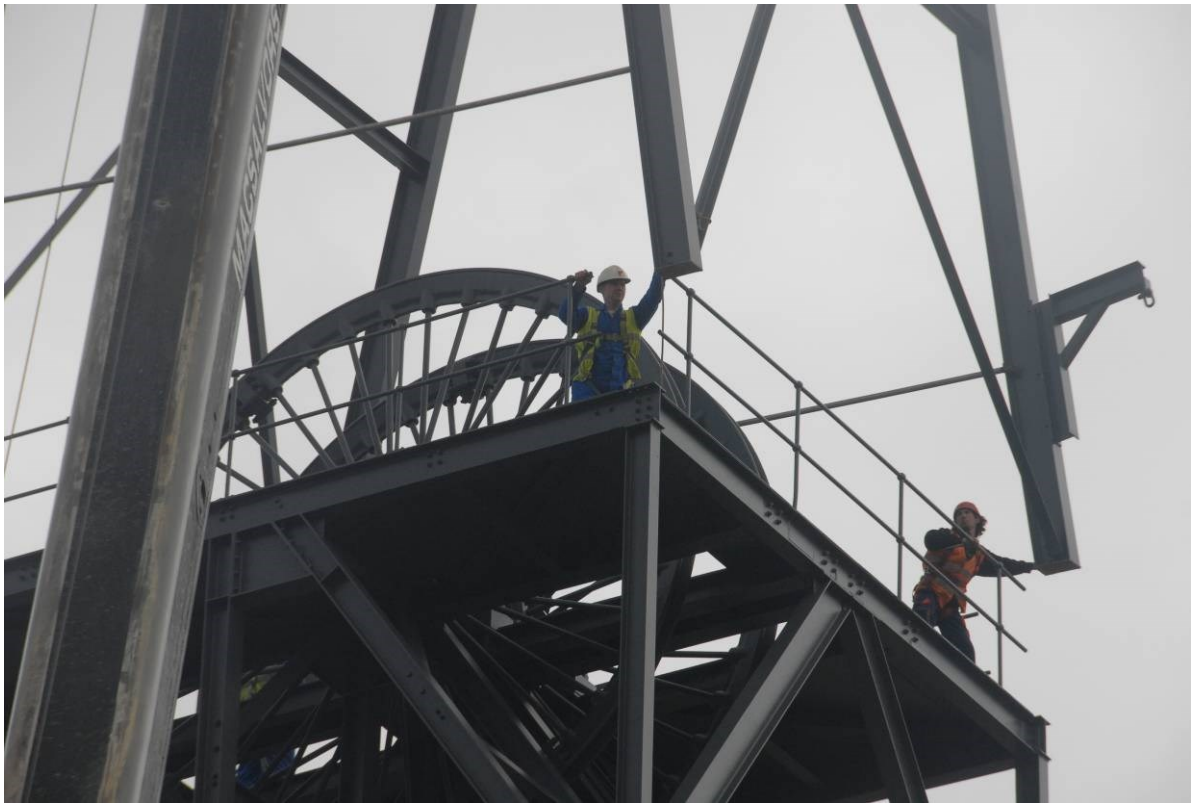
Report No: 2013R080

New Cook's Kitchen Shaft, South Crofty and Chapple's Shaft, Cook's Kitchen, Pool, Cornwall



Historic Environment Consultancy during conservation works to structures

Historic Environment Projects

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Client	**Cornwall Council**
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Acknowledgements

This study was commissioned by Sarah Jory, Major Projects Officer, Economic Development, Cornwall Council, and was carried out by Historic Environment Projects, Cornwall Council.

The Project Manager was Dr. Andy Jones.

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

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

Cover illustration

Craning on the sheave wheel maintenance gantry on New Cooks Shaft headframe

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Abbreviations

HER	Cornwall and the Isles of Scilly Historic Environment Record
HE	Historic Environment, Cornwall Council
OS	Ordnance Survey

1 Summary

Between October 2011 and June 2012, HE Projects were asked to provide input to a project design for the conservation of South Crofty's New Cook's Shaft headframe together with a pair of 19th century engine houses at Cook's Kitchen not far to the south. HE Projects subsequently undertook a historic building consultancy and watching brief at both sites during the conservation works programme, which was carried out between early February and mid-November 2013.

New Cooks was, for the whole of the 20th century, the principal hoisting shaft at South Crofty and its distinctive back to back double headframe, topped with a lofty maintenance gantry has long been a distinctive landmark within the mining landscape around Pool. As part of the redevelopment of former mining land between Tuckingmill and Barncoose, a new road link was planned to traverse the Red River and the South Crofty site. The site's occupiers – Western United Mines – proposed relocating any future milling operations to the southern part of the site – derelict structures around New Cooks Shaft would be levelled and the site redeveloped. Such is the iconic importance of this double headframe, however, that it was leased by Cornwall Council, together with a separate area containing the two Cook's Kitchen engine houses.

