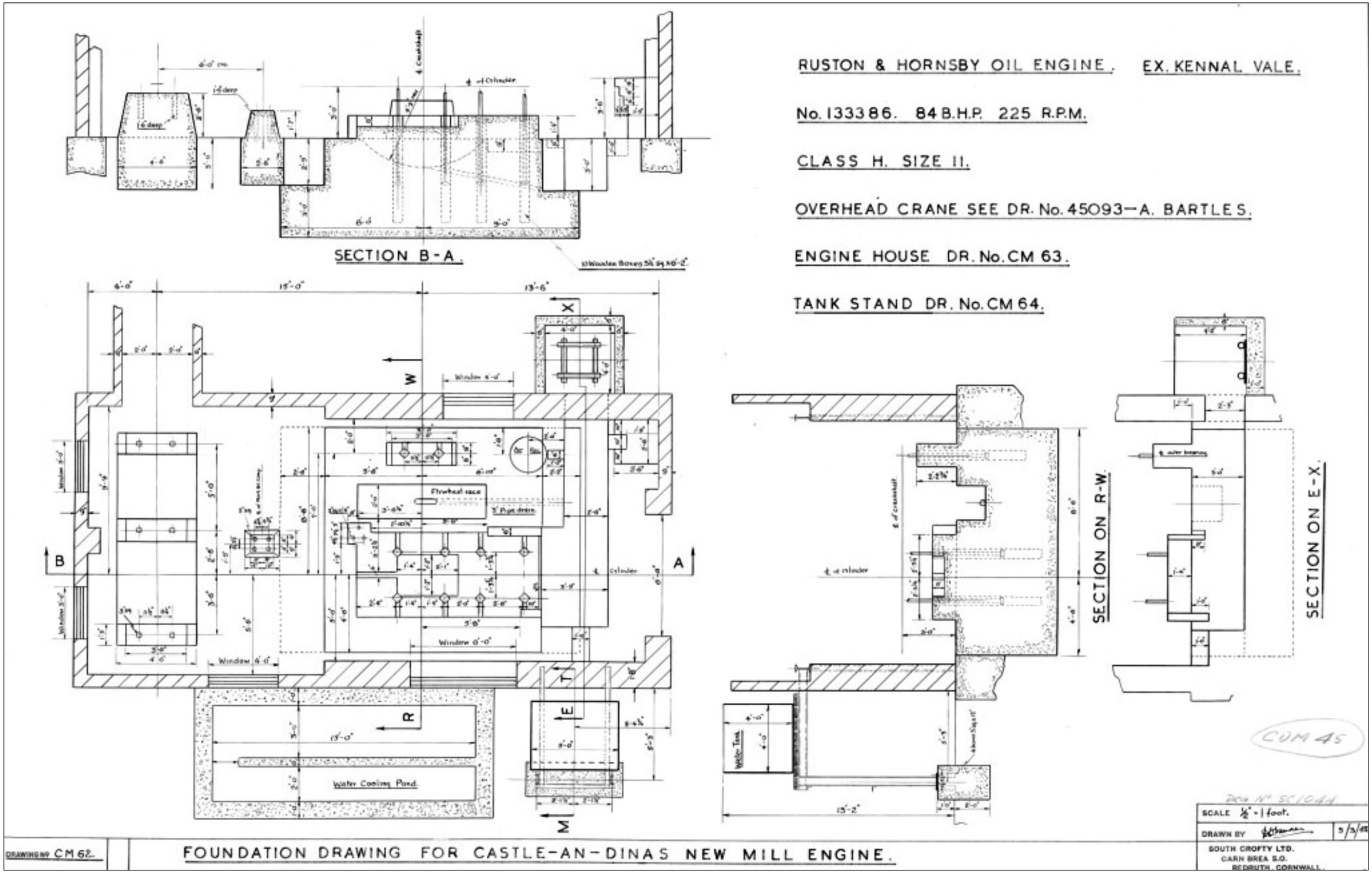


*Figure 17 Original construction plan for the new North Shaft Diesel Engine House (Site 45) (Reproduced with kind permission of Mr Chambers)*

*Figure 18 1946 RAF Aerial photograph of the North site (B28 1104)*

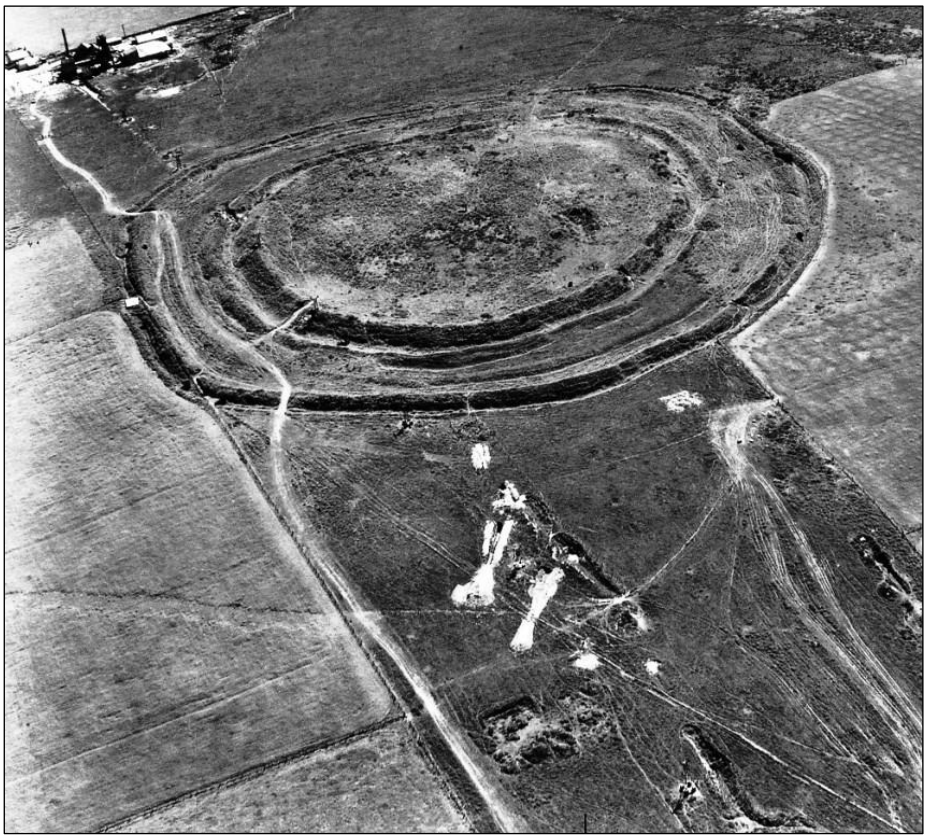

*Figure 19 1952 Cambridge University aerial photograph of the site (*CUC HV 56*)*

**1948** Near the end of January a fall of decomposed rock in the old No 4 level workings completely choked the main drainage adit and caused pumping to be stopped. It took nearly a month to rectify the situation. Again, this years production had been disappointing, with slow development work underground producing little ore. Up to the middle of the following year, the mine was only covering half its operating costs.

**1949** By the end of the year *'development footage was 1, 349 ft. mainly on the 4, 5, 6, and 7 levels south of the shaft … (but) the value of wolfram sales was £3,600 more than 1948, but including depreciation of £2,300 the loss was nearly £4,000'* (*op cit* 71). The lode had been followed south on Nos. 2, 3, 4, 5, 6, and 7 levels until all became either too poor to work or had split into unworkable strings. This only left work on the north side of the shaft, under the hill. This had been continuing all the while, but relatively unsuccessfully.

**1950** The Annual Report showed the mine treated 7,540 tons of ore (some 30 tons per day) that produced 61 tons of wolfram. High wolfram prices meant previous advances from South Crofty could be cleared (and paying a reduced royalty rate to the Duchy).

**1952** The only development work available was deeper below No 7 level. This was necessary as the Korean War had again pushed up demand and therefore prices for wolfram. The mine was finally connected to the National Grid in the summer, which now powered the surface air compressor and underground pumps. But the quality and amount of the ore was reduced as it processed its reserves *('the tonnage of ore milled remained nearly constant at 7,840 tons but the wolfram recovered had slumped to just below 26 tons, the recovery only being 7.4 lbs/ton'* (*op cit* 76). The mine continued to employ about 50 men.

Figure 19, the 1952 aerial photograph is quite clear and detailed. Recent surface workings and waste dumps at Cox's Level can be seen (but the original Cox's mine buildings were long gone; i.e. Sites 27 to 31). A car route linking the two mine sites through the hillfort's east side banks can be seen, as well as a clear view of the aerial ropeway.

**1954** By April, South shaft had been sunk to its final depth of 480ft from surface. The new No 8 level was extended 220ft north and south of the shaft. To the north it had hit granite and to the south the lode faded away, a disappointing result for the future of the mine.

**1956** The wolfram metal price declined as the Korean War had ended and demand reduced. At the end of the year the chairman remarked *'with the present fall in the market price for tungsten ore, the future outlook for the mine is obscure'* (*op cit* 76).

**1957** The new No 8 level was allowed to flood as the ore had been removed. No more payable ore had been discovered north of South Shaft, despite many fruitless diamond drilling and crosscut investigations. *'Unfortunately the continuing low price of wolfram and the poor reserves outlook forced the company to cease operations on Saturday August 3rd 1957… pumping finally ceased on 9th September'* (*op cit*, 78). The wolfram market price continued to fall to low levels.

Castle-an-Dinas Mine summary: *'The ore body has been worked over a length of nearly 3,300 ft. and to a maximum depth of 476 ft… The output of high grade wolfram was approximately 2300 tons and, as such, the mine is believed to have been the second largest tungsten producer in Cornwall. On an initial capital outlay of about £17,000 the mine gave £100,000 in dividends before it became necessary to spend money on sinking the New Shaft. Despite the high cost of sinking and equipping in war time, the shortage of suitable labour during 1939-45, plus the cost of the aerial ropeway the additional outlay was more than recovered from subsequent profits'* (*op cit*, 83 – quoting J Trounson). A view of the South Shaft mine, taken from the south in 1963 and reproduced in Figure 20 can be seen and compared to an equivalent view taken in 2012 (Fig 21). This shows that despite the removal of the chimney, ore-bin and headgear a significant number of buildings associated with the latter phase of the mine, still survive.

*Figure 20 1963 View of the South Shaft complex taken from the south (taken by Bernard Wailes during the hillfort excavations)*

*Figure 21 South Shaft complex in 2012 from the south. The ore-bin, shaft headgear and chimney have all gone (© CC HE Projects)*

***Postscript**:*

The lease from the Duchy of Cornwall expired in September 1965, the machinery having been sold or taken to South Crofty. The aerial ropeway supports, the steel chimney (Site 3.6), possibly the ore-bins (Site 9) were removed after 1963, presumably by September 1965. Further investigations (drilling and some underground work) occurred between 1977 and 1979 (*op cit*, 97), none of which showed ore reserves that were economic to retrieve. The steam winder engine at South Shaft has ended up at its original site, King Edward Mine (Buck 2012), as has the South Shaft capstan hoist. It is not known where other machinery went, presumably auctioned or used at South Crofty Mine.

## 4.3 Castle-an-Dinas Hillfort

Located in mid Cornwall on a hilltop overlooking Goss Moor (SW 9454 6236), Castle-an-Dinas is a large and roughly oval Iron Age hillfort with four well-preserved concentric ramparts forming a formidable defence. The site is a Scheduled Monument (1006173). The fact that the third rampart (middle) is a very much slighter feature than the others may suggest an early prehistoric origin, while within the central enclosed area are the remains of two Bronze Age round barrows (with another possibly sited south east of the study area (see Figs 22 and 23).

Castle-an-Dinas has legendary associations with the Dukes of Cornwall and King Arthur and has been the subject of extensive antiquarian description and recording but only one recorded archaeological intervention; this was in the early 1960s when a few trenches were excavated in the centre and across the ramparts by Bernard Wailes (Blick 2009 MA dissertation). Unfortunately, although the results of this excavation have appeared as short interim reports in *Cornish Archaeology* (Wailes 1963, 1964, 1965), they have never been fully published. Despite the fact that mining remains are abundantly recorded on the surrounding Castle Downs (see Figs 23 and 30). The fort itself has seen relatively little modern disturbance. There is a small quarry near the centre and in a couple of places the ramparts have been flattened to provide level stances for the pylons that carried an aerial ropeway from Castle-an-Dinas mine to the north of the fort with its processing works on the south. A roughly surfaced track, also linking the two parts of the mine, ran across the south-eastern side of the fort, taking a route between the two outermost ramparts.

Though formerly part of an extensive area of downland, the land around the hillfort was enclosed and agriculturally improved within the 20th century, leaving the fort and narrow strips of land to north and south containing the mining remains as a small fragment of rough ground in a swathe of improved pasture (see Figs 2 and 3). When the surrounding area was still rough ground access to the monument was through its original entrance on the south-west (Fig 2). However, enclosure of the area resulted in a realignment of access to the south-south-east (Fig 3) thereby resulting in erosion (via the public footpath) over the top of the banks to the interior. The impact of the site erosion has resulted in localised repairs (Preston-Jones 1994 and 2011) and removal of the concrete walls of a reservoir tank (Site 22). A relatively recent (2005) aerial photograph of the site and study area is reproduced in Figure 22.

Castle-an-Dinas had a brief involvement in the English Civil War when in March 1645 the Royalists, under their commander Sir Ralph Hopton, spent two nights there. Following defeat at Torrington on 16th February, the Royalists had withdrawn to Camelford, then Bodmin, pursued by the Parliamentarians under Fairfax. Hopton held a council-of-war in a farmhouse near Castle-an-Dinas and then on 10th March his army surrendered at Tresillian Bridge (Preston-Jones 2011, 13).

Previously a holding of the Duchy of Cornwall, Castle-an-Dinas hillfort has been in the ownership and management of the Cornwall Heritage Trust for over twenty years.

*Figure 22 2005 CC Aerial photograph of the project area*

# 5 Site inventory

## 5.1 General comments

Refer to the site inventory maps (Fig 23: South Shaft and hillfort and Fig 30: North Shaft) to locate the sites within the project area.

- All identified structures and sites are located by a 10-figure grid reference. In most instances these relate to a point at the centre of the feature/structure. If the feature covers a large area the NGR is an eight or six number grid reference. Linear features (flues, etc.) are given NGR at either end where possible.
- Management recommendations for each site have taken into account its short/long term preservation in its present form, as a significant feature.
- The site inventory text describes the study area features (Fig 2) from the South Shaft mine buildings, northwards over the hillfort to North Shaft mine.
- Where appropriate site background descriptions are given, but appropriate reference should be made to the historical text produced in Section 4.2.
- Appendix 10.1 (South Shaft Sites 2 to 7) and 10.2 (North Shaft Sites 41, 43 and 45) includes annotated survey drawings (base survey produced by pdp Green Cons. Eng.) by CC HE Projects with detailed survey comments about significant features that are also described in the site inventory.

## 5.2 Site inventory (text)

## South Shaft mine complex

**Site 1 Mine Captain's house SW 94567 62020**

*Description*

Tresaddern bungalow is a former Mine Captain's house on the South Shaft complex. This property is now in separate ownership and lies outside the study area.

The original access to the South Shaft buildings from the main road was by a straight track which emerged beside the east side of the house and mine office (as shown on the *c.*1963 OS map). The present access track was presumably created when the bungalow was sold off.

*Recommendations*

Not applicable.

**Site 2 Mine office SW 94568 62035**

*Description*

The mine office was originally a single-storey, single depth range of three rooms accessed by a slightly off-centre central corridor (Site 2.1), oriented east–west. At the rear (north) side is a lean-to and porch over the main entrance (Site 2.2); this does not appear in some historic photos (Bullen 2003, 55, 66) so is a later addition.

Its walls are of cement rendered block-work with similarly rendered chimney stacks. There is much ivy growth on the gable ends and south wall. Gable ended roof is built upon simple softwood A-frames, covered with corrugated asbestos sheeting. Red clay ridge tiles and simple red clay chimney pots (the east chimney pot is leaning and/or broken).

With the exception of the entrance corridor, all floors are of tongue and groove floorboards over joists. There are ventilation bricks visible on the south wall. The corridor floor is cement screed.

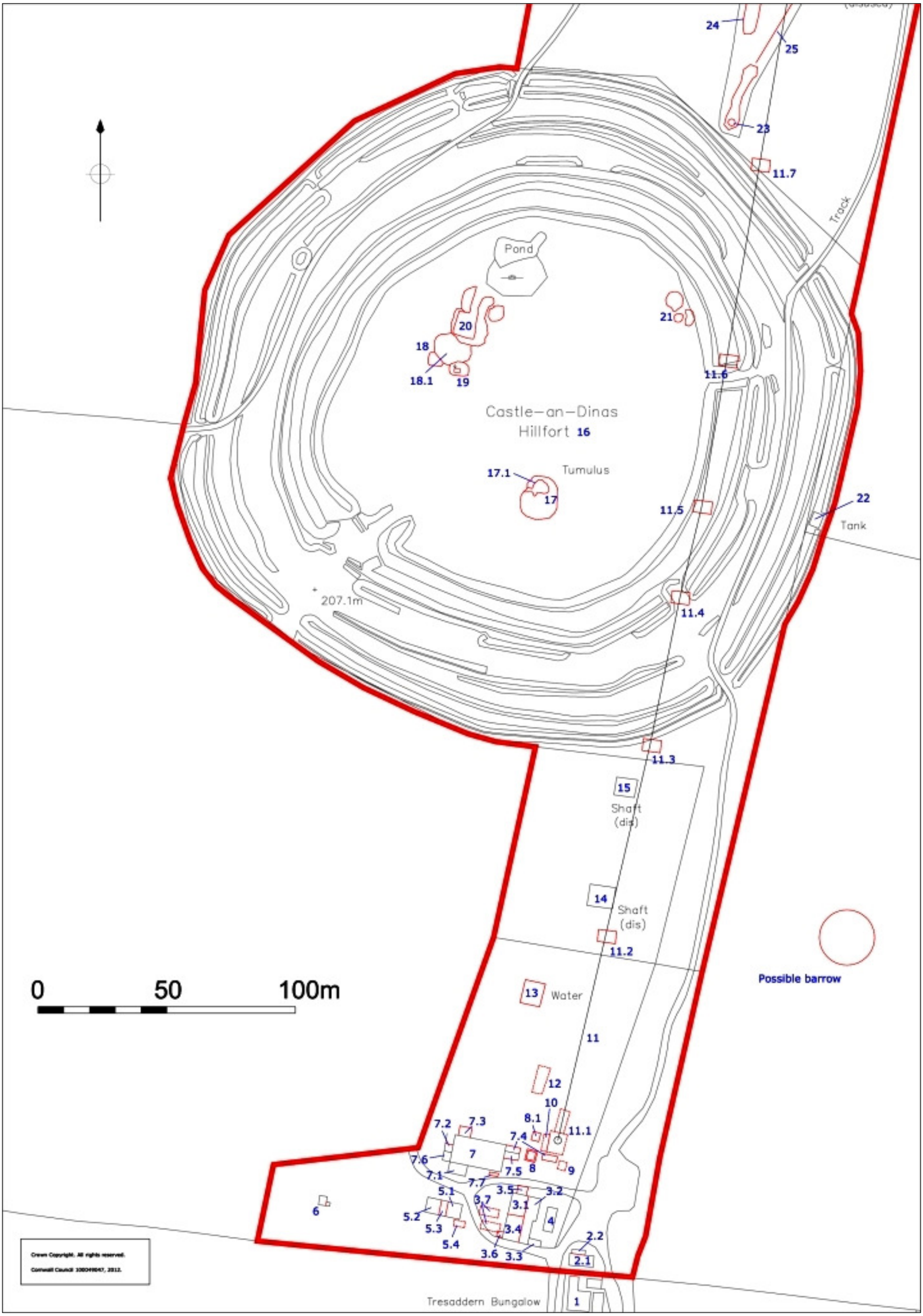


*Figure 23 Site inventory plan of South Shaft Mine and the hillfort*

Windows of the main rooms are horned 4-pane sashes; the western most room has two windows, an original 2-pane sash in the north wall and a casement window in the south wall, the latter is a replacement.

The easternmost room of the main range is a former office, heated by a small tiled fireplace. When examined, the room had the remains of a square of decorated carpet/mat. There is a 2-panel door from the entrance corridor.

West of the corridor are two rooms; the first may be another office or a mess room, heated by a small arched fireplace of unusual two part ceramic design. In the northwest corner is a stainless steel sink on what is likely to be a late 1960 or 1970s wooden kitchen unit, so perhaps a later fitting. There is a line of original coat hooks on the north wall.

Adjoining this space and accessed by a 4-panel door is a small narrow room containing a low level cistern WC and a hand-basin. These fittings appear to be of late 1960s or 1970s design so appear to be additions.

The rear lean-to and porch (Site 2.2) are of similar rendered block-work construction as the rest of the building. The porch is open to the east side and has remains of painted dogtooth plank above the doorway, now partially covered with corrugated sheeting. The lean-to is accessed by a wooden plank door within a chamfered frame. There are a row of ventilation holes in the upper part of the door. The main feature of the space is a tall recess within a chimney breast at the west end, most likely for a small boiler. The centre roof timber has nails to act as hooks for hanging clothes for drying, so perhaps this was a small change house for the mine manager/office staff. Refer to Appendix 10.1.1 for annotated survey elevations and plan of this building.

*Recommendations*

The principal conservation requirement for this building is to keep it watertight. A section of roof cladding has broken off the lean-to and needs replacement. It would be wise to periodically remove ivy from the gables or other places where it may otherwise penetrate the roof space. Other areas of roof may need attention once vegetation has been taken off, and some broken panes of glass replaced. The broken/leaning chimney pot on the main range needs replacement or refurbishment.

Inside the building the wooden floors are damp and the floorboards in the toilet have already broken through.

### Site 3 Steam winder house /boiler house /miners' dry SW 94545 62052

*Description*

Material from South Shaft of Castle-an-Dinas mine was wound to the surface by a horizontal steam winding engine located in a large building located south of the head-frame. Combined with the plan of the steam winder house was an integral boiler house and also a miners' dry or change house, which was supplied with hot water from the adjacent boiler.

This complex is oriented nearly north-south with the winding engine house occupying almost two storeys at the north west corner. The miners' dry is a single storey building to the south west. The boiler house and its associated stoking area occupy all of the eastern side of the site. The boiler flue and chimney base are to the south east.

The design of the winder house and boiler house was based upon a surviving proposal plan (reproduced in Fig 12), which shows a similar layout but with the chimney moved to the opposite side and the miners' dry occupying the space.

Like all the other principal buildings on the South Shaft, this complex is built of rendered block-work and has a corrugated asbestos sheet roof on softwood trusses. The structures are principally under one roofline, except that the roof is extended higher at the north east end to accommodate the winder house. A photograph reproduced by

Bullen (*op cit*, 57) shows this building under construction. Its roof is now more damaged than other buildings at South Shaft, having a few missing and broken asbestos sheets, and several missing or loose ridge tiles. Refer to Appendix 10.1.2 for an annotated survey plan and Appendix 10.1.3 for annotated survey elevations of this building.

*Site 3.1 Steam winder house*

*Background*

The engine was mounted with the two steam cylinders at the south end and the pair of winding drums toward the north. Cables from the winding drums were fed out through a window/openings set higher in the north wall. A view of the winding engine *in situ* is illustrated by Bullen (*op cit*, 79). This photo was taken from the south west corner of the house. Originally this engine was used at King Edward Mine, it was then bought by South Crofty Ltd and used at Castle-an-Dinas Mine. After closure of the mine the engine went to Wendron Forge/Poldark Mine. It has now been reacquired by King Edward Mine Museum where it is on display on its original foundation (see Fig 13, and by comparison an internal view of the site today; Fig 14). Figure 24 shows an external view of this building.

*Description*

The steam winder house is of almost two storeys, the basement of which only houses the central concrete foundation plinth together with its holding down bolts. At the perimeter of the concrete foundation the basement is separated from the main room by a wooden boarded floor fixed upon timber joists. Timbers are now largely rotten and the floorboards are missing at the southwest corner.

*Site 3.2 Boiler house*

The steam winder was supplied with steam from a 25 ton Lancashire boiler mounted alongside the steam winder house. Although the boiler has long disappeared (it was probably scrapped *in situ* as it would have been otherwise difficult to remove) the house still has brick foundations for the boiler, along with brick entrances to a pair of flues. The northern part of the boiler house was the concrete floored stoking area, and a wide coal chute in the north wall provided a means of tipping fuel directly into the building. A steep wooden stairs provided access into the steam winder house. Figure 25 shows an internal view of the building from the top of the stairs.

*Site 3.3 Flue and chimney base*

At the south east corner of the boiler house is a short length of block- work built flue leading into the chimney base. On this site, the chimney was built out of reused steel boiler tubes bolted together. When erected, the chimney (*c* 0.42m diameter), was held in place by steel stay cables anchored into the ground. Along with other now lost structures such as the head-frame and ore bin, the chimney was still in place when the mine buildings were photographed by Wailes in the early 1960s (Fig 20), but was probably demolished/scrapped soon afterward.

The present remains comprise the square concrete masonry of the chimney base (2.3m x 2.2m x 2.5m high), with a recessed doorway (1.4m x 1.6m high), in the east side for periodic clearing of soot. A broken stub of the steel chimney stack is still visible.

*Site 3.4 Miners' dry*

The miners' dry or change house lies within the L shape formed by the boiler house and steam winder house. This room used a hot water supply from the boiler itself, which was probably fed to a steel tank which survives on the higher part of the wall in the north east corner. The building was lit by windows in the west and south walls (now boarded over). A screen wall once existed in the entrance, forming an inner lobby. The room has a concrete floor with a drain at the south west corner. Concrete inclined slabs set against the west wall may have been associated with showers, or may be a post-abandonment feature. There is evidence of coat hooks on the north and east walls.

