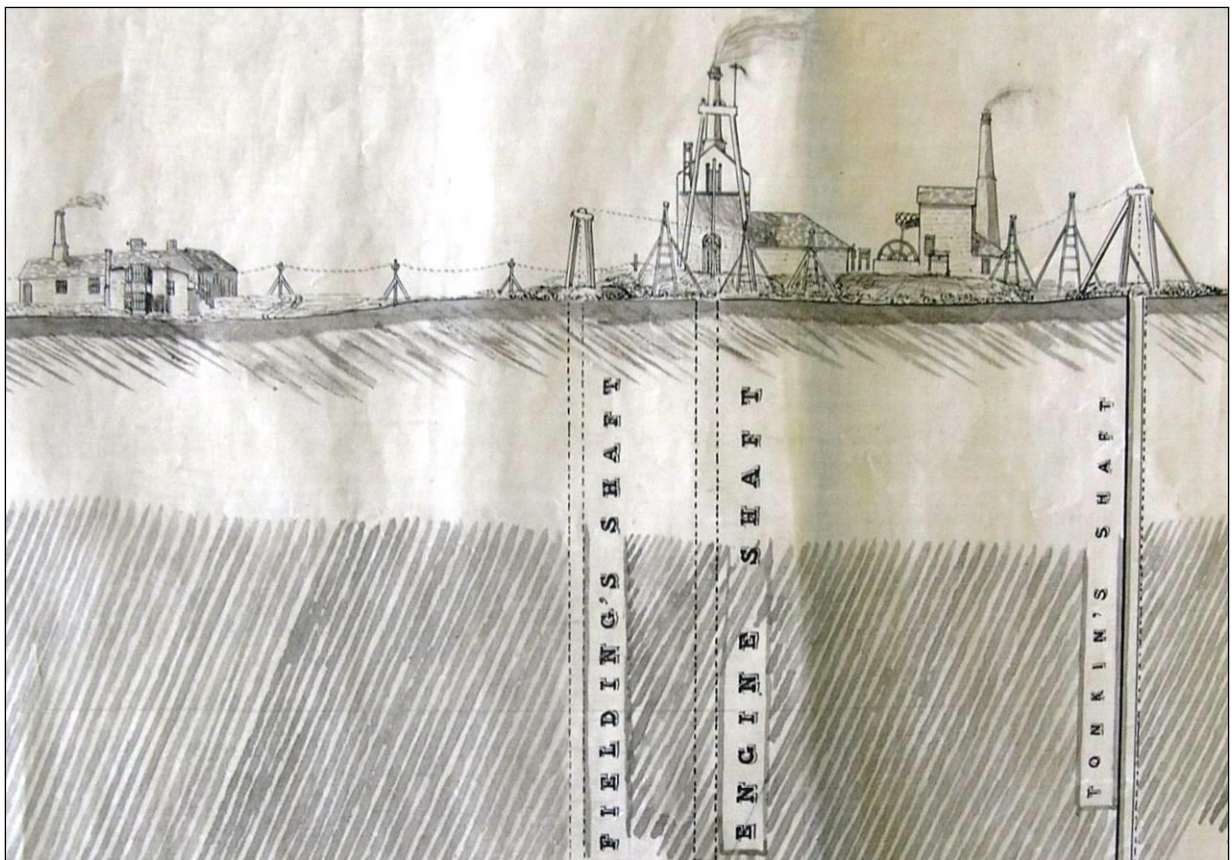




Wheal Busy Mine Chacewater, Cornwall Conservation Management Statement



Cornwall Archaeological Unit

Wheal Busy Mine, Chacewater, Cornwall

Conservation Management Statement

Client	PWH Surveyors
Report Number	2013R084
Date	December 2015
Status	Final
Report author	Colin Buck
Checked by	Andy Jones
Approved by	Andrew Young

Cornwall Archaeological Unit

Cornwall Council

Fal Building, County Hall, Treyew Road, Truro, Cornwall, TR1 3AY

Tel: (01872) 323603

Email: cau@cornwall.gov.uk Web: www.cornwall.gov.uk/archaeology

Acknowledgements

Text within this report for inclusion in a Conservation Management Statement (funded by NE Higher Level Stewardship Scheme), was commissioned by PWH Surveyors and produced by Cornwall Archaeological Unit (CAU - formerly Historic Environment Projects), Cornwall Council.

The views and recommendations expressed in these report sections are those of Cornwall Archaeological Unit and those of other authors and organisations whose reports are summarised here. They are presented in good faith on the basis of professional judgement and on currently available information.

I am grateful for the assistance given to me in drawing up this plan by a number of people, including Shaun Watts (PWH Surveyors), Nigel Thomas, Simon Leather (Tregothnan Estates), and Emma Trevarthen (HE Records).

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.



Historic Environment, Cornwall Council is a Registered Organisation with the
Institute for Archaeologists

Front Cover illustration

An excerpt of an undated (c 1860s) longitudinal section of Great Wheal Busy & Hallenbeagle Mine (MRO R151A). Reproduced with permission of the County Records Office, CC.

© Cornwall Council 2015

No part of this document may be reproduced, stored in a retrieval system, or transmitted in any form or by any means without the prior permission of the publisher.

Contents

1	Wheal Busy Mine: Understanding the site	1
1.1	Introduction	1
1.2	Area context	1
1.2.1	Location	1
1.2.2	Landscape setting and character	1
1.2.3	Defining attributes	2
1.2.4	Geology/mineral lodes	2
1.2.5	Site designations	3
2	Historic context	4
2.1	Pre-industrial history of the area	4
2.2	Industrial historic context	4
2.3	Wheal Busy Mine	5
2.3.1	Recent site impacts	19
3	Site assessment	21
3.1	CMS area	21
4	CMS area site inventory table	25
5	Site Significance	33
5.1	Methodology	33
5.2	Statement of Significance	33
6	Bibliography	36
6.1	Primary sources	36
6.2	Secondary sources (published)	36
7	Project archive	37
8	Appendices	38
8.1	Glossary of mining terms	38

List of Figures

Fig 1 Location map of Wheal Busy Mine and surrounding area

Fig 2 A map showing the mineral lodes in the surrounding area

Fig 3 1839 Kenwyn Tithe map of the CMS area

Fig 4 Symons 1861 Plan of the Chacewater District

Fig 5 1860s section of Gt. Wheal Busy Mine (underground workings)

Fig 6 1880 OS 25" mapping of the CMS area

Fig 7 1908 OS 25" mapping of the CMS area

Fig 8 NMP Mapping for Wheal Busy

Fig 9 Excerpts of the 1946 RAF aerial photographs of the CMS area

Fig 10 2005 AP of study area

Fig 11 Archaeological site inventory map

Abbreviations

CC	Cornwall Council
CMS	Conservation Management Statement
CMS Ltd	Cornwall Mining Services Limited
EH	English Heritage (now Historic England)
HE	Historic England
HER	Cornwall and the Isles of Scilly Historic Environment Record
HLC	Historic Landscape Characterisation
NE	Natural England
NGR	National Grid Reference
OS	Ordnance Survey
OUV	Outstanding Universal Value
PWH	PWH Chartered Surveyors
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WHS	World Heritage Site

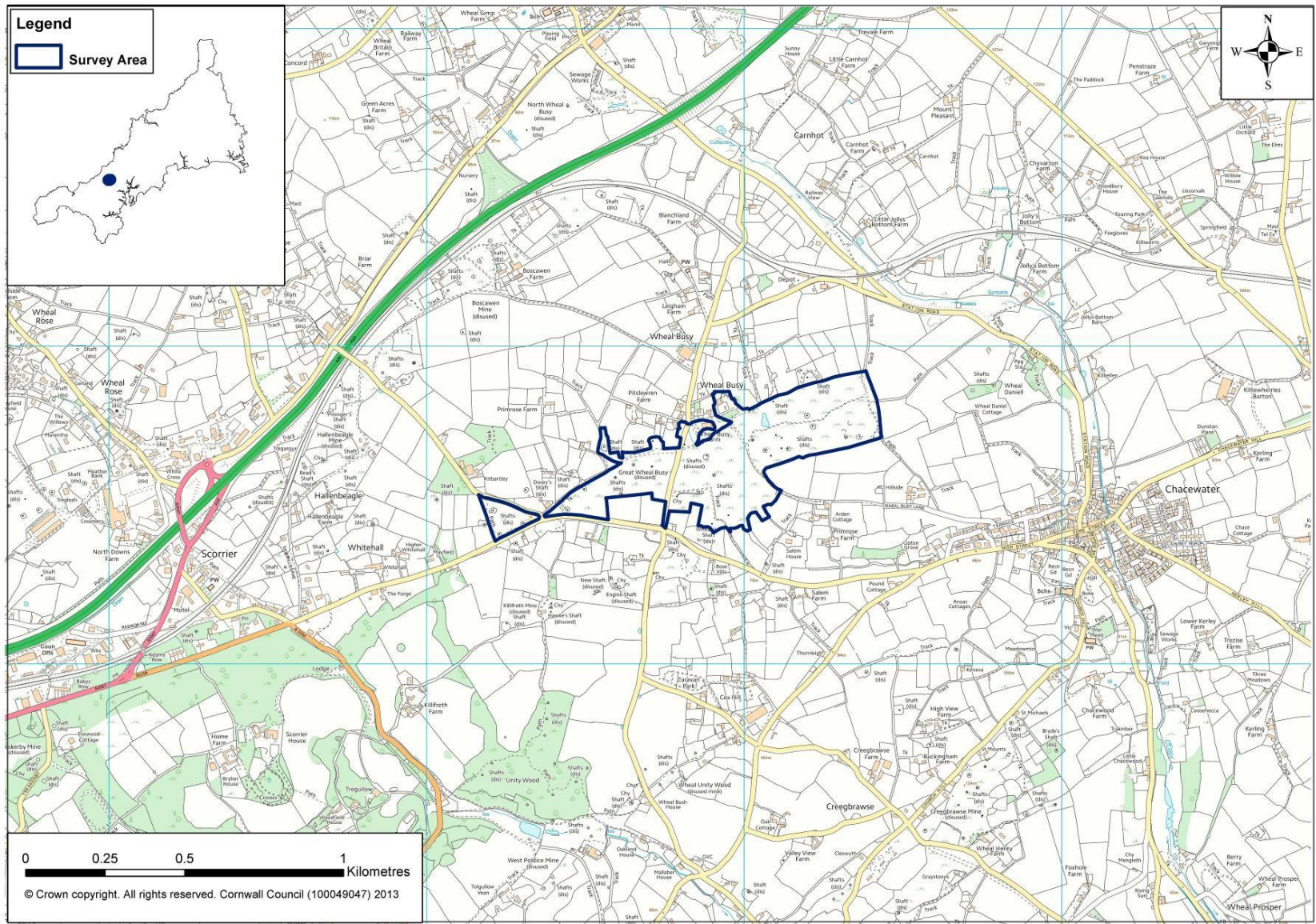


Figure: 1 Location map of Wheal Busy Mine and surrounding area.

1 Wheal Busy Mine: Understanding the site

1.1 Introduction

Cornwall Archaeological Unit were commissioned by PWH Architects of Barnstaple in May 2013 to produce an archaeological assessment and historical text sections for inclusion in a conservation management statement to be produced by PWH, as part of a Natural England (NE) Higher Level Stewardship Scheme. The scheme includes building conservation works and historic land management to Wheal Busy Mine, Chacewater, owned by the Tregothnan Estate.

This first section of this conservation management statement (CMS) seeks to describe and analyse a number of different important aspects in order to increase our understanding of the site, the CMS area and its hinterland. It should enable the reader to have a clear picture of Wheal Busy Mine and the factors that combine to make it one of the oldest and historically significant mine sites in Cornwall.

The historical, archaeological and industrial heritage of the CMS area will be described as well as the geological origins underlying (and the *raison d'être* for), Great Wheal Busy Mine. The contextual relationship of its early origins for copper mining, its subsequent use for technological innovations siting early 18th century steam (fire) engines, and the contrast of this early formative mining activity with today's barren nature of the site will also be discussed.

A detailed inventory of all archaeological sites within the CMS area is given in tabular form (section 4), with a summary description of the significant sites and themes in the site significance section.

It should be noted that the historical background section of this report has been revised (due to important historical information becoming available), compared to an earlier version that was produced for inclusion in the Wheal Busy Mine Conservation Management Statement produced by PWH Surveyors (2013).

1.2 Area context

1.2.1 Location

Wheal Busy Mine is located north and west of Chacewater, one mile east north east of Scorrier, and west of the more recently built A30 (grid reference SW 7391 4478, see Fig 1). The CMS area exceeds 30 hectares and occupies a shallow valley running east - west. Virtually all of the CMS area still shows signs of former mining-related activity, although nature has reclaimed much of the surface area, and the resulting consequence of mine shaft capping activities in the late 1980s.

1.2.2 Landscape setting and character

Landscape setting

Wheal Busy Mine is surrounded by a few medieval/post-medieval farming hamlets, north and west of Chacewater. It is likely that the mine site was not worked in an industrial fashion until tin streaming developed across the county from the 13th century onwards. Up until that date, the shallow valley is likely to have been used for outfield downland grazing and summer agricultural/pastoral functions. However as a consequence of a number of deep parallel lodes within the valley, the landscape of this area has been overturned; firstly by tin streaming during the medieval period and secondly by copper mining in the 18th century, in the relentless pursuit of mineral ore.

Deeper lode mining from the 18th century onwards finally totally changed the landscape setting and character of this site. Today, although the 18th and 19th century engine houses have mostly gone, the landscape will never return to its rural downland and later enclosed agricultural origins. Minerals and waste rock have been brought to surface, leaving mine dumps spread across the valley over a three hundred year period – resulting in the growth of heather, gorse and bramble; the setting and character of a typical 18/19th century mine. However, farming settlements still circling the mine

(Pitslowren, Boscawen, and Primrose Farm), are testament to the original forms of small 18th and 19th century rural settlements surrounded by small fields, that enclosed the former downland (see Fig 2). Beyond these, the landscape is dispersed with small built up settlements (often former mining houses), and expanded villages (for example, Chacewater), a result of the 18/19th century mining boom of this area.

The setting of Wheal Busy Mine within a surrounding agricultural environment is one of a tightly constrained island of remnant mine buildings within a landscape interspersed with numerous mine shafts and other mining-related earthworks.

The boundaries around the study area are a mixture of Cornish hedges and fields. The only regenerative feature within the mining landscape is the substantial heather growth to the west and east sides of the study area; giving an alternative visual impact of a splash of summer purple and yellow to contrast with the green of the surrounding fields.

Character

Historic Landscape Characterisation (HLC) is a tool used to gain a more holistic and integrated understanding of the ways in which our modern landscape has developed, identifying its values, potential and vulnerabilities. Thus, HLC is recognised as a valuable aid to landscape management (Cornwall County Council 1994).

1.2.3 Defining attributes

The HLC Type for the Wheal Busy CMS area is predominantly Ancient Enclosed Land in the Landscape Character Area of Redruth, Camborne and Gwennap (CA11, CC 2008 in HER). The summary description for this area is: *'rolling landscape with underlying slates and siltstones running from the exposed north coast to the Fal ... The strong influence of over 300 years of tin and copper mining has affected both the present day land use and landscape pattern of this area; this is reflected in the Gwennap, Redruth and Camborne mining districts. Extensive areas of disturbed or derelict land from this earlier industrial activity are evident with many developing into fragmented semi-natural habitats with scrub, bracken and heath'*.

In detail, the site is characterised at its western and eastern parts as 'Upland Rough Ground': summarised as 'areas of rough grassland, heathland and open scrub, usually on the higher or more exposed ground in the locality'. The central part of the site is defined as 'Modern enclosed land': summarised as 'mainly ancient enclosed land or post-medieval enclosed land whose field systems have been substantially altered by large scale hedge removal in the 20th century' (CC HE Landscape Area Character Description 2005-7 in HER).

1.2.4 Geology/mineral lodes

Cornwall derived its wealth from its geology. Its granite uplands extend westwards across Cornwall to West Penwith, creating a spine of outcrops, each surrounded by Devonian shales, locally known as killas. Mineralisation concentrates around the contact areas between the granite intrusions and the shales. This has created rich lodes, or deposits of tin, copper, zinc, lead and iron. This mineral wealth has been exploited since prehistoric times, giving Cornwall early importance as a supplier of metals to northern Europe.