The headframe was fully scaffolded, cleaned of grease, grit blasted, defective steelwork replaced where required and painted with a four part paint system. The engine houses and chimney were fully repointed using a lime based mortar mix, wall tops were re-laid and failed timber lintels replaced in new oak. On the pumping engine house, significant areas of collapsed stonework wall facings were rebuilt and, on its southern elevation, the gable was taken down and rebuilt and the doorway and middle floor window reveals were reconstructed.

The works on site were managed by CORMAC, the consulting engineers for the preliminary phase of the project were Knevitt Consulting of St. Kew Highway, scaffolding was constructed by Chris Sedgeman Ltd., the steelwork conservation was carried out by Mid-Cornwall Fabrications and the conservation mason was Ed Faull.

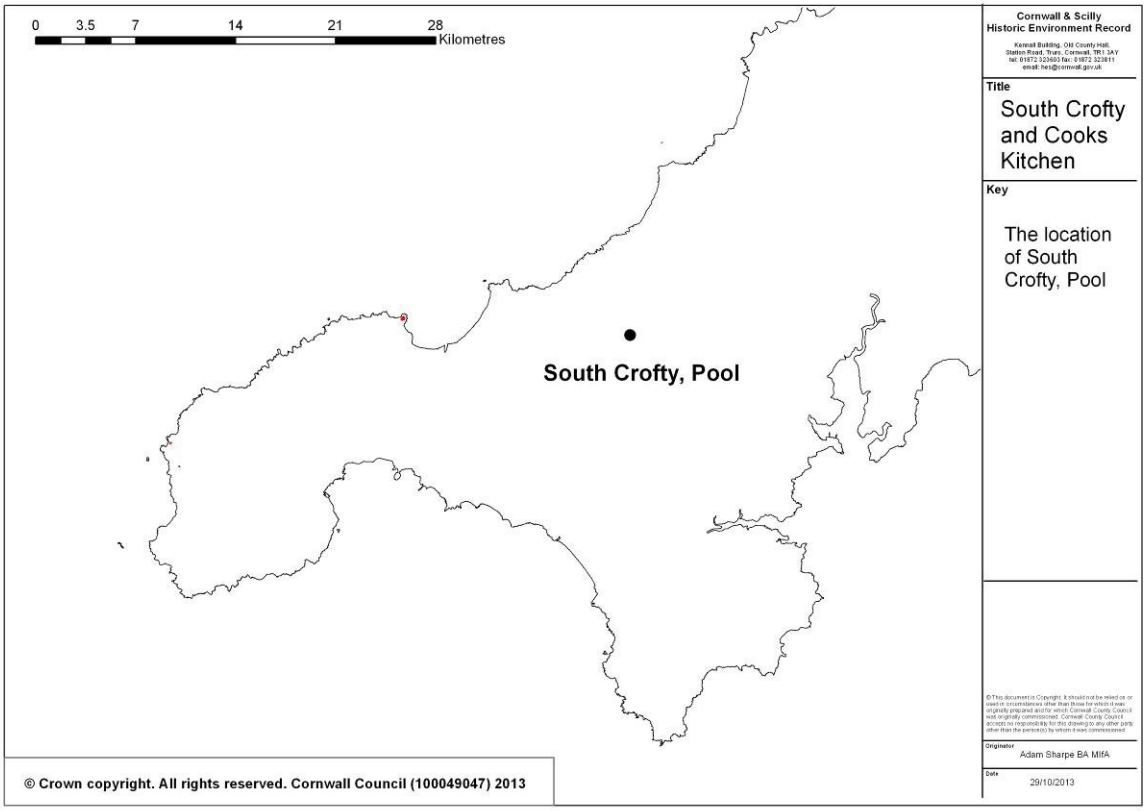

Fig 1. The location of South Crofty and Cook's Kitchen, Pool, Cornwall.