*Figure 24 The winding engine house (Site 3.1), boiler house (Site 3.2), and auxiliary boiler house (Site 4) from the north (© CC HE Projects).*

*Figure 25 An internal view of the Boiler House (Site 3.2) from the north (© CC HE Projects)*

*Site 3.5 Steam capstan house*

*Background*

A steam winch from Gurlyn Mine, near Relubbus, Penzance was erected to act as a capstan in 1942. This equipment also survives and is at King Edward Mine, Camborne (op cit, 59).

*Description*

A lean-to housing a steam capstan was once sited on the north side of the winder house. The construction of the building is shown in a photograph reproduced by Bullen (2003, 59).

The only part of this building now visible is a section of the east wall, where it forms a revetment to a ramp to the winder house doorway. The former roofline of the capstan house is also visible.

*Site 3.6 WC*

Outside the south west corner of the miners' dry is a small block-built extension, most likely a toilet. This was overgrown with bushes/scrub at the time of survey and inaccessible.

*Site 3.7 Site of buildings (former lamp room?)*

A pair of small flat roofed buildings are shown in historic photographs of the mine, located between the miners' dry and the forge/carpenters' shop (see Bullen 2003, 55; Wailes *nd c* 1963). These are no longer extant.

The proximity to the shaft and miners' dry suggests that one of these buildings may have been a lamp room.

*Recommendations for Steam winder house/boiler house/miners' dry complex*

Although largely intact the roof of this complex is in poorer condition than other buildings at South Shaft. The ridge tiles need urgent reinstatement and broken or missing sections of the asbestos sheeting need replacement.

Other exterior repairs include replacement of missing render on the south side of the boiler house and on the flue/chimney base. This would protect the underlying concrete block-work from further erosion/weathering and help to prevent damp penetration. If the roof can be repaired/the building made watertight then the wooden floor inside the steam winder house could be renewed with like-for-like timber.

## Site 4 Auxiliary boiler house SW 94557 62051 (centred)

*Background*

This building housed a locomotive type boiler which had previously been at North Shaft winder engine house (Site 41.3). It was used at this site to power pulsometer pumps for shaft sinking and drainage (Brooks 2001, 57). A photograph of this building under construction, with the boiler already in place, is shown by Bullen (2003, 65). The firebox end of the boiler was to the north, with the coal supply adjacent. The boiler's smokebox was at the south end, with a tall iron chimney exiting through the roof.

*Description*

A rectangular single storey building oriented almost north-south. It is built parallel with the main boiler house to the west and is almost linked to it by a length of walling. There is only one doorway, in the north-west corner, which faces the entrance to the main boiler house. There is a single boarded-over window in the south gable and two more windows in the east elevation. The interior was inaccessible at the time of survey.

Adjoining the north of the building is a rectangular unroofed area which is probably a former coal store. Fuel could be tipped in from the higher ground to the north. Close to

the south east corner is an open rectangular concrete framed tank – this was a cold water reservoir for the boiler feed.

Its walls are of rendered concrete block-work and roofing is corrugated asbestos sheeting on softwood A-frame trusses. The ridge has asbestos tiles; one has since been replaced by asbestos sheet where the iron boiler chimney once emerged. As the building only has one relatively narrow side door, the boiler must have been scrapped *in situ* after the mine closed. Refer to Appendix 10.1.4 for annotated survey elevations and plan of this building.

*Recommendations*

The building is relatively inaccessible due to dense scrub growth, particularly at its south side. It would benefit from limited vegetation control, and this would in turn permit assessment of its internal condition.

**Site 5 Forge and carpenters' shop SW 94515 62055 (centred)**

*Description*

A single storey single depth range, oriented east-west. The building is divided into a carpenter's shop in the east end (site 5.1) and a forge/blacksmith's shop at the west end (site 5.2). Doors in each gable provide separate access to the different parts of the building. It is interesting that the doorways to both of these workshops were only standard single opening doors, which would have limited the size of objects that could be brought inside. At the centre of the range is a narrow room accessed from the blacksmith's shop (site 5.3).

Built of block-work, externally rendered with cement mortar. Surviving windows in the N wall are triple casements, each casement having 4 panes. The outer casements can be opened whilst the centre ones are fixed. In the S wall the windows have not survived and the openings are infilled with sheeting. All doors have been replaced.

The roof is gabled at both ends and built on simple softwood bolted A frames. The roof covering is corrugated asbestos sheeting, mostly intact but with a few broken sheets and red clay ridge tiles. All floors are cement screed over concrete. Figure 26 shows a view of this site from the south west. Refer to Appendix 10.1.5 for annotated survey elevations and plan of this building.

*Site 5.1 Carpenters' shop*

The carpenters' shop at the east end of the building has few extant features other than a few fittings on the walls (Fig 26). At the northeast corner is a line of wooden coat hooks, and low in the east wall is a hole measuring, *c* 100mm diameter which may have been a flue pipe from a cast-iron stove. There are tool hooks/nails on the west wall and in the south east corner, suggesting there were once benches on each side of the room, most likely beneath the windows. The centre of the floor is likely to have been used for temporary storage of materials and for working on larger objects.

*Site 5.2 Blacksmiths' shop*

The blacksmith's shop is probably the most easily interpretable structure within the whole of the South Shaft site. The room was lit by a 3-light casement window in each of the north and south walls. The space is dominated by the block-built forge itself, with its sloping hood and chimney all intact. An air blast unit is extant within the forge bed. Behind it are remains of iron pipes which provided the air supply; as there are no traces of bellows in this or the adjoining room it is likely that a compressed air supply was brought from the nearby engine house. To the right of the forge is a coal/fuel bunker, still with traces of contents. A concrete anvil base is extant in front of the forge. Aside from the window the south wall appears blank but probably once had racks for tongs and other smithing tools.

On the north side of the blacksmith's shop is a long sturdy workbench beneath a window. Above this and to the left of the window are a line of nails for supporting tools.

In the floor between the work bench and the doorway is a wooden foundation containing a circular imprint and 4 former holding down bolts, now all bent over. This foundation appears to have been for supporting equipment which was subject to vibration or considerable expansion/contraction (hence incorporation of the wood). The circular mark is most likely to be the base of a specialised machine such as a rock drill sharpener, similar to one which survives in the old forge at Robinsons Shaft, South Crofty (Ainsley Cocks, pers comm.). An iron pipe running through the wall close to the machine base appears to be associated with it.

*Site 5.3 Central room*

This narrow room seems to have been a small store or mess area. It has white painted walls and a bench at the south end. Some nails/coat hooks are extant on the wall that backs onto the forge.

*Site 5.4 Site of shed*

A small shallow pitched roofed building is visible in historic photos of the mine, located at the south east corner of the forge/carpenters' shop (Bullen 2003, 55). There is now no trace of this structure.

*Recommendations*

This building appears to be in relatively stable condition.

*Figure 26 A view of the Carpenter's Shop (Site 5.1) and Forge (Site 5.2) from the west (© CC HE Projects)*

**Site 6 Magazine SW 94468 62058**

*Description*

A small rectangular building survives in the now heavily scrub-covered ground some 37m away to the west of the South Shaft complex. The main part of the building is a simple rectangular room with a doorway to the south. This building is slightly cut into the slope of the hill and an overgrown earth bank is extant around its northern side. At the south east corner is an adjoining lower structure, also with a low south facing opening.

The building has concrete block-work walls and a concrete roof. The door has long disappeared but there are traces of iron bolts where it was once attached. Inside there are traces of shelving on the walls and the concrete roof has traces of wooden plugs where a boarded lining was once attached.

The adjoining lower structure is of similar construction but as this part is now heavily overgrown, it could not be examined in detail. The form and location of the building clearly indicate that this was the explosives store for the mine. It is likely that the adjoining part was used for storing detonators. Refer to Appendix 10.1.6 for annotated survey elevations and plan of this building.

*Recommendations*

This site would benefit from periodic vegetation clearance to keep the structure from becoming entirely engulfed. It would also show the way the building was originally surrounded by a bund. The detonator store is currently inaccessible due to dense scrub growth.

**Site 7 Diesel engine house SW 94528 62076 (centred)**

*Background*

Two Ruston Hornsby horizontal diesel (oil) engines, one for powering the Cornish pump (66 bhp. Single cylinder), another for the air compressor (94 bhp. twin cylinder, see Fig 10 and 11), were purchased (presumably second hand) in 1942. The engines were started by a small high pressure air compressor which fed two air bottles. For flexibility the engine drive shafts were configured so that the compressor engine could also be used to work the pump (Bullen 2003, 68). Brooks (2001, 50, fig 10) provides a drawing showing the layout of the engines, the drive mechanism and gearing with a 'dog/jaw' clutch. Figures 27 and 28 show exterior and interior views of this, the largest and most imposing building in the entire mine complex. Refer to Appendix 10.1.7 for an annotated survey plan and Appendix 10.1.8 for annotated survey elevations of this building.

*Description*

The former diesel engine house is a large rectangular single storey building oriented almost east-west, which was built to align with pumping installations installed on South Shaft, located immediately east (Figs 27 and 28).

Walls of the engine house are of concrete block-work, covered with cement render. The roof is hipped at both ends and supported on softwood trusses. The hip trusses are held at their centres by semicircular iron brackets. At the northeast corner the roof is based upon a single pitched structure at a higher level. This is to accommodate tall concrete foundation plinths and the drive for pumping machinery on the adjacent shaft. Roof coverings are asbestos sheet, with occasional clear sheets used as roof lights. Floors within the building are cement screed over concrete.

Most of the original windows in the building are extant but currently boarded over; they are similar casement designs to those in the forge/carpenter's shop. An original door survives in the east wall, and a sliding door on track and pulleys is extant towards the centre on the south side.

The lean-to at the south west corner is built entirely upon wooden framing and has asbestos sheeting covering, but the gauge of the sheeting is much wider than that in the other buildings, suggesting it is a later addition. Within this lean-to is a concrete floor with a central rectangular pit, perhaps a garage with a vehicle maintenance pit, accessed by the double doors.

*Figure 27 A view from the north of the diesel engine house (Site 7) © CC HE Projects*

*Site 7 Engine house*

This building served as both a compressor house and the drive to the pumping arrangements on the nearby shaft. At the west end of the building were once two horizontal diesel engines mounted on concrete plinths. These drove flat belts to a countershaft towards the centre of the building. At the south east corner was the principal compressor (illustrated by Bullen, 69). At the north east corner is an arrangement of tall concrete plinths which supported a belt drive and reduction gearing to a crankshaft. The crank in turn linked to a balance bob and pitwork on the shaft itself. The countershaft within the building also incorporated a dog clutch, which allowed either engine to drive the pump or the compressor, should this occasionally be needed.

The engines also drove a small compressor for charging air bottles, used to start the engines. This compressor and air bottles were situated beside the west wall. An explosion of one of the air bottles during operations at the mine caused much damage to the building, including tearing off some of the roof covering at the south west corner (Bullen, 70-71). Fortunately no one was hurt in this accident. On the south wall of the building are remains of electrical boxes and installations. The electrical generator may have been sited in a lean-to (site 7.1).

Survey of the building indicated post-mine use of the engine house. After the mine was closed the two diesel engines and the countershaft were removed, their concrete plinths cut away and the patches of floor infilled so that the building could be used for other purposes. A red painted iron stanchion was also concreted into a former exhaust channel

at the south west corner of the building. Insertion of this tall stanchion also involved cutting away part of the hipped roof timber.

A distinctive round opening is also extant in the west wall of the engine house. This has been cut through the original wall and part of its circumference infilled with additional mortar. Pintail hinges (and traces of a latch position) have also been added to the external side of the opening. Inside and below the opening is a pair of roughly built concrete block piers or buttresses. Neither the opening nor the buttresses appear in historic photos of the engine house (*cf* Bullen 2003, 68).

*Figure 28 An internal view of the diesel engine house (Site 7) looking westwards towards the site of the two engines (© CC HE Projects)*

*Site 7.1 Lean-to*

At the south west corner of the engine house is a rectangular lean-to with a pair of double doors at its east end. Its different construction (see below) suggests it is an addition to the original engine house. Its principal feature is a rectangular pit in the floor, suggested to be a foundation for a generator.

An opening between the engine house and the lean-to is a former window, which was converted to a deeper opening/doorway once the adjoining structure was in place.

*Site 7.2 Platform and ramp*

Towards the centre on the western side of the building is a concrete plinth for water cooling tanks for an engine inside the building – the tall drums can be seen in a photo reproduced by Bullen (2003, 70). The photo also shows a compressed air reservoir cylinder outside the engine house; this was later moved to the south east corner (see 7.7 below). Adjoining the north side of the plinth is an un-surfaced ramp, now covered with vegetation.

*Site 7.3 Platform*

On the north west side of the engine house is a rectangular concrete plinth which once supported six tall cylindrical drums, which held cooling water for one of the engines inside the building.

*Site 7.4 Balance bob pit*

Adjoining the north east corner of the engine house is a rectangular pit now backfilled with lumps of broken concrete. A photo reproduced by Bullen (2003, 58) indicates that this was part of the balance bob arrangements attached to the pump rod drive.

*Site 7.5 Buttress*

A sloping concrete ramp-like structure is extant between the engine house and the shaft to the east. This does not appear in the early photographs of the mine *(cf* Bullen 2003, 58) so appears to be a later addition. It was probably built to counteract stresses caused by operation of the heavy pumping machinery in the shaft and on the surface.

*Site 7.6 Tank*

A concrete-framed tank with a galvanised iron roof is extant adjoining the south west corner of the engine house. It is secondary to the construction of the engine house and post-dates a photograph of this area shown by Bullen (2003, 70) as the location was then occupied by a compressed air reservoir.

Access to the tank appears to be from a hatch at the base of the wall from the interior of the engine house. The hatch is also secondary, and relates to infill of an engine exhaust channel and insertion of a steel stanchion in this part of the building. These features may therefore be at least partly associated with post-mine use.

*Site 7.7 Compressed air reservoir base*

On the exterior south east corner of the engine house is a pair of rectangular concrete plinths each supporting moulded ceramic blocks. These once formed foundations for a compressed air reservoir, most likely the one moved from the south west corner. An infilled channel in the floor of the engine house once contained the pipe to this reservoir.

*Recommendations*

The former diesel engine house has remained relatively watertight since the mine closed and this has probably been partly an effect of its reuse for agricultural purposes. Nevertheless some monitoring of its large roof area is necessary in order for the building to remain in relatively stable structural condition.

Figure 28 shows that the lower sections of wall are quite damp with prevalent algae/moss growth. This is probably the result of the building being set into the slope.

## Site 8 South/New Shaft SW 94550 62076

8.1 Footway Shaft SW 94551 62081

*Background*

South (or new) Shaft was first sunk in 1941 (upwards from underground and from surface). Figure 23 shows the outline of the shaft and the auxiliary (or Footway) shaft approximately 7.5m to the north (according to the mine section). South Shaft extended to a depth of approximately 150m vertically to No 8 Level, the deepest shaft of the mine, although later diamond drilling extended the depth to a further 60m. The shaft reached its final depth of 65m below adit (No. 4 Level) a little less than a year after sinking had started, thus the pumps raised the water from the bottom to a height of 60m, although the shaft was nearly 150m deep. Water was drained northwards back under the mine to a river on the north side of the hill. The shaft contained three timbered compartments: The hoisting section (3 ft X 6ft with a counterweight space); a middle section with the twin pump rods, guides and 6” compressed air main pipe; and

the 12" plunger pump column with another 6" Pulsometer column (for additional pumping – as this part of the mine had much water to pump/drain), a small auxiliary pump column and ladderway. The shaft had electric lights. The shaft dimensions were 11ft 6" X 9ft. A detailed plan is shown in Brooks (2001, 48). Figure 15 shows the headgear timbers over the shaft – with a gangway from this to the adjacent ore bin (Site 9), whilst Figure 16 shows the site today, and the fenced site of South Shaft.

Figure 9, the abandoned mine section drawing shows another (Footway) shaft a little way north of South Shaft. This provided access to No 2 Level, and may have been cut before South Shaft to access the lode to its north.

*Survey*

South Shaft has been capped at surface with a concrete slab measuring approximately 3m X 3.5m and 0.3m thick. The shaft area is widely fenced with timber posts and eight strands of barbed wire (the lower section with mesh wire). There appears to be no earth subsidence in the vicinity.

The site of the auxiliary or Footway Shaft is no longer visible at surface.

*Recommendation*

The shaft capping and timber fence posts appear sound, as well as the barbed wire, however it is slack in many places and should be tightened.

The site of Footway Shaft has not been confirmed at ground level. If public access to this area is to increase, then the shaft should be located and the vicinity fenced.

**Site 9 Site of concrete ore bin SW 94560 62075**

*Background*

*'When hoisting ore the cage was raised in the headgear to an elevated landing platform 18ft. above collar level. At this point the wagon was run out of the cage on to a straight track… The gantry led to the top of a concrete 60 ton capacity ore bin… The wagons were dumped onto a flat 6 ins. mesh grizzley … The gantry extended on the far side of the bin and carried the tramroad out to the waste rock dump beyond the bin'* (*op cit*, 62). The material would then have been loaded into the aerial ropeway (Site 11) buckets which went over the hill to the Mill on the north side (Site 47). Most of the ore bin appears to have originally been constructed with shuttered concrete, the upper section with concrete block (see Fig 15).

*Survey*

This tall prominent feature (over half the height of the headgear) is no longer extant.

*Recommendation*

The cleared site should not be impacted, but retained in its existing form. There will no doubt be extant foundations.

**Site 10 Site of Aerial Ropeway steam engine house SW 94565 62078**

*Background*

The aerial ropeway consisted of an endless wire rope driven by a steam engine at South Shaft. *'Power was provided by a second hand 11 h.p. Marshall vertical, single cylinder, slide valve, non-condensing engine'* (*op cit*, 63). Figure 15 shows two buildings north of the headgear and ore bin and next to the aerial ropeway terminus (Site 11.1), which housed the steam engine and winding apparatus linkages.

*Survey*

These buildings are no longer extant.

*Recommendation*

The site should not be impacted, but retained in its existing form. There will no doubt be extant foundations.

**Site 11 Aerial Ropeway SW 94568 62077 to SW 94726 62881**

| | | |
|---|---|---|
| 11.1 | South Shaft Terminus | SW 94568 62077 |
| 11.2 | Aerial Ropeway pylon base | SW 94582 62160 |
| 11.3 | Aerial Ropeway pylon base | SW 94595 62234 |
| 11.4 | Aerial Ropeway pylon base | SW 94607 62292 |
| 11.5 | Aerial Ropeway pylon base | SW 94616 62328 |
| 11.6 | Aerial Ropeway pylon base | SW 94625 62387 |
| 11.7 | Aerial Ropeway pylon base | SW 94639 62461 |
| 11.8 | Aerial Ropeway pylon base | SW 94650 62534 |
| 11.9 | Aerial Ropeway pylon base | SW 94653 62568 |
| 11.10 | Aerial Ropeway pylon base | SW 94669 62633 |
| 11.11 | Aerial Ropeway pylon base | SW 94691 62738 |
| 11.12 | North Shaft Terminus | SW 94726 62881 |

*Background*

*'The ropeway, with an installed capacity of 10 tons/hour, was carried on overhead pylons over the top of the hill and down to the mill, a distance of some 2,700 ft.. Above the mill a new unloading station and ore-bin was built .. a new overhead tramway was built from North Shaft to connect to the new bins… The ore was loaded into 4 cwt. capacity 'buckets' at South Shaft and hooked onto the ropeway'* (Brooks 2001, 63). The pylons were approximately 5-6m high. Jack Trounson, the Castle-an-Dinas mine surveyor took numerous photographs of the mine (see Bullen 2003, 55-80), and annotated the mine plans in 1957, when it closed.

*Survey*

Figure 15 shows the site of the south terminus when it was operational and Figure 23, its close relationship with the aerial ropeway steam engine (Site 10) and the ore from the ore-bin (Site 9). The site of the south terminus (Site 11.1) is shown as a 15m long, 6m wide, and 1.2m (max. depth) excavation. Lying close to the site of the aerial ropeway turnwheel is the remains of a shaft bearing. The site has been partially infilled through time. Bullen (2003, 75, 78) has reproduced some excellent photographs of this mechanism both at South Shaft and North Shaft taken by Jack Trounson.

There is very little site evidence of the aerial ropeway pylon bases (Sites 11.2 – 11.11). Figure 19, the 1952 aerial photograph is one of the best visual sources for these features, as evidence at ground level is scant. The rectangular concrete bases at many sites are possibly extant but have either been overgrown or possibly removed during ploughing or land management clearance (Sites 11.2 to 11.3 and Sites 11.7 to 11.10). Site 11.4 was covered over as part of a Scheduled Monument Management Project from 2008-2010 (Preston-Jones 2011). Sites 11.5 and 11.6 can be seen as 0.7m x 0.7m concrete bases. Site 11.11 is visible as a pair of protruding concrete pillars approximately 0.7m high (presumably from the concrete base), set within a barbed wire fence in the main lode cutting earthwork (containing two mine shafts (Sites 34 and 35).

The north site terminus (Site 11.12) is not visible. The equipment has all gone, as has any evidence of its former site.

*Recommendation*

The site of each terminus and the individual pylon bases should be retained if at all possible.

**Site 12 Lode outcrop collapse SW 94551 62103 to SW 94555 62111**

*Background*

The abandoned mine plan (MRO 15156), reproduced in part in Figures 4 and 5, shows how narrow the main wolfram lode was, the section (Fig 6), how deep the lode was. It is therefore not surprising that some localised collapse of the workings has occurred, it is perhaps demonstrated in a linear fashion to better effect on the north side of the hill (and subsequently fenced for long distances), but this site (and Fig 29) shows a surface collapse to great effect.

*Survey*

The linear collapse is 8m long and 3.5m wide, to a vertical depth of approximately 30m! (Fig 29). The area is safely fenced with timber posts and barbed wire. As Figure 29 shows, the narrow ground above No 1 Level has collapsed, revealing a few timbers across the sidewalls. The working is of course, directly aligned to South Shaft. Figure 6, a section of the mine shows the stoping that has occurred close to surface (under the word 'South Shaft'), and it is this section that has collapsed.

*Recommendation*

The collapse that has occurred at this site could occur at any point from north to south, however, the section shows that the stoping sites are closer to surface on the north side of the hillfort; an area of ground that already has much linear fencing.

*Figure 29 A view from the north of the surface collapse of the ground above the stope (Site 12) (© CC HE Projects)*

**Site 13 Concrete reservoir tank SW 94548 62139**

*Background*

For surface water, a small pump (supplying 4000 gallons per 24 hours) pumped water to the reservoir tank (Site 13).

*Survey*

The concrete block lined reservoir tank is still extant, is 8m long, 7m wide, and full of water, although it is densely overgrown. The top of the southern wall is 0.7m above ground level, whilst the northern wall is close to ground level. An iron outlet pipe set in the south east corner is visible, with a more modern galvanised steel water tank nearby (1.7m x 2.5m and 1m high).

*Recommendation*

This feature should be retained *in situ*. For the interest of industrial archaeologists, the vegetation could be removed.

**Site 14 Air Shaft SW 94576 62177**

*Background*

This air (or ventilation) shaft is shown on MRO 15156 (in section and plan). The section is reproduced in Figure 6.

*Survey*

The shaft opening is not visible (but it is presumably open). It is obscured by gorse and brambles. The site is securely fenced with timber posts and barbed wire.

*Recommendation*

This feature should be retained *in situ*. For the interest of industrial archaeologists, the vegetation could be removed.

**Site 15 Air Shaft SW 94585 62219**

*Background*

This air (or ventilation) shaft is shown on MRO 15156 (in section and plan). The section is reproduced in Figure 6.

*Survey*

The shaft opening is not visible (but it is presumably open). It is obscured by gorse and brambles. The site is securely fenced with timber posts and barbed wire.

*Recommendation*

This feature should be retained *in situ*. For the interest of industrial archaeologists, the vegetation could be removed.

## Castle-an-Dinas Hillfort

Note:

Information relating to Cornwall's Sites and Monuments record within the hillfort have been included as part of this report simply for context/reference purposes.

**Site 16 Castle-an-Dinas Hillfort** **SW 94552 62369 (centred)**

**SMR No. 21602** **Scheduled Monument No. 93**

*Background*

Castle-an-Dinas is a very large and roughly circular hillfort with four more or less concentric ramparts situated in an imposing position atop Castle Downs with extensive views over much of central Cornwall. The site is described by the antiquarians Leland, Carew, Norden, Hals and Tonkin, and many later authors, including a very full account by Henderson (1930). Bernard Wailes surveyed the site, carried out magnetometer and phosphate surveys, and excavated a few small trenches in the early 1960s for the University of Pennsylvania. His investigations have never been fully published, but appear as short interim reports in *Cornish Archaeology* (Wailes 1963, 1964, 1964). Excavation was limited in extent, but appeared to indicate that there had been a relatively brief period of occupation of the hillfort and only one minor phase of reconstruction of ramparts. All four ramparts were simple dumps of stone and earth derived from the ditches without any trace of revetment. The inner rampart (Wailes' rampart one) is the largest, and encloses an area 150m by 140m. The identification of six entrance gaps through the ditch prompted the suggestion that this may represent the remains of a Neolithic causewayed enclosure, or at least an earlier phase of enclosure, as a precursor to the Hillfort. Hals refers to a stone-covered causeway running south-west towards Trekenning, and Wailes discovered a cobbled entrance with slightly in-turned, stone-faced ramparts.

There appears to no longer be any visual impacts of the former wolfram mine affecting the setting of this monument. Figure 19, shows the site impacts whilst the mine was operating.

SM consent was granted for restoration work in July 1994 (Preston-Jones 1994). The Scheduling was revised in July 1997. A Management Agreement between English Heritage and Cornwall Heritage Trust continues for the care and maintenance of the site.