The main bedrock within the study area is *'metamorphosed killas traversed by an elvan dyke'*. *The elvan dyke, 15 to 40ft. wide, coursing generally E. 15° N. and underlying about 45° N., crops out 420 yds. N. of Salem House; it is impregnated in places, chiefly with sulphide ores. Against the hangingwall of the elvan is Winter's Lode, 3 ft. wide, and against the footwall is Chacewater Lode, up to 4ft. wide, followed immediately at its footwall by Hodge's Lode, also up to 4 ft. wide. Other lodes in the sett are Engine Lode and White Work Lode, parallel to the elvan and, respectively, 13 yds. and 50 yds. N. of Winter's Lode; William's (Matthew's or Wheal Chance) Lode, 60 yds. N. of White Work, coursing about E.10° N. and underlying 12° S.; King's Lode, coursing E. 25° N. and intersecting Matthews Lode in the west of the sett, and on the south, Wheal Vor*

Lode, 240 yds. S. of the elvan, coursing E. 25° N. and underlying 35° N.; it extends south westwards into Killifreth Mine. The chief ore bodies are those on Winter's, Elvan, Chacewater and Hodge's lode (cassiterite, chalcopyrite, mispickel and wolfram)' (Dines and Phemister 1956, 389).

Figure 2 shows the lodes at surface and underground as consisting of tin and copper, etc trending south south-west to north north-east.

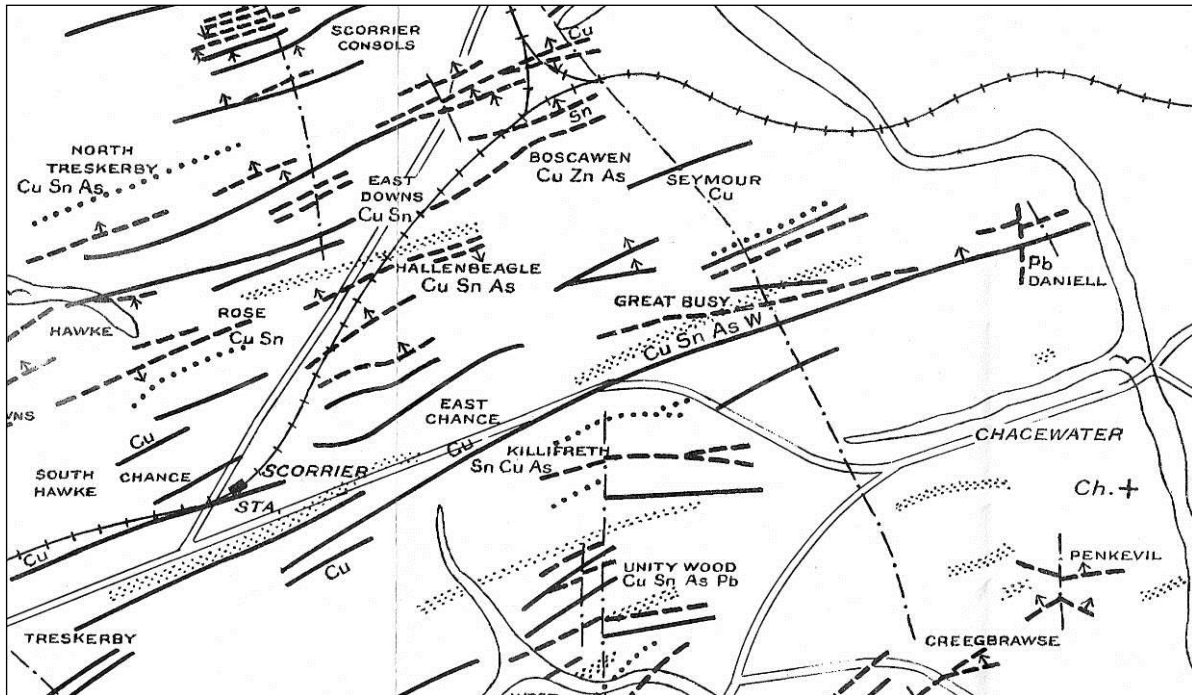


Figure 2: Map showing the mineral lodes in the Wheal Busy surrounding area (Dines and Phemister 1956, Map VIb).

1.2.5 Site designations

The significance of the site is demonstrated by the fact that it is not only a partially Scheduled Monument of National importance, but is also described as one of the most important surviving mining landscape remains in the Cornish Mining WHS (WHS 2001, 2007). A full list of designations is given below:

International

All of the CMS area is included in Area A6i (Gwennap Mining District) of the Cornwall and West Devon Mining Landscape World Heritage Site ('Cornish Mining World heritage Site'), inscribed by UNESCO in July 2006 (WHS 2001; 2007).

National

Three distinct sites within **Wheal Busy** are nationally protected **Scheduled Monuments (SM 32992 List No. 1021392)**: **Great Wheal Busy Engine House** (Site 32) at SW 73926 44825, the **Arsenic processing complex** (including a Brunton Calciner, shaft kilns, a reverberatory furnace, labyrinth condensing chambers and arsenic chimney), described in Sites 65-67 at SW 7385 4454 to SW 73788 44526, and the **eastern half of Wheal Busy Mine** (centered SW 7421 4474). In addition, the **Arsenic Calciner** itself (SW 73868 44540) is Listed Grade II (No. 63814), and the former **Great Wheal Busy Smithy Building** (SW 73882 44750) is also Listed Grade II (No. 492506).

Regional/County

The CMS area is wholly within an Area of Great Historic Value (AGHV12) for the St Day to Gwennap Mining District. The eastern half of the site and the western end both have Biodiversity Action Plans for Lowland Heathland. There are no other designated sites of nature conservation importance within the CMS area.

2 Historic context

This chapter provides an outline history of Wheal Busy Mine. This will be described within the context of the historic development of mining in Cornwall and in particular the use of this site during a formative period of technological development for utilising and developing steam engine technology to pump the ever deepening mines. In recent years there has been much written about the history of tin and copper mining in Cornwall. Although this has been summarised within the World Heritage Site Nomination Document (2005), and may be familiar territory for many, it is important to understand the historical significance, context and importance of Wheal Busy Mine.

2.1 Pre-industrial history of the area

Within the CMS area, there are no pre-industrial sites recorded on the Cornwall and Isles of Scilly Sites and Monuments Record. However, many former areas of Upland Rough Ground often include earlier prehistoric ritual monuments including Bronze Age cairns and barrows. The high upland sites often have traces of later prehistoric unenclosed settlements and field systems and of Iron Age and Roman-period defended farmsteads (rounds), the latter particularly around the margins of the upland area. However, it is likely that within the study area the gradual enclosure and/or 18th century mine works obliterated much of any surviving sites of prehistoric date. A pair of Bronze Age barrows located from aerial photographs, suggest that the higher ground near Scorrier might have been the focus for a small barrow cemetery, similar to others scattered along the route of the A30. In addition, there is a possible barrow at Boscawen Farm, to the west of the study area. The HER contains no evidence for Iron Age or later prehistoric occupation in the study area. It is likely that during the post-Roman and medieval periods, upland areas supported unenclosed grazing, with intermittent use for cultivation. However, these activities rarely leave any trace.

Within and in close proximity to the CMS area, it is likely that the dominant pre-industrial history would have been a combination of medieval streamworks along the shallow valley sides within the study area, followed by periods of inactivity when farming prevailed. It would not have been until the early 18th century onwards, when lode back and shaft mining spread across the landscape; the long lines of shafts (see Fig 4), testament to the mineral lode riches that lay beneath the fields and valley bottom.

2.2 Industrial historic context

By the mid-medieval period, tin streaming was carried out on an industrial scale across Cornwall; in the 12th century legal control of Cornwall's tin mining industry was granted to Richard, Earl of Cornwall and the stannary system conceived soon after (Barton 1967). However, half a millennium later, copper mines in the west of Cornwall were, in many regions, of greater significance in terms of the sheer quantity of ore produced and their impact on the Cornish landscape and economy than were the tin mines. Wheal Busy is one of the best examples (through documentary and historic evidence) in Cornwall of a site that has been worked for copper from the early years of the 18th century; leading to its use as a testing ground for the development and innovations of steam engine technology and design from the early 18th century to the mid-19th century. By the mid-19th century the greatest copper mining district in Cornwall was around St Day and Gwennap, where the Consolidated and United Mines both produced nearly a million tons from 1815 to 1872, (two-thirds of the world's copper production). However, even by 1850, Cornwall's copper production had been overtaken by

competition from other parts of the world: South America, North America and Australia. In Cornwall, tin maintained pre-eminence until the last quarter of the 19th century when it had reached its peak of production. The decline thereafter (apart from the later discovery of the deep 'Great Flat Lode' bringing a temporary resurgence of tin mining south of Carn Brea), was caused by competition from other parts of the world: easily accessible ore deposits from Malaya, Bolivia and Australia.

The lasting legacy of these different mining operations in Cornwall is the physical evidence of the surviving buildings in their industrial landscape context. Overall, there were at least 3000 engine houses at work in Cornwall but unfortunately, only about 300 sites now remain (c.200 within the World Heritage Site). The iconic remains of a pumping, winding or stamps engine house are visible reminders to everyone of Cornwall's historic legacy and contribution to the Industrial Revolution. In particular, the 19th and 20th century remains of mine sites both within the study area and to the south west (Killifreth Mine), can still be seen. This underlines the strong influence of the former mining industry on the landscape character of the area, justifying its status as a key part in Cornwall and west Devon's World Heritage Site.

2.3 Wheal Busy Mine

The history of Wheal Busy has detailed and documented origins from the 18th century onwards. Contemporary accounts (Brookes 2001), describe an active mine worked by many miners for decades from the early years of the 18th century onwards. Its promising outlook (the most productive of the prolific Scorrier mines), and healthy finances (through wealthy mining adventurers), must have ensured development capital for the introduction and testing of new steam engine pumping technology. This was an ideal testing site for the construction and use of the earliest Newcomen, Smeaton, Boulton & Watt and other steam engines in Cornwall from 1726 onwards (Rolt and Allen 1997), given its rich but wet, close lodes.

Numerous parallel lodes cross the study area and run roughly west to east along the shallow valley north of Chacewater (see Figure 2). It is likely that deep tin mining from the 17th century (on the former summer grazing downland), gave way to the discovery of copper lodes in depth, which were exploited when market conditions improved in the early years of the 18th century through the early demands of the industrial revolution.

Collins (1912, 219) hints at late 17th century origins: *'Wheal Busy, the old Chacewater mine, is known to be one of the oldest copper mines in Cornwall, and smelting works for the local treatment of its ores with those of some neighbouring mines were set up on the North Downs before the end of the seventeenth century. Borlase, writing in 1758, mentions the Chacewater and North Downs mines as being among the most profitable Cornish mines in the period from 1718 to 1758'*.

By the 1720s (working in 1718 and producing a profit of £200,000), small concerns that later became Wheal Busy consisted of a mile long lode worked in depth by at least three mines. The eastern works named **Resnorth** (worked by various adventurers), **Metal Work** (worked by Mr Coster of the Bristol Copper Smelting Co.), and **Pitsloarn** or **Wheal Busy** (by the same Bristol Company) in an area named Chacewater Mine (Brookes 1986, Chacewater Mine). Resnorth sold copper ores from 1706 onwards. It should be noted that the Coster family of mine adventurers took on the leases of many Cornish copper mines, including a number in the Tamar Valley (Buck 2003, 14), and were influential in developing improved techniques for adit drainage, waterwheel technology and improved horse whims (technologies developed in Germany in the late 1600s (Barton 1978, 12-14). A water-driven rag-and-chain type pump was in operation on the edge of the Pittslourn or Wheal Busy Section by around 1710 (probably in the eastern section of the study area, pumping water from a depth of 44 fathoms). This is the earliest known example of this type of pump in Cornwall and is understood to have been inspected by Henric Kahlmeter, after 1724 (Brooke 2001). Twin adits had been cut (one 80 fathoms in ten weeks), and many shafts were operational (Brookes 1986, Chacewater Mine). However, this work was very labour-intensive and costly. However,

for any mining entrepreneur (who had sufficient funds) the development of steam engine technology at this mine would have been an exciting proposition.

The jury is out as to the exact dates and locations of the earliest atmospheric steam engines in Cornwall (Greener 2014; Rolt and Allen 1997, 44), but early versions of the Thomas Newcomen engine appear to have been at Great Work Mine, (c1705-1714), Wheal Vor (c1709-1714, c1718-1721), and later Wheal Fortune (Ludgvan: 1718-1721). However, the doubling of sea-going coal duties in 1713 seriously affected the economics of using these inefficient coal hungry machines. Later in 1719 the National Debt Act further raised coal duties hastening the death knell of these earliest engines. Both the engines at Wheal Fortune and Wheal an Vor (Wheal Vor?), stopped work two years later (Greener 2014).

Under the agency of Joseph Hornblower, Newcomen atmospheric steam engines began to make more of an impact upon Cornish mines from 1725, the first site being Wheal Rose near Truro, the second at Wheal Busy (c1725), and a third at Polgooth, St Austell. In fact, by 1727 there were five such engines in Cornwall, although it is likely that Thomas Newcomen himself supervised construction of the early engine at Wheal Fortune in 1718, when he was in Cornwall for most of the year (Rolt and Allen 1997, 85).

The first steam engine at Wheal Busy, the c1725 Newcomen engine erected under the supervision of Joseph Hornblower (only a year after Kalmeter's visit), may well have stood at Old Engine Shaft (possibly Site 46). It had a 66" cylinder that drew an 18.5" bucket from a depth of 24 fathoms, and used 216 bushels of coal in 24 hours (Rowe 1932, 151).

In 1728 the Coster family began a lawsuit against people who obstructed the water flow to the steam engine. In 1757 the mine was 70 fathoms deep, and a year later documented that there were two Newcomen 'fire-engines' on the mine works (still called Pitt-louarn, Resnorth and Metal Work); a 62" and 66" (Brookes 1986, Chacewater Mine). Rowe (1932, 151) states that this second engine was a 64" which drew a 17.5" bucket from a depth of 26 fathoms, and worked at 8 strokes per minute. This engine was possibly sited at Fieldings Shaft (Site 36), but its erection date is unknown. Brown & Acton (1995, 51) states that a 54" cylinder and other parts were sent to Wheal Busy in 1750, whilst a few years later Borlase (1758), in his *Natural History of Cornwall* lists two engines at Pittlouarn. *'In 1766 Chacewater mine was sent a 66" cylinder and a lot of other parts, while in 1770 the 66" and 64" cylinders with two bobs and other parts were for sale on the mine'* (Brown & Acton 1995, 53).

A 72" John Smeaton engine was erected in 1775/76 (later converted to a Watt engine in 1778), possibly at Offard's Shaft (Site 21), which operated at 9 strokes per minute, 9.5 feet length which drew a 16.75" bucket (46,200 gallons per hour), and described as the most powerful in Cornwall at that time (Rowe 1932, 152). Possibly the fourth engine erected on the mine in the 18th century was a smaller 30" Boulton & Watt engine in September 1777 (their first engine erected in Cornwall, later sold in 1798 to Wheal Susan (Hamilton Jenkin 1969, Vol 11, 36). This engine was intended to be temporary, for driving and pumping a level to the County Adit. It cost £800 and worked two shafts with flat rods 300 ft from the building at a depth of 45 fathoms. It worked a 6.5" pump at 14 strokes of 8 ft per minute. The coal consumption by this date had reduced to 20 bushels in 24 hours (Rowe 1932, 152).

Other Boulton & Watt engines were built between 1778 and 1789: A 63" cylinder and parts were purchased in 1778 to replace Smeaton's 72" on Offard's Shaft (although the 72" cylinder was retained as the new 63" steam case). This engine also had a 9 ft stroke that worked a 17" pump at 53 fathoms at 11 strokes per minute using 128 bushels of coal in 24 hours (Rowe 1932, 152). This engine was sold in 1791 to Old Herland Mine (Hamilton Jenkin 1969, Vol 5, 18). Subsequent Boulton & Watt engines at Wheal Busy included a 60" (1785-86), another 63" (1787-9), and a 14.75" rotative engine (1787-9). *'In 1787 it employed 218 married men, 112 young men, 279 women*

and children, a total of 609. The loss in that year was £2,508, and ... closed about 1788, due to the over production of copper by the Anglesey mines. In 1799 Boulton & Watt noted that their capital loss on the mine was (over) £700'. In 1781 the mine produced 3,441 tons of copper ore, and from 1785 to 1790 averaged approximately 2,000 tons per year (Brookes 1986, Chacewater Mine).

Another significant development for Wheal Busy by 1778 was construction of a principal part of the Great County Adit (Cornwall's most extensive drainage tunnel network – and still functioning), through Wheal Busy into North Downs, connecting to a number of shafts within the sett, and discharging some 3.5km to the south east.