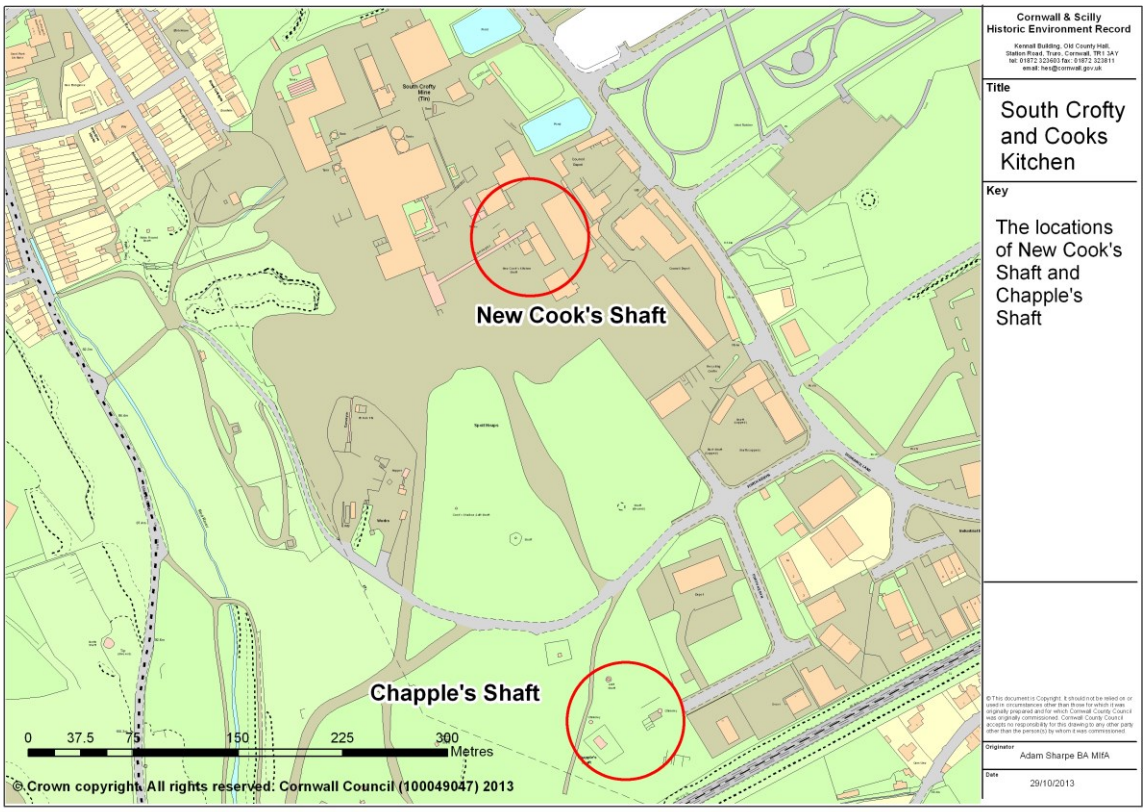

Fig 2. The locations of New Cook's and Chapple's Shafts, South Crofty and Cook's Kitchen.

2 Introduction

2.1 Project background

South Crofty tin mine at Pool, Camborne – a mine whose antecedents had been working for at least four centuries and which was the last to work in the formerly pre-eminent Camborne-Redruth mining district – closed in 1998, a belated victim of the International Tin Crash of October 1985, having worked continuously under this name since 1863. Its future is uncertain. The right to work this extensive mining sett was acquired by Baseresult Holdings Ltd in 2001, this being replaced by Western United mine Ltd (WUM) in November 2007. The tin price in 1975 had been artificially inflated to a peak of $38,000 a tonne (adjusted to 2009 prices). In late 1985, it dropped to around $10,000 a tonne (adjusted), reaching a low point of $5,000 a tonne in 2001, but, driven by demand from fast-growing eastern economies, it has now risen to just under $23,000 a tonne, and seems destined to rise yet further. Based on proven reserves, considerable exploratory drilling and some underground development, WUM eventually attracted financial backing in May 2011 from the Celeste Copper Corporation of Canada, and the reopening of the mine seemed likely. However, in June 2013, this backing was withdrawn, and the mine was placed in administration.

The economically-enforced closure of almost all of the mines in the Camborne-Redruth mining district at the end of the 19th century had left much of this area derelict and polluted. During the 20th century, much of this land had been turned over to light industrial and retail development, with the consequent loss of many of its former mining landmarks. This process continues, and the area between Barncoose and Camborne is now Cornwall's premier location for light industry. Should the reopening of South Crofty take place, it was proposed that new milling facilities would be constructed adjacent to the Tuckingmill Decline mine access driven from a portal in the Red River Valley near Brea. The existing mill at South Crofty had been progressively shut down between 1985 and 1988 and had become redundant and increasingly derelict. Although disused since 1998, the distinctive New Cook's Kitchen Shaft double headframe, topped with its high sheave wheel maintenance gantry, set on what had been since 1899 the principal shaft at South Crofty had become a distinctive local landmark.

The need to develop a strategic development plan for the former mining district between Camborne and Redruth had led to the creation of the Camborne Pool Redruth Regeneration initiative – this group had produced a development plan for the whole of this area, including a new distributor road cutting across the south of the area, and linked via Dudnance Lane directly to the A30, removing much service traffic from the urban roads within Barncoose, Illogan Highway, Pool and Tuckingmill. This road, to be developed by Cornwall Council, would cut across the South Crofty site, necessitating the demolition of most of its surviving structures. In recognition of the iconic importance of the New Cook's double headframe, however, this structure was to be retained and conserved as a landmark by Cornwall Council within an area which would eventually become a redevelopment site.

Not far to the north, a winding and a pumping engine house are almost the only above-ground physical markers of Cook's Kitchen mine. Allegedly developed on a lode by a miner named Cook, who claimed that the lode he had discovered was 'as wide as his kitchen', this mine, originally worked for copper during the late 17th century, subsequently discovered rich lodes of copper and was worked until the 1920s, the sett subsequently being acquired and worked by South Crofty. The pumping engine house dates from before 1838, and, with its adjacent detached chimney, is one of the earliest mine structures surviving in the Camborne-Redruth mining district; the nearby mid century constructed whim engine house had been partially conserved by the Kerrier Groundwork Trust during the 1990s. The project proposed the leasing of the land on which the engine houses and chimney stood and their conservation, again as landmarks.

The timing of the project was bound up with a land exchange between Cornwall Council and the site owners to enable the former to acquire the road corridor for the new link road and the latter a site for its proposed new mill. This was finally completed in early May 2012.