*Recommendation*

Famed in Cornish legend, one of the largest hillforts in Cornwall and remarkably well preserved, Castle an Dinas is also an imposing landscape feature in the care of Cornwall Heritage Trust. It is a popular venue for local people, dog walkers and visitors from far afield. The car park, located at the previous site of a mine waste tip for South Shaft, is the public car park, from which walkers access the monument. Improved visitor information relating to both the mine site and the hillfort would be appropriate.

Given its iconic status, it is vital that any development respects the setting and significance of this most impressive and accessible of Cornish hillforts.

**Site 17 Bronze Age barrow** **SW 94556 62334**

**SMR No. 21604** **Scheduled Monument No. 93**

17.1 Robbing pit SW 94551 62336

*Background*

One of two Bronze Age barrows that lie within the inner ramparts of Castle-an-Dinas. According to the OS who surveyed the site in 1972, it is a mutilated mound 17m across and 0.8m high. It might be the barrow 'opened' by W C Borlase in 1871.

*Survey*

This Bronze Age barrow can be seen to have been robbed – a common circumstance of the 19th century. There is a robbing pit in its centre and west side.

*Recommendation*

This feature is included within the Scheduling of the site as being of National importance.

**Site 18 Bronze Age barrow SW 94518 62389**

**SMR No. 21605 Scheduled Monument No. 93**

18.1 Robbing pit SW 94519 62389

*Background*

One of two Bronze Age barrows that lie within the inner rampart of Castle-an-Dinas.

*Survey*

It is sited close to the spring and boggy area (perhaps also a low point of the inner rampart), its base may have been added to by waste from quarrying or perhaps from Wailes' excavations in the 1960s. It is quite low and badly mutilated, with two random stones sticking out of it (which may have originally been a kerbed stone), and two pits in the surface suggest that it may also be the barrow 'opened' by W C Borlase in 1870.

This Bronze Age barrow can also be seen to have been robbed – a common circumstance of the 19th century. There is a robbing pit in its centre and north-west side.

*Recommendation*

This feature is included within the Scheduling of the site as being of National importance.

**Site 19 Viewing site and information board/cairn SW 94520 62382**

**Scheduled Monument No. 93**

*Survey*

A stone cairn has been erected some time in the recent past at this site. An information board is set into its top section. Surrounding the cairn is stone surface set at ground level and around the feature.

*Recommendation*

This feature should be retained *in situ*. It is presumably included within the Scheduling of the site as being of National importance.

**Site 20 Post-medieval quarry SW 94527 62401**

**SMR No. 21663 Scheduled Monument No. 93**

*Background*

A quarry in the interior of the hill fort at Castle-an-Dinas is marked on the Tithe Map of 1840 and the OS 6 inch map of 1963. It is visible on air photographs (Fig 22) and was plotted as part of the NMP.

*Survey*

The quarry is visible as a deep linear excavation, infilled with water when wet conditions prevail. It may be that this site was further affected by the Wailes excavations of the early 1960s (Wailes 1963).

*Recommendation*

This feature is included within the Scheduling of the site as being of National importance.

**Site 21 Possible site of Air Shaft SW 94607 62409**

*Background*

This air (or ventilation) shaft is shown on MRO 15156 (in section and plan). The section is reproduced in Figure 6. The detailed section plan (MRO 15156) shows that the shaft was infilled by the date of the final amendments made in 1957 by Jack Trounson.

*Survey*

The shaft opening is not visible. It has been located by a combination of measurement from the mine section and plan, fieldwork at ground level and assessment of aerial photographs (Fig 22). The site manifests itself as low mounds of grass and dips.

*Recommendation*

Even though the site does not show signs of earth movement, given the high frequency of site use by visiting members of the public, this shaft site should be fenced as a precaution. However, any fencing works will require Scheduled Monument Consent. It should be noted that there is a proposed geophysical survey of Castle an Dinas, which may shed further light on this feature (*Pers comm* Ann Preston-Jones). Therefore the nature and extent of any fencing should probably be determined by the results of the geophysical survey.

**Site 22 Site of reservoir tank SW 94660 62322**

*Background*

A reservoir tank is shown on the 1952 aerial photograph (Fig 19). It may have been of agricultural or perhaps mining-related function. In 2009, Scheduled Monument Consent was given to remove the walls of this feature, and to use the material to infill an eroded section of the hillfort's inner rampart bank. The following text has been reproduced from the resulting report (Preston-Jones 2011, 11):

*'The concrete water tank located in the outer ditch reflects agricultural improvement of the surrounding downs in the twentieth century. It therefore has significance in the history of the site, but is clearly not its most important attribute. The decision was therefore taken not to remove it entirely, but to leave the base in the ground and cover it over. This would have the further benefit of reducing the risk to the Iron Age ramparts that might have been posed by fully excavating out the tank.*

*Demolition of the tank was undertaken by John Hart on 8th February 2009; an archaeological watching brief was carried out by Dick Cole.*

*To minimise damage to the ground, the work was done using a tracked mini-digger. A tractor with trailer conveyed the demolition material to the point where it was to be used in restoring the rampart. The tank was not completely removed: only the parts that protrude above the ground were demolished; then the resulting platform was levelled, covered with soil, and left to re-vegetate naturally. No re-seeding or re-turfing was considered necessary since the location is relatively inconspicuous.*

*Two years later, the site now appears as a rectangular grass-covered platform where the former presence of the tank would hardly be suspected. Only the level platform in the ditch gives a clue to its existence'.*

*Recommendation*

Not applicable.

**Site 23 Air Shaft SW 94627 62476**

*Background*

This air (or ventilation) shaft is shown on MRO 15156 (in section and plan), and may have been the first shaft sunk on site by Mr Cox in 1916 (see Section 4.2). The section is reproduced in Figure 6.

*Survey*

The shaft opening is visible, although its edges are obscured by gorse and heather. The shaft site and its linear cutting (as shown on Fig 23, Site 24), has two fences, a rusty iron post with rusty barbed wire remnants, and a more recent secure timber post and barbed wire fence. The shaft opening is 2.4m x 1.8m and vertical (with visible shaft timbers), to a visible depth of approximately 20m.

*Recommendation*

This feature should be retained *in situ*, and fencing maintained.

## North Shaft mine complex

**Site 24 Adit portal (Cox's Level) SW 94633 62510**

*Background*

The site of this portal was determined by measurement from the abandoned mine plan and section (MRO 15156). The section is reproduced in Figure 6.

*Survey*

The entire length of this feature is fenced with barbed wire, and its interior overgrown with gorse, brambles and heather. It is not safely accessible. However, a linear cutting is visible running down its centre and some low spoil mounds. Given the close proximity of the top of the excavated lode (see Fig 6, the mine section), it is likely that further collapse has occurred along its narrow site (within the fence). Thus, the sites of the adit portals and shafts (shown on the site inventory plans) have been determined by measurement from the abandoned mine plan and section, rather than fieldwork.

*Recommendation*

This feature should be retained *in situ*, and fencing maintained.

**Site 25 Site of tramway to former (primary) mine waste dump**

**SW 94631 62491 to SW 94656 62529**

*Background*

The site of this feature has been recorded from early aerial photographs and the abandoned mine plan and section (MRO 15156).

*Survey*

This site is not visible, mainly a consequence of the site vegetation overgrowth of gorse and brambles. A tramway was built (by Mr Cox in *c.*1916), to take the excavated waste material from the primary working level (No 1 – see Fig 6, the mine section) to a mine waste dump. In fact Figure 19, the 1952 aerial photograph appears to show a smaller (later) tramway linear feature below this older site. The waste dump has either been removed or has eroded to a flatter profile.

*Recommendation*

This site should be retained and fencing maintained.

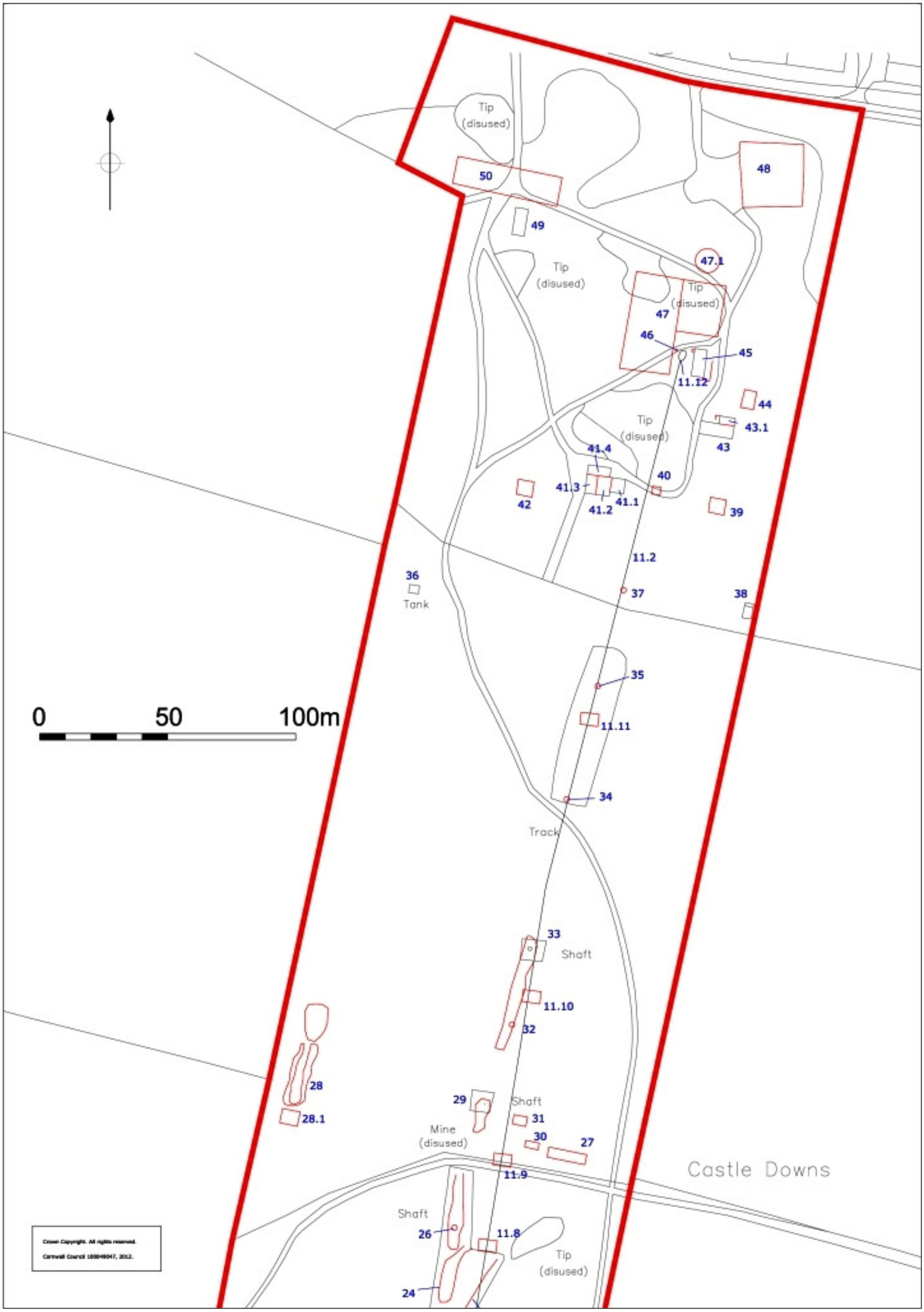


*Figure 30 Site inventory plan of North Shaft Mine*

**Site 26 (Air) Shaft SW 94637 62543**

*Background*

This air (or ventilation) shaft is shown on MRO 15156 (in section and plan). The section is reproduced in Figure 6.

*Survey*

The shaft opening is not visible (but is presumably open). It has been located by a combination of measurement from the mine section (Fig 6) and plan (Fig 5), fieldwork at ground level and assessment of an aerial photograph (Fig 22). The site manifests itself as low mounds of grass and dips.

*Recommendation*

Even though the site does not show signs of earth movement, it should be fenced as a precaution, and maintained.

**Site 27 Site of Smith's Shop and Dry SW 94678 62568**

*Background*

This was the first set of primary mine buildings constructed on the site by Mr Cox in approximately 1915. At that time, the lode had been proved from a shaft at Site 23, and accessed via a nearby adit (Site 24). Ancillary buildings (probably timber framed with corrugated iron roof and walls) were necessary for the miners, including a Smith's Shop to sharpen the tools and a Dry to permit changing (and possibly drying) facilities. These sites are shown in plan on Figure 5.

*Survey*

The site manifests itself as a rectangular building platform cut into the side of the sloping hill. It is approximately 12m long and 4.5m wide. The upslope bank is 0.5m high for the length of the building.

*Recommendation*

The site should be retained in its present condition.

**Site 28 Portal cutting and WWII Bunker SW 94572 62592 to SW 94577 62609**

28.1 Site of Magazine SW 94571 62590 **SMR No. 167287**

*Background*

The site of this portal was determined by a combination of fieldwork and reference to the abandoned mine plan and section (MRO 15156). Again, this would have been the primary site of the mine magazine. The site after this date appears to have been used to site another exploratory drive and crosscut – perhaps extending west in search of a parallel lode. The earthwork is shown on aerial photographs from 1946 onwards (Fig 19). On the east side of this site was an operational bunker for the St Columb Major Resistance Patrol. *'It was built into the mine workings at the Castle-an-Dinas wolfram mines. A chamber was built into a tunnel measuring 16ft by 10ft. It was fitted out with bunks and so on however, no emergency exit was constructed. Explosives such as gelignite and dynamite were also stored in the bunker'* (SMR No. 167287 description).

*Survey*

All features are overgrown with brambles and gorse, although the site is visible as a partially infilled linear depression (0.5m deep for a length of 15m). There is no site fencing, and the sites of the magazine and bunker are not visible. The WWII bunker may have been sited in an old mine tunnel cut west from the main lode (as shown on the mine plan: 15156) but accessed from the portal cutting, west of the site.

*Recommendation*

This small site includes the original location of the mine magazine, a possible entry to the WWII bunker and a portal cutting. An opportunity to access the WWII bunker may be advantageous for interested WWII historians – although there should be safety concerns due to mining remains.

**Site 29 Possible Shaft/collapse SW 94648 62590**

*Background*

The site of this feature is not shown on MRO 15156 (in section and plan). The section is reproduced in Figure 6. Refer to Site 24, which describes how the actual location of shafts and adit portals has been calculated from the mine plan. This site is labelled by the OS as a shaft – which it could be, but not necessarily sunk as part of the mine, rather a collapsed section of upper stoping (no doubt to a substantial depth).

*Survey*

The feature opening is not visible (but presumably open), and is obscured by gorse and brambles. The site is securely fenced with timber posts and barbed wire

*Recommendation*

Even though the site does not show signs of earth movement, it should be fenced as a precaution, and maintained.

**Site 30 Site of Store SW 94667 62573**

*Background*

This was the first set of primary mine buildings constructed on the site by Mr Cox in approximately 1915. At that time, the lode had been proved from a shaft at Site 23, and accessed via a nearby adit (Site 24). Ancillary buildings (probably timber framed with corrugated iron roof and walls) were necessary for the miners, including a mine store (for a number of necessary items). This site is shown in plan on Figure 5.

*Survey*

This site is not visible at ground level. It originally measured approximately 2.5m x 3m in plan.

*Recommendation*

The site should be left undisturbed, as there may be below ground remains.

**Site 31 Site of mine office SW 94662 62584**

*Background*

This was the first set of primary mine buildings constructed on the site by Mr Cox in approximately 1915. At that time, the lode had been proved from a shaft at Site 23, and accessed via a nearby adit (Site 24). Ancillary buildings (probably timber framed with corrugated iron roof and walls) were necessary for the miners, including a mine office. This site is shown in plan on Figure 5.

*Survey*

This site is not visible at ground level. It originally measured approximately 3.5m x 3m in plan.

*Recommendation*

The site should be left undisturbed, as there may be below ground remains.

**Site 32 Adit portal (No. 1 Level) SW 94662 62625**

*Background*

The site of this portal was determined by measurement from the abandoned mine plan and section (MRO 15156). The section is reproduced in Figure 6.

*Survey*

The entire length of this feature is fenced with barbed wire, and its interior overgrown with gorse, brambles and heather. It is not safely accessible. However, a linear cutting is visible (1 to 1.5m deep) running down its centre and some low spoil mounds on either side. Given the close proximity of the top of the excavated lode (see Fig 6, the mine section), it is likely that further collapse has occurred along its narrow site (within the fence). Thus, the sites of the adit portals and shafts (shown on the site inventory plans) have been determined by measurement from the abandoned mine plan and section, rather than fieldwork.

*Recommendation*

This feature should be retained and fencing maintained.

**Site 33 (Air) Shaft SW 94669 62649**

*Background*

This air (or ventilation) shaft is shown on MRO 15156 (in section and plan) at the northern end of No. 1 level. The section is reproduced in Figure 6.

*Survey*

The shaft opening is not visible (but it is presumably open). It is obscured by gorse and brambles. The site is securely fenced with timber posts and barbed wire.

*Recommendation*

This feature should be retained *in situ*. For members of the public with an interest in industrial archaeology, the vegetation could be removed.

**Site 34 (Air) Shaft SW 94681 62710**

*Background*

This air (or ventilation) shaft is shown on MRO 15156 (in section and plan). The section is reproduced in Figure 6.

*Survey*

The shaft mouth is not visible (but it is presumably open) at the south end of a linear fenced area, a consequence presumably of further ground instability along the lode outcrop. All features are obscured by gorse and brambles. The site is securely fenced with timber posts and barbed wire.

*Recommendation*

This feature should be retained *in situ*. For members of the public with an interest in industrial archaeology, the vegetation could be removed.

**Site 35 (Air) Shaft SW 94695 62753**

Refer to details given for Site 34.

**Site 36 (Modern) reservoir tank SW 94622 62791**

*Background*

This feature appears to provide water to the nearby farm. Water is electrically pumped into the concrete block water tank, which then (given its siting uphill of the farm), runs by gravity feed to the farm. It has been at this site since the 1980s.

*Survey*

A pump house with locked doorway is sited over the reservoir tank, which also has a manhole access. The outer dimensions are 4m x 3m. The downslope height of the tank is 1m.

*Recommendation*

Not applicable.

**Site 37 Adit portal (No. 2 Level) SW 94704 62791**

*Background*

The site of this portal was determined by measurement from the abandoned mine plan and section (MRO 15156). The section is reproduced in Figure 6, and the plan in Figure 4.

*Survey*

This site was not located at ground level. It may have been infilled when this northern part of the site had its waste dump removed and ground levelled.

*Recommendation*

The site should be monitored for ground movement.

**Site 38 Water reservoir SW 94752 62782**

*Background*

This feature appears to provide water for agricultural purposes, although its use from an earlier period for mining cannot be discounted.

*Survey*

Again, built of concrete block, this is 3.6m wide and 5.8m long, including a separate section at its north end. It is full of water and dense brambles, but appears to be 0.9m deep, with the downslope wall 1m above ground level.

*Recommendation*

Not applicable.

**Site 39 Site of Smithy SW 94740 62826**

*Background*

The roof and chimney (on the west gable end) of this building can be seen in Figure 7 (behind the Miners' Dry - Site 43). This was the smithy for the second phase of the mine's history (prior to construction of the South Shaft mine site from 1942).

*Survey*

This building is no longer extant.

*Recommendation*

Not applicable.

**Site 40 North Shaft SW 94718 62829**

*Background*

North Shaft was first sunk in the mid 1930s. It extended to a depth of approximately 60m vertically to No 5 (or 'Intermediate') Level (MRO 15156). The shaft was *'8ft. 10ins. by 5ft. 10ins. outside the timbers and was divided into two compartments'* (Brooks 2001, 37). One compartment for ladderway access, the second for a winding cage which could carry a single wagon or six men. *'Ore and waste were hoisted (by the winding engine – Site 41), to a platform, or discharge level, 15ft. above the collar of the shaft. The ore was dumped into a bin and thence trammed into the mill via the rail track from No. 2 Level. Waste was trammed across a gantry and tipped on the waste dump'* (*op cit*, 38).

Figure 7 shows the headgear timbers over the shaft – with a gangway from this to the adjacent ore bin and waste tip.

*Survey*

North Shaft is visible as a linear (east-west excavation), 6m long, 2m wide and 1.2m deep. The landowner has stated that it has been capped at approximately 3m below ground level. There is no sign of any ground instability. The site is not fenced.

*Recommendation*

Although the shaft is capped at depth, it may be appropriate to fence this site. A public footpath runs down the eastern side of the site.

**Site 41 Steam winder house/boiler houses SW 94696 62832 (centred)**

| | |
|---|---|
| 41.1 Steam winder house | SW 94701 62831 |
| 41.2 Boiler House | SW 94695 62831 |
| 41.3 Auxiliary boiler house | SW 94691 62832 |
| 41.4 Coal store ? | SW 94693 62837 |

*Background*

Material from North Shaft was wound to the surface by a steam winding engine mounted in a building west of the shaft. The hoist/winding mechanism was a large converted twin cylinder ship's winch, single geared with a 3ft 6ins. diameter drum fitted with a 1ins. wire rope. Steam at 120lbs per sq. ins. was generated by two locomotive type boilers (Brooks 2001, 37). Refer to Appendix 10.2.1 for annotated survey elevations and plan of this building.

*Description*

The building is a sound, single-storey structure which once housed two boilers and the winding engine (Fig 31). The original structure consisted of the winder house (Site 41.1) and an adjoining structure for a single locomotive-type boiler (Site 41.2). This was later extended on the west side so that a second boiler could be accommodated (Site 41.3). However, the second boiler was not eventually needed and this was later moved to the South Shaft site (to be incorporated inside Site 4). On the north side of the two boiler houses is a large rectangular space which is likely to have been a coal store for the boilers (Site 41.4).

The rooflines reflect the development of the site as the earlier boiler house and winder house are beneath a single roof structure. The second boiler house was built with a parallel roof, while the area of the coal store was probably roofed over later, when the building was adapted for agricultural use. The building is now used as an animal shelter.

The footings and lower walls of this building are built of rendered concrete block-work. Upper walls are built of timber framing with corrugated asbestos sheet outer cladding. In

places the original sheeting has been replaced with modern corrugated cladding. The former coal yard has walls of galvanised iron sheeting and a roof of modern corrugated sheets.

*Site 41.1 Steam winder house*

The part of the building which housed the steam winding engine is a roughly square room space set at a higher level than the boiler houses. This is presumably for the engine's plinth and holding down bolt arrangements. At the time of the site visit the floor was largely covered in dung and straw so little of the floor could be seen. Nevertheless traces of a rectangular plinth were visible close to the east wall, beneath a dormered structure which was once a window and the cable entry to the pulleys on the head-frame. Concrete steps with moulded grips lead down to the adjoining boiler houses.

*Site 41.2 Boiler house*

A rectangular building which once housed a locomotive-type boiler. As the floor was deeply covered in dung and straw at the time of the site visit no features could be seen. The party wall between the two boiler houses was once on the exterior, before the auxiliary boiler house was built on the west side. This wall has a vertical iron stanchion built in, and a corresponding buttress on the (once) exterior face; the purpose of these is not known.

A photograph published by Bullen (2003, 64) shows the main boiler house before the second boiler house was built alongside. Another slightly later photograph shows the two boiler houses in use, with smoke escaping from the two iron chimneys.

*Site 41.3 Auxiliary boiler house*

This was added to the west side of the main boiler house and built under a separate roofline, forming a valley roof with the main structure. As the floor of the building was deeply covered in dung and straw at the time of the site visit no features could be seen.

*Figure 31 Winding engine house complex (Site 41) east side showing the opening for the winding wire (© CC HE Projects)*

*Site 41.4 Coal store*

A rectangular space adjoining the north side of the two boiler houses was probably originally a coal store, sited at the firing/stoking end of the two boilers. It appears to have originally been open, and was roofed over when converted to an animal shelter.

*Recommendations*

The building has been reused as an animal shelter and this has assisted its survival. Periodic removal of straw and dung should permit better visibility of any surviving plinths/foundations for boilers and the steam winder.

**Site 42 Site of mine reservoir SW 94666 62825**

*Background*

Figure 4 shows the site of this rectangular tank. This would have provided water for the mill (Site 47). *'Water to supply the mine was pumped from the valley on the north side of the hill by means of the Tangye three-throw ram pump that delivered 3,600 gallons per hour, and was driven by a 12hp semi-diesel oil engine. The water was delivered into a small reservoir* (this site) *which held 2,000 gallons and the overflow was piped to the main reservoir* (Site 48) *which could hold 67,000 gallons. Water for use underground, for the steam boiler, for the air compressor, Lister oil engine cooling tanks, and for the Willoughby concentrator was drawn from the main reservoir'* (Brooks 2001, 43).

*Survey*

This site is no longer extant, although there is some slight evidence on the ground for this former site, although most is obscured by vegetation.

*Recommendations*

The site should be retained.

**Site 43 Miners' dry SW 94740 62853**

43.1 Wash room SW 94743 62856

*Description*

A single storey building which is L shaped in plan. It comprises an original east-west oriented range, with a washroom added parallel to the northeast corner.

Entry is by a doorway leading into the washroom from a now roofless lobby. Another doorway leads from the washroom into the main range. Examination of the east wall shows that the gable of the washroom has been added to the main range. This suggests that the washroom probably relates to the final operation of the mine from World War 2 whereas the main range may date from an earlier episode.

Like other buildings at Castle-an-Dinas Mine, the miners dry is built of externally rendered block-work. Unusually the west gable is of plain block-work, suggesting it may originally have been clad to make it weatherproof from the prevailing wind. The roof of the main range is entirely missing and that on the washroom is slowly collapsing. Surviving roof materials are corrugated asbestos sheets on softwood trusses. Refer to Appendix 10.2.2 for annotated survey elevations and plan of this building, and Figure 32 for an image of the wash room.