In 1786 over £50,000 had been spent in setting the mine to work, but a new company was formed in 1802, named **Chacewater Mine** (Brookes 1986, Chacewater Mine). This company was worked in 1802, and continued until 1823. Jenkin (1969, Vol 3, 43) refers to events at nearby Carnhot Mine being affected as a result of forcibly supplying water from the adit to the boiler of a steam engine in 1811 at Chacewater Mine. 'By 1814 a double acting 66" engine of 1008 hp and a duty of 23.66 gallons had been erected by Samuel Moyle of Chacewater. It pumped 700 gallons a minute from 88 fms. below adit (39 fms). In 1818, known locally as Wheal Busy, the mine was worked to 85 fms. below adit and employed 700 people. Monthly sales of copper amounted to 325 tons, valued at £1700 and tin sales came to £300 a month. William's, Chacewater, Winter's and Wheal Vor (tin and copper) lodes were being worked... In the eastern part of the sett, south of Winter's lode, Vazie's copper lode had recently been discovered' (Brookes 1986, Chacewater Mine). Rowe (1932, 153) also comments that this final Watt engine was erected in 1811 and had a 10 ft stroke working at 6.5 strokes per minute. The engine is shown in elevation on a detailed 1813 plan of the mine (CRO X397/91). It was sited at Old Engine Shaft (New Sump – Site 46), and was a double acting pumping engine house with a boiler house and chimney on each side – at this time it was the most powerful engine in Cornwall. However, from 1802 to 1811, copper ore sales were reducing, although they picked up to over 5000 tons in 1819. In 1822, costs for repairs to engines had caused financial hardship, and the last sale of ore for this company was in October 1822. Later in 1823, Arthur Woolf, the celebrated Harveys of Hayle mining engineer, altered the engine to be single acting on the Cornish system (Brown & Acton, 1995, 61). The site of this engine house is now occupied by houses.

Allegations made in later years relating to the management of Wheal Busy focussed on problems with its (mis)management by Robert Vazie, the owner. From 1815 to 1822, the mine sold 30,140 tons of copper ore for £143,635 (Collins 1912, 431). Later in 1855 it was claimed that between 1810 and 1828, Lord (Falmouth) had received £17,192.19s.6d. However, another company was soon formed by 7th August 1823, and held from Lord Falmouth at 1-20th dues. It was formally named **Wheal Busy** when its first sale of copper was made. In 1826, the 66" engine was superseded by a 70" (Cornish) engine (again designed by Arthur Woolf: 10 ft stroke working at 129 fathoms below adit), which pumped 478 gallons per minute, but this was put up for auction two years later as well as another engine with related capstans, shears, horsewhims ,etc, when the mine again closed.

For the next 28 years the mine worked above the County Adit level. In 1832 a 66" cylinder engine and five boilers, etc were auctioned (Brookes 1986, Wheal Busy). In 1837-8 112 people were employed and at the end of 1842 the mine was about 120 fms. deep (Collins 1912, 431). Operations were still mainly above adit (perhaps as deep pumping machinery had been sold), and about £1200 worth of ore was being sold annually.

The 1839 Tithe map (Fig 3: **Wheal Bissy**) shows the steam pumping engine (Site 32), Mine buildings included the Dry House and Pitman's House (later to become the Smithy in the 1870s – Site 39) and south of this, the Counthouse (Site 40), and Carpenter's Shop (Site 41). To the east of these buildings, a long, narrow, line of structures is depicted which were possibly dressing floor buildings.

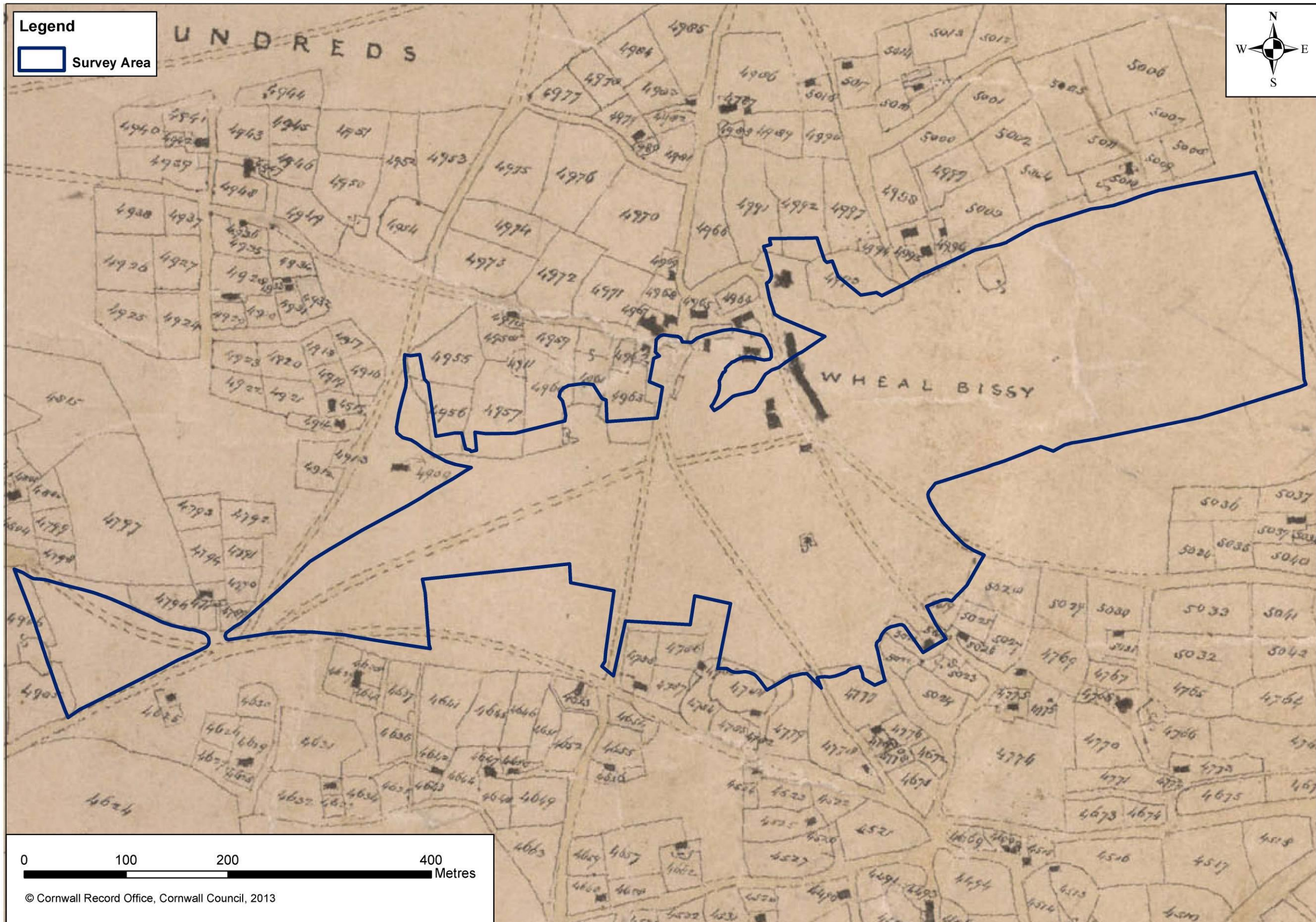


Figure 3: 1839 Tithe map of Kenwyn Parish.

'At Wheal Busy a depth of 220 fathoms had already been attained in the year 1842, and this depth, I believe, was never exceeded in the subsequent working... but full of water and working above adit (46 fathoms)' (Collins 1912, 219). The mine continued to produce approximately 1,000 tons of copper ore per year and over 6 tons of black tin, valued overall at approximately £4000 per year. The mine stopped working in 1848, briefly reopened from 1853-55, but later in 1855 the mine was flooded by a 'break in' and subsequently closed. Over this company's tenure (1823 to 1856), the mine had sold 33,486 tons of copper ore and 577 tons of black tin, realising £126,230 (Collins 1912, 431).

Great Wheal Busy United Mining Company (1855-1868) appears to have seen the most prosperous period of tin working and appears to relate to the undated (but c1864) mine plans (CRO R151A: Figure 5 and front cover). The new sett included Wheal Busy, Wheal Daniel, Wheal Seymour (formerly Wheal Ann), and South, Old and new or North Hallenbeagle, covering an area a mile and a half long and a mile wide. Some of the mine shafts were renamed (Brookes 1986). In May 1856 a new foundation stone was laid to start building the Wheal Busy pumping engine house (Site 32). A great celebration followed; over 10,000 people attended, many by train via the West Cornwall Railway! The event included a procession to the mine, a service at Chacewater Church, a roasted ox, a formal dinner for the gentlemen, followed by fireworks. The 85" cylinder engine was manufactured by Harvey's & Co. of Hayle, and was working in mid-November. By March the following year water was drained to 42 fms. below adit (the inflow of water was 900 gallons/min), and works proceeding at Harvey's Shaft, New Wheal Hodge, King's, Pool's, Old Sump and Bennett's Shafts. By March 1858, the mine was drained to the bottom, with engine shaft sunk by 23rd August to the 150 fathom level (Rowe, 1932, 153). In February 1860 the 85" engine had a 20" plunger working 10 strokes a minute, but despite the addition of an 18" plunger lift, was unable to fork the water owing to rains (Brookes 1986).

'In May 1860 Wheal Busy ... in addition to the 85" pumping engine, had a 24" engine working the capstan and drawing, a 26" engine drawing, a 30" stamping, and an 18" crushing'... At the end of 1862 there were eight steam engines in all (including Hallenbeagle, Wheal Daniel and Boscawen and other mines to the north west, all served by a total of 24 boilers - see Fig 4). But the water was 'very sulphuric', and boiler replacement was costing the company about £1200 per year. Employment in 1862 reached a peak for this company of 900 people. Closure of this mine came about through declining mineral prices and, presumably, the ore lodes having mostly been worked out; dues were also owed to Lord Falmouth, all making the company uneconomic. Tutwork was suspended in early August 1866, and the engine presumably sold. By this date, the mine was over 170 fathoms deep and over 43,000 tons of copper ore produced realising over £126,000, with 1791 tons of Black tin that sold for over £104,000. Arsenic soot is reported for the first time (136 tons realising £260 and small amounts of lead ore and blende. The total ore sales figure was £231,352 (Brookes 1986). The wind-up order from the Vice-Warden's Court was made in June 1868, and the 85" engine sold. Figure 5, the c1864 mine plan shows similar buildings as the earlier Tithe map (Fig 3), but for the first time, a large number of shafts and surface workings can be seen.

Great Wheal Busy Copper and Tin Mine (1871-1874) was the next company to work this mine. 'In January 1872, a new 90" steam engine was ordered from Perran Foundry at a cost of £4300. A second hand 76" was bought for £725 and a 27" winding engine bought from Chiverton Valley for £709. In March, operations for tin were started on a large scale. The 90" engine was christened Jose's engine and started early in December' (Brookes 1986). The engine was erected in the same engine house built for the earlier 85". The mine was un-watered to the 50 fathom level below adit. By 1873, tin had been discovered in the east of the sett (the Black Dog western end), and a steam stamps with 32 heads was soon working (a purchase cost of £700). It also appears likely that the Arsenic calciner (Site 52) was built at a cost of £150 at this time. Several hands employed in construction of the stamps dressing floors (a cost of

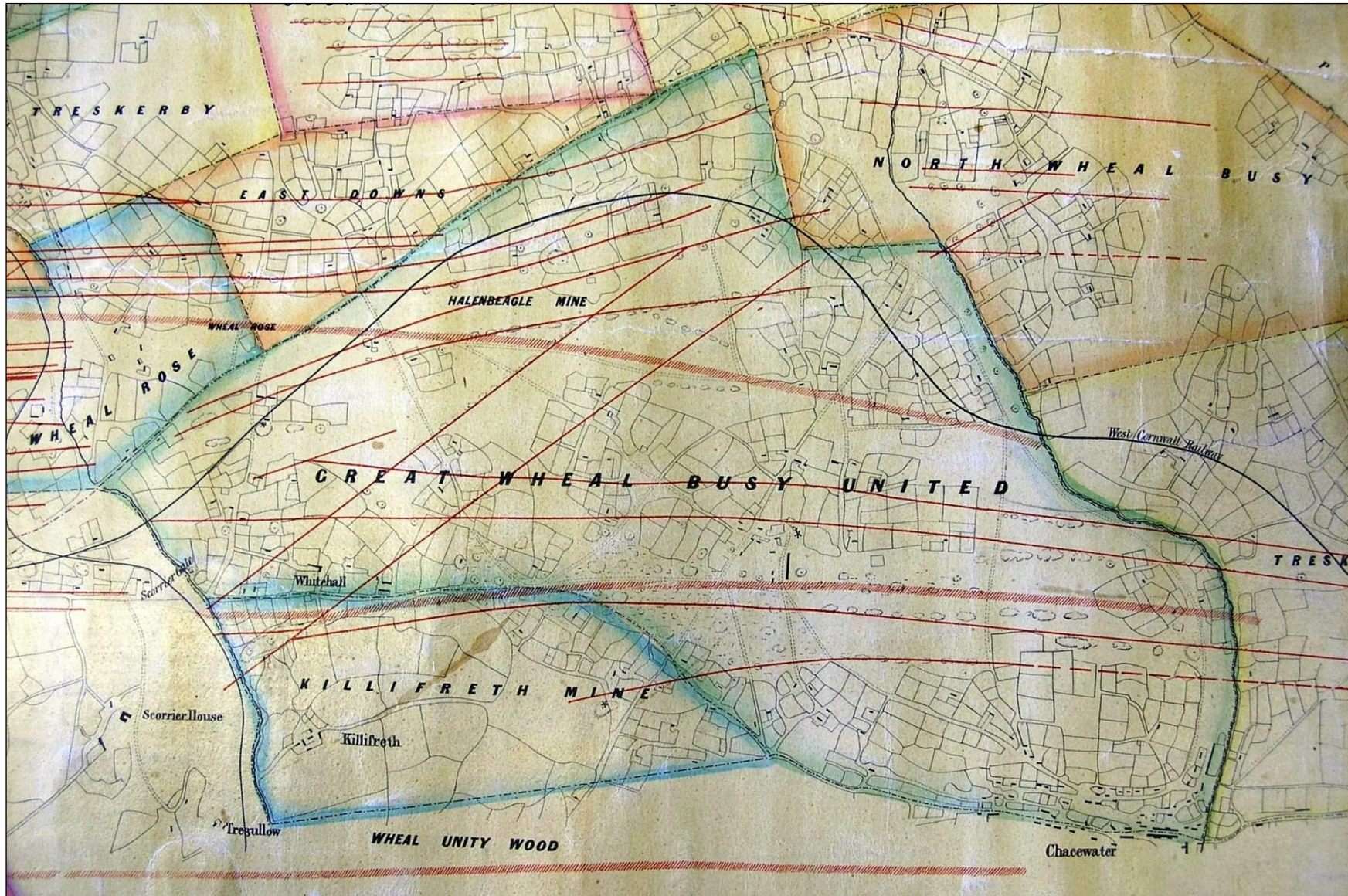


Figure 4: Symons 1861 Plan of the Chacewater District (Reproduced with permission of CRO).

£1000), were discharged in June 1873 and fifteen men working the Black Dog stopes were put on tribute when tin prices collapsed; a result of the opening up of the Australian tin mines (Brown & Acton 1995, 48). Also at Engine Shaft, the water was not yet below the 40 fm. Level. Later in the year shareholders complained that too much was spent on the surface (£30,000) and not enough underground. Given insufficient capital to develop the lodes further, the mine closed towards the end of July 1873. *'The machinery was auctioned in September 1873, including the two pumping engines (90" and 70"), the 36" stamps engine, a 24" double acting rotary engine and four boilers for the 90" etc. In the fitting shop (the Smithy: Site 39) there was a 13" high pressure engine, a 10" Rigby's patent steam hammer, a saw bench, a blast fan, and six forges (all in the Fitting Shop). The dressing floors had twenty Borlase's and other buddles, water wheels, frames, kieves, and an Oxland & Hocking large sized patent calciner with water wheel and revolving gear'* (Brookes 1986). This was all sold for £7,750 to JC Lanyon & Son. At the time of closure, Jose's engine shaft was 150 fms. deep below adit, and Black Dog shaft was 50 fms. below adit underground. Given insufficient capital to develop the lodes further, the mine closed towards the end of July 1873. *'The machinery was auctioned in September 1873, including the two pumping engines (90" and 70"), the 36" stamps engine, a 24" double acting rotary engine and four boilers for the 90" etc. In the fitting shop (the Smithy: Site 39) there was a 13" high pressure engine, a 10" Rigby's patent steam hammer, a saw bench, a blast fan, and six forges (all in the Fitting Shop). The dressing floors had twenty Borlase's and other buddles, water wheels, frames, kieves, and an Oxland & Hocking large sized patent calciner with water wheel and revolving gear'* (Brookes 1986). This was all sold for £7,750 to JC Lanyon & Son. At the time of closure Jose's engine shaft was 150 fms. deep below adit, and Black Dog shaft was 50 fms. below adit.

During the next two years **JC Lanyon & Son (Great Wheal Busy)** produced no ore, but appear to have simply sold off the machinery. There were no other mine companies formed during this period until 1897. Figure 6, the 1880 OS map shows the mine as disused. However, the main pumping engine (Site 32), its winding engine (Site 31), the Smithy (Site 39), the Couthouse (Site 40), and the Stamps engine house (Site 68) were still present. Remnants of the earlier rotary engine house (Site 10) is also visible, as well as the Oxland & Hocking Calciner (Site 52), and related flue and chimney (the labyrinth complex having been removed). Other extant features recorded by the OS include numerous shafts and reservoir ponds. To the west, Black Dog engine house (Site 106 - engine never installed), is shown as unroofed.