Historic Environment Projects Cornwall Council were approached in October 2011 with a request to assist in the drawing up of specifications for the conservation of both the double headframe and the engine houses, working with the Cornwall Council Major Projects Team, Knevitt Consulting of St. Kew Highway and Andrew Richards, Conservation Officer, Cornwall Council. An application for Listed Building Consent was drawn up once detailed specifications for the work were finally agreed.

The contract for the works was put out to tender, CORMAC being appointed in mid January 2013, their sub-contractors being Ed Faull (stone mason), Chris Sedgeman (scaffolding contracts) and Mid-Cornwall Fabrications (steelwork treatment). Historic Environment Projects were awarded the historic environment consultancy. Work on site began in late February 2013, and continued until mid November 2013.

2.2 Aims

The principal aim of the study is to ensure the successful and appropriate conservation of Chapple's pumping and whim engine houses and Chapple's pumping engine house chimney and the conservation of New Cook's Shaft headframe. This was achieved through the provision of a historic environment consultancy in the drawing up of specifications for the work and through an HE consultancy and archaeological watching brief during the works programme.

The principal objective of the project was to report on the results of the consultancy; a secondary objective was the creation of an OASIS/ADSonline record.

2.3 Methods

2.3.1 Desk–based assessment

Previous desk-based assessments and surveys (as follows) provided sufficient detail to inform the fieldwork stage:

- Baseresult Holdings Ltd. 2003, *Various reports submitted for renewal of Mineral Planning Permission*
- Buckley, J.A. 1982, *South Crofty Mine*, Dyllansow Truran
- The Cahill Partnership and Cornwall Archaeological Unit 2002, *Cornwall Industrial Settlements Initiative: Pool*, Cornwall Archaeological Unit report
- Morrison, T.A. 1980, *Cornwall's central mines: the northern district 1810-1895,* Alison Hodge
- Sharpe A., Lewis, R., Massie, C. and Partners 1991, *Engine house survey: the Mineral Tramways Project*, Cornwall Archaeological Unit
- Sharpe, A. 1993, *South Crofty and Cooks Kitchen: archaeological assessment, Cornwall Archaeological Unit report to Kerrier District Council*
- Sharpe, A. 2003, *An archaeological assessment of the proposed Dudnance Lane to Station Road development area, Pool, Redruth, Cornwall*, CAU report 2003R064
- Sharpe A. 2004, *An archaeological assessment of the proposed development area at South Crofty, Pool, Redruth,* Report for Crofty Developments Ltd.

Other sources consulted included:

- Historic maps and plans, including

  - Joel Gascoyne's map of Cornwall (1699)
  - Thomas Martyn's map of Cornwall (1748),
  - OS 1 inch survey (c1810)
  - Illogan Tithe Map (c1840),
  - 1st and 2nd Editions of the OS 25 inch maps (c1880 and c1907)
  - relevant mining maps and plans
- Modern maps
- GIS map layers

2.3.2 Fieldwork

Archaeological recording was undertaken both in advance of and during the conservation programme. This included the examination, interpretation and upgrading (where required) of the pre-works building records prepared by other members of the project team, input to an application for Listed Building Consent for the works, the direct recording of features not accessible for recording until scaffolding or other access had been put in place, and the provision of both general and detailed ongoing advice to the project team on the significance of and any requirements for the retention and conservation of structural detail, and, where appropriate, methods appropriate to achieve this. All such advice was agreed in discussion with Kieren Couch (sub-agent in charge of works for CORMAC), Mark Hughes (project manager for Cormac Consultancy on behalf of Cornwall Council) and (where appropriate), Andrew Richards (Historic Environment Advice Team Leader, Cornwall Council).

2.3.3 Fieldwork: photographic recording

High resolution (>10Mpx) digital photography was used as the principal recording tool during the works programme. This photographic record comprised:

- General views.
- Examples of structural and architectural detail.

2.3.4 Creation of site archive

This included:

- Archiving of digital photographs to HER standards.
- Detailed site/building descriptions were created based on information supplied by other members of the team (incorporated within this report).
- Detailed elevation drawings and plans prepared by other member of the project team.
- Completion of an English Heritage/ADS OASIS online archive index for the project.

2.3.5 Archive report

A written report describing the project findings has been produced (this report).

3 Location and setting

See Figures 1 & 2.

Chapple's pumping engine house is sited at SW 66496 40602, its chimney is at SW 66490 40617, the whim engine house is just to the east at SW 66536 40620 and the associated man engine house remains are just to its south at SW 66545 40592. New

Cook's Shaft double headframe is at SW 66449 40964. Both sites lie within the site formerly operated as South Crofty mine.

4 Designations

4.1 International

The Cook's Kitchen engine houses at Chapple's Shaft fall within the Cornwall and West Devon Mining Landscapes World Heritage Site, Area 5 – the Camborne and Redruth Mining District.