*Site 43 Main range of Miners dry*

The principal range was lit by windows in the north and south walls (those on the north wall have been blocked). A small fireplace is extant in the centre of the west gable. Remains of a block-work partition wall survive in the main range. This divided the range into two rooms, the east room having the doorway from the washroom and the west

room containing the fireplace. The floors of the main range are entirely grown over with vegetation.

*Site 43.1 Washroom*

The washroom survives relatively well and the principal features are slate surrounds for inset basins (the basins themselves all missing). Beneath the basins are built–in drainage channels. An iron flue pipe exits from the east gable so there is likely to have been a small stove/boiler sited here. There are windows in the north and east gable walls and parts of the internal wooden frame survive in the westernmost window opening (Fig 32).

*Recommendations*

Although ruinous the main range of the former miners dry is in relatively stable condition. The interior of the main range was overgrown with light vegetation and this needs periodic control.

The washroom roof is slowly collapsing as the ridgeline timbers have failed. It may be appropriate to remove the remainder of this roof for safety reasons and for security of the masonry structure. However, removal of the roof would expose other elements, such as the surviving wooden door, to become subject to increased weathering and accelerated decay. It may be appropriate to search for grant aid to enable complete re-roofing of the building – as a long-term preservation measure.

*Figure 32 A view from the east of the Miners' Dry wash house (Site 43.1) (© CC HE Projects)*

**Site 44 Site of mine office SW 94753 62864**

*Background*

The northern gable end of this building is shown on the left side of Figure 7. It appears to have been constructed of concrete block with a corrugated steel roof.

*Survey*

This site is not visible. It originally measured approximately 4m x 3.5m in plan. A low mound of rubble marks its former site.

*Recommendation*

The site should be left undisturbed, as there may be below ground remains.

**Site 45 Mill engine house SW 94733 62880**

*Background*

The mill engine house is now all that remains of the former mine's processing plant that once dominated this part of the hillside. This building is shown under construction in a photo published by Bullen (2003, 63). There are also surviving blueprints of the building including an original plan showing the layout for the intended engine and drive (reproduced in Fig 17). The diesel engine installed in this house was to replace a gas engine previously used to drive the mill/processing plant:

*'The mill was normally run for two shifts per day… with one 10 hour shift on a Saturday, and was capable of treating approximately 60 tons of ore during these two shifts, from which about 15 cwt. of marketable concentrate was obtained, giving an average value for the mine ore, at this time, of 28 lbs of wolfram per ton'. All mill machinery was driven by a 65 HP Tangye gas engine, the gas being generated on the premises from anthracite. An 8HP Lister oil engine drove a DC dynamo which generated current at 100 volts for lighting purposes in the mill, and other surface building's* (Brooks 2001, 42).

Refer to Appendix 10.2.3 for annotated survey elevations and plan of this building.

*Description*

The engine house is a single-storey rectangular building built of block-work with a corrugated sheet roof, hipped at both ends. As the building is levelled into a slope, there is a substantial foundation plinth at the northern end, where there is also a stepped access to the doorway. This doorway was once closed off by a sliding door supported on a track. There are two windows in the south and east wall but the west wall only has a single smaller window as the drive from the engine to the mill also exited on this side.

Two horizontal steel girders emerge from the higher part of the east wall; these once supported a water tank used to cool the engine. According to the engine layout drawing a further tank was once situated at ground level. Close to the northwest corner is a small lean-to with a concrete roof. This once housed the exhaust pipe and silencer for the engine.

Inside the structure little could be seen at the time of the visit as it was in use to store hay bales. The scar of an infilled plinth was visible near the entrance and there is an unusual moulded concrete foundation, most likely for a tank, inside the northwest corner. The channel for the exhaust pipe could also be seen heading into the lean-to. Ironwork above head height in the building probably once supported a travelling crane used to service the engine. Figure 8 is a view of this building from the north.

*Recommendations*

The mill engine house has been kept relatively watertight due to its reuse as a hay-barn. Such use would secure its foreseeable future. This building appears to be in relatively good condition and the only significant part that is missing – aside from its original contents - is the sliding door and supporting rollers that once secured the northern end.

Although inaccessible and not fully recorded during this study it appears likely that the function of the building would still be discernable from traces of plinths and other features that survive.

The original eaves boards have largely disappeared, exposing brickwork beneath. It would be appropriate to replace the boards, to enable better weatherproofing of the structure.

### Site 46 Portable iron magazine SW 94729 62885

*Background*

*'Sitting amongst the sad remains of what was the mill is a small 'portable' steel explosives magazine, presumably left from the prospecting works in the 1970s'* (Brooks 2001, 105).

*Survey*

The container is sited close to the concrete base for what was possibly the aerial ropeway terminus or part of a dressing mill loading foundation. The steel feature has a main front opening approximately 1.25m high and 1m wide. It is 1.3m deep. It has welded lugs front and back each side to transport it.

*Recommendation*

The feature should be retained in its present condition.

### Site 47 Site of wolfram mill (and Carpenters' Shop) SW 94726 62900

47.1 Site of large buddle SW 94738 62912

*Background*

*'The ore was trammed from the headgear to the crusher house, where it was passed over a grizzley. The oversize was broken up in an Edgar Allen jaw crusher after which it joined the undersize from the grizzley in the mill ore bin. From here it was wet fed into sets of high speed crushing rolls which reduced it to a quarter inch cube and under'* (*op cit,* 38). The material was then passed into jigs (Hartz and Green's), separated into 'Heads, Middles or Tails' then sent to the Willoughby Concentrator, before going to the Sand Tables and buddles. During the 1930s, the mill was run for two shifts per day and was capable of teating approximately 60 tons of ore during these two shifts, from which about 15 cwt of marketable concentrate was obtained, giving an average value for the mine ore, at this time of 28 lbs of wolfram per ton. All mill machinery was driven by a 65 hp Tangye gas engine, the gas being generated on the premises from anthracite (Brooks 2001, 42). An external photograph of this large building is reproduced in Brooks (2001, plate 29, 81). Figure 4 (MRO 15156) is a plan of the building.

*Survey*

This site is not visible as a large high extant structure, although a section of waste dump is visible near Site 46 with concrete foundations, and an adjacent concrete block wall 1.9m high, possibly related to this building. Figure 4 shows a large buddle to the north of the building, as well as smaller buddles to the west – all of which are no longer visible. There is very little surface evidence for the existence of this large structure, nor the layout of its interior (machinery plinths, etc).

*Recommendation*

The site should be retained and ground undisturbed, as there may be below ground remains (especially of piped water ways etc).

**Site 48 Main reservoir pond SW 94760 62954**

*Background*

Refer to Site 42 background account.

*Survey*

This site bears little resemblance to its former status as a large reservoir pond holding 67, 000 gallons of water. Only a remnant of the east and south east bank remains as a 0.9m high bank overgrown with vegetation and trees, the remainder has been removed.

*Recommendation*

The site should be retained in its present condition.

**Site 49 Site of building SW 94663 62935**

*Background*

This building footprint is shown on OS maps. Its function is unknown but is of similar proportion to a garage. This site is not visible on the 1946 aerial photograph (Fig 18).

*Survey*

This site has no upstanding walls – simply a concrete floor or hard-standing. It may post date the mine.

*Recommendation*

The site should be retained in its present condition.

**Site 50 Site of settling tanks SW 94649 62954 (centred)**

*Background*

These features are shown on the 1946 aerial photograph (Fig 18). They appear to be two sites of linear settling tanks (probably concrete block walled). They would have been used to settle contaminated mill water before it was released back into the reservoir pond.

*Survey*

These sites are no longer visible. In fact trenches have been excavated at the western end of this site – possibly as part of a site drain run-off.

*Recommendation*

The site should be retained in its present condition.

## 5.3 Summary management table of archaeological sites

A descriptive site significance rating, Low (L), Medium (M) and High (H), has been applied to every site inventory entry in Section 5.3, the site inventory and summary management table. The descriptive significance rating within the site includes the elements: feature condition, survival, complexity, context and rarity value. However, the final significance grading may also be skewed by a further comparative rating with other sites in the locality. Note that a Low significance rating does not imply that the site can or should be impacted or otherwise affected to any greater degree than a High significance site.

| Site No. | Feature | NGR (SW) | Recommendations | S (Rating) |
|---|---|---|---|---|
| **Castle-an-Dinas Mine (South site)** | | | | |
| **1** | **Tresaddern Bungalow** (former Mine Captain's House) | 94568 62019 | Privately owned. | M |
| **2**<br>2.1<br>2.2 | **Mine office**<br>Mine office<br>Lean-to | 94568 62036<br>94568 62036<br>94568 62038 | Some sections of roof covering and floorboards should be replaced. There are instances of rising damp. | H |
| **3**<br>3.1<br>3.2<br>3.3<br>3.4<br>3.5<br>3.6<br>3.7 | **Winding engine house, Boiler house and Dry**<br>Steam winder house<br>Boiler House<br>Flue and chimney base<br>Miner's Dry<br>Steam capstan house<br>Site toilet<br>Site of buildings (former Lamp Room?) | 94545 62051<br>94543 62058<br>94549 62053<br>94551 62041<br>94541 62047<br>94546 62061<br>94537 62044<br>94534 62047<br>94534 62054 | Some sections of roof covering and all floorboards to the winder house should be replaced. There are instances of rising damp. | H |
| **4** | **Auxiliary boiler house** | 94556 62051 | Site not inspected internally. Dense vegetation obscures access. | H |
| **5**<br>5.1<br>5.2<br>5.3<br>5.4 | **Forge/Carpenters' Shop**<br>Carpenters' Shop<br>Blacksmiths' Shop<br>Store ?<br>Site of shed | 94515 62056<br>94519 62054<br>94510 62056<br>94515 62056<br>94521 62049 | Site is in a relatively stable condition. Site to be retained, undisturbed. | H |
| **6** | **Magazine** (Powder House and detonators) | 94468 62058 | Site to be retained, undisturbed | M |
| **7**<br>7.1<br>7.2<br>7.3<br>7.4<br>7.5<br>7.6<br>7.7 | **Diesel Engine and Compressor House**<br>Lean-to (Electric generator?)<br>Platform/ramp (water tank)<br>Platform (for water tank)<br>Balance bob pits<br>Buttress<br>Concrete water tank<br>Compressed air reservoir footings | 94528 62077<br>94520 62070<br>94517 62079<br>94521 62085<br>94542 62078<br>94553 62076<br>94540 62075<br>94516 62075<br>94534 62068 | Some sections of roof covering should be replaced. There are instances of rising damp. Some original glass panes have been broken and should be replaced. | H |
| **8**<br>8.1 | **South/New Shaft** (and headframe)<br>Site of (Footway Shaft) | 94550 62076<br>94551 62081 | Monitor for any ground movement. | M |

| Site No. | Feature | NGR (SW) | Recommendations | S (Rating) |
|---|---|---|---|---|
| **9** | **Site of concrete ore bin** | 94560 62075 | Site to be retained, undisturbed. | L |
| **10** | **Site of Aerial Ropeway steam engine house** | 94565 62078 | Site to be retained, undisturbed | L |
| **11**<br>11.1<br>11.2<br>11.3<br>11.4<br>11.5<br>11.6<br>11.7<br>11.8<br>11.9<br>11.10<br>11.11<br>11.12 | **Aerial Ropeway**<br>South Shaft Terminus<br>Aerial Ropeway mounting<br>Aerial Ropeway mounting<br>Aerial Ropeway mounting<br>Aerial Ropeway mounting<br>Aerial Ropeway mounting<br>Aerial Ropeway mounting<br>Aerial Ropeway mounting<br>Aerial Ropeway mounting<br>Aerial Ropeway mounting<br>North Shaft Terminus | 94568 62077<br>94568 62077<br>94582 62160<br>94595 62234<br>94607 62292<br>94616 62328<br>94625 62387<br>94639 62461<br>94650 62534<br>94653 62568<br>94669 62633<br>94691 62738<br>94726 62881 | Sites to be retained undisturbed. | M |
| **12** | **Lode outcrop collapse** | 94551 62103<br>94555 62111 | Monitor for any additional ground movement | M |
| **13** | **Concrete reservoir tank** | 94548 62139 | Site to be retained, removal of vegetation will aid interpretation. | M |
| **14** | **(Air) Shaft** | 94576 62177 | Monitor for any ground movement. | H |
| **15** | **(Air) Shaft** | 94585 62219 | Monitor for any ground movement. | H |
| **Castle-an-Dinas Hillfort** | | | | |
| **16** | **Castle-an-Dinas Hillfort** | 94552 62369 | Site managed by Cornwall Heritage Trust for EH. | H |
| **17**<br>17.1 | **Bronze Age barrow** (south east)<br>Robbing pit | 94556 62334<br>94551 62336 | Site managed by Cornwall Heritage Trust for EH. | H |
| **18**<br>18.1 | **Bronze Age barrow** (north west)<br>Robbing pit | 94518 62389<br>94518 62389 | Site managed by Cornwall Heritage Trust for EH. | H |
| **19** | **Viewing site** | 94520 62382 | Site managed by Cornwall Heritage Trust for EH. | L |
| **20** | **Post-med quarry** | 94527 62401 | Site managed by Cornwall Heritage Trust for EH. | L |
| **21** | **Possible (Air) Shaft** | 94607 62409 | Monitor for any ground movement. | M |
| **22** | **Site of concrete reservoir tank** | 94660 62322 | Site managed by Cornwall Heritage Trust for EH. | L |
| **Castle-an-Dinas Mine (North site)** | | | | |
| **23** | **(Air) Shaft** | 94627 62476 | Assess hazard, fence if necessary | H |
| **24** | **Adit portal (Cox's level)** | 94633 62510 | Site to be retained, | H |

| Site No. | Feature | NGR (SW) | Recommendations | S (Rating) |
|---|---|---|---|---|
| | | | undisturbed | |
| **25** | **Tramway to former dump** | 94631 62491<br>94656 62529 | Site to be retained, undisturbed | H |
| **26** | **(Air) Shaft** | 94637 62543 | Site to be retained, undisturbed | M |
| **27** | **Site of Smith's Shop and Dry** | 94678 62568 | Site to be retained, undisturbed | H |
| **28**<br><br>28.1 | **Portal cutting** (X cut drive?)<br><br>Site of magazine | 94572 62592<br>94577 62609<br>94571 62590 | Monitor for any ground movement. | H |
| **29** | **Possible Shaft/collapse** | 94648 62590 | Monitor for any ground movement. | M |
| **30** | **Site of store** | 94667 62573 | Site to be retained, undisturbed | L |
| **31** | **Site of mine office** | 94662 62584 | Site to be retained, undisturbed | L |
| **32** | **No 1 level Adit portal** | 94662 62625 | Monitor for any ground movement. | H |
| **33** | **(Air) Shaft** | 94669 62649 | Monitor for any ground movement. | H |
| **34** | **(Air) Shaft** | 94681 62710 | Monitor for any ground movement. | H |
| **35** | **(Air) Shaft** | 94695 62753 | Monitor for any ground movement. | H |
| **36** | **(Modern) reservoir tank** | 94622 62791 | Not relevant. | L |
| **37** | **No 2 level Adit portal** | 94704 62791 | Monitor for any ground movement. | H |
| **38** | **Reservoir tank** | 94752 62782 | Site to be retained, undisturbed | L |
| **39** | **Site of Smithy** | 94740 62826 | Site to be retained, undisturbed | L |
| **40** | **North Shaft** | 94718 62829 | Monitor for any ground movement. | M |
| **41**<br>41.1<br>41.2<br>41.3<br>41.4 | **Steam Winder house and boiler houses**<br>Steam Winder house<br>Boiler house<br>Auxiliary Boiler house<br>Coal store (?) | 94696 62831<br><br>94701 62831<br>94695 62831<br>94691 62832<br>94693 62837 | Site to be retained, undisturbed | H |
| **42** | **Site of reservoir tank** | 94666 62825 | Site to be retained, undisturbed | L |
| **43**<br>43.1 | **Miner's Dry**<br>Wash room | 9474062853<br>94743 62856 | If funding permits, re-roof building and remove vegetation to aid site preservation. | H |
| **44** | **Site of Mine office** | 94753 62864 | Site to be retained, undisturbed | L |
| **45** | **Diesel Mill engine house** | 94734 62879 | Site to be retained, undisturbed | H |
| **46** | **Portable iron magazine** | 94729 62885 | Site to be retained, undisturbed | M |

| Site No. | Feature | NGR (SW) | Recommendations | S (Rating) |
|---|---|---|---|---|
| **47**<br><br>47.1 | **Site of Wolfram Mill** (and Carpenters' Shop)<br>Site of buddle | 94726 62900<br><br>94738 62912 | Site to be retained, undisturbed | L |
| **48** | **Mill reservoir pond** | 94760 62954 | Site to be retained, undisturbed | L |
| **49** | **Site of mine building** | 94663 62935 | Site to be retained, undisturbed | L |
| **50** | **Site of settling tanks** | 94649 62954 | Site to be retained, undisturbed | L |

# 6 Significance

Within the landscape character of the area, Castle-an-Dinas hill is seen as a distinctive landscape feature, topped by one the most significant and well preserved Iron Age hillforts in Cornwall. English Heritage has previously reflected its national significance by designating the site as being worthy of consideration as a Scheduled monument, (i.e. of national importance).

## 6.1 Castle-an-Dinas Wolfram Mine

Castle-an-Dinas mine, unusually sited on two sides of a hill with a central lode, is the most significant 20th century wolfram mine in Cornwall, if not the south west, the only one to specifically focus on Tungsten production. As a result it was the country's main producer for a number of years when tungsten was in high demand (during world conflict). Few complete mines specialising in tungsten production exist to this extent, none to this degree in Cornwall. Its buildings, a high percentage still preserved at both sites, represent a late but significant chapter of Cornish mining and the associated mining technologies used in Cornwall in the early to mid 20th century. The survival of so many different building forms, on both sides of the hill gives the complex added significance of group value. The mine was recommended by consultants to be assessed for Scheduling (MPP Step 4 in 1998), as a nationally important site.

## 6.2 Castle-an-Dinas hillfort

Castle-an-Dinas is one of the largest and best-surviving hillforts in Cornwall, and without doubt one of the County's most outstanding monuments (hence the Scheduling as a nationally important monument). Despite past problems with localised erosion and scrub and bracken infestation, a progressive management regime has reduced site and visitor erosion. It has previously been impacted upon by the mid 20th century wolfram mine, but this is now hard to see, and no longer affects the setting of the monument. Being one of the best-preserved and arguably the most famous hillfort in Cornwall, giving spectacular views across the countryside and in the ownership of a charitable trust, Castle-an-Dinas has high historic, archaeological potential and public amenity value.

# 7 Management recommendations

The following management recommendations form a broad range of site assessment, building conservation guidelines, site management and maintenance guidelines and recommendations for further archaeological interventions, all of which should be taken into account during any future project implementation stage. The present landowner has intimated that there are current plans to reuse or adapt the former South Shaft buildings described in this report.

## 7.1 General recommendations

- Appropriate building conservation works to significant buildings would minimise further structural deterioration and preserve the sites for future generations.
- Consultation between any project developer and the relevant agencies should form a cohesive overall site project and conservation plan that not only conserves and protects the main significant site assets, but does this in a way that preserves the setting and character of the site.
- The current condition of the mine buildings are described in the Site Inventory (Section 5.2, and summarised in Section 5.3). The highest priority of remediation works relate to Sites 3 (Winder and boiler house: roof and Winder house floor), Site 7 (Engine house: roof and rising damp in walls), and Site 43 (Miners' Dry and wash room: roof collapsed. If building conservation works are not carried out in the near future, further structural deterioration of some significant buildings (Sites 3, 7, and 43 in particular), may well mean either further collapse or increasing damp problems which will exacerbate structural issues.
- Given the detailed results of this report, it is recommended that both the north and south sites be (re) considered for assessment for Scheduling by English Heritage.
- Due to the complexity of the management options available for this site, and the variety of variable end options, it may be advisable to hold a meeting with all statutory and non statutory organisations involved with this project after production of this report to further clarify options and enable the project to proceed.

## 7.2 Statutory designation of Castle an Dinas Wolfram Mine

Castle-an-Dinas Wolfram Mine was (in 1998), chosen as a candidate site of such significance to Cornwall (if not the country), that it was recommended to be on a list of sites for assessment for potential Scheduling by English Heritage (MPP Step 4). Due to other priorities (especially as the site was not at any immediate risk), the Scheduling assessment work was not carried out. However, the site remains as significant today as it was a decade ago, and may still be considered a prime candidate for Scheduling. However, this designation may not necessarily guarantee funding for long-term (structural) preservation of the mine (although some funding could be available if the buildings are at risk). Current EH policy (from a development context), given that the site has been identified as being potentially of national importance, is that this information should guide its handling during the planning process with emphasis being on understanding the significance of the site and mitigating the application accordingly.

## 7.3 Future management options

The landowner utilises the northern part of the mine as land for grazing, storage of hay (Site 45), and a cattle barn (Site 41). The landowner does not currently use the empty southern site buildings. As a result (through lack of use), the buildings are slowly deteriorating: the roof covering breaking and cracking, vandalism has resulted in broken windows, and dampness (including rising damp), is pervading each structure causing internal concrete block exfoliation, whilst timber floor joists and floorboards are deteriorating (some too dangerous to walk on). Any future management options should necessitate in the short-term, rectification of the above issues and vulnerabilities, which if not ameliorated will soon start to affect the structural integrity of the site.

NE, under a stewardship scheme may possibly be able to fund both production of a Conservation Management plan and a project to conserve the buildings for another generation, and provide improved site interpretation. However, if EH schedule the site, and it is at 'risk', funds from EH budgets could be applied for to fund repairs, etc. However, these options would <u>not</u> ameliorate long-term issues of lack of use (causing dampness), nor possibly vandalism (given the proximity of the public car park adjacent).

Another option, namely for adaptive reuse, could provide not only short-term conservation but also a longer term opportunity to manage the site and preserve the buildings, albeit with a different functional use. This could not be funded by NE (nor EH), rather by another agent, for adaptive reuse for domestic occupation (either holiday or leased accommodation). This would have the advantage of meeting short and long-term conservation management goals (to preserve the building form, setting and group value of the site). However, depending on the specifications for the adaptive re-use of the mine buildings, it may not accentuate and improve the character of the mine site, nor possibly the setting of the nearby hillfort, to which people frequently visit.

If the option for adaptive reuse is preferred it would no doubt result in some loss of character (i.e. to one of the best preserved mid 20th century mines in Cornwall with excellent group context both within and between each site). However, the buildings would be standing, heated and occupied, hopefully for some time to come. Very careful planning constraints could set appropriate benchmarks for mitigating such issues as countering loss of character and setting, etc, although other 21st century issues of integrating modern building regulations to a mid 20th century mine site may not be so easy to overcome in practice.

To summarise:

**Option 1**: HLS is an appropriate way forward for management of these structures, **if preservation** (and presumably public access), is the preferred end use. However, this could only be a short term solution, as lack of use and damp would again affect the structures in time (unless a more adventurous public use could be determined). Given the undoubted significance of the site (its physical remains of extant buildings, its photographic record and detailed history), it is recommended that if this option is followed production of the main elements of a Conservation Management Plan should be undertaken to guide and inform (both the landowner and planning officers), its short and long term use and provide ongoing management/maintenance principles for the south mine buildings.

**Option 2**: Non-HLS schemes for building preservation are likely to involve **adaptive reuse** funded by the site developer, although rigid guidelines for this to minimise impacts to the setting and character of the site would need to be acceptable to all parties. This option should necessitate production of an impact assessment report to inform the project developer and any other statutory or non-statutory agencies, of the impact of the site proposals on the identified significant site assets described in this report, as well as ways to mitigate or minimise those impacts.

**Option 3**: Castle-an-Dinas mine has already (in a 1998 county survey) been recommended to be assessed for Scheduling as a nationally important monument. Although an EH site assessment has not taken place, a re-referral to EH may be appropriate, as a statutory designation could unlock funding for site preservation as it would be a site at 'risk'.

To summarise, there appears to be three options. Options 1 and 3 can only be seen as short term and may provide funding for limited conservation to keep the site in its present character and significance. The second option, adaptive reuse, has longer term consequences for site preservation, but these may affect character and significance. The most appropriate options from a historical preservation view are 1 and 2. But the best long term sustainability option is 2 – a conflict of preservation, and character interests.

### 7.3.1 Building conservation principles

Appendix 10.5 reproduces a 'Mine landscape and buildings conservation philosophy' which includes general building conservation specifications and an appropriate mitigation strategy to reduce the effect of any impacts. It is recommended that the following guiding principles for the Castle-an-Dinas Mine site buildings should be adhered to:

- The standard conservation recommendations made in this report are generic and relate to a basic philosophy or wish to conserve all historic buildings for future public gain.
- The building conservation philosophy is based on respecting the character of each significant feature and its contextual relationship generally with other parts of the site. The long-term conservation and preservation of the built and standing archaeology should reflect its individuality, character and construction. The methodology of using traditional and appropriate mortar and timber structural components is intended to replicate its original construction technique; however, the end product is intended not to monumentalise the site but to conserve, protect and give the appearance of an old but safe structure.
- Contractors for the building conservation works should be experienced in the use of traditional materials and mortar techniques and specifications for use.
- An essential component of the mitigation strategy is the employment of an historic environment consultant who should ensure that English Heritage principles of conservation practice are adhered to both in terms of the design of appropriate schemes, to ensure that consolidation works are carried out to acceptable (EH) standards, to ensure close liaison between statutory agencies, and to record any changes to the historic fabric. In addition, it is important that the nature, extent and development of the site conservation works should be guided by the relevant short and long-term management plan policies (statutory, archaeological, conservation, ecological, mineralogical and WHS, etc.), which are an important part of any mitigation strategy of the site.