There seems to have been no mining activity at Wheal Busy from 1873 until at least twenty years later, when 916 tons of tin (stuff) was sold in 1894, and 2995 tons a year later realising £748 (Burt *et al* 1984, 66). However, early in 1897, the mine was leased by **WJ Trythall**, of Bissoe Arsenic Works. By the end of February over a hundred men were working above adit for arsenic ores left along the sides of the lode – it was this arsenical pyrites that had caused the water to cause so much havoc to the mine's boilers in the earlier years. In fact arsenic pyrites had been produced from 1893, but this increased to nearly 3000 tons in 1896, increasing yearly to a maximum figure of over 6000 tons in 1900 (Burt *et al* 1984, 67).

Unfortunately, WJ Trythall was bankrupted in 1902, and the Bissoe Works put up for sale in July of that year. *'The ores sold from 1871 to 1900 were raised from above adit or burrows, which have also yielded some ores since then'* (Collins 1912, 431).

The Consolidated Nickel, Tin and Copper Mines, Limited Company was registered in March 1903. A lease was obtained in June 1906 and active operations to drain the mine to 40 fms. below adit started in April 1907. An electric pump and suction gas pump was installed into the former boiler house sited on the east side of the engine house, but problems ensued, resulting a year later in the mine being 'in fork' only to about 15 fms. below adit. In August the following year further pump failures culminated in the installation of an (other) 85" engine into the pumping engine house.

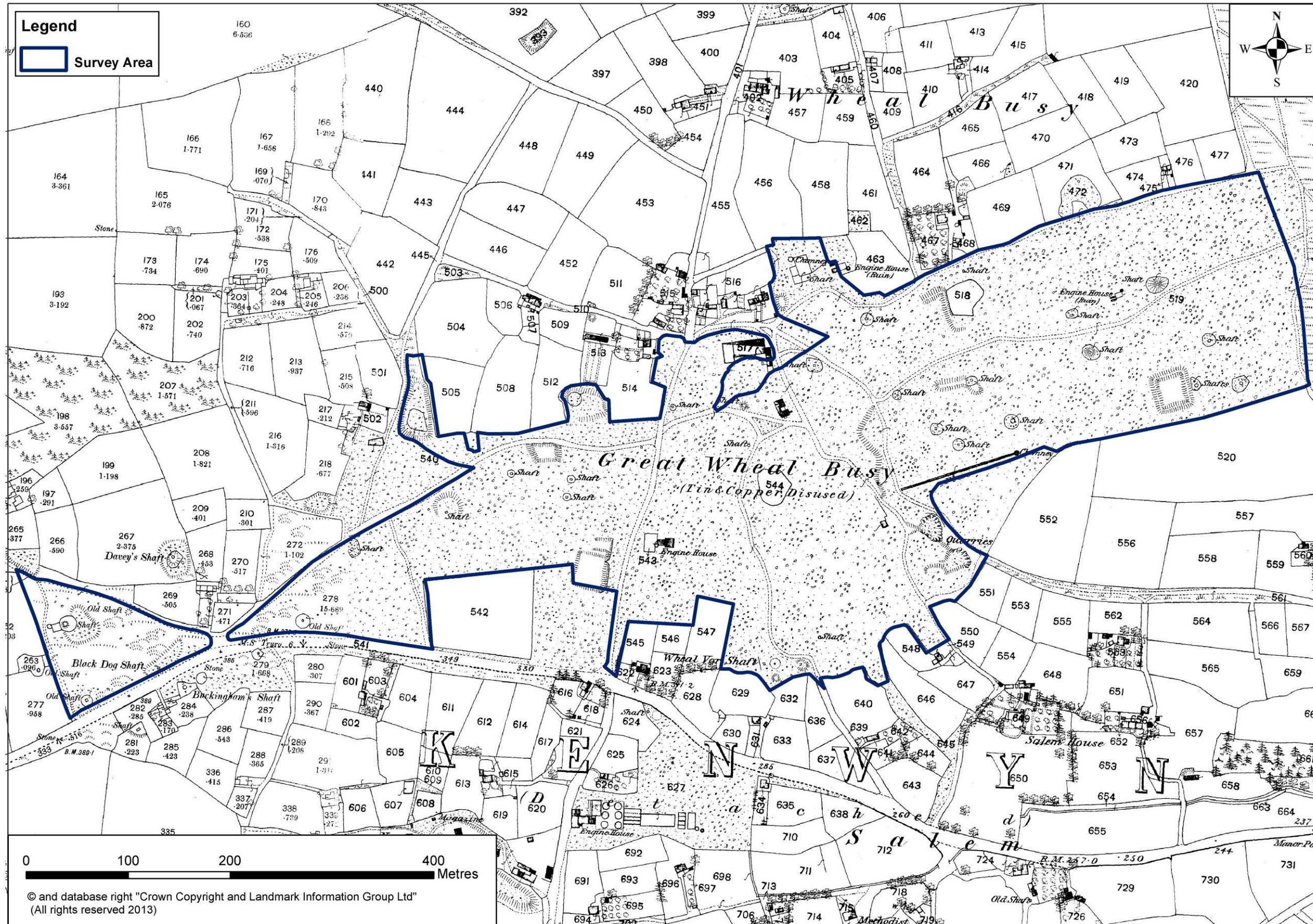


Figure 6: 1880 OS 1:2500 map.

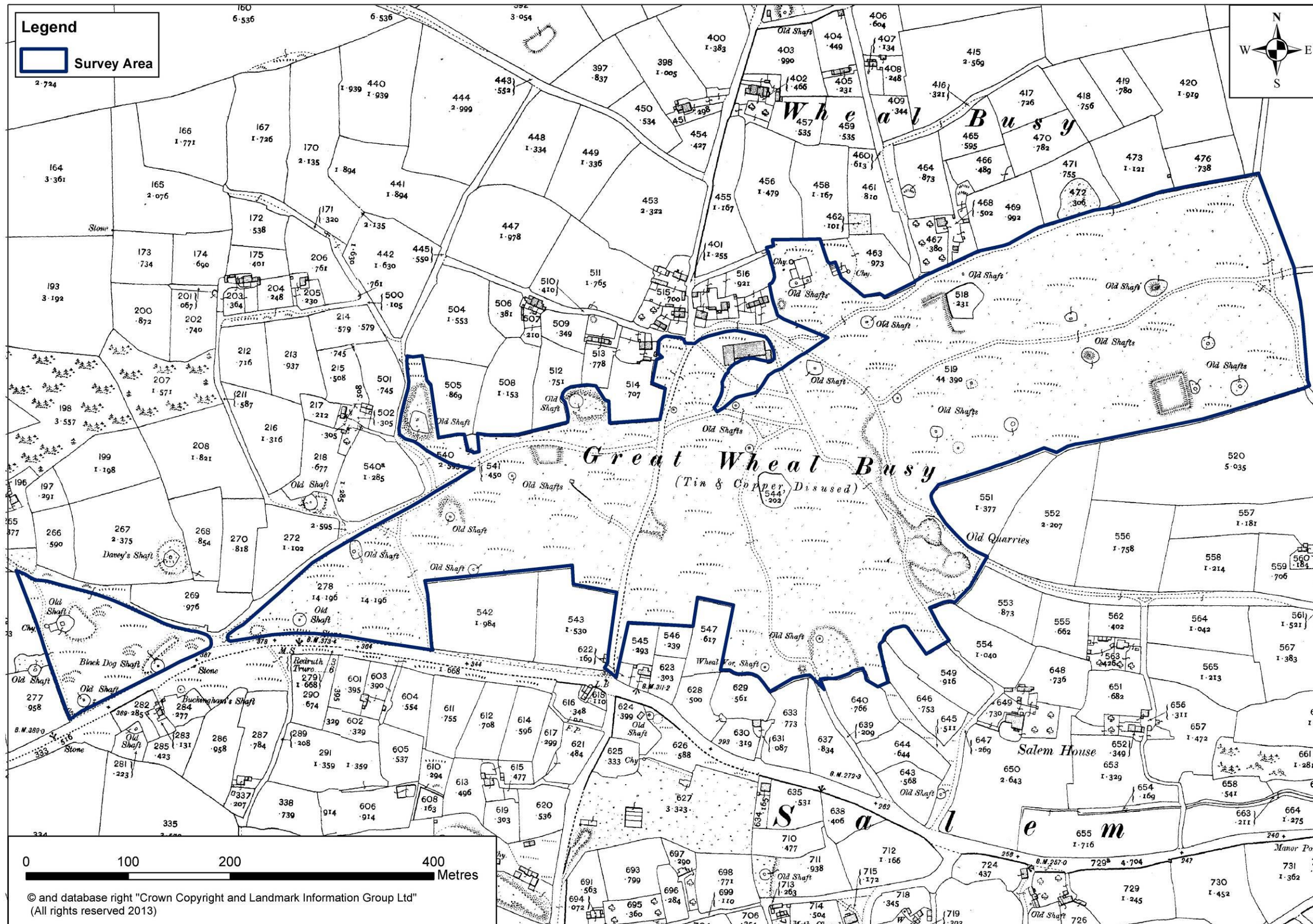


Figure 7: 1908 OS 1:2500 map.

The engine was originally made by Perran Foundry for a mine in St Austell, it was then sold to Pencoed Colliery in South Wales, when a new 85" cylinder cast by Harveys of Hayle was installed. After ten years of standing idle, the engine was later purchased by the mine company and re-erected in the engine house by Michell Bros. of Redruth (Rowe 1932, 153). *'The company intended to lay down heavier pumping machinery that would no doubt meet all needs, the mine already having been equipped with a crushing and calcining plant, and would soon be making returns on a large scale'* (Brookes 1986,). Sites 65 to 67, the (Scheduled) arsenic complex may date from this period of working, and includes an extant Brunton Calciner, associated shaft kilns, a reverberatory furnace, labyrinth, flues and chimney. In addition, the crushing/milling plant (Site 68) is also partially extant. Subsequently, in 1908 this company was transferred to another; **Compagnie Anglo-Belge pour l'Industrie de l'Etain, S.S.** Figure 7, the 1908 OS map for the study area shows the sites of some mine shafts, and some reservoir ponds. The main pumping and winding engine houses (Sites 32 and 31 respectively) are shown unroofed, whilst the crushing/stamps engine house (Site 49), has gone. The early arsenic complex (Sites 52 to 54), have also gone. This map was produced before the second main phase of arsenic refining buildings were built (Sites 65 to 67), and the new crushing plant and stamps (Site 68).

This was the last company (registered in Brussels), to work Great Wheal Busy (1908 – 1921). *'The mine was held from Lord Falmouth on a 21 year lease from 20th June 1906... The machinery under option included consisted of a complete winding plant with motive power, oil engine with generator, electric alternators and pumps with a capacity of 33,000 gallons per hour etc as well as a battery of 25 Californian stamps, a 140 hp motor, two boilers, crusher etc'* (Brookes 1986). A general view of the arsenic milling plant from the east is shown in Trounson (undated,72).

In February 1909 the Mining World Journal noted that there was insufficient water for the stamps, and the boiler installed in the battery engine house was not capable of generating enough power to run more than five heads of stamps. Later in June, the company, having made a fairly large outlay in crushing and dressing plant, and had drained the mine to an appropriate depth, decided to erect a third-hand Cornish pumping engine (an 85", originally built in 1852), as well as a steam capstan and winding engine. A new boiler house was constructed on the west side of the engine house (possibly cheaper for a new build than reusing the old boiler house which presumably had been reformed to site the new gas electric pumps), and three Lancashire boilers installed. *'By September the 85" Cornish engine at Engine Shaft had 17" rods down to adit (40 fms.), where a 10" bucket drained the mine to a depth of 145'. However, work was suspended towards the end of 1910, in order to arrange further funds for treating the minerals. The Mining Journal stated in November 1911 that the mine was being worked. In addition to the 85" engine working a 19" lift of pumps, the mine had ten heads of Californian Stamps, two Wilfley tables, two Frue vanners, and three slime tables'* (Brookes 1986.). The work of clearing the adit continued until 1913.

Work seems to have ceased (possibly due to manpower reductions and the political European situation during the First World War), which led to the liquidation of the company in June 1920. However, some ore was produced: Black Tin (over 84 tons realising over £2000), Tinstone (over 171 tons realising £240), Arsenic (over 126 tons realising £904), and Arsenic ore (calcined pyrites – over 795 tons realising over £3761), and lastly roadstone (over 3699 tons realising £449). *'An attempt was made by the Killifreth Company to work the mine for Arsenic in 1920, and in 1923, it is said, 600 tons of ore were raised per month, but the project was a failure owing to a sudden fall in the price. Between 1917 and 1924, 735 tons of arsenic were sold. The dumps have been worked over for arsenic and wolfram'* (Dines and Phemister 1956, 391). The 85" steam engine was kept idle in the engine house after 1913, presumably maintained by the Tregothnan Estate until the Killifreth Mine Company venture a decade later – it is not known if it worked again until 1952, when it was finally scrapped (Trounson Undated, Vol 2, 76).

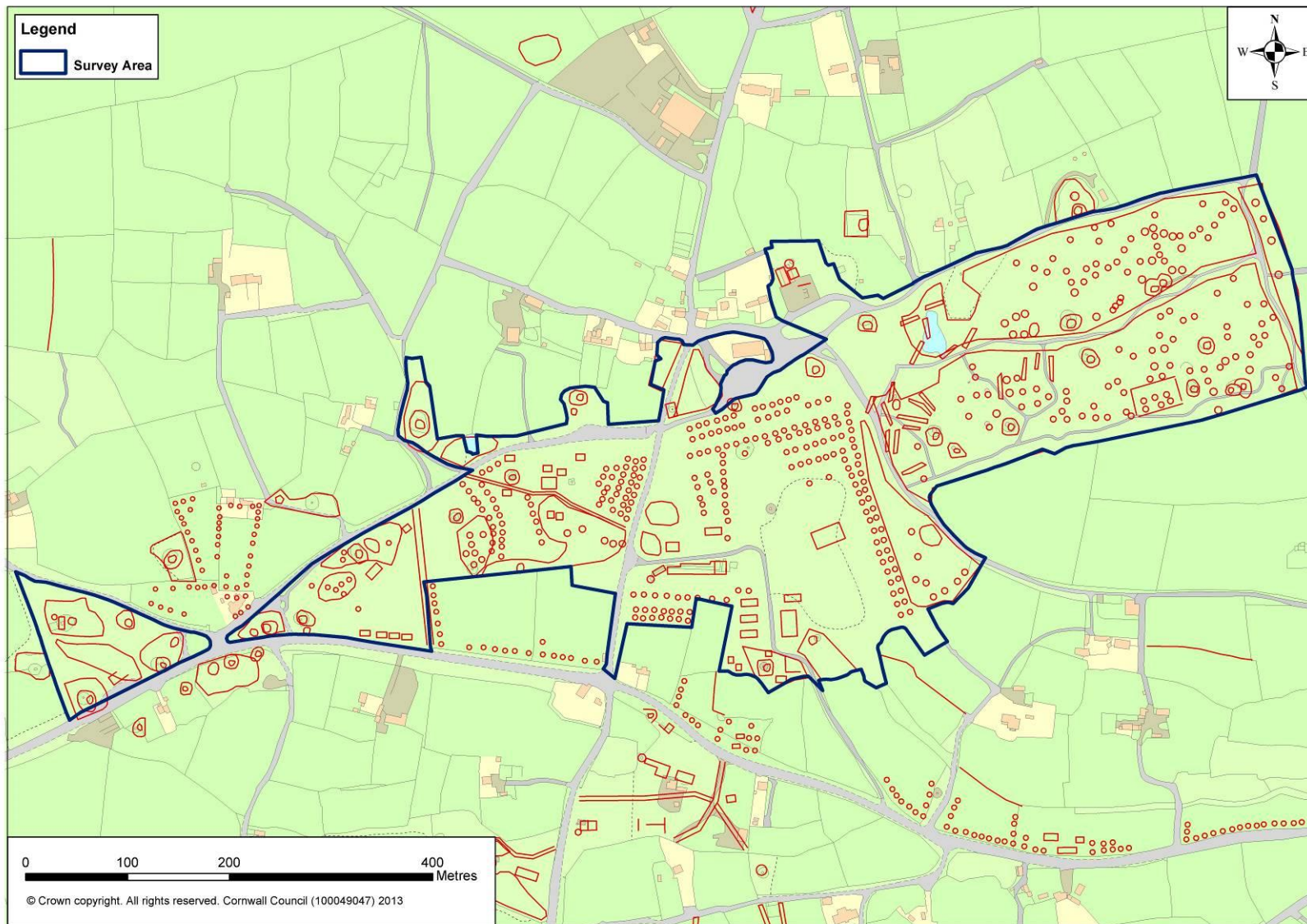


Figure 8: NMP Mapping for Wheal Busy (showing sites previously occupied by mustering D-Day forces - 29th Division US Army and earlier mine works). NMP Mapping © Historic England.