4.2 National

- Chapple's Shaft whim is Listed Grade II – ref 114229, Listed 12/09/1989.
- Chapple's Shaft pumping engine house is Listed Grade II – ref 1328162, Listed 12/09/1989.
- Chapple's Shaft detached chimney is Listed Grade II – ref 1160769, Listed 12/09/1989.

4.3 Regional/county/local

None apply.

5 Site history

The sett of Cook's Kitchen, centred at SW 66470 40586, lay immediately to the east of the Red River Valley to the south of Tuckingmill, its lodes being essentially continuations of those worked in Dolcoath to the west, though dislocated along a north-south line by the Great Cross Course. As such, very great things were expected of this undertaking and Cook's Kitchen was, during its heyday, the second deepest mine in Cornwall. Like Dolcoath, it was at first worked very successfully for copper ores, is thought to have been at work in 1690 and was described in 1796 as '*one of the most remarkable mines for copper perhaps in the world*.' Its revenues were used by the Bassett family to fund a major rebuild of Tehidy House, and although it was initially worked by waterwheels, by 1794 it had already acquired a Boulton and Watt pumping engine.

However, by the 1820s, the richer deposits of copper available from the Cook's Kitchen lodes were already becoming substantially worked out and the adventurers' attention had begun to turn the exploitation of its tin resources. A new pumping engine was installed in the 1830s together with surface plant to treat the tin ore, but the mine remained dependant on copper revenues, and the ever-diminishing production of these ores forced a temporary closure in 1848.

In 1849, emboldened by discoveries of rich tin resources below the copper deposits in Dolcoath, Tincroft and Carn Brea, the mine was taken up again, though found to be in a poor state. New steam-powered dressing floors were constructed, but most of the adventurers' attention was given to the deepening of Chapple's Engine Shaft – virtually the only deep shaft on the sett. A man-engine powered by a large underground water wheel was installed in 1859 and considerable expenditure was laid out on re-structuring the surface plant. By 1865 the mine possessed a 50" pumping engine (at Chapple's Shaft), three steam whim engines, a stamps engine and six large water wheels, whilst the mine was employing 370 people and working to a depth of 500m below adit.

In 1872, the mine was divided in two, New Cook's Kitchen taking over the northern part of the sett. However, declining tin prices and poor management over many decades had inevitable results, the last dividend for Cook's Kitchen being paid to the

shareholders in the following year. Nevertheless, rock drills were introduced to attempt to improve production, Chapple's Shaft continued to be deepened, as was the shaft utilised by the man engine, by 1886 this being powered by a horizontal steam engine. A new skip road was also installed at considerable expense, though winding continued to be by the means of a single kibble, seriously restricting production. Critically, the mine essentially continued to be worked from a single shaft, there had been expensive equipment failures, extensive areas of weak ground had been encountered which required heavy timbering, the eastern and southern parts of the mine had been found to be not worth working in depth and the ground to the west bordering Dolcoath could not be worked because of an agreement between the two mines. The only option was to work the core area of the mine ever downwards, at increasing expense. The mine was amalgamated with neighbouring Tincroft in 1875, though this was found to be in a worse state than Cook's Kitchen. A famous image of the mine during this period was used on the cover of Trounson and Bullen's 1999 Mining in Cornwall (Volume 1). The scene, looking east from Dolcoath, shows the group of engine houses around Chapple's Shaft, including those for pumping, winding and stamping, as well as the man engine house. The two other whim engine houses can be seen a little further to the east.

In 1893, a further fall in world tin prices looked as if it would prove the end for the mine. By this time, it was in a poor state. Its engines were ancient, working a single, cramped and very deep shaft. Its dressing floors had not been remodelled for nearly four decades, and the man engine reached only half way to the lower levels of the mine, where the heat was so intense that working conditions were described as 'stupefying'. In 1896 Tincroft and Cook's Kitchen were amalgamated with the Carn Brea Mines, though the Cook's Kitchen workings had effectively been abandoned by this date. Carn Brea was abandoned in 1913/14 and Tincroft (with Cook's Kitchen) in 1921.

New Cook's Kitchen, created in 1872 to the south of Cook's Kitchen, also proved unsuccessful and was closed in 1893, parts of the sett being acquired by South Crofty in 1899, a new shaft (New Cook's) being sunk within this part of the enlarged sett.

South Crofty has a long and complex history, from small beginnings during the 18th century, gradually absorbing all of its neighbours to become the last working mine in Cornwall during the second half of the 20th century. Its story began in a plethora of small, shallow but often rich copper mines developed in the area around Pool and Tuckingmill during the 18th century, one of these being Wheal Crofty. The nearby East Wheal Crofty, which came into being in 1823, worked the former Longclose, Dudnance, Penhellick, Trevenson and Pool setts. After a short-lived closure, the mine was re-started in 1831, becoming one of the most important copper mines in Cornwall, and in 1854 its sett was subdivided into North Wheal Crofty and South Wheal Crofty along the line of the Pool to Tuckingmill road. South Wheal Crofty thus worked the setts of the former Wheal Susan, Copper Tankard, Longclose, Dudnance and Penhellick mines, though Longclose was sold off to become Wheal Crofty. Contrary to expectations, South Wheal Crofty did not prove particularly successful, and closed in 1896.