### 7.3.2 Possible further work

This report identifies and informs the client of the significant site assets and site constraints. Measured building surveys have also been commissioned for all the extant buildings (work undertaken by pdp Green Cons. Ltd), and annotations of significant assets noted and reproduced on the surveys (see Appendix 10.1 and 10.2, at the rear of this report). However, if it is proposed that a separate capital works building conservation scheme is to be funded by NE and accepted by the landowner as part of increased public access to Castle-an-Dinas Mine, a separate conservation management plan should be produced to facilitate short and long term management (and perhaps used as a tool to procure future grant aid for preservation).

If statutory designation for Scheduling is the preferred option, and funds were made available for repairs to 'buildings at risk', Scheduled Monument Consent would need to be gained which would necessitate production of an Impact Assessment report.

If adaptive reuse is the preferred option for long term preservation (albeit in a slightly different functional form), pre-planning permission advice is likely to stipulate that an impact assessment report should be produced to inform statutory planning officers of the various impacts and mitigation options of such a scheme to the significant site assets. This would also inform the project developer and any other statutory agencies (HE – Planning Advice team, or perhaps EH if the site is to have a statutory designation), of the impacts of the site proposals on significant site assets.

## 7.4 Archaeological potential below ground

Funding should be made available as part of any proposed works (including habitat management works), to allow for an appropriate level of archaeological recording if shallow mining or other archaeological features are revealed during the course of any works programme. A planning condition to mitigate future development may well necessitate production of a brief (by the CC Planning Advice archaeologist) for archaeological recording. However, consultations with the Cornwall Council Historic Environment Archaeologist (HE Countryside Advice) should take place at every stage of the project, especially where below ground archaeological features are likely to be affected.

## 7.5 Statement of likely COSHH hazards

COSHH hazards within the study area are likely to be high over both mine sites, mainly due to the presence of concentrations of lölingite (arsenic: several iron arsenides occur as minerals; lölingite, FeAs2, forms silvery rhombic prisms; mispickel or arsenical pyrites – Section 3.3). This mineral accompanied removed sections of the wolfram lode. These deposits may be of a higher concentration near the mill (north side, Site 47), although there is also likely to be deposits in and near the former waste dump (ie public car park) on the south side. Further testing at both sites is recommended if public access (or adaptive reuse) to these sites is to be further encouraged.

Note:

Although this report identifies some health and safety issues it is not intended as a health and safety assessment of the site or of individual features. The CC Historic Environment Service disclaims liability for Health and Safety issues arising from the use and management of the site.

# 8 References

## 8.1 Primary sources

*Cornwall Record Office*:

Maps/Plans: MRO 15156 (Castle-an-Dinas Mine 1957)

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## 8.2 Published sources

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Wailes, B, 1965. *Castle-an-Dinas excavation,* Cornish Archaeological Society Journal (Vol 4)

# 9 Project archive

The HE project number is **146194**

The project's documentary, photographic and drawn archive is housed at the offices of Historic Environment, Cornwall Council, Kennall Building, Old County Hall, Station Road, Truro, TR1 3AY. The contents of this archive are as listed below:

1. A project file containing site records and notes, project correspondence and administration.
2. Electronic drawings stored in the directory R:\Historic Environment (CAD)\CAD Archive\Sites C\Castle-an-Dinas Mine
3. Black and white photographs archived under: GBP 2261/14-37; 2262/1-36; 2263/1-24.
4. Digital photographs stored in the directory R:\Historic Environment (Images)\SITES.A-D\Castle-an-Dinas Wolfram Mine
5. English Heritage/ADS OASIS online reference: cornwall2-138569

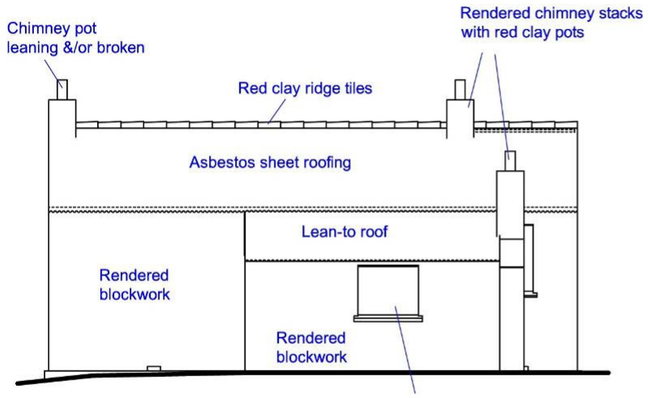
This report text is held in digital form as: ..\Historic Environment\Projects\Sites\Sites C\Castle-an-Dinas Mine assessment 2012\Report\Castle-an-Dinas assessment report.doc

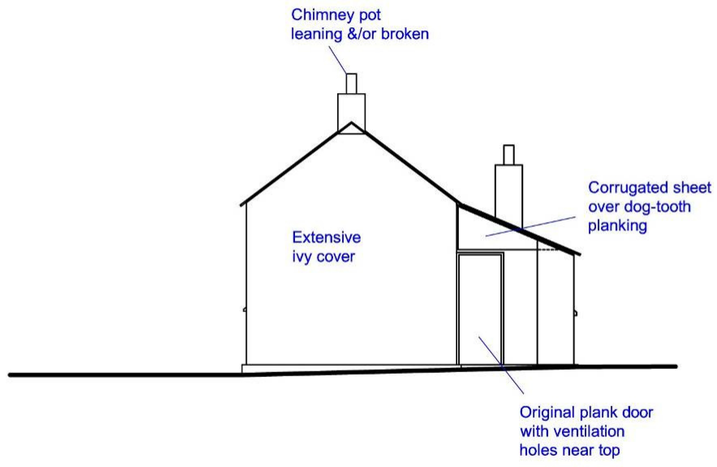
# 10 Appendix

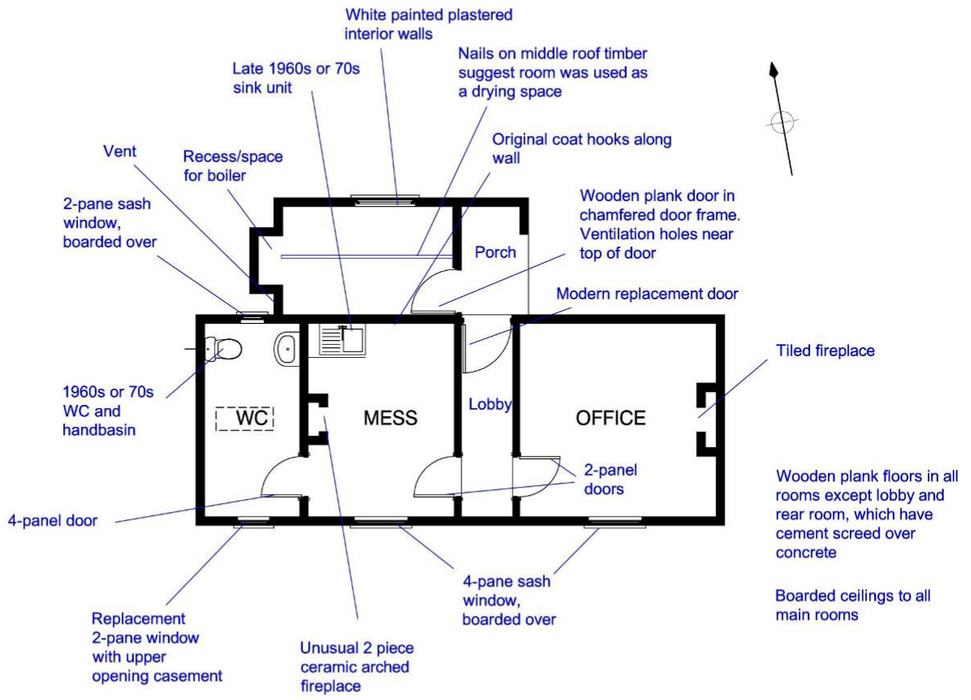
## 10.1 Annotated measured survey plans and elevations (South site):

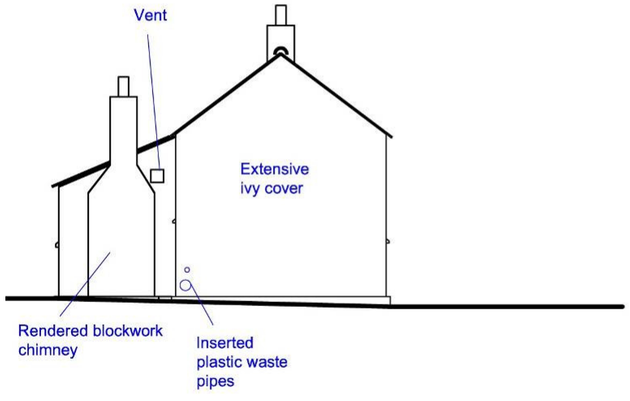
Note: All base survey plans and elevations were provided by pdp Green Eng. Cons. Annotations by CC HE Projects

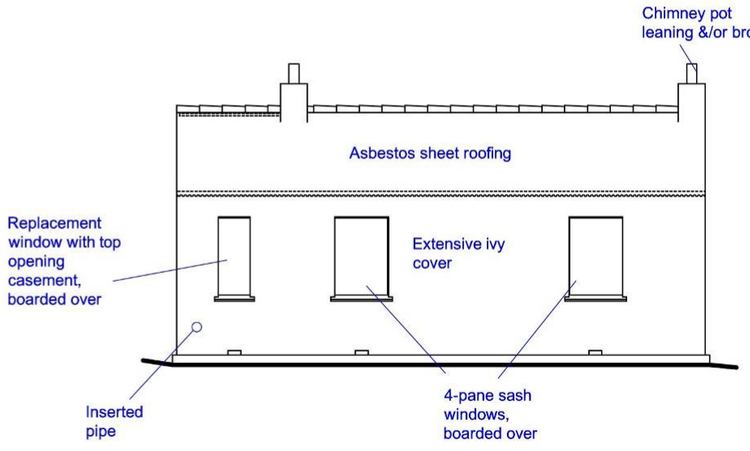
### 10.1.1 Mine office (Site 2)



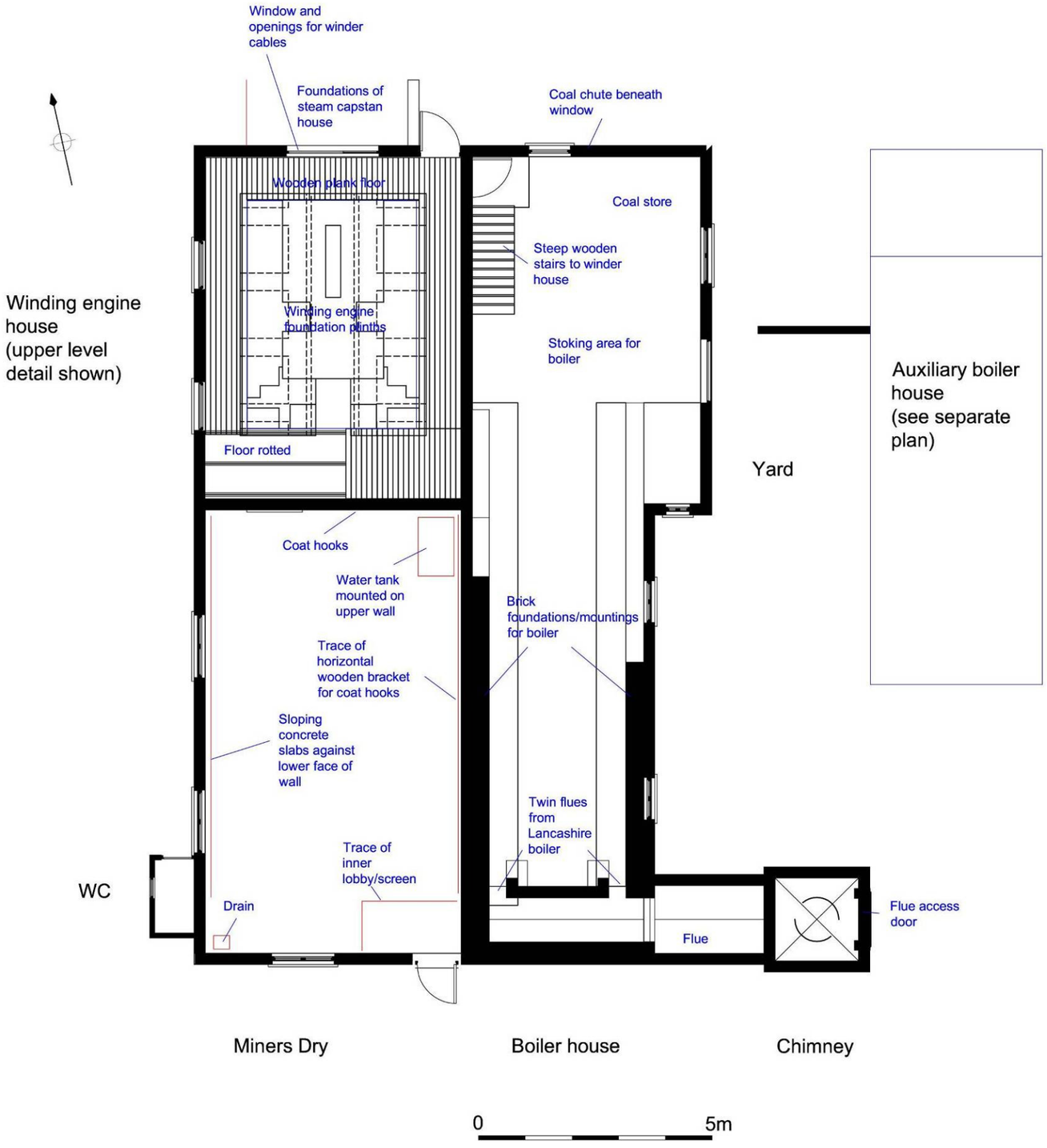



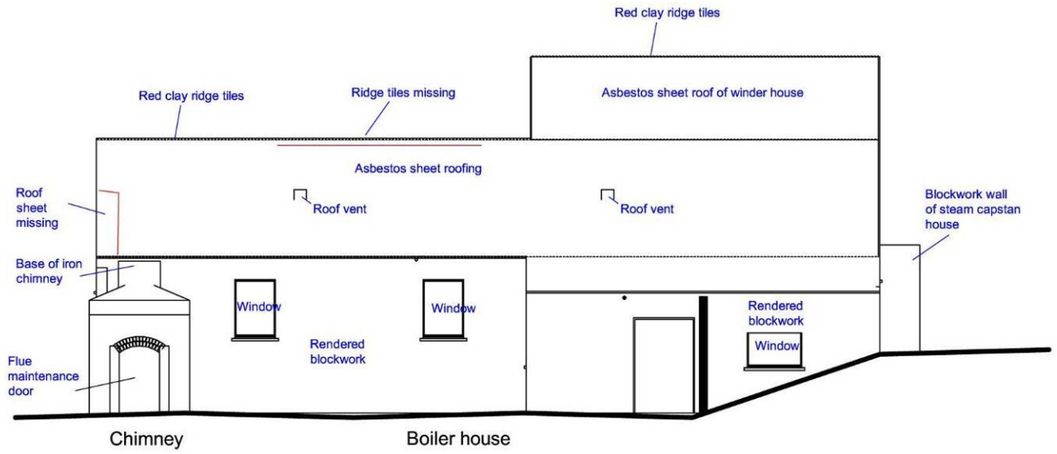



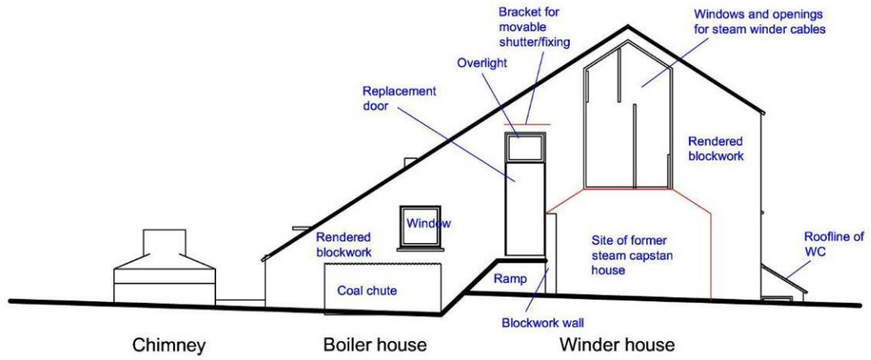
### 10.1.2 Winding engine and boiler house with Miner's Dry plans (Site 3)



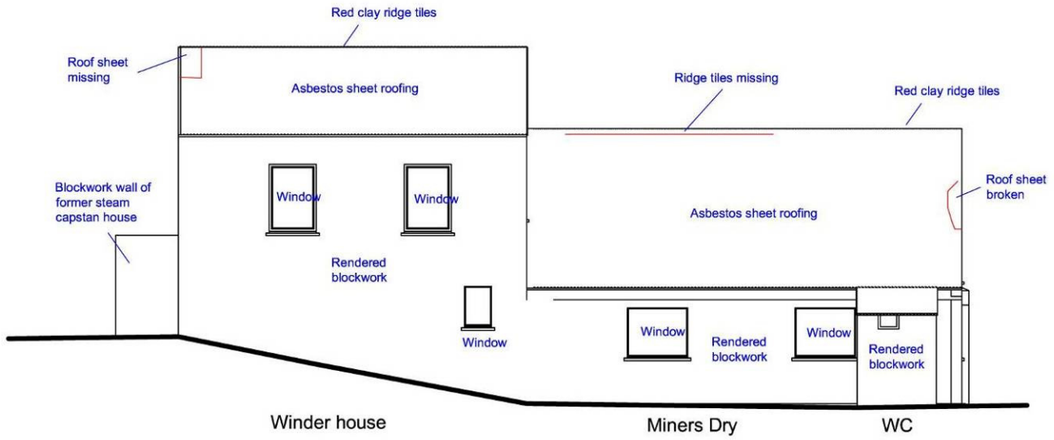
### 10.1.3 Winding engine/boiler house/Miner's Dry elevations (Site 3)



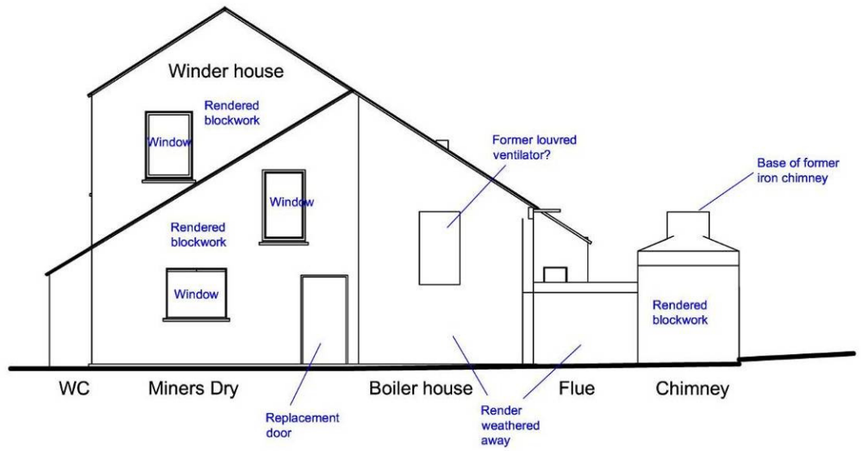

East elevation




North elevation



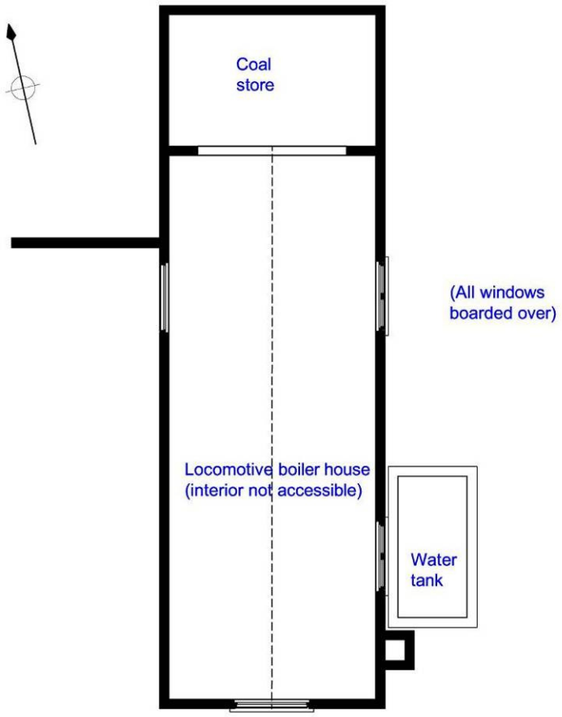

West elevation



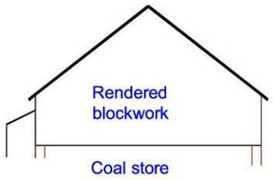

South elevation

0 5m

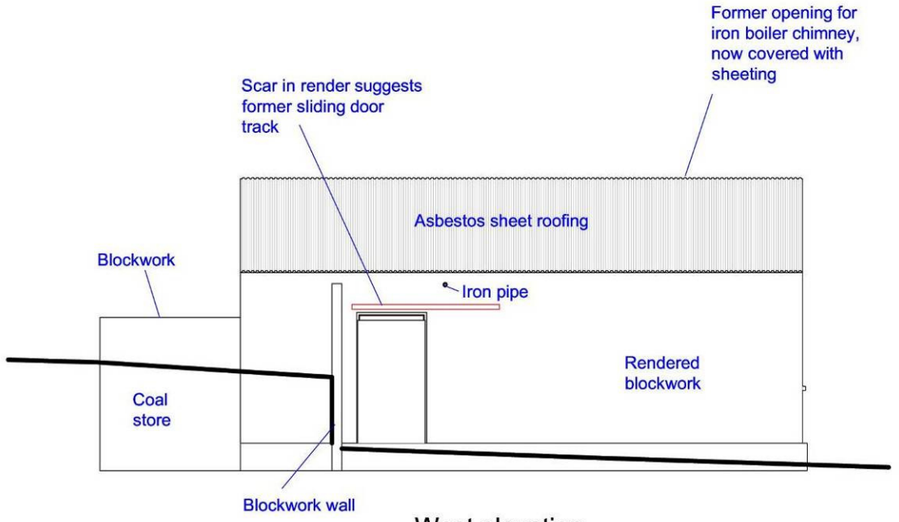
### 10.1.4 Auxiliary boiler house (Site 4)