Figure 9: Excerpts of the 1946 RAF aerial photographs of the CMS study area. The left image (RAF C05 3070) shows the Black Dog area of the Wheal Busy mine, the right image (RAF C32 4396) shows the central and part of the western part of the mine (including the earthwork remnants of the temporary US army camp).

In summary, the site is likely to have been tin streamed during the medieval period, whilst its early post-medieval ore production focussed on slightly deeper tin lodes through shaft mining. The start of the industrial revolution in the early 18th century accelerated demands for copper, which incentivised improved techniques for water wheel powered drainage to pump the deepening workings (especially on mines like Wheal Busy where parallel copper/tin lodes were close together). These innovations were soon superseded by steam engine technology, as the old rag and chain pumps could not cope with the ever water logged workings. The 18th century steam engines of Newcomen, Smeaton, and Boulton & Watt were all tested on this mine – a rarity in Cornwall. The bulk of the copper output was raised before 1856 when the mine was 100 fms. below Deep Adit, but after that year the workings were sunk another 40 fms. and tin and copper ores raised for the next ten years. The overall recorded outputs were: 104,700 tons of copper ore varying between 5 and 8% for the period 1815–1867; between 1858 and 1867, 1,758 tons of black tin and 26,650 tons of mispickel (Dines and Phemister 1956, 391). As with a number of mines, the production of arsenic provided an opportunity for a stay of execution, as companies came and went in rapid succession to cash-in on its high market price, until this too, finally succumbed due to cheaper chemical methods, driving down the price of pure arsenic as an insecticide.

2.3.1 Recent site impacts

The following non-mining related (known) site impacts are summarised (since the 1920's):

- During World War II, elements of the 29th Division US Army (which occupied much of Cornwall before D-Day), were camped in the centre of Wheal Busy (see Fig 8), as part of extensive preparations for the European invasion force. United States aerial photographs (US/7PH/3054 AP 81618) show the numerous tents, training grounds and slit trench excavations. As one can see, a US Company was sited at this mine (the land scars even visible two years later (see Fig 9). Figure 8, a reproduction of the NMP for this site, shows these sites, as well as the mining residue earthworks from centuries of earth extraction.
- In 1986, Cornwall Mining Services Ltd (CSM Ltd) undertook a Stage 1 desk-based assessment of the mine, and a Stage 2 site investigation excavation of three long linear trenches (up to 3m deep) along the bottom of the valley (CMS Ltd 1986, Site investigation plan dated 17/9/1986). This was undertaken in advance of proposals to redevelop this 'brownfield site' and to build houses, an industrial estate, a food park, a hotel, a leisure park and a 'European Airport'. This plan was rejected in 1990 by Carrick District Council and Cornwall County Council. In 1994, a scheme for a £3m golf and leisure complex with eighty holiday lodges, timeshare homes, houses and service buildings was also proposed (Brown and Acton 1995, 49), it seems this scheme also was refused permission.
- A few years later at the end of the decade, Operation Minecap, managed by Carrick District Council, undertook mine shaft capping to numerous sites in Wheal Busy (and the surrounding area), excavating the known open mine shafts, and forming (infilled) Clwyd caps over their openings. Many are extant and visible to this day (see Fig 10).

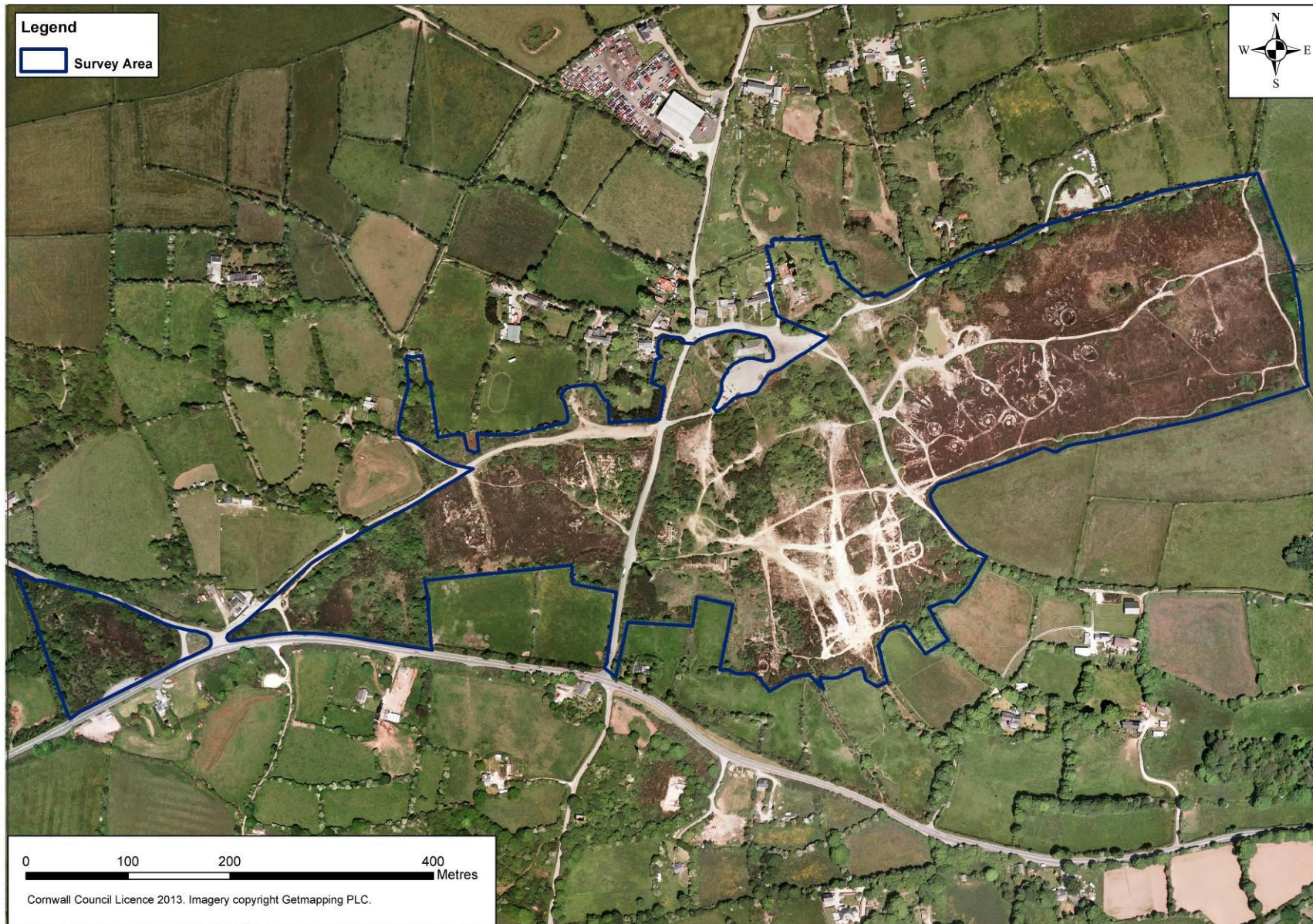


Figure 10: 2005 Aerial photograph of the study area (CC Copyright).

3 Site assessment

Methodology

During the desk-top assessment historical databases and archives were consulted in order to obtain information from a variety of sources about the history of the site, its existing structures and former features that were known to have existed. The main sources located and consulted are summarised as follows (refer to Bibliography Secondary section for a detailed list). In addition, primary historical documents, maps, plans and other published material held by statutory and non-statutory agencies are also listed (see Bibliography):

- Copies of Historical documents, maps, plans and other published material held by Cornwall Records Office and reproduced in other reports.
- Published histories of local industrial archaeology: Cornwall Archaeological Unit report from 1989 (1989R006).
- Cornwall Council Historic Environment Records and Events record for the CMS area.
- Cornwall Mining Services Limited: Wheal Busy Leisure Project: Structural Mining Report (Phase 1) March 1986.
- Cornwall Mining Services Limited: Wheal Busy Leisure Park: Structural Mining Report (Stage 2) Site Investigation September 1986.
- The principal unpublished source is *Justin Brooke: A Parochial History of mines in Cornwall (CRO X 745: Chacewater and Kenwyn Parishes)*.

Documentary research and fieldwork has been orientated towards the industrial development of the site. Nevertheless, sufficient background research has been undertaken in order to summarise the pre-industrial history of the landscape within the CMS area. This research took place in late September 2013.

Fieldwork

Detailed maps for use in the field were produced from the Ordnance Survey Landline Digital Mapping and amalgamated with information derived from historic maps (including the 1st, 2nd edition 1:2500 Ordnance Survey maps), and other documentary sources. Site fieldwork within Wheal Busy Mine was undertaken on 15/8/2013 and 5/9/2013 by the author. These maps were also used during the fieldwork survey component of the project. Field recording was based on a mixture of photography (digital), and site notes.

3.1 CMS area

Figure 1 shows the overall CMS area as part of the location map, whilst Figure 11 shows in detail the archaeological site inventory map. The CMS area boundary includes land owned by Lord Falmouth. The site numbers given on the map are reproduced in a site inventory table (Table 1), which gives the site name, national grid reference (NGR), comments relating to approximate date, and the site's significance rating.

CMS area summary description

The CMS study area essentially follows the main core site of Wheal Busy Mine. This extends to the west and east, following the route of the main east-west copper lodes within a shallow valley. As a result of its long history of metallic ore extraction, there are over seventy documented mine shafts within the study area, only a few shown on any particular OS or mine plan. The Cornwall Mining Services Stage 1 report (1986), contained information siting many more shafts – these have now all been amalgamated into a single site inventory map and tabulated with additional information (each with its site number, OS NGR and supplementary information).

The eastern section of the study area has numerous mine shafts – reflecting the impacts of the past three hundred years. Reservoir ponds predominate, while the sites

of transitory engine houses are often completely invisible. Even the former trackways have gone, leaving a landscape of upturned subsoil and stone, upon which only heather and gorse can grow.

The central section of the area previously sited mine buildings through its various phases of existence. Thus, Couthouses, Engine houses (pumping, winding, crushing and rotary unusually over a three hundred year period), Smithy, and Carpenter's Shops have come and gone, again leaving little evidence. However, two buildings; the large pumping engine house (Site 32) and its extant (second phase) boiler house are both impressive, whilst the former 1860s Dry House and Pitman's House, was extended to form the later 1870s Smithy and contained a small engine, forge and bellows, etc. This part of the mine also contains a good survival of the final main phase of the mine, namely its arsenic complex. This dates to the early years of the 20th century, when the final working of arsenic deposits took place (above adit level).

To the west of the CMS core area, the landscape is similar to the eastern area, and again mine shafts predominate, with a similar heather and gorse covering, although some parts are now densely overgrown with vegetation. The early steam engines (and an 1860s winding engine), have all gone leaving no surface trace. The Black Dog engine house, however, is still partially extant following the attentions of the US Army's demolition engineers in 1944, but again access to it could only be gained with the help of much clearance. The contextual relationship of the east and west parts of the CMS area to the core of the mine cannot be understated. This site retains its 17th to 19th century relationship between processing/dressing the ore, and underground access via visible (now capped) shafts to excavate, develop and pump the workings.

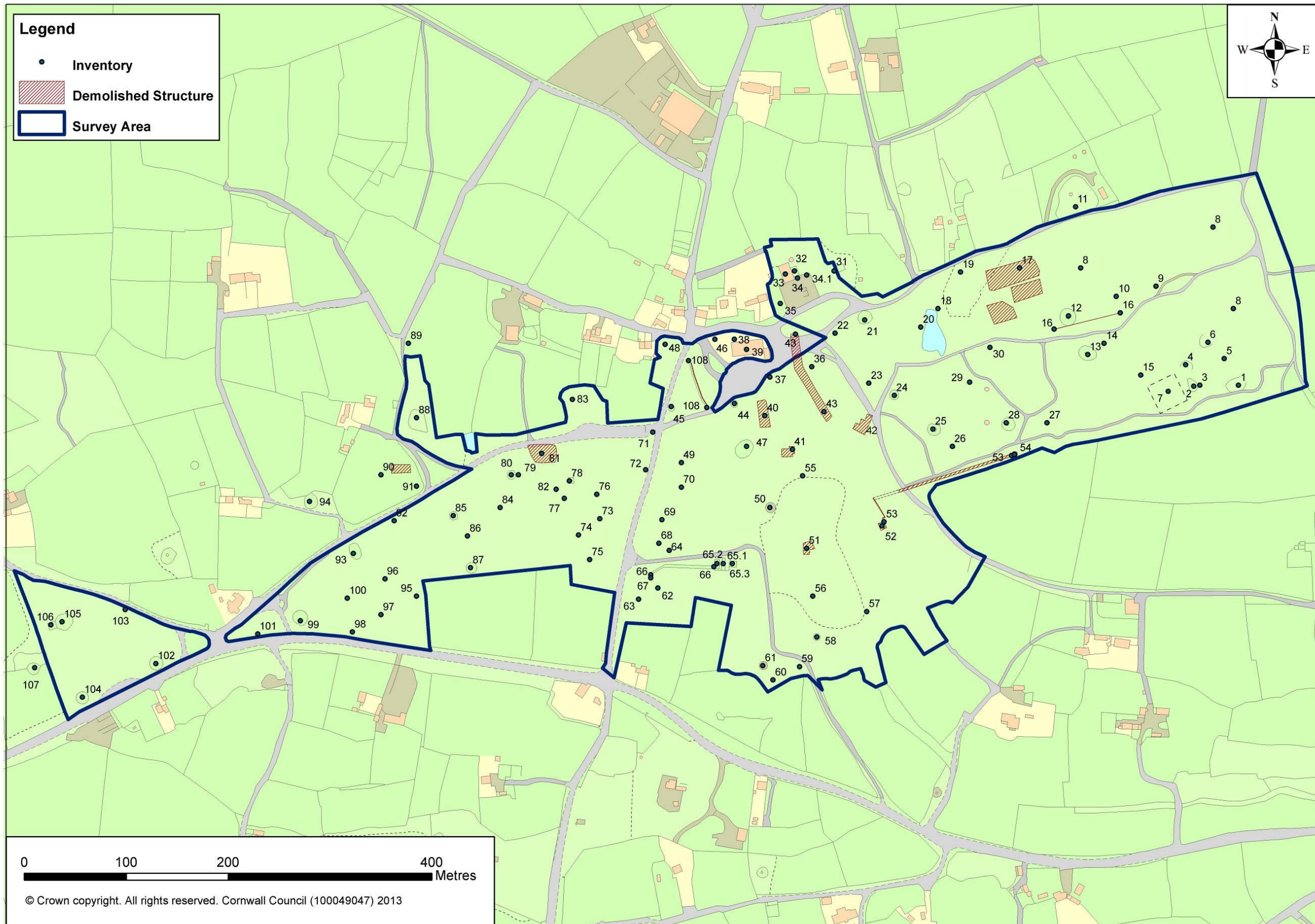


Figure 11: A map showing all archaeological sites as point data within the CMS area. Refer to the site inventory table for site description.