However, in 1899, combined with the former Cook's Kitchen sett, the mine was re-started and was completely refurbished. Over the following decades this new amalgamation weathered the economic conditions which saw almost every other Cornish mine go to the wall. Adjacent adjoining setts were acquired and the mine eventually became the deepest ever to work in Cornwall. In 1985, however, the effects of the International Tin Crisis made even South Crofty uneconomic to work. Despite heroic efforts to keep the mine operational, it eventually closed in 1999.

Over recent years, a significant upturn in world tin prices has made the reopening of South Crofty an increasingly viable prospect. The acquisition by Baseresult Ltd of the rights to work the sett kept hopes for a reopening alive through the decade following the 1999 closure, and the mine has most recently been taken over by Western United Mines (WUM). An extensive programme of prospection drilling has confirmed the presence of abundant reserves of tin, copper and zinc, together with small quantities of

rare earth minerals in an unworked ore body within the sett, as well as significant amounts of unworked ore within the neighbouring Dolcoath sett. Efforts are currently under way to prove the extent of these and other reserves, with an intention to reopen the mine for both tin and these other economically important minerals.

However, if a re-opening occurs, it is intended that future operations will be radically different in approach from those which were used in the past. The workings will be accessed from the decline tunnel in the Red River Valley rather than via New Cook's Shaft, waste will be disposed of underground and ore will be processed in a new mill complex in the north-western part of the site at the location of the former Cook's Kitchen dressing floors. This approach frees up the bulk of the former South Crofty surface site for disposal for development, this dovetailing with over-arching plans for the redevelopment of the Camborne-Pool-Redruth (CPR) area, including the construction of a new distributor road whose route will cross the centre of the former South Crofty site. Although the majority of the surviving buildings associated with the mine are to be demolished as part of this programme, it was recognised that the distinctive and highly visible double headframe had become a significant local landmark and should, if possible, be retained as such.

Part of the land formerly forming part of the Cook's Kitchen sett to the south of the main line railway which included its surviving engine houses and parts of the site proposed for the new South Crofty mill had been acquired by Kerrier District Council in the 1990s as part of one of their land reclamation programmes, in part to help to keep South Crofty at work. A land exchange between Cornwall Council and Western United Mines was therefore proposed, under the terms of which Cornwall Council would receive the land required for the new road, Western United Mines getting in return the land required for their new mill. In order to ensure the conservation of the historically important and visually New Cook's headframe and Cook's Kitchen engine houses, these were to be leased to Cornwall Council. The headframe has been disused since 1999, and whilst some conservation work had been undertaken by Kerrier District Council to Chapple's whim engine house in the 1990s, Chapple's pumping engine house and chimney had lain within the blast radius of South Crofty's explosives magazine and could not be conserved at that time; the nearby man engine house had been demolished to its foundations and had become substantially buried in rubble and rubbish.

6 Results of historic environment consultancy

In the late decades of the 19th century, men equipped with the brand new technology of photography had recorded a handful of views of the extraordinary mining landscape to the north of Carn Brea. Nothing like it had ever been captured on film before, and these rare surviving images of Cornwall's central mining district record this complex and busy mining district at the height of its development (for example, see Bullen 1999 and 2004). The landscape they portrayed was utterly dominated by chimneys, by engine houses and by industrial activity on a scale which still beggars belief, yet the evidence for this world-leading expertise would be almost entirely swept away within less than a lifetime. The catastrophic decline of Cornwall's mining industry during the late 19th century, the resulting wholesale clearance of all of these mine buildings and the 20th century evolution of a new kind of commercial and trading economy in mid-Cornwall has utterly changed the local landscape on a scale and at a pace not experienced anywhere else in Cornwall.

Given the scale of the changes which have happened here, it is extraordinary that a very small number of features recorded in those historic views still survive and can be recognised. The profile of a hill here, the spike of a chimney there, but above all, the engine houses at Chapple's Shaft, Cook's Kitchen, sited on one of the extraordinarily rich mines whose development had been critical to the pre-eminence of this mining

district. The survival of these buildings had been no more than a matter of chance, leaving them amongst a small number of landscape features which still connect present day Camborne-Redruth with its past.

A new future is proposed for South Crofty. Miners have once again been drilling, clearing levels, sampling lodes, planning new buildings. The conservation of the pair of engine houses at Cook's Kitchen and the headframe over New Cook's Shaft will ensure that historical continuity is preserved within the wider landscape, in which these landmark structures will continue to remind us of the former worldwide importance of Cornish mining and technology.

6.1.1 Chapple's whim SW 66536 40621

Listed Grade II, Cornish Mining World Heritage Site Area 5

Erected in 1865 for a 26" cylinder double-acting winding engine, the house is 8.6m x 5.55m in plan and 11m high to its gable. Its chimney stands to 17.5m high (Figs 9 and 10). Its construction is of mortar-laid rubble granite and mine waste, with granite quoins to wall corners. It was a workaday building, built of locally-derived materials, erected to do a mundane but necessary job, one of a huge number which served this function in the surrounding landscape, almost all of which were built to a more or less standard pattern, most of which have now long gone. The small dimensions of the (eastern) cylinder doorway – 1.52m wide by 1.82m high to the arch springings - confirm the small size of the engine recorded as having been installed here.