Plan

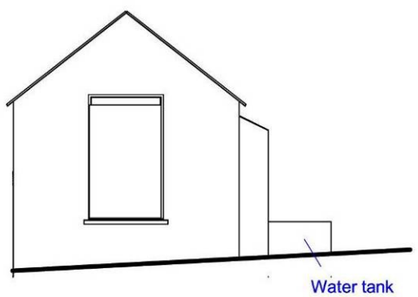



North elevation

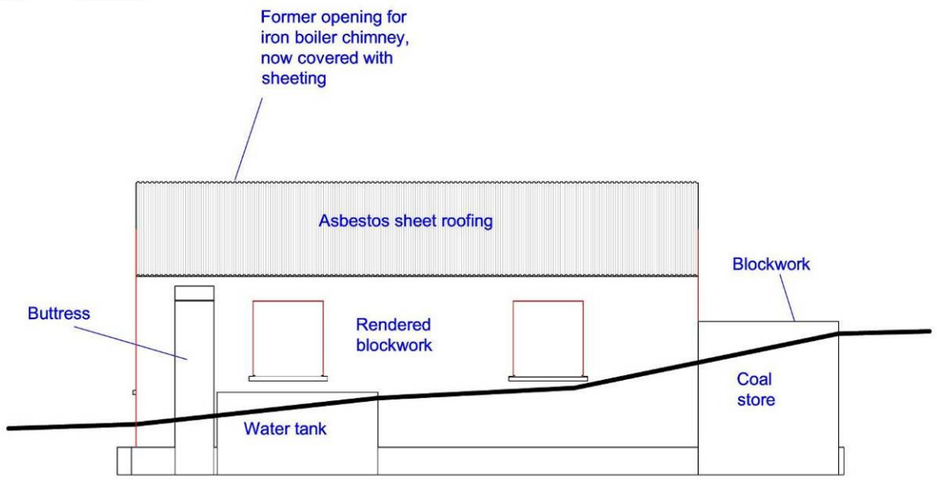



West elevation

0 5m

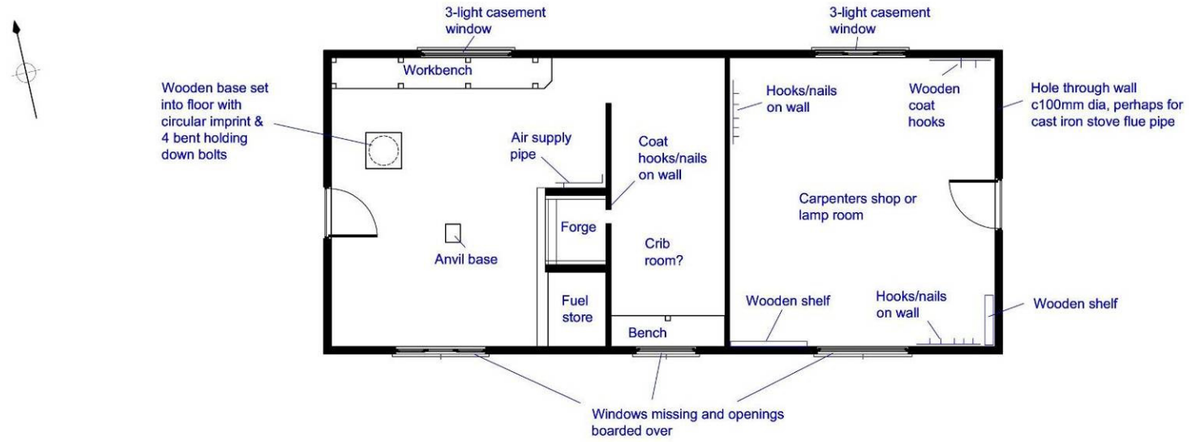


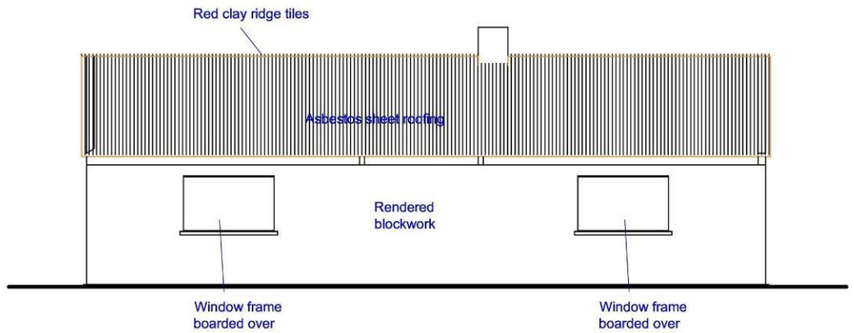

South elevation



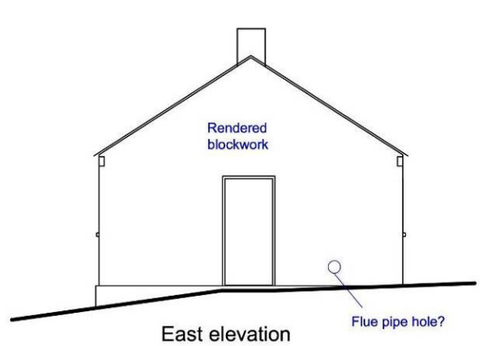

East elevation

### 10.1.5 Forge and Carpenters' Shop (Site 5)



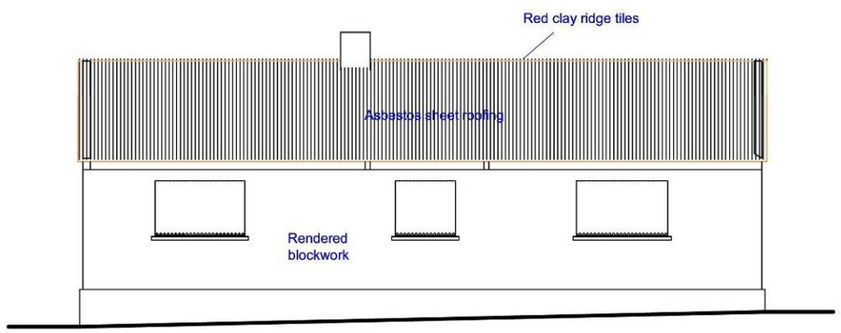




North elevation

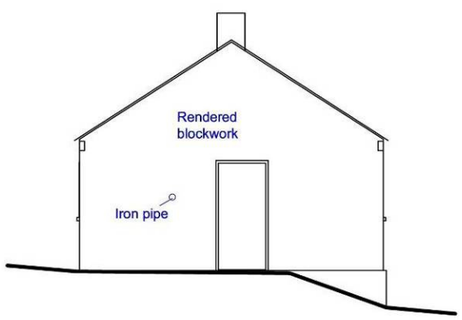



East elevation

0 5m

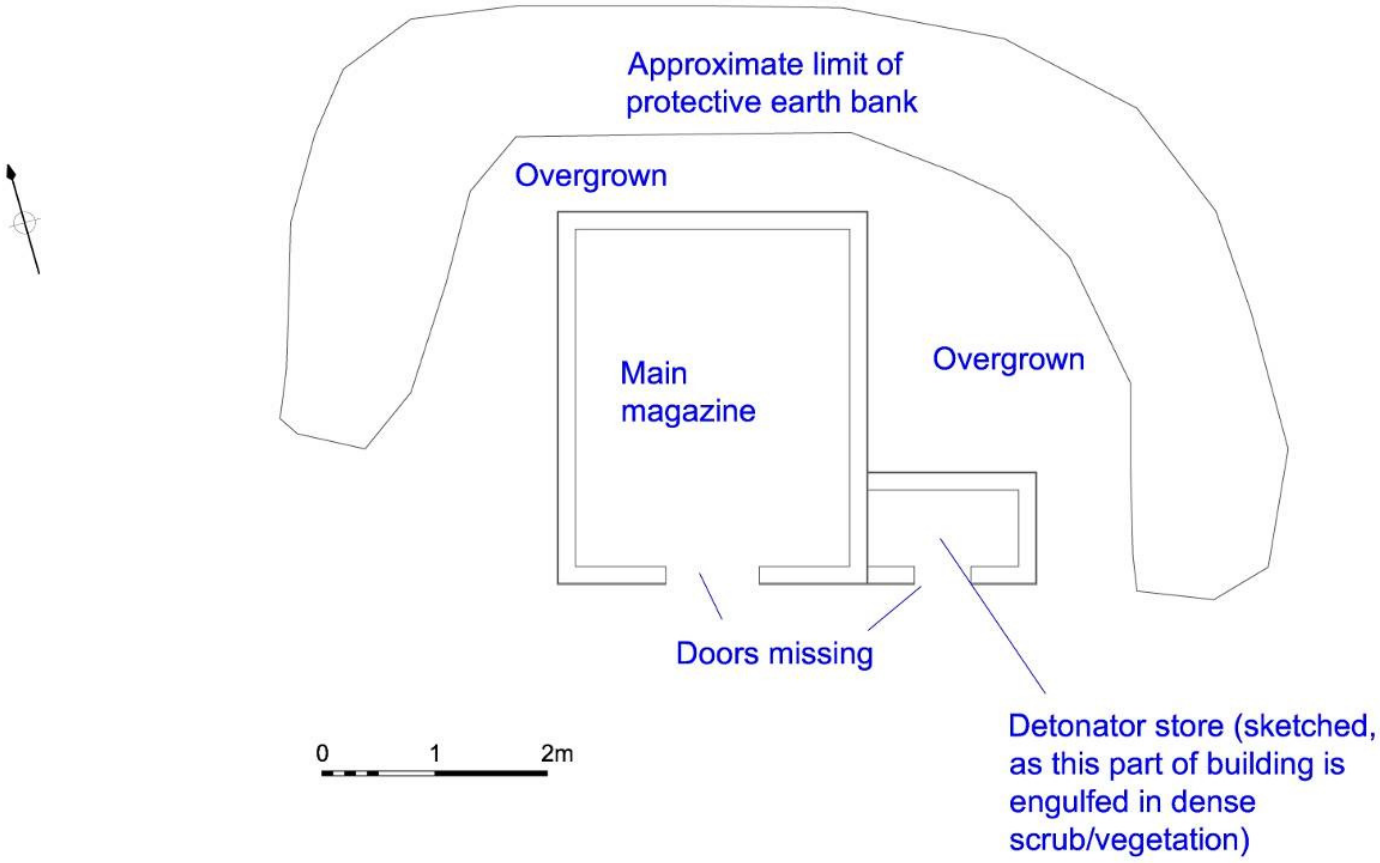



South elevation

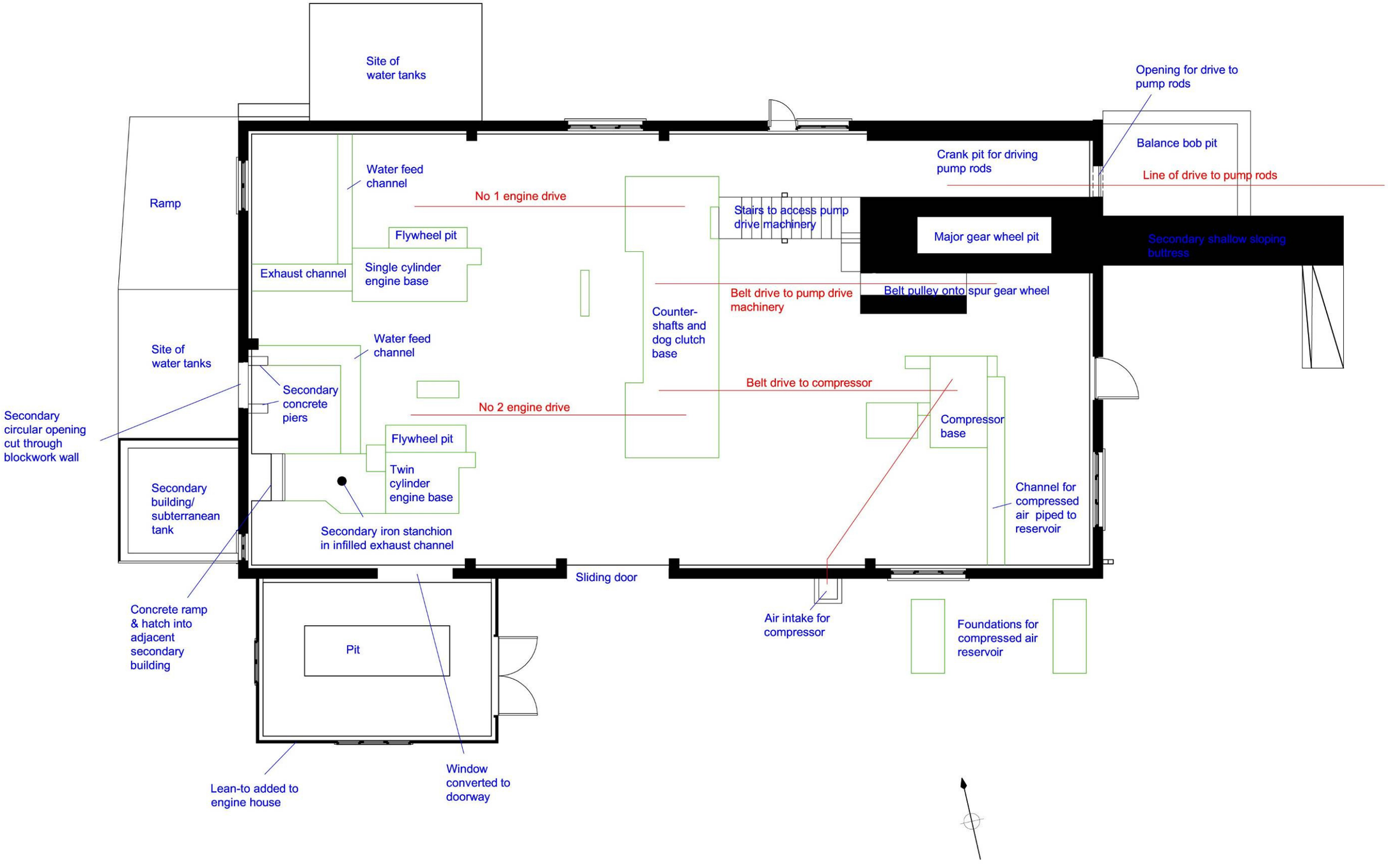



West elevation

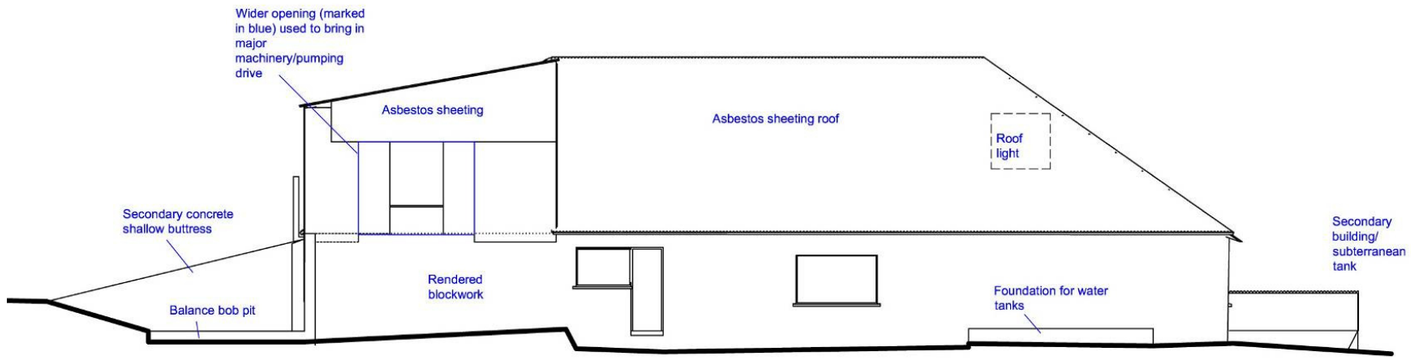
### 10.1.6 Magazine (Site 6)



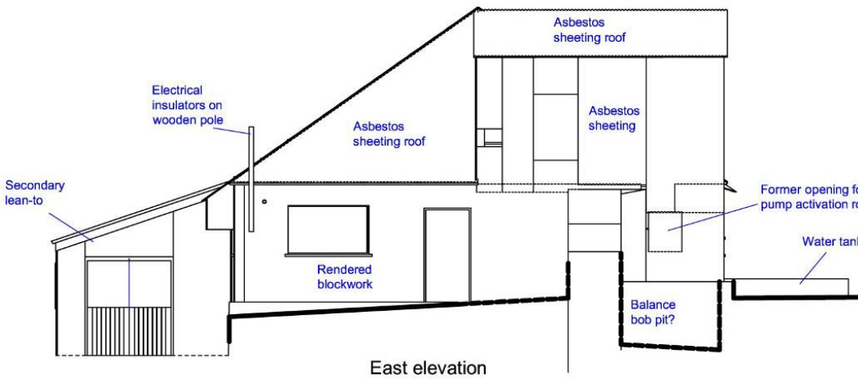
### 10.1.7 Diesel engine house plans (Site 7)



### 10.1.8 Diesel engine house elevations (Site 7)

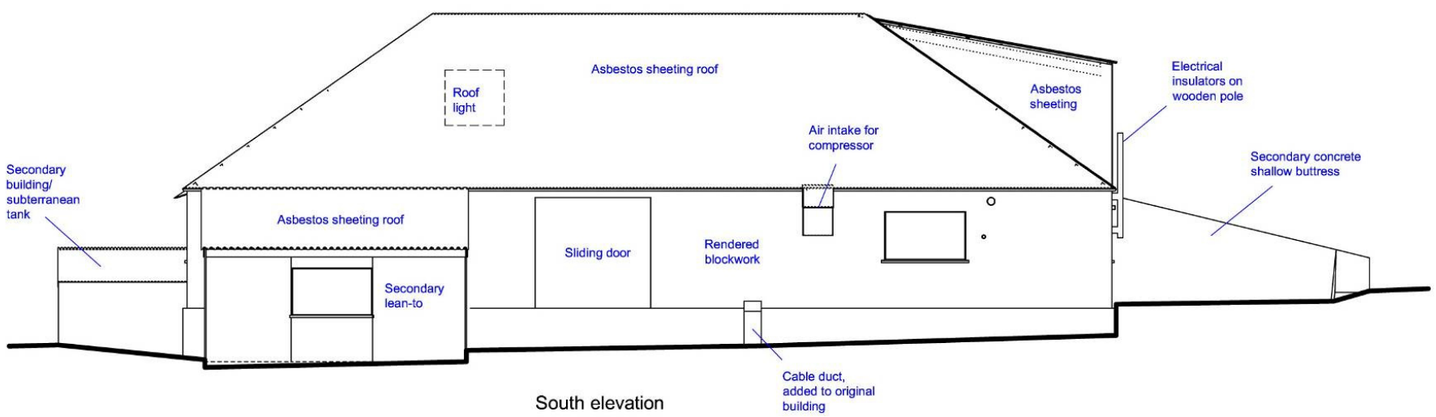



North elevation

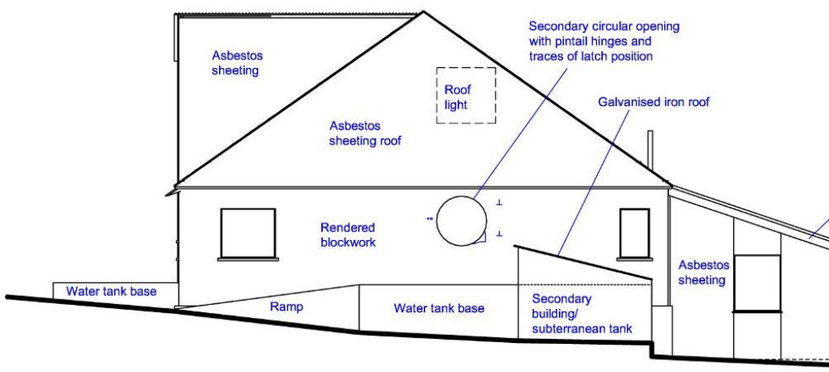



East elevation

0 5m




South elevation

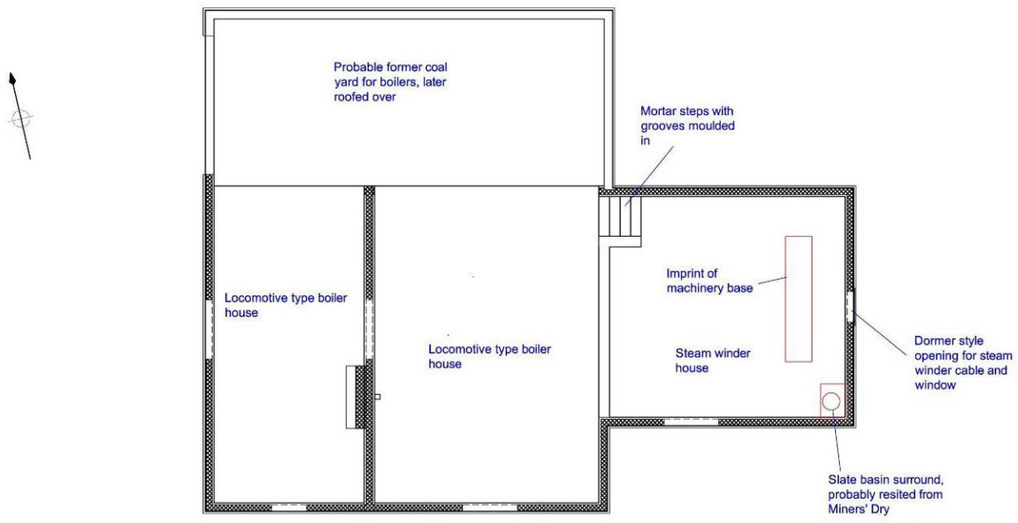



West elevation

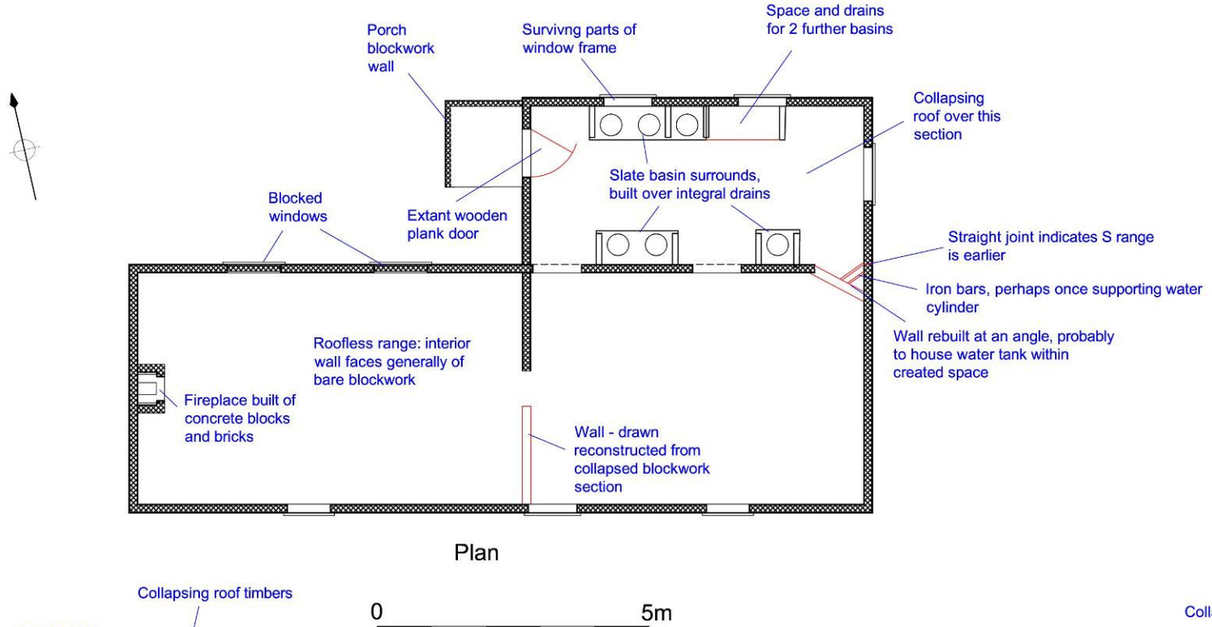
## 10.2 Annotated measured survey plan and elevations (North site):

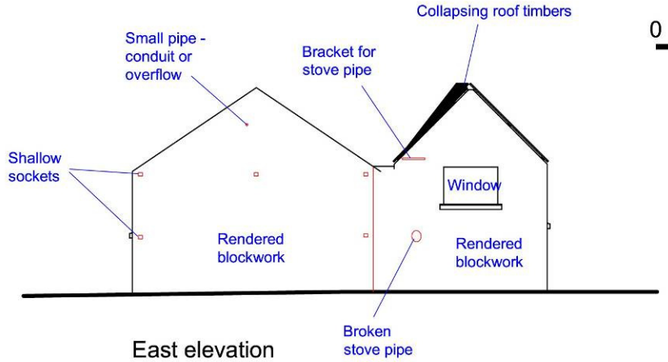
Note: All base survey plans and elevations were provided by pdp Green Eng. Cons. Annotations by CC HE Projects

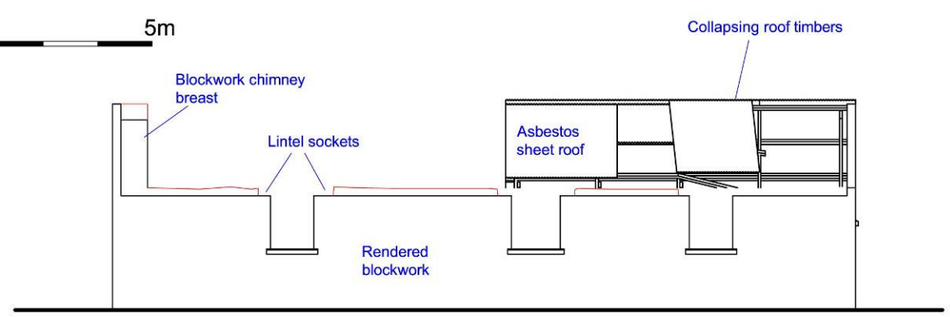
### 10.2.1 Winding engine and boiler house (Site 41)

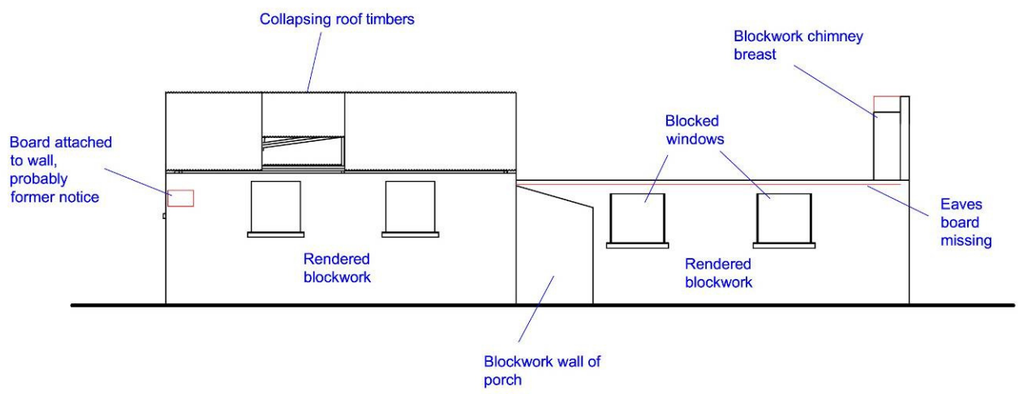


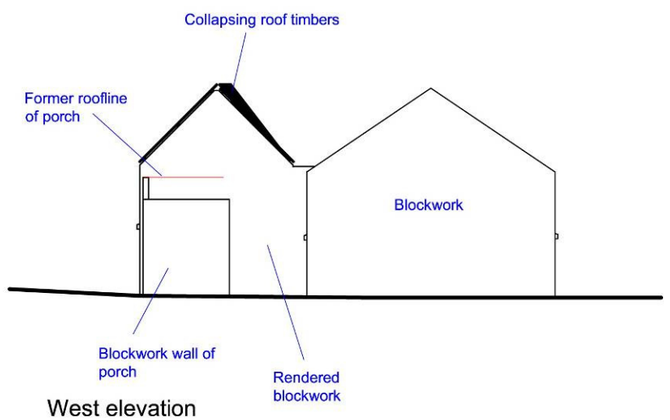
### 10.2.2 Miner's Dry (Site 43)