4 CMS area site inventory table

Site No.	Feature	NGR (SW)	Comments	S (Rating)
1	Mine shaft: South Pitslewren.	74365 44715	Large pit 8m diam. 3.8m deep. Shown on 1880 OS and CMS (1986) shaft maps.	M
2	Mine shaft: Unnamed.	74321 44714	Partial shaft hedge remnants. Shown on 1880 OS and CMS shaft maps.	L
3	Site of Engine House.	74327 44715	Disturbed rubble ground. Site evidenced by K. Brown (1990, 473).	M
4	Possible shaft/large pit.	74313 44735	Large pit 6m diam, 2m deep. Shown on Master Map.	L
5	Mine shaft: Mathew's.	74351 44741	Shaft hedge remnants (shaft 1.5m BGL). Shown on CMS shaft map, working in 1813.	L
6	Mine shaft: Robinson's.	74335 44757	Shaft hedge remnants. Shown on OS and CMS shaft maps.	L
7	Rectangular reservoir pond.	74296 44709	Extant banks 1.3m high, 2m wide with sluice in west side, infill from east. On all OS maps after 1880.	M
8	Post medieval lode back pits and dumps with heather/gorse.	74210 4483 74340 4487 74360 4479	Large area of pits 1-2m BGL (2-4m diam), dumps 1m AGL (E-W aligned)	L
9	Mine shaft: Walker's (Robin's).	74284 44812	Not located, (infilled), Clwyd cap on nearby site (SX 74310 44805). Shown on OS and CMS maps.	L
10	Rotary engine house.	74245 44802	Not visible at ground level. Area covered by ferns. Probably winding from both Matthew's and Walker's Shafts (22" rotary engine). Shown on 1880 map (as ruin) but installed 1868 (Brown 1990, No. 480). Possibly the site of an early Newcomen Engine (Brown CAU SMR – Engine house site, No. 469).	M
11	Mine shaft: Richard's.	74205 4489	Dump on west side. Shaft opening obscured by trees/vegetation. Shown on OS and CMS Shaft maps.	L
12	Mine shaft: Mathew's (Pitslewren).	74198 44783	Wide shaft opening (c10m diam), 3m BGL with Clwyd cap. 0.8m high stone hedge. Shown on OS and CMS shaft maps, working in 1813. Horsewhim remnants on NE side (7m diam).	M
13	Mine shaft: Unnamed.	74217 44745	Wide shaft opening (c10m diam), 3m BGL with Clwyd cap. 1m high stone hedge. Shown on OS and CMS maps.	L
14	Possible mine shaft:	74233 44756	Wide shaft opening (c8m diam), 2m	L

Site No.	Feature	NGR (SW)	Comments	S (Rating)
	Unnamed.		BGL. Not shown on OS/CMS maps.	
15	Possible mine shaft: Unnamed	74269 44725	Wide shaft opening (c7m diam), 1.2m BGL with Clwyd cap. Not shown on OS nor CMS shaft maps.	L
16	Leat/flat rod/US Army training trench.	74249 44786 74184 44770	Possible leat/flat rod/or WWII trench. 0.5m wide at base, 0.7m high sides.	L
17	19C Reservoir ponds.	74150 44830 (centered)	Banked remnants of ponds visible. One engine pond shown on 1813 map and 1840 Tithe Map, two additional ponds (to south) shown on 1860s mine plan (dressing floor ponds).	M
18	Early 19C dressing floors and late 19C Reservoir ponds.	74070 44790 (centered)	1813 mine plan shows dressing floors with WW power (for eastern shafts). Later pond visible overlying floors (OS 1880). Linear feature to west may have been raised aqueduct/bank of another pond. Existing internal ground 1.7m BGL. Later pond to south west on MM.	M
19	Mine shaft: Teague's.	74092 44826	Not visible at surface. Shown on OS and CMS Shaft maps.	L
20	Mine shaft: Tonkins.	74053 44772	Not visible at surface. Shown on CMS shaft map and 1813 map as working.	L
21	Mine shaft: Offards (New Chynoweth).	73998 44779	Shaft partially fenced with post & wire. Choked to surface. Shown on OS/CMS and 1813 shaft plans.	L
22	Mine shaft: Unnamed.	73969 44766	Not visible at surface. Shown on CMS Shaft map.	L
23	Mine shaft: Old Chynoweth.	74002 44717	Not visible at surface. Shown on CMS shaft map.	L
24	Mine shaft: Old Tonkins.	74027 44705	Clwyd cap with low wall surround, 7m diam. Shown on OS and CMS shaft maps. 1813 era mine magazine shown west of this site on mine plan.	L
25	Mine shaft: Unnamed.	74065 44672	Clwyd cap with low wall surround, 8m diam. Shown on OS/CMS maps.	L
26	Mine shaft: Unnamed.	74084 44655	Clwyd cap with low wall surround, 7m diam. Shown on OS/CMS maps.	L
27	Possible mine shaft: Unnamed.	74177 44678	Clwyd cap with low wall surround, 8m diam. Not shown on OS/CMS maps.	L
28	Mine shaft: Unnamed.	74137 44678	Clwyd cap with high wall surround, 9m diam. Shown on OS/CMS maps.	L
29	Mine shaft: Dippa Footway.	74101 44718	Clwyd cap with slight wall surround, 8m diam. Shown on OS and CMS shaft maps. Linear feature to west	L

Site No.	Feature	NGR (SW)	Comments	S (Rating)
			may have been spoil dump, with possible horsewhim to south – both features now gone.	
30	Mine shaft: Dippa (Mathews/South).	74121 44752	Not visible at surface. Shown on CMS shaft map and 1813 map as working.	L
31	Site of Winding engine house.	73968 44827	No remains visible at surface. Shown on 1860s mine plan, ruinous by 1880. Possibly 24" for sale in 1873. K. Brown (1990, No's 481, 477 (22" whim sold 1868, 26" 1872).	M
32	Pumping engine house.	73929 44827	Extant engine house with detached chimney. Building shown on 1840 Tithe Map, 1860s mine plan and 1880 OS maps. K. Brown (1990, No 476 (85" erected 1856, then 90" erected 1872, for sale 1873, then 85" 1909).	H (SM)
33	Boiler house.	73920 44824	Original boiler house on east side, new one built on west side in 1909 (for three Lancashire boilers).	H
34	Mine shaft: Engine Shaft.	73932 44820	Engine Shaft in front of engine house (sunk in 1856). Footway Shaft shown in front of original boiler house by OS and capped in 1980s as part of Operation Minecap.	H
34.1	(Footway Shaft).	73941 44823		H
35	Possible mine shaft: Unnamed	73915 44795	Slight dip in overgrown ground. Not labelled by OS nor CMS shaft maps.	L
36	Mine shaft: Fieldings (Old Engine).	73946 44733	Not visible at surface. Probably site of second Newcomen engine (1740/50s) house. Shown on CMS/OS maps, and working in 1813.	M
37	Site of engine house (s).	73905 44723	Sites evidenced by K. Brown (1990, No. 475, 474: 66" pumping engines). Not viewed on any site plan.	M
38	Site of engine house.	73870 44760	Site evidenced by K. Brown (1990, No. 471: Smeaton's 72" erected 1775). Not viewed on any site plan.	M
39	Gt Wh. Busy Smithy.	73882 44750	Site shown as Dry House and Pitman's House from 1856. Shown on Tithe Map (unknown date of Smithy erection). Used as forge/fitting shop in 1870s. Building (Listed, SM).	H (SM)
40	Site of Counthouse and Yard (to south). Earlier Carpenters' Shop to north.	73900 44685	Building shown on 1840 Tithe Map, 1860s mine plan and 1880 OS map. Site not visible (obscuring overgrowth).	L
41	Site of Carpenter's Shop (mid 1840s)	73927 44652	Building shown on 1840 Tithe Map and 1860s mine plan. Pool Shaft	L

Site No.	Feature	NGR (SW)	Comments	S (Rating)
	and Pool Shaft.		working in 1813. Site not visible (obscured).	
42	Site of Steam Stamps and crusher.	73999 44662	Site of building only shown on 1860s mine plan. Maybe K. Brown (1990) No. 478/479 (33" Stamps engine sold 1868). No visible site evidence.	L
43	Probable dressing floor buildings.	73930 44765 73958 44689	Site of linear building(s) only shown on 1840s Tithe Map. No site evidence.	L
44	Mine shaft: New Shop.	73870 44697	Shaft fenced with post and rail, overgrowth obscures shaft details. Shown on CMS/OS maps and working in 1813.	L
45	Mine shaft: Webb's (Pooles).	73808 44694	Shaft posts visible – but site overgrowth obscures shaft details. Shown on CMS/OS maps and working in 1813.	L
46	Mine shaft: Old Engine (New Sump).	73851 44760	Shaft posts and wire visible – but site infilled. Shown on CMS map. Possibly the shaft worked by the first Newcomen engine (1725). Shaft later worked by Watt's 66" (1811 shown on 1813 elevation/plan).	M
47	Mine shaft: Old Shop.	73882 44655	Shaft fenced with post and wire, but overgrowth obscures shaft details. Shown on CMS/OS maps and working in 1813.	L
48	Mine shaft: Moyle's (Rawling's).	73802 44755	Shaft infilled – site not visible. Shown on CMS map. Shown on CMS/OS maps and working in 1813.	L
49	Site of Crushing engine house.	73818 44639	Site evidenced by K. Brown (1990, No. 479). No map nor site evidence.	M
50	Mine shaft: Unnamed.	73905 44595	Shaft infilled and overgrown with posts and barbed wire surround. Shown on CMS/OS maps.	L
51	Site of building/shaft (Unnamed).	73941 44555	Site not visible at surface. Site shown on 1840 Tithe Map (possibly collar wall around this shaft). Shaft shown on CMS map.	L
52	Possible site of arsenic calciner.	74015 44577	Site shown on 1880 OS map. Site not visible.	M
53	Site of arsenic flue (calciner to chimney).	74017 44581 74142 44646	Two sections of site. First section visible as underground flue of timber posts (0.45m width, 0.7m high) from calciner northwards. Above ground section of flue missing from point at SW 74005 44604 uphill for straight course to arsenic chimney (Site 54). Site shown on 1880 OS, small	M

Site No.	Feature	NGR (SW)	Comments	S (Rating)
			remnant on 1907 OS map.	
54	Site of arsenic chimney.	74145 44647	Site not visible, but base may be extant under dense vegetation. Shown on 1880 OS map.	M
55	Possible mine shaft.	73937 44626	Shaft infilled – site not visible. Shown on CMS map.	L
56	Mine shaft: Unnamed.	73947 44508	Shaft infilled – site not visible. Shown on CMS map.	L
57	Mine shaft: Unnamed.	74000 44493	Shaft infilled – site not visible. Shown on CMS map.	L
58	Mine shaft: Footway.	73951 44468	Shaft infilled – site not visible. Shown on CMS and OS maps.	L
59	Possible mine shaft.	73934 44439	Mine dump on east side, shaft interior obscured by trees/brambles. Detail shown on OS maps.	L
60	Possible mine shaft.	73908 44426	Shaft not visible in dense vegetation. Detail shown on OS maps.	L
61	Mine shaft: Wheal Vor.	73898 44440	Stone collar surrounding shaft, 0.6m AGL. Shaft base 4m BGL, 9m diam. Possible horsewhim shown on 1880 OS to east. Shown on CMS, OS maps and working in 1813.	M
62	Possible mine shaft.	73795 44516	Shaft not visible in dense vegetation. Detail shown on CMS map.	L
63	Site of (Crushing) engine house.	73776 44505	Site evidenced by K. Brown (1990, No. 496). No map nor site evidence.	M
64	Mine shaft: Golden ?	73806 44553	Shaft not visible. Shown on CMS/OS maps and working in 1813.	L
65	Arsenic complex:	7385 4454	Arsenic Complex dates to c1908 All partially extant features. All sites shown on Third Edit OS map. Photograph of sites shown in Trounson's undated Mining in Cornwall Book (Site 72).	H (SM)
65.1	Bottle (Shaft) Kilns.	73859 44540		H (SM)
65.2	Reverberatory Furnace.	73853 44540		H (SM)
65.3	Calciner.	73868 44540		H (SM)
66	Arsenic complex:	73850 44537	Arsenic Complex dates to c1908. Partially extant features. All sites shown on Third Edition OS map.	H (SM)
66	Labyrinth and flues	73788 44529		H
67	Arsenic complex: Arsenic chimney.	73788 44526	As above. Fully extant chimney (c 13m high).	H (SM)
68	Site of Stamps (1870s and 1908),	73796 44560	Evidence of timber stamps framework, with plinth and adjacent	H

Site No.	Feature	NGR (SW)	Comments	S (Rating)
	engine house and Battery House.		building remnant. No evidence of former engine house site. Location evidenced by K. Brown (1990, No's. 47, 483: 31/32" engine house enlarged to 36". For sale 1873). First phase only shown on 1880 OS map.	
69	Possible mine shaft.	73799 44583	Shaft interior overgrown with posts and barbed wire surround, cut on south side. Open to 3m BGL. Shown on CMS map.	L
70	Mine shaft: Golding.	73818 44615	Shaft not visible in dense vegetation. Detail shown on CMS map.	L
71	Mine shaft: Boarding	73790 44669	Shaft not visible. Detail shown on CMS map.	L
72	Mine shaft: Boarding (alternative position).	73783 44632	Shaft not visible. Detail shown on CRO MA 3 1/8.	L
73	Mine shaft: Moy's.	73738 44584	Shaft possibly visible as elongated feature 2.5m BGL; 9mX7m. Shown on CMS map.	L
74	Site of engine house.	73717 44568	Site evidenced by K. Brown (1990, No. 487). No map nor site evidence.	M
75	Reservoir Ponds.	73728 44544	Partially extant pond banks (1.5m high). Shown on 1880 OS map.	M
76	Mine shaft: James's	73735 44608	Shaft not visible. Detail shown on CMS map.	L
77	Mine shaft: Tonk's (winding).	73703 44604	Shaft not visible (indistinguishable from other pits). Shown on CMS and OS maps.	L
78	Mine shaft: Old Hodge (pumping).	73708 44621	Shaft visible as infilled Clwyd cap (part dismantled). C1904 conc. headgear bases visible. Shown on CMS, OS maps and working in 1813.	H
79	Site of pumping engine house.	73658 44627	Site evidenced by K. Brown (1990, No. 474: 66" engine). No map nor site evidence.	M
80	Mine shaft: Wheal Fire (Vazies Middle).	73651 44627	Shaft visible as infilled Clwyd cap. Detail shown on CMS map.	L
81	Reservoir Pond.	73681 44648	Rectangular feature shown on 1880 OS map. No longer extant – likely to be related to Site 79.	L
82	(Horizontal) winding engine.	73695 44613	Extant Conc. foundations/plinths for small (c1908) horizontal steam hoist (K Brown 1990, No. 494, 1995, 62).	H
83	Mine shaft: Pinniger's (Wheal Hodge engine shaft).	73711 44701	Shaft visible within spoil mound but obscured by vegetation. Detail shown on CMS and OS maps.	L
84	Mine shaft: Wheal	73640 44595	Shaft not visible. Detail shown on	L

Site No.	Feature	NGR (SW)	Comments	S (Rating)
	Sparable.		CMS map.	
85	Mine shaft: Bennetts (Vazies West)	73594 44587	Shaft not visible (infilled). Detail shown on CMS and OS maps.	L
86	Mine shaft: North Wheal Fire.	73608 44567	Shaft (infilled) by Clwyd cap. Shown on CMS/OS maps, working in 1813.	L
87	Mine shaft: South Wheal Fire.	73611 44536	Shaft not visible (infilled). Detail shown on CMS and OS maps.	L
88	Mine shaft: King's (Taylor's).	73558 44683	Visible shaft collar, but interior densely obscured by vegetation. Detail shown on CMS and OS maps.	L
89	Mine shaft: Turner's.	73550 44756	Shaft mapped outside project area (in corner of field), but shaft feature shown within study area at SW 73553 44739 (tree growing from its centre). Shown on CMS, OS maps, working in 1813.	L
90	Site of Winding engine house (Out of study area).	73523 44627	Winding from Sites 83, 85 (and Davey's Shaft). Shown in plan and elevation on MRO R151A (1860s). 20" whim, 7 ft stroke, sold Aug. 1868. Not on OS maps. Site not visible but reservoir pond site shown on 1880 OS at SW 73516 44659.	M
91	Possible mine shaft.	73558 44616	Shaft not visible in field (infilled). Detail shown on CMS map.	L
92	Possible mine shaft.	73536 44582	Shaft not visible (obscured by vegetation). Detail shown on CMS map.	L
93	Mine shaft: Black Dog.	73496 44550	Visible shaft fence, but interior densely obscured by vegetation. Detail shown on CMS and OS maps.	L
94	Mine shaft: Unnamed.	73453 44601	Visible low shaft collar, with small Clwyd cap over open deep shaft (only 0.5m x 0.7m). Detail shown on CMS and OS maps.	L
95	Possible mine shaft. Sites labelled 'Back Shafts-out of use' on 1813 map. (Sites 95-100).	73558 44508	Shaft not visible (obscured by vegetation). Detail shown on CMS map.	L
96	Mine shaft: Highburrow.	73527 44525	Shaft not visible (obscured by vegetation). Detail shown on CMS map.	L
97	Possible mine shaft.	73523 44490	Shaft not visible (obscured by vegetation). Detail shown on CMS map.	L
98	Possible mine shaft.	73495 44473	Shaft not visible (obscured by vegetation). Detail shown on CMS	L

Site No.	Feature	NGR (SW)	Comments	S (Rating)
			map.	
99	Mine shaft: Unnamed.	73444 44484	Visible low shaft collar, with Clwyd cap collapsed into shaft following recent collapse. Detail shown on CMS and OS maps.	L
100	Possible mine shaft.	73490 44506	Shaft not visible (obscured by vegetation). Detail shown on CMS map.	L
101	Possible mine shaft.	73402 44471	Shaft not visible (obscured by vegetation). Detail shown on CMS and OS maps.	L
102	Mine shaft: Camborne (Black Dog Shaft).	73302 44442	Visible high shaft collar, with double fence. Inner shaft fill 1m BGL. Detail shown on CMS and OS maps.	L
103	Mine shaft: Unnamed.	73272 44495	Visible shaft collar (9m diam). Inner shaft fill 1m BGL. Tree growing from north side. Detail shown on CMS and OS maps.	L
104	Mine shaft: Black Dog Footway.	73230 44409	Shaft not visible (obscured by vegetation). Detail shown on CMS and OS maps.	L
105	Mine shaft: Black Dog North.	73210 44483	Shaft not visible (infilled and obscured by vegetation). Detail shown on CMS and OS maps.	L
106	Black Dog pumping engine house (E. House built for 2 nd hand Harvey's 70" in 1858. Bob wall rebuilt for 2 nd hand 76" – never erected).	73199 44480	Engine house bob wall extant but engine house lower walls visible. Chimney at rear partially extant. Very dense vegetation (and Cotoneaster) covered the site. Site evidenced by K. Brown (1990, No. 465; 1995, 64).	H
107	Mine shaft: Unnamed.	73183 44438	Shaft out of study area. Detail shown on CMS and OS maps.	L
108	Adit leat ?	73825 44739 73843 44693	Probable adit drain leat. Shown on MM	L

Table 1: Inventory of sites.