It seems that the engine was worked hard, as paired longitudinal tie rods were retro-fitted just below bob wall height to keep the building from shaking itself to pieces, the northernmost running through the attached chimney (Fig 14 and 24), whilst three tie rods were inserted just behind the bob wall, these having external wrought iron strapping (Fig 23). The work was functional but hardly pretty, some of the patrasses being roughly hacked out of pieces of old boiler plate.

Being constructed during the second half of the 19th century, the windows of the building are typically arch-headed in two courses of brick, these being on all three floors on the south elevation, where there are two relatively large windows at ground floor level and a pair of smaller, centrally-placed windows on the upper two floors (Fig 9). In the eastern elevation, which includes an arch-headed cylinder doorway at ground level, there are windows on the middle and upper floors (Fig 10). The northern wall has completely collapsed, though as the boiler house was on this side of the building, there may only have been a centrally-located window on the upper floor and a boiler house door at ground floor level. A girder opening survives only on the southern wall. The plug door on the western elevation is headed with three courses of brick, though has been partially infilled, the uppermost section taking the form of a brick arch and piers, the lower section being in mass concrete reflecting a late adaptation of the building for an unknown purpose (Fig 11). A large-diameter iron pipe of unknown function has been incorporated at floor level in the lower section of the infill. An iron lintel below the base of the concrete infill supports three baulks of timber, probably originally part of the framing for the condenser housing. Below again is a flat brick arch set just above ground level, whilst to the west are the remains of whim and flywheel loadings, though these have been damaged and partly over-dumped, and are now incomplete. To the south of the plug door are the remains for a flywheel cut-out in the bob wall. The pattrassess on the bob wall stand proud of the wall facing, and clearly formerly bore onto a substantial elongated timber.

The attached chimney survives, together with most of its brick capping courses; this incorporates brick drip rings at both base and top (Fig 10). A lightning conductor was installed inside the chimney in the 1990s, though had been cut off at ground level by vandals. Within the interior of the building some joist pockets survive (Fig 13), together with the cylinder bedstone, indicating that the engine was scrapped *in situ*, most probably having been dynamited, which might also have been the cause of the loss of

the northern wall. A few scraps of wall plaster also survived (Fig 13). The remains of the boiler house lie on the northern side of the engine house, though its surviving walls (mostly that to the north) are cloaked in ivy; Buddleia is growing within the interior of this building and along its northern side, whilst its eastern end has been subjected to some recent trenching. The surrounding area is squalid, repeatedly dug over and dumped upon – long viewed as waste land without any value or purpose.

Following a report drawn up by Sharpe and Massie in 1991, some conservation works were undertaken to this building by Kerrier Groundwork Trust on behalf of Kerrier District Council, who acquired this site using a Derelict Land Grant. Substantial parts of the building were repointed in a cementitious mortar, though this had not has weathered particularly well, whilst a new section of timber had been installed on the inside face of the southern wall. The failing cylinder door arching noted in 1991 was reconstructed at the time. Whilst a number of cracks were noted within the fabric of the building, none appeared to be active, and were probably the result of the wrenching of the structure resulting from the collapse or demolition of the northern wall of the building in the early years of the 20th century. The building was considered to be in fair structural condition though emanated a sense of long neglect.

The following works were proposed:

- Re-set wall head masonry to an average depth of 300mm using an approved lime mortar in order to prevent water ingress to the wall core.
- Patch point the engine house internally and externally in an approved lime mortar where the existing mortar or replacement mortar had failed.
- Clear rubble, vegetation and rubbish from the area surrounding the engine house.
- Clear vegetation, rubbish and rubble from the interior and immediate periphery of the boiler house; undertake any necessary consolidation and repointing works to exposed stonework (not undertaken).
- Repair the lightning conductor.
- Treat exposed ironwork to prevent any further corrosion.
- Enclose the conserved engine house within a chainlink fence on concrete posts.

The condition of the majority of the whim engine house could be adequately and safely assessed from ground level prior to the erection of scaffolding, and it was hoped that the conservation works undertaken during the 1990s would limit the requirement for replacement pointing. On closer inspection once the building had been scaffolded, however, much of this cementitious pointing was found to have blown (weathered and detached from the underlying gauging mortar). Some of it had clearly contained far too low a level of binder to have any real durability, and the wall capping which had been applied in the past was almost pure sand in places. The replacement timberwork had weathered well and the brick pointing was good, with the exception of the flaunching above the lower drip ring, some of which had become detached. It was decided on this basis not to replace the pointing in the brick section of the chimney, but to patch point the flaunching where required.