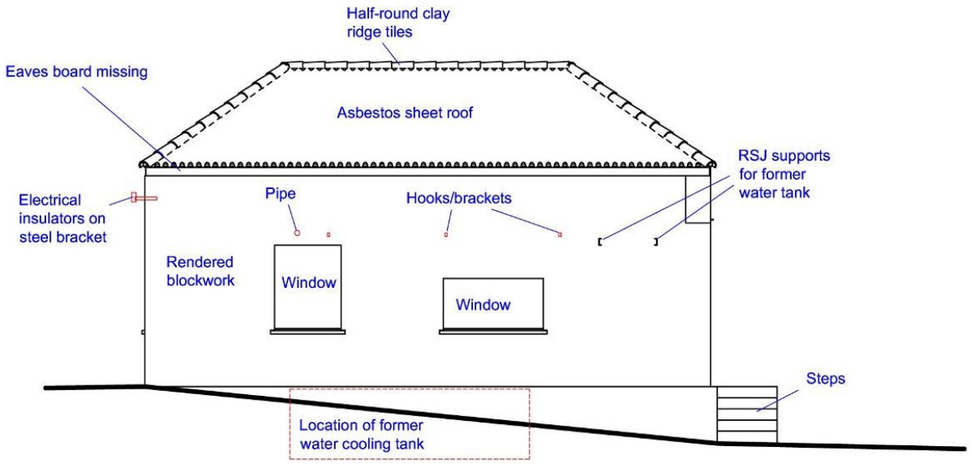



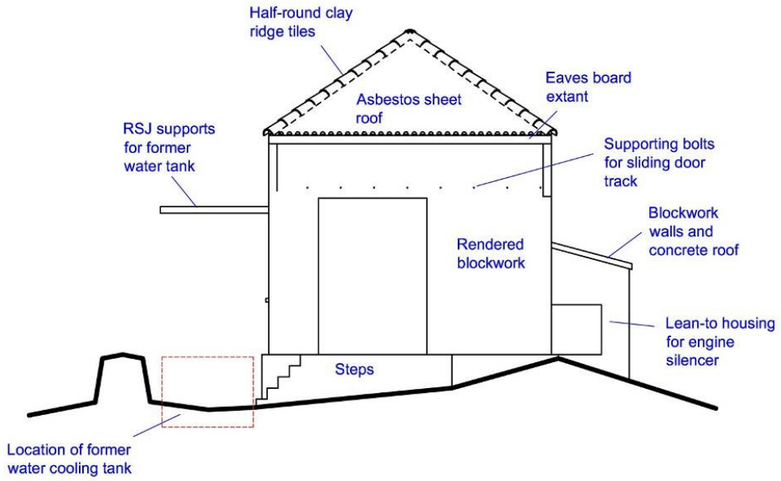



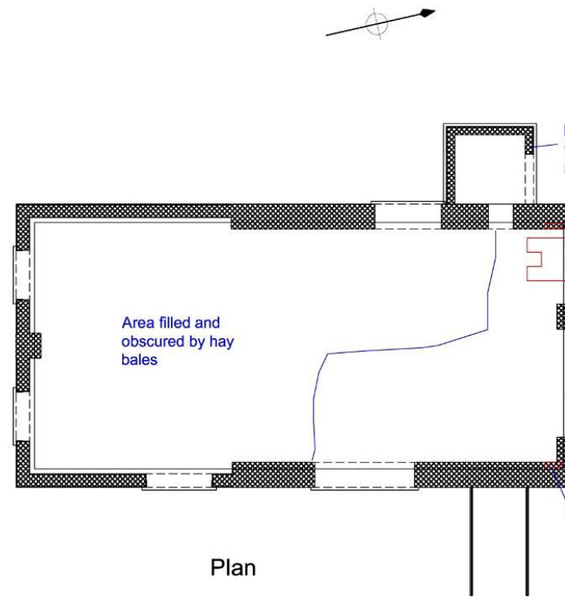
### 10.2.3 Diesel engine house (Site 45)




East elevation

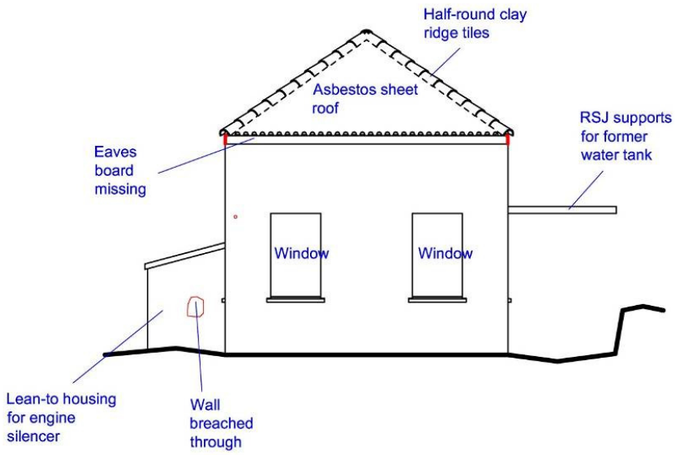



North elevation

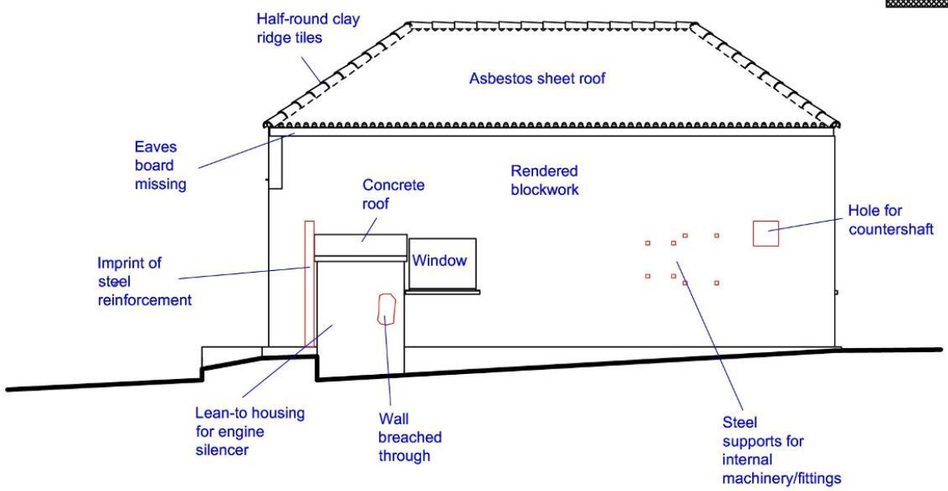



Plan

0 5m




South elevation




West elevation

## 10.3 Planning brief

**BRIEF FOR BUILDING AND ARCHAEOLOGICAL ASSESSMENT AND RECORDING**

**Address:** Castle-an-Dinas Mine, St Columb Major, Cornwall.

**Date:** 13th July, 2012

**HES Advisor:** Address - Cornwall Council, Historic Environment Service, Kennall Building, Old County Hall, Truro, TR1 3AY

**Local Planning Authority Officer:** Michelle Billing

This brief is only valid for six months. After this period the Historic Environment Planning Advice Officer should be contacted. Any written scheme of investigation (WSI) resulting from this brief shall only be considered for the same period. The contractor is strongly advised to visit the site before completing their WSI as there may be implications for accurately costing the project.

Contractors Written Scheme of Investigation

No ground works are to be undertaken until the Historic Environment Planning Advice Officer and the Local Planning Authority has approved the contractor's written scheme of investigation.

### 1. Introduction

This brief has been written by the Historic Environment Planning Advice officer. It sets out the minimum requirements for a programme of assessment and baseline recording to inform options appraisal for the site of a redundant wolfram (tungsten) mine at Castle-an-Dinas, near St Columb Major, Cornwall.

### 2. Site Location and Description

Castle-an-Dinas mine [grid reference SW945624], lies to the south of Castle-an-Dinas Hillfort, a Scheduled Monument. It consists of a group of disused but generally weather-tight industrial buildings consisting of concrete block cast *in situ* concrete, asbestos and galvanised sheeting sitting within a landscape with known open and capped shafts and mining upcast. The mine lies very much within the setting of the Scheduled site which itself contains evidence of an aerial ropeway associated with the mine. The site for assessment includes all the key buildings of the mine complex including engine house, workshops, and winding house. A former mine captain's bungalow lies immediately adjacent but is in separate ownership.

### 3. Planning Background

A Pre-application discussion with the council has involved the advice of HES. HES Advice has indicated the potential high significance of the mining heritage of the site and recommended that detailed assessment of its significance be a part of decision making regarding future conservation options. If further assessment demonstrates national significant archaeological values at this site then the NPPF would require that any planning application for the site would sustain those values.

Other options for the site include potential grant funding through inclusion in agri environment schemes. HES strongly advises that the applicant contacts Natural England to discuss such funding options and requirements for assessment in this regard.

The current brief should be seen as the first stage of assessment required to support proposals for change and should result in an assessment of the site's significance and make recommendations for further more detailed archaeological and heritage assessment work as required.

## 4. Historic Building and Archaeological Background

Castle-an-Dinas mine is recorded on the Cornwall and Scilly Historic Environment Record as MCO11953. The monument description reads "Castle-An-Dinas mine was opened for wolfram in 1815 and was in operation from 1930-1950 (b3). It is marked as disused on the OS 6 inch map of 1963 (but the aerial railway was then extant) (b4). In 1974 the aerial railway was removed. Production statistics of the mine are given by Collins (b1) and Burt (b7). Two groups of buildings, a line of shafts, an adit, and a possible reservoir at SW94661 62882 are visible on air photographs (p1-3) and were plotted as part of the NMP." Wolfram (also known as Tungsten) was an extremely important mineral during World War II due to its role in the production of 'high speed' steels which critical in the production of machine tools for the armaments industries and for the hardening of shell casings. Castle-an-Dinas mine was one of only a handful of mines in Britain solely dedicated to the production of tungsten during world war II (Blundell 2005 http://www.cumbria-industries.org.uk/wolfram.htm). Very little is known about tungsten production archaeologically and it has been identified as a key research aim in the regional research agenda (SWARF 2008 aim 15.3.4 L). My assessment of the monument's heritage values against the Secretary of State (DCMS) criteria for establishing 'national importance' is that this is a site highly characteristic of tungsten mining of the WWII period, of high rarity, likely to have excellent documentation, the survival of which is good, possessing excellent group value due to the survival of all key buildings of the site, and the vulnerability of which to changes in character and form is also high. The archaeological potential of the site to contribute to regional and national research agenda is also high.

The mine site lies very much within the 'setting' of the adjacent Castle-an-Dinas Hill fort, which is already a Scheduled Monument. Whilst clearly the mine is a modern intrusion into the setting of the monument, derelict industrial sites are very common feature in the settings of upland Cornwall prehistoric sites and are in the view of HES entirely in keeping with the aesthetic values of such places.

## 5. Requirement for work

### 5.1 Building Recording

The site specific aims are to record the buildings photographically and descriptively to EH Level 2 standards focussing on the:

- External elevations
- Internal elevations
- Materials, method of construction
- Architectural detailing
- Fenestration
- Internal arrangements
- Original fixtures and fittings
- Evidence for change and adaption

### 5.2 Archaeological and Setting Assessment

An Archaeological Desk Based Assessment should focus on gathering and making a rapid assessment of HER data, written sources, archive material held in local repositories or by the site owners, historic map and pictorial (including aerial photography) evidence, the results of a 'walk over survey', any available geotechnical logs or mining surveys and oral evidence. This evidence should inform assessment of the heritage values of the site (including its built, landscape and buried components) and of the setting of Castle-an-Dinas hillfort using the

broad approach set out in EH guidance documents *Conservation Principles* and *The Setting of Heritage Assets.* In assessing the significance of the mine complex as a whole the assessment should make additional reference to the Secretary of State's (DCMS) Criteria for evaluating the national importance of archaeological remains; to the South West Archaeological Research Framework; to comparative examples nationwide; and to any relevant EH Designation Selection Guides.

## 6. General Methodology

6.1 All stages of the investigation shall be supported by a written scheme of investigation.

6.2 The contractor is expected to follow the code of the Institute for Archaeologists (IfA) and/or the code of the Institute of Historic Building Conservation (IHBC).

6.3 Details including the name, qualifications and experience, of the site director and all other project personnel (including specialist staff) shall be included within the written scheme of investigation.

6.4 All the latest Health and Safety guidelines shall be followed on site.

6.5 The IfA's Standards and Guidance should be used for additional guidance in the production of the written scheme of investigation, the content of the report and the general execution of the project.

6.6 Terminology will be consistent with the English Heritage Thesaurus.

## 7 Additional Archaeological Assessment Methodology

**HES Advice advises that the Archaeological Assessment undertaken should follow the following methodological approach.**

i) Collection should be undertaken of all existing information on the archaeological resource from the sources set out at 5.2

ii) A visual inspection in the form of a walk-over survey to locate unrecorded sites and to analyse the topography of the area shall be undertaken

Iii) Determination of heritage values and archaeological importance of sites located in i) and ii) in accordance with the guidance documents listed in 5.2

iv) Analysis of results of i), ii) and iii) to determine potential for further archaeological sites being present in the assessment area

v) Determination of the effect of the proposed options for development on the heritage values of the resource

vi) Preparation of a report containing results of i) to v) above (see below)

vii) Preparation of an ordered archive of the project and its deposition in an appropriate archive.

## 8. Additional Building Recording Methodology

8.1 Prior to the commencement of on site works the contractor should familiarise themselves with the site by examining the information held by the Cornwall and Scilly Historic Environment Record and the Cornwall Records Office at Truro and the Cornwall Centre at Redruth, where appropriate.

8.2 Use is expected to be made of existing measured surveys of the buildings and sites which should be reproduced in any report. The site plan will be tied to the national grid.

8.3 The photographic record shall be a comprehensive record to archive standard of the existing buildings and structures. This should include both external and internal coverage with black and white prints and negatives. Colour photography may be utilised for general shots and where it is appropriate for detail shots (negatives or CD shall be included). For both general and specific photographs, a photographic scale shall be included. In the case of detailed photographs a north arrow will be included. The photographic record shall be accompanied by a photographic register detailing as a minimum, feature number, location and direction of shot.

**9-11** ***Deleted from template brief***

## 12. Reporting

12.1 The report shall be submitted within a length of time (but not exceeding six months) to be agreed between the applicant and recording contractor, Cornwall County Council Historic Environment Record and the appropriate archive. A further digital copy shall be supplied on CD-ROM preferably in 'Adobe Acrobat' PDF format.

12.2 The archaeological contractor will undertake the English Heritage/ads online access to the index of archaeological investigations (OASIS).

12.3 This report will be held by the Cornwall and Scilly Historic Environment Record and made available for public consultation.

12.4 The report must contain:

- A concise non-technical summary of the project results.
- The aims and methods adopted in the course of the investigation
- A discussion of the findings in terms of both the site specific aims and any desk based research
- Evidenced recommendations for a range of future management options for the site, including recommendations for further appropriate levels of investigation for each option.
- Location map, a drawing showing those areas examined as part of the recording. All plans shall be tied to the national grid.
- Any specialist reports or assessments
- A summary of the archive contents and date of deposition
- A copy of the brief and the approved written scheme of investigation will be included as an appendix

12.5 A copy of the archive prints will be included with the submission.

## 14. Archive Deposition

14.1 An ordered and integrated site archive will be prepared in accordance with: *Management of Research Projects in the Historic Environment (MoRPHE) English Heritage 2006* upon completion of the project. This should be deposited with the Cornwall Record Office as well as the Courtenay Library of the Royal Institution of Cornwall.

14.2 A summary of the contents of the archive shall be supplied to the Historic Environment Planning Advice Officer.

**15. Monitoring**

15.1 The Historic Environment Planning Advice Officer will monitor the work and should be kept regularly informed of progress.

15.2 Notification of the start of work shall be given preferably in writing to the Historic Environment Planning Advice Officer at least one week in advance of its commencement.

15.3 Any variations to the written scheme of investigation shall be agreed with the Historic Environment Planning Advice Officer, preferably in writing, prior to them being carried out.

## 10.4 Written Scheme of Investigation

## Castle-an-Dinas mine: Written Scheme of Investigation for archaeological assessment and recording

Client: Mr and Mrs David Chambers

Client contact: Dean Benson, pdp Consulting, Truro

Client tel: 01872 265400

Client email: dean.benson@pdpgreen.co.uk

### Site history

Castle-an-Dinas hill near St Columb Major is renowned for its prehistoric hillfort, now a Scheduled Monument. On the north and south slopes below the hillfort are the shafts, dumps and former buildings of Castle-an-Dinas Mine, which was worked for wolfram (tungsten) between 1916 and 1957. The mine was the principal working in Cornwall for this relatively rare metal. Following the mine's closure and the removal of the majority of the associated machinery, its remaining buildings have lain derelict and the spoil heaps and workings have become covered in vegetation.

### Project background

Mr and Mrs David Chambers, owners of the former mine complex on the north and south sides of the hill, sought pre-application advice regarding proposals to renovate and convert the remaining mine buildings on the south side of their property to residential use. As the proposals for the site could affect the setting of the Scheduled Monument (sited between the north and south mine sites), and would impact and change the character of these historic mine buildings, a brief for archaeological assessment and building recording was issued by the local Historic Planning Advice Officer on behalf of Cornwall Council.

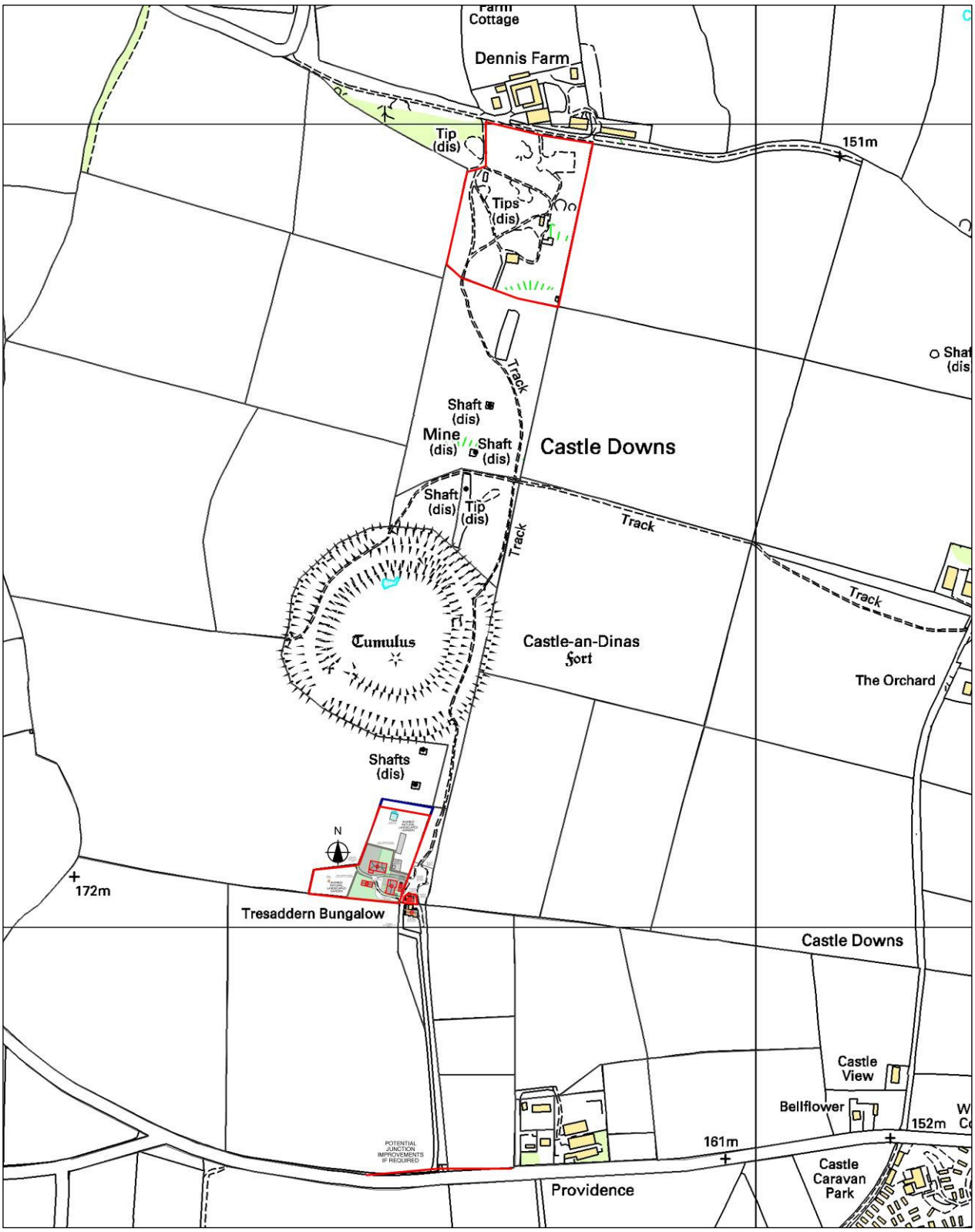
The two areas of the former mine are also subject to a Higher Level Stewardship agreement with Natural England. The HLS scheme has requested that both areas of the mine are included within the archaeological assessment, although the northern area is not currently subject to any development proposals.

Historic Environment Projects, along with other archaeological contractors, were approached with a view to satisfying the planning brief and applying its methodology to both areas of the former mine. Following agreement of costs, HEP was commissioned as the archaeological contractor. Cornwall Environmental Consultants was commissioned as the ecological contractor.

This Written Scheme of Investigation (WSI) acts as a project design for the assessment process and sets out the approach and methodology.

## Project extent

The project extent includes the two areas outlined in red on the plan below:



## Aims and objectives

The principal aim of the study is to undertake an assessment of the development, significance and survival of the structures and features at Castle-an-Dinas. The objectives are to obtain an archaeological record and building survey analysis of the site prior to potential alterations.

The report will be used to assess a range of future management options for the site (including conservation and the potential for HLS as a land/building management option). Recommendations will also be made for any other appropriate levels of investigation for each management option (either as part of the HLS scheme or other potential sources of grant funding).

## Working methods

All recording work will be undertaken according to the Institute for Archaeologists *Standards and Guidance for Archaeological Investigation and Recording.* Staff will follow the IfA *Code of Conduct* and *Code of Approved Practice for the Regulation of Contractual Arrangements in Archaeology.* The Institute for Archaeologists is the professional body for archaeologists working in the UK.

**Desk-based assessment**

A desk-based assessment will be carried out to inform the fieldwork stage. This will comprise:

- Published sources, including a history of the mine produced by Tony Brooks in 2001
- Historic maps, including 1st and 2nd Editions of the OS 25 inch maps (c 1880 and *c* 1907)
- Modern maps
- Air photos (1946 and more modern mapping series, and oblique shots held by Cornwall Council)

**Fieldwork: assessment survey**

Archaeological recording will include noting and sketch-plotting of earthwork features. Information and detail, will be added to enlarged copies of current maps/surveys or existing contractors drawings (to be supplied to HE by the client or agent).

An inventory of features (with 10 figure NGR) will be created, with notes on potential management issues.

This evidence should inform assessment of the heritage values of the site (including its built, landscape and buried components) and of the setting of Castle-an-Dinas (Scheduled), hillfort.

**Fieldwork: building survey**

Several former mine buildings, as well as foundations/remains of built structures remain on the hillsides. Analysis of the building fabric will be undertaken on site (recorded as notes) to allow descriptions to be written up as annotations on CAD drawings supplied by pdp.

**Fieldwork: photographic recording**

The buildings will be recorded by photography. This will include:

1. Black and white photographs using a 35mm camera on fine grain archive quality film.
2. Supporting colour photographs taken with a digital camera (with a resolution of 8 million pixels or higher), to be used to illustrate the report.

The photo record will comprise:

- accessible building elevations
- examples of structural and architectural detail

Methodology for the archive standard photography is set out as follows:

- Photographs of details will be taken with lenses of appropriate focal length
- A tripod will be used to take advantage of natural light and slower exposures
- Difficulties of back-lighting will be dealt with where necessary by balancing the lighting by the use of flash
- A metric scale will be included in all views, except where health and safety considerations make this impractical
- A photo register will be produced for the monochrome photos, indicating date, site, subject and direction of photo
- The directions of monochrome photos will be indicated on a plan

**Creation of site archive**

To include:

- Archiving of black and white photographs to HER standards. All monochrome photographs will be archived using the HE photo database
- Digital colour photographs (stored according to HER guidelines and copies of images made available to the client)
- A site inventory
- Detailed building descriptions
- Preparation of finished drawings
- Completion of the English Heritage/ADS OASIS online archive index

**Archive report**

A written report will include:

- Summary
- Project background
- Aims and objectives
- Methodology
- Location and setting
- Designations
- Site history
- Archaeological results
- Building survey results
- Chronology/dating evidence
- Significance and setting
- Recommendations of appropriate land management options (including those under the HLS scheme)
- Conclusions
- References
- Project archive index

- Supporting illustrations: location map, historic maps, plans, elevations/sections, photographs

A paper copy and a digital (PDF) copy of the report, illustrations and any other files will be held in the Cornwall HER. Paper copies of the report will be distributed to the client, to local archives and national archaeological record centres.

**Archive deposition**

An index to the site archive will be created and the archive contents prepared for long term storage, in accordance with HE standards.

The archiving will comprise the following:

1. All correspondence relating to the project, the WSI, a single paper copy of the report together with an electronic copy on CD, stored in an archive standard (acid-free) documentation box
2. A2 drawn archive storage (plastic wallets for the annotated record drawings)
3. Archive standard negative holders and archive print holders, to be stored in the HE system until transferred to the Royal Cornwall Museum.
4. The project archive will be deposited initially at ReStore PLC, Liskeard and in due course (when space permits) at Cornwall Record Office.

## Timetable

The study is anticipated to be commenced in mid October 2012.

A draft of the archive report will be completed by the end of October and the clients have requested the finalised report by the end of November 2012.

Note: results from this study are expected to feed into the preparation of a Conservation Management Plan, which is the subject of a separate project.

## Project monitoring

Monitoring of the project will be carried out by Dan Ratcliffe, Historic Environment Planning Advice Officer, Ann Reynolds (Historic Environment Service, on behalf of Natural England) and Dean Benson of pdp (project manager).

Monitoring points during the study will include:

- Approval of the WSI
- Commencement and completion of fieldwork
- Completion of archive report
- Deposition of the archive

## Historic Environment Projects

Historic Environment Projects is the contracting arm of Historic Environment, Cornwall Council (HE). HE employs some 20 project staff with a broad range of expertise, undertaking around 100 projects each year.