Note:

The site numbers in this table are mapped in Figure 11 (within the CMS area).

CMS references in the 'Comments' column relate to the Cornwall Mining Services shaft site plans (Cornwall Mining Services Limited, 1986, *Wheal Busy Leisure Project: Structural Mining Report (Phase 1)*). These plans are not reproduced in this report.

OS references to mine shafts in the 'Comments' column relate to those shown on the 1880 map (Fig 6) and the 1908 map (Fig 7), which are reproduced in this report.

The 'S' or Significance rating denotes the relative significance of **Low**, **Medium** or **High**. It is formulated by a combination of factors including the quality and extent of the remains

(both within the site and compared to adjacent sites), as well as the importance and understanding of the feature as part of a complex and how it contributes to the overall site character. **SM** refers to individual Scheduled Monuments of National importance. Note that Sites 32, 39 and 65 - 67 are Scheduled Monuments.

5 Site Significance

This section examines and assesses the significance of Wheal Busy Mine. It not only considers the relative significance of all remaining structures on site but also its wider relationship with the Cornish Mining World Heritage Site mining landscape. It is intended that this information will help inform proposals for the future conservation of the mine and buildings.

5.1 Methodology

This assessment of significance has been prepared after going through the process of undertaking a detailed understanding of the site following research of both published and unpublished sources, and analysis of its main significant components. This has included research of the 1986 reports and documents relating to a different proposal, mooted over two decades ago. Perhaps the most important methodology was to undertake a field assessment to analyse the site in detail. This methodology has led to a greater understanding of Wheal Busy Mine's historical impacts, the function of its remaining buildings, the site's *raison d'être*, and the way it evolved through time.

Within the parameters of this report, the assessment of significance has been generated by following the methodology of assessing the relative merits and significance of each site, analysing historical site phasing and recording the location of extant buildings. A working knowledge of other adjacent industrial mine sites within the World Heritage Site (particularly the Gwennap area (Area 6i), has provided additional comparative criteria from which to base significance comments.

5.2 Statement of Significance

International significance

Significance of the Site to the World Heritage Site/Outstanding Universal Value

Wheal Busy Mine, as part of Area A6i is one of the central pillars within the Cornish Mining World Heritage Site (WHS) for the 1700 – 1914 period as inscribed by UNESCO. The mine has Outstanding Universal Value as one of a number of mines that have been titled '*the Copper Kingdom of the Old World*' (mineralogically the most significant in the WHS), and (together with United Mines, Poldice, etc), produced a major proportion of the world's supply of copper during the eighteenth and first half of the nineteenth century. In addition, Wheal Busy itself sited some of the earliest beam engines in Cornwall, such as those produced by Newcomen, Smeaton and Watt (WHS2007, 57). Outstanding Universal Value is a central theme of the World Heritage Convention, and it means exceptional international significance. The World Heritage designation is only granted to heritage that meets the World Heritage Convention relevant criteria and conditions of integrity, authenticity and management for the particular WHS.

The **Outstanding Universal Value** statement for WHS Area A6i (relating to Wheal Busy) is: '*An area of contrasts, this, once the richest of Cornwall's mining districts and the site of some of its earliest beam engines, appears at first site to have returned to post-industrial rural sleepiness... To the south, the farmland gives away unexpectedly to some of the starkest industrial landscapes to be found anywhere in the Site – hectares of shaft-littered heathland, the sprawling un-vegetated mine dumps of Poldice and the poisoned, ochre stained valley of Wheal Maid, each giving a small indication of the sheer scale of industrial activity which took place here during the 18th century and the early 19th century, where the richest copper mines to be found anywhere in the world were sited here. There are only three substantial settlements in the main part of the area – Chacewater, St Day and Carharrack. Each is distinct and different in character, the histories of Chacewater and St Day being linked to the early period of Cornwall's*

industrialisation ...Within their core areas, each retains much of its historic character, despite considerable new development around their peripheries' (WHS 2007, 64).

National significance

Individual aspects of natural and cultural heritage have differing levels of significance; some may be of an international level, and others of national, regional or local significance. The reasons why a site is significant also vary.

Wheal Busy Mine

The eastern part of the mine survives as a complex palimpsest of mine shaft and other earthworks (mostly reservoir ponds and leat remnants), some superimposed, developed over three hundred years. The area is characterised by numerous early post-medieval lode back pits (shallow shafts accessing the upper part of a lode: Site 8), as graphically demonstrated in Figure 10, as lines of shafts following the lode outcrop. To the centre, south and west of the area, deeper shafts can be seen. Those in the centre are associated with the name Pittslouarn (or Pitslewren) and with early steam engine sites (Site No's 3 and 10). One or perhaps two shafts have related horsewhims, which may date back to the early 18th century. Earthworks for managing water are another feature of the area – namely reservoir ponds for the steam boilers (especially in the north-west area (Sites 17 and 18), with related leats supplying water to and from the ponds. Given the site's surviving archaeological evidence, and its relationship with the documentary evidence, the entire area is a Scheduled Monument (SM No. 32992).

The central (core area) of the mine includes the 1856 pumping engine house (Site 32), which sited at least three different engines (85" erected 1856, 90" erected 1872 and 85" erected 1909), and its original boiler house on its east side. During its latter phase the original boiler house was replaced with a new equivalent on its west side (which is still mostly extant: Site 33). The engine house is fully extant, sturdily built, but missing its roof and windows, and covered with dense ivy. The detached chimney, although also obscured by dense ivy, appears to be extant and retains its brick upper section. When the original boiler house was taken down (see front cover elevation of these buildings including the profile of the original boiler house), the stone may possibly have been reused to build the new boiler house in 1909. It has a corrugated steel roof, with timber posts and rafters supporting the roof – however, some of this is now rotting and the roof collapsing. Access to the Engine Shaft (Site 34) was not possible during the field assessment but *'Engine Shaft itself is typical of pre-20th century shafts in that it descends at an angle, slanting to the north along the tilt of the lode so that it passes under the engine house. It extends to the maximum depth of the mine'* (EH Scheduling text). A Footway Shaft (Site 34.1), is sited in front of the original boiler house. The final significant building in the core area sites the Smithy (described below under a separate heading).

The remaining significant building to the central core area relates to the mine's arsenic production from 1908. It appears the lodes worked for arsenic were sited primarily in the eastern section, thus the arsenic processing complex and crusher plant was sited as close as possible to these lodes. A Brunton calciner (Site 65.1), arsenic shaft kilns (Site 65.2), and a reverberatory furnace (Site 65.3), were connected to the condensing chambers (Site 66), and the extant arsenic chimney (Site 67). To the north, the remnants of the contemporary Californian Stamps (Site 68) with extant vertical timbers are still visible.

Significance of individual buildings to group value

All the major extant buildings within the study area are either Scheduled Monuments or Grade II Listed. The Smithy building (Site 39) and the Arsenic calciner (Site 65.1) are also both Grade II Listed. However, the close proximity of these sites to the Scheduled areas ensured that group value factors increased these designations to Scheduled status.

Smithy

The Smithy (Site 39) is a building that in the 1840s was a mine building (possibly the first Smithy), but in the 1860s (CRO MRO R151A Mine plan), was shown on a mine plan as a Miner's Dry and Pitman's House. The front cover image shows it was of rectangular shape, with a chimney, presumably for the forge at its west end. The Carpenters' Shop (Site 41) is in the foreground in front of the Smithy. The historical section for the 1870s describes how the mine company, when focussing on tin production from the Black Dog (western) end of the sett, installed a steam engine, a blast forge, a steam hammer, new forges etc in the Smithy. It may be the case that the building's east and west ends were extended at this time.

This building is located at SW 73882 44750, and in terms of statutory designation, is Listed Grade II (No. 492506), after formerly having been a Scheduled Monument. Sited sixty metres south-west of the Wheal Busy engine house it is intact apart from some crude repairs and has fine cast iron lintels with "**Great Wheal Busy Mine 1872**" in relief. The building is both Scheduled and Listed. Although its basic footprint is remarkably well preserved, the central section of the original scantle slate roof has been repaired with new roofing felt and battens, although the slates have not been replaced. The masonry fabric has also deteriorated in many places, with some 'repairs' undertaken – to varying standards. This building is on Historic England's 'Heritage at Risk' Register. The internal condition of the building is not known, but it is recommended that grant aid or funds be raised to re-roof and generally repair what is probably the most impressive Smithy in Cornwall.

Significance to Cornwall

In its prime, Wheal Busy was a major Cornish employer, requiring many surface and underground workers for mining and hand breaking and sorting copper ore from the early 1700s to the mid 1850s. However, the main significance of the mine relates to its part in the development of technology for early and mid-18th century steam engines: the siting of Newcomen, Smeaton, Boulton & Watt engines, many for the first time in Cornwall.

Also, the mine contributed greatly to the development of Chacewater. It also influenced regional transport networks by sending copper ore for smelting by road to both coasts of Cornwall in the 18th century, and later by a pioneering horse drawn tramroad to the north coast.

Summary:

Wheal Busy Mine (the CMS study area) has high *evidential value*, given its long documented history of being worked from the early 1700's (a rare documented occurrence), and a site that was the testing ground for so many early steam engines during the 18th century. It has high potential (through archaeological excavation or recording during any site works), to yield primary evidence for 18th century mining techniques, and even the nature and form of below ground surviving features relating to early steam engines (especially of the Newcomen design). Both the Smithy (Site 39), and pumping engine boiler house (1909, Site 33) are both significant, extant buildings, a rarity in Cornwall.

The *historical value* of the site is described in detail in section 2 of this document, and includes aspects described within the evidential value criteria. This is one of the few mines in Cornwall and the WHS that can demonstrate near continual mining from the early 1700s through to the 1920s: from tin mining to deep copper mining to arsenic production, and surface processing. For this reason, the historical value is perhaps of greater importance than the evidential value, if priorities are necessary.

The *communal value* is perhaps very different now compared to what it would have been two hundred years ago. In fact, from the early years of the 1700s to the mid-1850s the communal value (as evidenced perhaps by the public attendance at one of the mine company start-up celebrations described in the history section), would have been very high – it gave employment to hundreds of local men, women and children (given the labour intensive form of copper dressing floors), many of whom would have lived in the settlement at Chacewater. Nowadays, Wheal Busy Mine appears to be a resource for local

dog walkers – although the local inhabitants of Wheal Busy ‘village’ appear to have a lot of pride in their history and the character of its surroundings.

The *aesthetic value* of the mine appears to be more sensory – as a quiet, low-key environmentally significant site (heather, etc), than intellectual. Although specialists in industrial archaeology have much to see and learn, the aesthetic value relates more to the ecological environment of an old mine, long worked out, but slowly regenerating.

6 Bibliography

6.1 Primary sources

Cornwall Record Office:

Abandoned Mine Plan MRO CRO R41A: North Wheal Busy

AD 508/2 Undated plan of buildings at Wheal Busy

Abandoned Mine Plan MRO CRO R151A (1860s) Longitudinal section and plan): Great Wheal Busy and Hallenbeagle

M/A/3/1-8 Plans and Assay Samples: Wheal Busy Mine

M/89 Plans of the 85” engine for Wheal Busy Mine (1909)

Symons 1861 Plan of Treskerby, Wheal Busy & Tolgus Mining District, Cornwall (CRO H/166/2 & MRO A/67)

X26/6/1/1-26 Assorted Mine Plans (incl. Wh Busy)

X397/91 Chacewater Mine: Plan and elevation engraving by S Moyle (1813)

X475 Justin Brookes Parochial Mines Index for Cornwall (Chacewater and Kenwyn Parishes, 1986)

Cornwall Council:

Aerial photographs (overhead and oblique) of Wheal Busy Mine, 1946 RAF and 2005 CCC
Brown, K., 1990, Engine House list for Mineral tramways area (held in CC HER)

Kenwyn Tithe Apportion Map, 1839 (digital copy)

Ordnance Survey, c1877. *25 Inch Map* Second Edition (licensed digital copy at HE)

Ordnance Survey, c1907. *25 Inch Map* Second Edition (licensed digital copy at HE)

Ordnance Survey, 2007. *Mastermap Digital Mapping*

6.2 Secondary sources (published)

Barton, D.B., 1967, *A History of Tin Mining and Smelting in Cornwall*, Truro: D. Bradford Barton.

Barton, D.B., 1978, *A History of Copper Mining in Cornwall and Devon*, Truro: D. Bradford Barton.

Borlase, 1758, *Natural History of Cornwall*.

Brown, K. and Acton, B., 1995. *Exploring Cornish mines* (Vol 2 – Wheal Busy).

Buck, C., 2003, *Bedford United Mine*, Assessment report, CAU

Burt, R., Waite, P. and Burnley, R., 1987, *Cornish Mines – Metalliferous and Associated Minerals 1845 – 1913*, Exeter: University of Exeter Press.

Brooke, J., 2001, ed, *Kahmeter Journal*, Truro: Twelveheads Press.

Collins, J H., 1912, *Observations on the West of England Mining Region*, (reprinted 1988).

Cornwall Archaeological Unit, 1989, *Wheal Busy, The archaeological impact (Part 1)*, CAU

- Cornwall Mining Services Limited, 1986, *Wheal Busy Leisure Project: Structural Mining Report (Phase 1)*.
- Cornwall Mining Services Limited, 1986, *Wheal Busy Leisure Park: Structural Mining Report (Stage 2) Site Investigation*.
- Cornwall County Council, 1996, *Cornwall Landscape Assessment, 1994*, produced by Landscape Design Associates and Cornwall Archaeological Unit.
- Dines, H. G. and Plemister, J., 1956, *The metalliferous mining region of south-west England Vol.1*, London: HMSO.
- Greener, J., 2014, Article for Newcomen Society on 'The Cornish Connection'.
- Jenkin, AKH, 1969, *Mines and Miners of Cornwall*, Vols. 1, 2, 3, 5 & 6.
- PWH Surveyors, 2013, *Wheal Busy Mine Conservation Management Statement*
- Rolt, LTC, and Allen, JS, 1997, *The steam engine of Thomas Newcomen*
- Rowe, J, 1932, *Pumping engines on Great Wheal Busy*, Transactions of the Newcomen Society, Vol. 13.
- Trounson, J, (undated) *Mining in Cornwall, Vol 2 (Images)*.
- WHS Team, 2001, *Cornish Mining WHS Nomination Document*, HE.
- WHS 2007, *The Outstanding Universal Value of the Cornwall and West Devon Mining Landscape*, WHS.
- WHS, 2013, *Cornwall and West Devon Mining Landscape - World Heritage Site Management Plan 2013-2018*.

Websites

- <http://lbonline.english-heritage.org.uk> The Listed building database of Historic England and the Department of Culture, Media and Sport
- <http://www.cornish-mining.org.uk> The Cornwall and West Devon Mining Landscape World Heritage Site website

7 Project archive

The CAU project number is **146296** (Wheal Busy Mine: Conservation Management Statement excerpts).

The project's documentary, digital, photographic and drawn archive is maintained by Cornwall Archaeological Unit, Cornwall Council, Fal Building, County Hall, Treyew Road, Truro, TR1 3AY.

Electronic data is stored in the following locations:

Project admin: G:\TWE\Waste & Env\Strat Waste & Land\Historic Environment\Projects\Sites\Sites W\Wheal Busy\Wheal Busy Conservation Management Statement Report 2013R038

Digital photographs: (R:/Images/HES Images/Sites U-Z/Wheal Busy Mine CMS 146296).

Historic England/ADS OASIS online reference: cornwall2-234041

8 Appendices

8.1 Glossary of mining terms

Cornish mining terms, taken abroad by the miners who left Cornwall in their thousands in the nineteenth and early twentieth centuries, have been adopted across the world and remain a significant reminder of the impact this small part of southwest Britain had on the world of non-ferrous mining.

Adit	A horizontal level taken up at the foot of a hill, and either driven on the lode, or to intersect it, for dewatering or draining the mine at that level; and also occasionally used for bringing out the ores.
Adventurers	The individuals who have parts or shares in a mine.
Anker	Small barrel containing drinking water
Arch	A piece of ground that is left un-worked near a shaft.
Assay House	The house in which the ores are assayed.
Attle	Waste from mine workings.
Back	The back of a lode is the part of it nearest the surface; the back of a level is that portion of the lode extending above it to within a short distance of the level.
Bal	A Cornish miner's term for a mine; miner's shovel.
Bal maiden	A female surface worker employed mainly in dressing the ores prior to smelting.
Bargain	A miner's contract negotiated with the Mine Captain to perform certain work for a certain price.
Beu-heyhl	Live stream; rich for tin
Binder	Timberman
Bit	The steeled end of a borer
Bob	The engine beam that transfers the power from the engine to the pitwork. The bob wall of the engine house supports this beam.
Black-jack	Blende
Black tin	Tin ore ready for smelting
Blasting	Forcing off portions of rock by means of gunpowder or other high explosive.
Bonney	A distinct bed of ore that communicates with no vein of ore
Borer, augur, or drill	A round piece of iron, the one end steeled
Bottoms	The lowest workings either in a stope, level, or elsewhere
Bounds	The proprietary of tin ore over a given tract
Bounder	Denouncer of mining claims
Brace (to lay down at the)	If a person wished to relinquish his dole (claim) in a tin mine, he declined his 'dole at the brace' by placing his hand on the axletree and declaring he would no longer be involved with the mine

Branch	A small vein which separates from the lode, and frequently again unites with it, or a string of ore falling into the lode
Bryle	The traces of the presence of a lode, found in the loose matter, on or near the surface
Bucket	The piston of the lifting pump.
Bucking	The final hand reduction of ore for the separation of waste. A <i>bucker</i> performs this task using a bucking iron (short handled, flat faced hammer) on a buck stone.
Bunch or squat of ore	A quantity of ore of small extent; more than a stone, and not so much as a course.
Bunchy	Said of a mine which is sometimes rich but at other times poor
Buddle	An apparatus in which stamped tin is washed from its impurities.
Burning House	The furnace in which ore is calcined to sublime the sulphur from pyrites; being more decomposed, pyrites are then more readily removed by washing.
Burrow	A mound of waste rock or attle.
Cal	Wolfram
Calcination	The roasting of ore to remove impurities, particularly arsenic, performed in a calciner.
Capel or carrack	A stone composed of quartz, schorl and hornblende, usually occurring on one or both walls of a lode, and more frequently accompanying tin than ores.
Capstan	A machine consisting of an axle and several long arms, by which pumps and other equipment is lowered or raised from a shaft by manual force.
Captain or Agent	A superintendent in charge of the running of a mine. There were also subordinate captains who attended exclusively to underground or surface operations.
Carbonas	Irregular offshoots of minerals from lodes
Catch-pit	Area where slimes are retained for dressing
Caunter	When two lodes intersect, one is said to be caunter to the other diagonal lode
Chimming	A process similar to tossing but performed on much smaller quantities of ore; the kieve is supported on the verge of its bottom
Cistern	A large box at the bottom of each lift in the engine shaft
Clack	The valve of a pump
Clapper	An implement erected at the top of a shaft to sound from the mine to the engineman
Claying	Lining the hole (in which gunpowder is to be placed) with clay, to prevent the powder becoming damp.
Cobbing	The intermediate stage of the hand reduction of ore when the valuable parts are chipped away from the gangue

	prior to bucking.
Cockle	Schorl
Cofer	A case containing a set of stampers or lifters from 3 to 6 in number
Coffen, coffin, koffen	Open working, resembling a quarry without shafts, where tin stuff was excavated by digging and casting up from one stage of boards to another
Combed ore	Veins made up of layers of different materials parallel to the walls
Conglomerate	Consolidated gravel, pebbles, and boulders in a cementing fine-grained matrix
Core	Division of time, shift. Cores were usually 8 hours long, 3 per day, except in difficult working conditions (foul air, water), where 4 six-hour cores were usual.
Costean	Shallow pits to trace or find tin
Cost Book Company	A form of extended partnership that evolved in the Stannaries in which a group of adventurers came together to initiate a mining venture by opening a cost book that recorded their names, addresses, and all subsequent transfers of shares and costs of the undertaking. 'Adventurers,' who held shares in almost any fraction of the capital, put up enough cash in proportion to their share to finance operations, or paid 'calls' (demands for money) to enable operations to continue, or received their share of the divided profits at regular meetings.
Count House	Mine account house; mine captain's residence or office.
Country rock	The rock containing the lode fissure
Courses of ore	Deposits of ore having small vertical but considerable lateral extent
Creazes	Work of dressing tin in the middle part of the buddle
Cross course	A lode or vein that intersects or crosses a lode at various angles, and generally throws the lode out of its regular course.
Crop	Ore of tin dressed and cleaned for smelting; finest black tin
Cross cut	A level driven at right angles to the direction of the lode.
Country	The strata or rock through which the vein or lode traverses
Crusher	A pulverising machine for reducing the ores; worked either by steam or water.
Cylinder	The circular case of iron in which the piston receives the steam to give the engine motion.
Dead ground	Ground without mineral values
Derrick	A digger or miner
Dialler	An underground surveyor.
Dileuing	Washing ore, supported on a hair-bottom sieve in water

Dip	The angle of inclination of beds or strata measured in relation to a horizontal line
Dippa	A pit or a hole sunk in the lode to collect water to be drawn out by small barrels; a pit sunk in a bunch of ore
Dish	A portion of the produce of a mine payable to the mineral owner, also known as a due or royalty
Dol, dole	Any part or share of the adventure of tin ore; a small heap of ore
Draught engine	Engine used for pumping
Dressers	Cleaners of the ore.
Dressing Floor	Surface area of a mine where ores are separated from their matrix ready for smelting.
Drill	A machine invented for boring blasting holes using steam and later compressed air.
Driving	Cutting and blasting horizontally.
Druse	Cavity in a vein
Dry	A room fitted with steam pipes where the miners' underground clothes were dried.
Dun-mwyn	A hill of minerals
Durns	A frame of timber with boards placed behind it to keep open the found in shafts and levels
Dyke	A vertical or highly dipping injected sheet or eruptive origin. Igneous rock injected into fissures in older rocks.
Elvan	Porphyry - clay-stone.
Engine house	The masonry structure built to accommodate the steam engine, complete with chimney or stack, and which has come to internationally symbolise Cornish industrial genius and technical innovation.
Engine man or driver	Man who attends to and works the engine.
Fathom	Six feet in height, depth or length; measurement of stoping, driving, and sinking
Fault	An intersection of the strata
Fissures	Open cracks
Flang	A two pointed pick
Flat rods	Rods for communicating motion from an engine horizontally.
Floran	Small-grained tin, scarcely visible in stone but extremely rich. Any tin stamped extremely finely is known as floran tin (flower tin)
Flookan, fluccan	A soft clay-like substance
Fluorspar	Fluoride of calcium used as flux by copper-ore smelters
Flue	The connection between a boiler and chimney; also chambers in which arsenic soot is collected
Fluke	The head of a charger; an instrument used for cleaning

	the hole prior to blasting
Foge	Forge or blowing house for smelting tin
Footwall	The wall under the lode; also referred to as the underlying wall.
Footway	The ladders by which the workers ascend and descend.
Fork	A mine 'in fork' has all the water drawn out; the bottom of the engine shaft.
Frames	A type of buddle
Fuggan	Miner's lunch made of pastry containing meat
Fuze or fuse	Straws or hollow briars, reeds, etc., filled with powder.
Gad	A pointed wedge of a peculiar form having its sides of a parabolic figure.
Galena	Sulphide of lead
Gangue	Waste matrix of ore.
Glist	Mica
Gozzan	Oxide of iron and quartz, generally occurring in lodes at shallow depths.
Grass	The surface of a mine. A grass captain was therefore one in charge of surface operations.
Griddle	A sieve.
Growan, grouan	Rough pebbles, granitic gravel
Guag	Emptiness, void; ground previously worked for tin
Gulph	Large quantities of ore that continue at depth
Gunnies	Breadth or width. Single gunnies are 3 feet wide. Former vaults or cavities dug in nay mine are termed 'the old gunnies'. If full of water they are referred to as gunnies or houses of water
Gurt	A gutter or channel for water
Hanging wall	The wall or side over the lode.
Halvans, halvaner	The ores not sufficiently rich to be offered for sale; man responsible for dressing the halvans.
Heave	The horizontal dislocation that occurs when one lode is intersected by another having a different direction.
Helling stone	Slate
Hoggan	Miner's lunch consisting of baked pastry containing figs or currants
Horse	Portion of dead ground in a lode
Huel, wheal	A hole, or mine pit. A prefix to the names of most Cornish mines
Hulk, dzhu	To excavate a portion of rock on one side of an end to render the blast more efficient
Jigging	A method of separating larger pieces of mixed ore and waste rock by agitating the mixture under water: the

	heavier pieces of ore sink to the bottom of a sieve or container and the lighter pieces of waste rise to the top.
Keenly	Ground that looks favourable for ore.
Kerned	Mundic ore hardened by exposure to the sun
Kibble	A bucket usually made of iron, in which ore etc. are drawn to the surface.
Kieve	A large circular vat used in tin dressing
Killas (call-ys, cales, callys)	Clay-slate (sedimentary rock).
Kindly ground	Those rocks in which lodes become productive of mineral of value
Knockers	Benign spirits believed to inhabit the mines
Lander	Man who attends at the shaft mouth to receive the kibble in which ores, etc., are brought to the surface.
Lappior	The dresser of the leavings
Launder	A tube or gutter for the conveyance of water.
Learys, learies	Old men's workings; emptiness
Leat	A water-course.
Leavings	The ores that are left after the crop is taken out
Levels	Galleries driven on the lode usually at 10, 20, 30, etc., fathoms below adit level.
Limp	A semi-circular scraper to collect the skimpings in copper ore dressing
Lobby	Open drain
Lock-piece	A piece of timber used in supporting workings
Lode	A regular vein, producing or affording any kind of metal.
Loobs	Slime containing ore
Looby	To toss the ore
Lost-slovan	Either beginning or tail of an adit
Moor	Quantity of ore in a particular part of the lode
Moorstone	Surface as opposed to quarried granite
Mun	Any mineral
Mundic	Iron Pyrites
Nogs, nays	Support for the roof of a mine
Old men's workings	Ancient workings usually on the backs of lodes
Outcrop	The emergence of a rock or lode at ground surface
Pack	To facilitate the speedy subsidence or settlement of ore in the process of tossing by beating the kieve with a wooden hammer
Parcel	Pile or heap of dressed copper ore ready for sale
Pare	A gang or party of men.

Pasty	Miner's lunch consisting of a pastry case containing meat and vegetables
Peach	Chlorite
Pednan	Head of a buddle, where tin is dressed
Pedn cairn	A bunch of ore at a distance from the lode
Pillar	A support for the roof, of timber, stone, or other material
Pitch	Limits of the ground set to tributers who agree with the Mine Captain to work it at a pre-negotiated price
Pitman	One employed to look after the lifts of pumps and the drainage of the engine shaft.
Pitwork	The pumps and other apparatus of the engine shaft.
Planchun	A platform
Plat	A flat area used for the storage of ore or deads; whim plat is the level area whereupon a horse whim is erected
Poder	Rotten, corrupt; the former name for copper ore.
Pol-rôz	Water-wheel pit
Prian	Kaolin; a favourable sign when found in a lode
Prill	Lump of solid virgin metal, or the button from an assay
Purser	The cashier or paymaster at the mines; the financial officer of a cost book company
Queres or Quears	Crevice in the lode.
Racking	A process of separating small ore from the earthly particles by means of an inclined wooden frame; the impurities being lighter are washed off, the ore remaining near the head of the rack which will be removed to undergo tossing
Raffain	Poor ore of no value
Rake or rabb	True vein or lode
Red-rabb	Red killas
Reverse faults	Faults due to thrust, the hanging wall saide of the fault being forced upwards on the footwall
Riddar, riddle	Sieve
Rising	Digging upwards - a man working above his head in the roof is said to be rising.
Rôz	A wheel
Run	When excavations fall together.
Run of a lode	Its direction
Safety Fuse	Invented in 1830 and patented in 1831 by William Bickford of Tuckingmill. A stream of gunpowder was inserted into the core of twisted flax yarns, bound with twine and sealed with a waterproof varnish of tar. The fuse burnt at a regular 30 seconds per foot.
Saller	A floor at the bottom of the ladder to rest on; ground

	room; an empty passage or chamber
Sampling	The taking of a portion of ore for the assayer.
Scal, scale	A shale or portion of earth or rock which separates and falls from the main body
Scorran	St Just mining term for an iron-like quartz vein
Scovan	A tin lode
Scove	Very rich tin ore
Scrowl	When a metallic lode is interrupted by a cross gozzan, it may sometimes be picked up again by the presence of some loose stones of the true lode in the body of gozzan, known as the scrowl
Seem	Pack-horse load
Sett	A mine or number of mines taken on lease; the ground granted to a company of adventurers.
Shaft	A pit - the perpendicular opening to a mine. A shaft worked by horse engine or whim is called a whim shaft. Where the water is drawn, it is known as an engine shaft and an access shaft is a footway shaft
Shammel	A stage of boards used in coffins before shafts were in common use
Shoots	Deposits of ore in lodes which have a limited lateral extent, but considerable extent in depth; they generally dip at varying angles between horizontal and vertical
Skimpings	Skimmings of the light ore in the dressing process
Slimes	Mud containing metallic ores; muddy or earthy particles mixed with the ore.
Sollar	A small platform at the end of a ladder; also the covering of a shaft
Spal, spalling	Reduction of the ore into smaller fragments with long handled hammers after which it is cobbled; one's wages could be spalled (deducted) for absence from work or some other misdemeanour
Spaliard	A pickman
Spar	Crystalline white mineral: quartz, lime or feldspar
Squat	A large lode or heap of the lode in one place
Stamps	Machinery for crushing ores
Stannaries	An area of customary mining law in Devon and Cornwall
Stem, stemmyn	A day's work.
Stent	Rubble – loose dead earth
Stockwork	Rock that is traversed by numerous metallic veins rendering the whole deposit of sufficient value for treatment.
Strake	A launder or wooden box without ends, in which the process of washing or tying is performed.

Stope	A horizontal lode. To stope - to excavate horizontally layer after layer.
Stream tin	Tin ore found in the form of pebbles in valleys
Stream works	A place where detrital tin is washed
Strík	To lower a man into a mine by windlass
Strike	A horizontal line upon the floor of a bed or footwall of a lode
Stull	Timber placed in the backs of levels and covered with boards to support rubbish.
Sturt or start	A pitch taken by a tributer at high tribute and which subsequently proves very rich.
Sump, sumph	A pit sunk in the engine shaft below the lowest workings. The sumpmen assist the pitmen and attend to the machinery in the bottom of the engine shaft.
Syncline	Strata bent in the form of a trough
Tackle	Windlass, rope and kibble.
Tailings	Refuse from the previous dressing operations.
Tamping	Process of inserting clay into a charge hole prior to blasting to confine the force that could often pass up the hole
Team	To lade water in bowls
Tide	A smelter's working for 12 hours
Tods	To shake and toss the wet tin to and fro in a kieve; to cleanse and dress it
Tol	A bounder's portion of tin stuff
Toller, tollur	A man who inspects or superintends tin bounds
Tossing, tozing	A process by which ores are suspended in water and violently agitated; the ore subsides aided by packing, leaving the lighter worthless parts on top
Trawn	A cross course (common in the St Just mining area only)
Treloobing	Working slimy tin earth in a pit allowing the mud to wash off with water and the ore to settle at the bottom
Tributers	Men whose pay is a certain proportion of the ore, or value of the ores they raise.
Trunk	A long, narrow cistern or pit, in which mixed ore and slimes are separated by the subsidence of the former
Trunking	Process of separating ores from the slimes prior to racking and tossing
Tutwork	Work in which the labourer earns in proportion to his labour, paid for driving at a certain price per fathom.
Tye	A long trough to separate roughs from slimes by washing. Tying therefore refers to the washing of minerals.
Umber	Oxide of iron and manganese
Underlie shaft	A diagonal shaft on the course of the lode

Van	The tin ore washed and cleaned on a shovel.
Vein	Any substance different from the rock; a rake vein is perpendicular, or nearly so; a pipe vein, nearly horizontal.
Vooga	A cave or cavern
Vou hole, vug	A natural cavity in the mine
Wey	Measure of coal
Wheal	A hole, or mine pit. A prefix to the names of most Cornish mines
Whim	A machine worked by horse, steam, or water, for raising ores etc.
Winze	A sinking on the lode communicating one level with another for proving the lode, or ventilating such workings.
Wits	The undressed tin nearest the stamps after reduction; the 'crop' of the stuff
Zawn	Sea cave
Zighyr	A small underground stream