HE is committed to conserving and enhancing the distinctiveness of the historic environment and heritage of Cornwall and the Isles of Scilly by providing clients with a number of services including:

- Conservation works to sites and monuments
- Conservation surveys and management plans
- Historic landscape characterisation
- Town surveys for conservation and regeneration
- Historic building surveys and analysis

- Maritime and coastal zone assessments
- Air photo mapping
- Excavations and watching briefs
- Assessments and evaluations
- Post-excavation analysis and publication
- Outreach: exhibitions, publication, presentations

### Standards

HE is a Registered Organisation with the Institute for Archaeologists and follows their Standards and Code of Conduct.

As part of Cornwall Council, the HES has certification in BS9001 (Quality Management), BS14001 (Environmental Management), OHSAS18001 (Health, Safety and Welfare), Investors in People and Charter Mark.

## Terms and conditions

### Contract

HE Projects is part of Historic Environment, Cornwall Council. If accepted, the contract for this work will be between the client and Cornwall Council.

The views and recommendations expressed will be those of the HE projects team and will be presented in good faith on the basis of professional judgement and on information currently available.

### Project staff

The project will be managed by Colin Buck (Senior Archaeologist) who will:

- Discuss and agree the detailed objectives and programme of each stage of the project with the client and the field officers, including arrangements for health and safety.
- Monitor progress and results for each stage.
- Edit the project report.
- Liaise with the client regarding the budget and related issues.

The project team is expected to include:

*Colin Buck, Dip Arch, MIfA*

Senior Archaeologist. Specialist in conservation works to Cornish mining landscapes/buildings, archaeological assessments and watching brief recording since 1993. Involved in numerous projects including consultancy for conservation works to many engine houses and other building conservation projects, shaft safety works and mine site access improvements, particularly in east Cornwall and west Devon. Other projects include archaeological Impact Assessments, Conservation Management Plans and Historic Building Consultancies for the Mineral Tramways Project, East Cornwall Regeneration Project, Tamar Valley Mining Heritage Project, Caradon Hill Area Heritage Project and Natural England projects. Produced over 120 archaeological assessments, impact assessments and watching brief reports.

*Nigel Thomas BA MIfA*

Senior Archaeologist who has worked with HE and its predecessors since 1987. Responsible for management of projects relating to historic building recording and surveys of historic landscapes. Past work has included recording and structural analysis at Launceston and Restormel Castles, medieval chapels at Rame, Bodmin and Hall (Bodinnick), as well as landscape surveys at Lanhydrock park and Godolphin gardens. Project manager for historic building analyses at Tintagel Old Post Office, Cotehele House, St Michael's Mount summit complex and Trerice for the National Trust. Has recorded numerous industrial structures including Harveys Foundry, Loggans Mill (Hayle), Town Mills at St Columb Major, and china-clay area features including the waterwheel at Virginia CC Works, Greensplat engine house and Carrancarrow chapel. Project team leader for the Lostwithiel Town Characterisation Study. Member of the IfA's Buildings Group and Graphic Archaeology Group. An experienced user of AutoCAD and is responsible for HE's survey methodology.

**Copyright**

Copyright of all material gathered as a result of the project will be reserved to the Historic Environment, Cornwall Council. Existing copyrights of external sources will be acknowledged where required.

Use of the material will be granted to the client.

**Freedom of Information Act**

As Cornwall Council is a public authority it is subject to the terms of the Freedom of Information Act 2000, which came into effect from 1st January 2005.

HE will ensure that all information arising from the project shall be held in strict confidence to the extent permitted under the Act. However, the Act permits information to be released under a public right of access (a "Request"). If such a Request is received HE may need to disclose any information it holds, unless it is excluded from disclosure under the Act.

**Health and safety statement**

HE follows the Council's *Statement of Safety Policy*. For more specific policy and guidelines HE uses the manual *Health and Safety in Field Archaeology* (2002) endorsed by the Standing Conference of Archaeological Unit Managers and also the Council for British Archaeology's Handbook No. 6 *Safety in Archaeological Field Work* (1989).

Prior to carrying out on-site work HE will carry out a Risk Assessment.

**Insurance**

As part of Cornwall Council, HE is covered by Public and Employers Liability Insurance, with a policy value of £50m. The Council also has Professional Negligence insurance with a policy value of £5m.

*Nigel Thomas*

*Senior Archaeologist*

*25th September 2012*

*Historic Environment Projects*

*Cornwall Council*

*Cober Building, Old County Hall,*

*Station Road,*

*Truro, Cornwall. TR1 3AY*

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## 10.5 Mine landscape and buildings conservation philosophy

**Conservation philosophy**

A site's importance may relate to its historic heritage, its ecological or mineralogical heritage, or more usually, to a combination of two or more of these factors. Statutory designations (Scheduled Monuments, Listed Buildings, SSSI, RIGS, SAC, etc.) and non-statutory designations (World Heritage Site), may well affect or constrain the scope of a proposed scheme and detailed consultation with relevant statutory agencies will need to take place both prior to and during the scheme with a marked emphasis on a continual dialogue with consultants, focussing on the preservation of the historic character of the mining landscape and buildings.

Conservation work usually involves more than just the consolidation of a building or structure. The work carried out must respect its character and should take into account future access and interpretation, as well as the integrity of its surroundings. It is particularly important that all of these aspects are considered from the outset to avoid situations where consolidation or safety works compromise future plans for the site. Thus the process of professional dialogue and assessments needs to be co-ordinated often by County Council Historic Environment (Planning Advice Agencies), broadly following the pattern of Assessment, Evaluation (excavation or Impact Assessment), and Mitigation (the results of an agreed Mitigation Strategy). The assistance and close liaison of a Historic Buildings Consultant is very important before, during and after works have finished to ensure communication protocol with the respective statutory agencies and to ensure that the works are undertaken to the required standard.

The proposals should be specified in the schedule of works and specifications (through consultation with the appropriate statutory and non-statutory bodies), that result in the conservation, protection and enhancement of the historical authenticity, biodiversity and mineralogical heritage potential of the site. Therefore disturbance to a site should be kept to the minimum required to achieve the aims of the schedule of works and impact assessment mitigation strategy (all of which should have been designed in close consultation with appropriate statutory agencies i.e. EH, NE, CCC (HE Advice), etc.). Thus the site should be (as far as possible), left in an enhanced or similar condition to that when work started.

**Building Conservation**

The conservation of a structure is likely to include a combination of one or more of the following approaches: Stabilisation, Partial or full Reconstruction, Selective or full Demolition and adaptive Reuse. Schedules of work should incorporate some flexibility of approach and be tailored to specific site conditions and problems. The particular options selected are likely to be influenced as much by immediate objectives (e.g. stopgap measures to prevent further deterioration) as long term aims intended to serve for many decades, but should always take into consideration the intended long-term use of both the structures and the sites within which they stand.

The preferred conservation approach is based on retaining the essential appearance of a structure, whilst tackling the effects of time, weather and previous destructive interventions, with the aim of undertaking the minimum of work necessary to produce a stabilised ruin in the medium term. This may involve limited demolition and reconstruction, and, in rare cases, the addition of aids to long-term stability - underpinnings to foundations, hidden reinforcing and stitching, though it is preferable to avoid such solutions unless no other options exist. Preventing the ingress of water to wall heads not designed to be exposed to the elements is almost always likely to be required; lintels and other structural timbers should be carefully examined, and where necessary, replaced. Such interventions should be kept to a minimum in order to maintain the integrity of the structure, however and all wall capping and masonry reconstruction should be to profiles existing at the commencement of the works.

Wherever possible, conservation approaches should be based on carrying out repairs rather than rebuilding, other options being resorted to only where absolutely necessary. Reducing the ingress of water is the main pre-requisite of building conservation, and this will usually result in re-pointing and wall capping. Other structural remediation works are likely to necessitate operations such as masonry removal and re-setting, masonry replacement, re-installation of lintels and other structural timber or stonework, pointing and weatherproofing of areas of exposed wall cores and wall heads, installation of strengthening features such as hidden steel rods or 'beams', treatment of chemical hazards, removal or control of vegetation, clearance of rubble or rubbish, installation of lightning conductors and perhaps reinstatement or replacement of roof structures and coverings. Archaeological excavation may also be necessary, in particular of floor deposits within buildings.

**Specifications**

- Traditional building materials (e.g: similar brick or stone, Oak/Douglas Fir timber lintels) should be used when consolidating historic buildings. Where material is to be site won, advice must be taken from the archaeologist and ecologist on the project team to ensure that the sites where this is to take place are appropriate.

- Mortar test panels should be made to permit the selection of appropriate aggregate mixes/colour and finish before the pointing work is undertaken.

- Cement and modern materials should be used very rarely and only when the need for their use can be demonstrated, or replicating the build of structures built in the 20th century.

For public access and interpretation, additional works are likely to be required, including hazard treatment, safety barriers or hazard warnings, site access arrangements – paths, parking, perhaps steps or ramps to enable public access, including arrangements for those with restricted mobility. There may also be a need to restrict access to the structure, or to parts of it, using railings or other barriers. Signs or interpretative features may also be installed.

Whatever approach is taken, the need for flexibility, sensitivity and above all, authenticity must be recognised from the outset, and, where possible incorporated into the design brief. It should also be remembered that many of the surviving former industrial buildings in Cornwall are Listed Buildings or Scheduled Monuments, or are likely to become so in the near future, and that a vast majority lie within Cornwall and West Devon's World Heritage Site. Work to such buildings will almost certainly need specific and detailed written consent from local or national agencies. Any existing consents, permissions and approvals should always be checked, and attached conditions strictly adhered to.

**Mitigation strategy**

The project briefs for the site assessments and any follow on evaluation or impact assessments should be specified by the appropriate statutory or non-statutory authorities.

As part of the mitigation strategy (described in the Impact), Historic Building Consultants should be utilised to ensure that English Heritage principles of conservation practice are adhered to both in terms of the design of appropriate schemes, to ensure that consolidation works are carried out to acceptable (EH) standards and to ensure close liaison between statutory agencies and the project works.

In addition it is important that the nature, extent and development of the site (conservation works) should be guided by the relevant short and long term management plan policies (statutory, archaeological, conservation, ecological, mineralogical and WHS etc), which are an important part of any mitigation strategy of the site. These will then inform and guide subsequent practical site management actions, to facilitate the long term conservation and preservation of these archaeological features and sites.

**CCC (HES Projects) 11/2/2008**

## 10.6 Mining glossary

ADIT A level tunnel (usually driven into a hillside) in order to give access to a mine, and used for drainage or the hauling of broken ore. Deeper adits did not necessarily connect to surface, and were used to carry water back from distant workings to a pumping shaft.
ANGLE BOB A simple lever-based device using which the direction of a reciprocal motion (of pump rods, flat rods) could be changed (for example from horizontal to vertical).
ASSAY HOUSE The mine laboratory, where samples or ore were analysed for mineral content.
BAL or BALL From Cornish "*Pal*" a shovel, and hence "a digging" = a mine. Generally applied to earlier mines. See also WHEAL.
BALANCE BOB A large counterweighted lever attached to the shaft pump rods and used to offset their weight and thus reduce the work of a pumping engine to lifting water alone. A surface balance bob would be mounted adjacent to the shaft on a pair of plinths or on a masonry support at ground level (balance bob mounting), the attached counterweight - a large box filled with scrap iron or rocks - working in an adjacent stone-lined pit. Other balance bobs would be installed in chambers cut into the rock adjacent to the shaft wall as needed to counterbalance the weight of the pump rods, especially on a deep shaft..
BAL-MAID A woman or girl employed at surface on a mine, generally for ore dressing.
BEAM-ENGINE A type of steam-engine much favoured in Cornwall for use in pumping, winding, and providing the power to crush ores preparatory to dressing on Cornish mines. The power from a large cylinder set vertically in an engine-house was transferred via a massive rocking beam or bob to the pumps in the shaft outside. For winding and crushing, the bob was instead attached to a flywheel and crank on a LOADING next to the BOB-WALL (or in the case of all indoor engines, the side wall). In most cases, the engine house formed an integral part of the framing of the engine.
BEDSTONE The granite slab which formed the foundation for the cylinder of a Cornish Engine.
BLOWING-HOUSE An early form of tin smelting furnace, small in scale and using charcoal as a fuel.
BOILER HOUSE A generally lightly-built structure attached to an engine house, and designed to contain the horizontal boilers for a steam engine; the associated chimney stack may be attached to this structure, or built into one corner of the engine house.
BRATTICING Timber partition work in a mine, for instance the LAGGING BOARDS which lined the upper section of a shaft where it ran through soft ground.
BUCKING The breaking down of copper ore on an anvil to about 10mm in diameter by bal-maids using small hammers, after which the ore was separated from the waste by hand. This process followed cobbing, in which it had been broken down to about 25mm in diameter, the waste again being hand removed. These processes, through which the majority of the highest quality copper ore was recovered, took place within roofed structures called bucking houses.
BUDDLE A device for concentrating tin ore. In the mid-19th century these most usually took the form of a circular pit with rotating brushes; the tin from the stamps was fed into the centre or side of the pit and was graded by gravity, concentrating the heavy ore near the inlet point. These were often mechanically worked. Earlier buddles were trapezoidal in shape, and manually operated. A variation used in tailings works to treat sands and slimes was the ROUND FRAME: a free-standing, all wooden, mechanically-actuated buddle, whilst a further variation was the dumb buddle or dumb pit, not mechanically operated.
CALCINER A furnace and heating chamber in which ores were roasted to drive off impurities such as sulphur and arsenic. These were also known as Burning Houses, later patterns being of REVERBERATORY design. The Brunton pattern calciner, introduced in the mid-19th century, was mechanically powered, and operated on a continuous basis, unlike earlier designs. Other patterns of calciner were also devised, the majority named after their designers (e.g. Oxland, Hocking and Loam).

CAPSTAN A manually or steam-operated winding drum, usually installed on a mine to raise pitwork from the shaft for maintenance or repair.
CATARACT PIT (or cock pit) A sub-floor area within the foundation levels of an Engine house between the Cylinder Plat and the Bob Wall, containing the regulating apparatus, and giving access to cylinder hold-down bolts.
CILL The base of a window or other wall opening.
COFFIN or GOFFEN The narrow excavation resulting from stoping on a lode being carried to or from surface on part or all of a lode. See also GUNNIS, STOPE, OPENWORK.
CONDENSER The cast-iron cylinder set in a tank of cold water immediately in front of the bob wall of an engine house in which the exhaust steam was condensed, creating a vacuum which greatly increased the efficiency of a steam engine. For a pumping engine this equipment was often contained within a pair of masonry walls projecting from the bob wall towards the shaft.
COST BOOK COMPANY A company of unlimited liability into which shareholders either paid 'calls' for further finance or shared any profits. Mines kept a 'cost book' to record expenses/costs/dues/earnings. This system was replaced by the end of the 19th century by limited liability companies.
COUNT HOUSE Properly ACCOUNT HOUSE, but generally shortened. The mine office, sometimes incorporating accommodation.
CULVERT A small tunnel constructed to carry a channel of water.
CYLINDER OPENING The often large, arched opening in the rear wall of an engine through which the steam cylinder was brought into an engine house during the erection of the engine. This opening was generally subsequently closed off with a timber partition and usually incorporated the principal doorway into the engine house.
CYLINDER PLAT The massive masonry base on which the cylinder of a Cornish Engine was bolted down (see also BEDSTONE).
DRESSING The concentration of the tin (copper or other ores) contained in the rock excavated from the stopes of a mine. Carried out on DRESSING FLOORS.
DRESSING FLOORS An (often extensive) area at surface on a mine where the various processes of concentration of ore took place - these consisted of crushing or stamping to attain a uniform size range, sizing (particularly on later mines), separation of waste rock, concentration (generally mechanically and hydraulically on tin mines, manually on copper mines), the removal of contaminant minerals (by calcination, flotation, magnetic separation), and finally drying and bagging for transportation to the smelter. Tin floors in particular were generally laid out down a slope to reduce mechanical or manual handling between stages in the process.
DRIVE (alternatively lode drive or heading). A tunnel excavated on the line of a lode as the first stage of the development of a STOPE.
DRY or CHANGE HOUSE (earlier MOOR HOUSE) The building within which miners changed their clothes before and after going underground. Some were heated by steam pipes connected to the engine boilers. Where there were large numbers of women or children employed on a mine, there might be two drys - one for men, the other for women and children. The pithead baths or showers found in collieries were rarely found in Cornwall.
DUMP or BURROW (alternatively spoil dump, spoil tip). A pile of waste material, usually from a mine or quarry. May contain primary waste (where this could not be disposed of underground) or waste from various stages in the dressing process. TAILINGS LAGOONS stored the extensive slimes from the final stages in the process; in earlier mines these were flushed over cliffs or allowed to wash away in streams or rivers.
EDUCTION PIPE The large diameter pipe through which exhaust steam was drawn into the condenser set outside the bob wall.
ENGINE HOUSE A building designed to contain steam, gas, oil or electric engines on a mine or other works. When forming part of the framework of a beam engine, these were particularly strongly constructed.
FATHOMS Measurement of horizontal or vertical distance at surface or underground (1 fathom is the equivalent of 6 feet)
FINGER DUMP A linear dump of waste material from a mine or quarry, flat-topped to allow material to be barrowed or trammed along it, and often equipped with a temporary tramway track.

FLAT RODS Reciprocating (or very occasionally rotative) iron rods used to transfer power from a steam-engine or water-wheel to a remote location.
FLUE A masonry-constructed tunnel or conduit connecting a furnace to a chimney stack
FRUE VANNER A mechanically-driven, laterally vibrated, inclined rotating belt on which fine tin-containing material in suspension in water was treated by relative density.
GIRDER The massive timber beam set across an engine house just below top floor level to which the parallel motion was attached and on which the spring beams sat.
GOSSAN The upper part of a mineral vein as it breaks surface. The natural weathering of rock will decompose the metallic sulphides, characteristically leaving a porous Quartz.
GUNNIS A narrow linear excavation left where a lode has been worked, most commonly used when open to surface. See COFFEN
HANG A TACKLE A temporary headframe construction with a winding mechanism to aid in the sinking of a shaft on a lode or to access a lode
HEAD or CROP The richest part of material in a buddle - nearest its feed point.
HEADFRAME The tall construction set over a winding shaft which carried the sheave wheels over which the winding ropes ran. Headframes usually contained ore bins or ore chutes to allow the broken rock in the skips or kibbles to be tipped into trams at surface.
HORIZONTAL ENGINE A steam engine where the cylinder(s) are set on a horizontal bed and the piston rods are attached via a cross-head to a crank and flywheel.
HORSE WHIM Similar to a capstan, but in this case power supplied by a horse walking around a circular platform (PLAT) was applied to an overhead winding drum; frequently used for winding from small shafts on Cornish mines, especially during exploratory work and shaft sinking. The smaller under-gear whims found in some 19th century farms were little used on mines.
JIG A large mechanically or hand-operated sieve set in a tank of water using which ore could be separated by waste. Sometimes constructed in groups within jigging houses.
KIBBLE A large, strongly-constructed, egg-shaped, iron container used for ore and rock haulage in earlier shafts. Superseded by SKIPS.
LAGGING BOARDS The timber planks lining the upper part of a shaft, or where it ran through soft ground.
LAUNDER A wooden or steel trough used to carry water or other liquids; often used to feed water or finely-divided material in suspension around a dressing floor.
LABYRINTH (colloquially "lambreth") A series of interconnected masonry-constructed chambers set adjacent to one another on whose walls the arsenic vapourised in a calciner or arsenic furnace was condensed out. The gas followed a zig-zag path through such groups of chambers, and one end of each chamber would be closed off with a door using which the condensed arsenic could be collected.
LEAT An artificial water-course, built to carry a supply of water to a mine.
LINTEL The horizontal timber or stone support above an opening in a wall or structure.
LOADING A masonry platform in front of an engine-house (or elsewhere) on which machinery such as cranks, flywheels or winding drums were mounted, upon which the reciprocal motion of the sweep rod attached to the beam was turned into rotative motion.
LOBBY The excavated cutting running up to an adit portal.
LODE A linear area of mineralization underground. In other parts of Britain a VEIN, or SEAM. Generally vertical or near-vertical, and often extending for considerable distances along its strike.
LODE-BACK PIT A shallow shaft dug from surface into shoad or the upper part (backs) of a lode, from which ore could be extracted from shallow stopes to the depth of the water table or just below. Waste material was generally dumped adjacent to the shaft mouth.
MAGAZINE Small strongly built store containing explosives (gunpowder or dynamite); often circular, sometimes with additional enclosing walls to contain the blast of an accidental explosion.
MELLIOR STONE The granite bearing stone for the upright shaft of a HORSE WHIM.
MIDDLES The material in a buddle found between the crop and the tailings, this generally containing enough ore to warrant its re-treatment.
OPENWORK or BEAM. A mineral extraction site open to the surface, and similar to a quarry but usually distinguished by its elongated shape, and steep sides. Generally applied

to features broader in extent than a GUNNIS OR COFFIN. A variety is a STOCKWORKS, where an area of ground containing a large number of small parallel lodes was removed.
OVERBURDEN The topsoil and subsoil removed in the process of opening or extending a quarry, streamworks or mine.
PELTON WHEEL A small enclosed water turbine, working at high pressure and rotational speeds. In use from the later 19th century.
PITWORK The term used to describe the pump rods, rising main, shaft guides (buntons) etc. within a shaft.
PORTAL The entrance to an adit beyond its LOBBY. Often timbered or stone vaulted.
PROSPECTING PIT/FOSSICKING PIT OR COSTEANING PIT A small pit dug in search of minerals, and almost always found in linear groups, often arranged cross-contour, or at right angles to the projected strike of known lodes or deposits of shoad. A COSTEANING TRENCH is a linear excavation cut for prospecting purposes.
RAG FRAME or RACK FRAME An inclined table-like surface on which very fine slimes in slurry form were treated to recover their tin. Large mines would have hundreds of such frames arranged in groups.
REVERBERATORY KILN A design of furnace in which there was indirect contact between the heat from a hearth and ore to be roasted, usually by incorporating a baffle flue.
ROTATIVE ENGINE A beam engine in which the reciprocating motion of the beam was converted to rotary motion via a sweep rod, crank, and flywheel.
SETT The legal boundary within which a mine could extract minerals.
SETT One of a series of stone supports for a tramway, performing similar function as sleepers.
SETT One of the components of timber framing of an adit where it ran through loose ground; also the timber framing of a shaft to which the shaft guides and LAGGING BOARDS were attached.
SHAFT A vertical or near-vertical tunnel sunk to give access to extractive areas of a mine.
SHAKING TABLE A slightly inclined, mechanically vibrated table on which fine tin (as sands or slimes) in suspension in water was concentrated by relative density.
SHEARS or shear legs. A tall timber frame carrying a pulley or sheave wheel erected in front of an engine house over a shaft and used for the installation and maintenance of PITWORK.
SHOAD or SHODE Ore weathered from the load and moved (in geological time) downslope under the force of gravity. Material reaching a river valley would be to some degree concentrated before redeposition in horizontal beds. These beds of detrital material (placer deposits) were exploited in streamworks.
SKIP A (generally elongated) iron or steel container equipped with small wheels or brackets running on the shaft guides (buntons), used for rock/ore haulage in later mines.
SOLLAR A timber platform in a shaft, stope or underground working (often between a series of ladders).
SPRING BEAMS The pair of longitudinal timbers extending from the rear of an engine house parallel to and on either side of the BEAM at top floor level. These served to arrest any unwanted excess indoor motion of the beam via catches set onto its rear and were extended out from the front of the house to form the foundation for the bob-plat (the timber platform from which the bearings on the outdoor section could be serviced).
STACK A chimney on an industrial site, used to carry away smoke or fumes from boilers, furnaces and calciners. Often situated at the end of a Flue.
STAMPS A mechanical device for crushing ore-bearing rock to a fine sand. Heavy vertically-mounted beams (or later iron rods) carrying cast or forged iron heads were sequentially lifted and dropped onto the prepared ore beneath them by a series of cams mounted on a rotating drum; this usually driven by a water-wheel or steam engine.
STOPE Excavated area produced during the extraction of ore-bearing rock. Often narrow, deep and elongated, reflecting the former position of the lode. Where open to the surface, these form GUNNISES or COFFENS.
STREAMWORKS An area worked for detrital (redeposited) tin deposits by shallow excavation. Often characterised by linear dumps, river diversion, and evidence for leats. Some streamworks (dryworks) exploited deposits of shoad in now dry valleys and on

hillsides, where concentrations of this material were economically workable. Leats and reservoirs were necessary to work these sites, and are characteristic of them.
STRIPS (settling strips) Elongated shallow tanks in which the primary settlement and subsequent separation of tin ore from waste took place after it had been stamped.
SWEEP ROD The elongated iron rod which connected the beam of a Cornish engine to a crank and fly wheel.
TAILINGS The waste sand and slime from a mine dressing floor, not containing workable quantities of mineral.
TAILRACE The channel along which water flows after having passed over or under a water-wheel and is then generally returned to the water course.
TRIBUTE A system of payment (by percentage of value of ore broken), whereby groups of miners contracted to work at previously-agreed rates.
TUTWORK A system of payment ("by results") in which groups of miners bid against one another for contracts to work sections of the mine for a percentage of the value of the ore raised from that area.
VANNER A person employed on the surface of a mine to check or assess the tin content at each stage of the refining process. The VANNING SHOVEL was used to test the relative concentration of ore in a sample of finely crushed ore or partially dressed ore.
WATER-WHEEL Wheel fitted with buckets or paddles around its periphery, and driven by the weight or force of a stream of water directed onto them.
WHEAL also WHELE, WHILE, HUEL. A mine.
WHEELPIT A structure built to house a water-wheel, often excavated and stone-lined, but sometimes free-standing.
WHIM PLAT The level and usually circular platform on which a horse-whim was sited.
WHIM The winding gear used for hauling from a shaft; consists of a power source and a winding drum. See Horse-Whim.
WIND BORE The cast-iron strainer attached to the bottom lift of pumps