The incorporated metalwork had not been treated in the 1990s; most was wrought iron, and though it had weathered, any corrosion present was stable; sections of incorporated rolled iron boiler plate were in far worse condition, and some sections used as lintels had disintegrated almost completely. Ivy had take root adjacent to the building, particularly on its southern wall, on the leading edge of the remains of its northern wall, and on the chimney (Fig 10). In places the ivy had rooted into the structure. Elsewhere, apart from within the interior of the building and on the broken edges of the northern wall, vegetation establishment was found to be limited. The interior of the boiler house had become filled with rubble from the collapse of the northern wall. This had become overgrown with scrub vegetation, hiding much fly tipped rubbish. Mature Buddleia grew along the line of the surviving northern wall of the boiler house, almost completely obscuring it.

A small amount of manual levelling of ground levels around the building was required for the installation of the scaffolding. No significant archaeological layers were affected by this activity.

The conservation of this structure was straightforward, all failed pointing being cut out and replaced (Figs 16 to 26) utilising a 5:2 mix of CLS11 sand and NHL 3.5 hydraulic lime. Where patches of the original plaster were found to be soundly attached to the masonry they were pointed in place with a fillet of mortar; detached sections were removed. The wall capping was lifted, the poor quality bedding mortar removed and the stonework securely re-set, the mortar utilised to reform the gable peak incorporating stainless steel expanded metal lathing. Small sections of rebuilding were required on the broken wall ends where they were potentially unstable and original wall pockets were gently fleeted in slate and mortar to prevent standing water finding its way into the wall core. The ironwork was cleaned of any loose corrosion, then given two coats of an epoxy-based paint to prevent it from further degradation (Fig 24). It was originally intended that this would be a buff colour, mimicking the hue of corroded iron, but as the finished paint colour fell somewhere between a light buff and salmon, a final coat of black paint was applied to reduce the visual impact of this treatment. The lightning conductor connection was repaired where it had been vandalised.

Unfortunately, budget constraints enforced by the growing awareness that the works to the pumping engine house would be considerably more than had been budgeted for forced a limit on what could be done to the other sections of this part of the site. The whim loadings therefore remain unconsolidated and mostly covered with dumped soil and stone which has become overgrown with scrub, obscuring them. In some places substantial remains of the boiler house remain overgrown, unconsolidated and largely invisible to the visitor.

6.1.2 Chapple's pumping engine house SW 66496 40602

Listed Grade II, Cornish Mining World Heritage Site Area 5

Erected by 1838 for a 50" cylinder pumping engine (later replaced by a 55" cylinder engine), this was the principal pumping engine on Cook's Kitchen mine, and is now one of the oldest surviving engine houses in the whole of the Camborne-Redruth mining district.

The engine house, which measures 8.6m by 5.79m in plan and stands to 12.5m high, was constructed of a mix of mine waste and rubble granite with granite quoining, though its bob wall is of entirely of carefully coursed, squared granite blocks in the style used for engine houses of this period, before these structures became far more utilitarian, and when their builders were still uncertain as to what would stand the dynamic forces imposed by the working of the engine (Figs 27 to 54). Some of the stone used in the engine house, particularly that in its upper sections, was small and of poor quality (Fig 38); scribed pointing had been used to disguise this (Fig 36). The two side walls (to the east and west) are 0.9m in width for most of their height, though there are narrow steps at cylinder plat level and again at bob wall head level (where the step is 0.15m wide). The walls are topped by erection steps 0.3m wide which have granite top courses, though full height brickwork inner facings (Fig 52). There is a low level plinth course on the external face of the bob wall alone. The engine was evidently hard-working, and the house was retrospectively fitted with paired high level longitudinal tie bars and three elongated iron patrasses (see Figs 31 and 42) and a closely-set pair of lateral tie bars were installed just inside the face of the bob wall, the highest being just below bob wall height, installed to ensure that the building would not break itself apart as a result of the dynamic forces exerted on it whilst the engine was operating.

Although the plug door in the bob wall (measuring 1.56m wide and 4.3m to the springings, 0.70m high from the springings to the underside of the arch crown) is arch-headed in elegant and carefully-shaped granite voussoirs with a projecting keystone

(Fig 27), most of the remainder of the wall openings are flat-headed, unusually having timber (rather than granite) lintels, their eventual decay introducing significant areas of weakness into the structure (Fig 30, 34). Paired openings on the ground floor to the rear of the bob wall measure 1.75m high x 1.65m wide to the west, this being a window, as it has an arched head with projecting brick courses above it, and 2.30m high and 1.0m wide to the east, this being the doorway between the engine house and the boiler house (Fig 27). There are windows on the middle floor on both the eastern and western elevations (these measuring 1.45m high x 1.30m wide to the east and 1.60m high x 1.30m wide to the west). All of the windows have brick external facings at their bases (Fig 50) and formerly had cement-faced sloping internal cills. Some appeared to have originally had longer lintels, this being indicated by brick infill panels (Figs 44 and 45). The girder openings measure 0.99m high and x 0.75m wide, the easternmost being closed off with a panel of masonry, indicating that the girder had been taken out from the house to the west during the dismantling of the engine.

In the rear wall to the north, wall collapse has resulted in the loss of some detail (Figs 28, 32 47). Whilst the bob loft (top floor) window was intact (measuring 1.5m high and 1.25m wide on its external face – the reveals have slight splays), of the middle floor window, the lintel and southern reveal alone survived, though indicated the size of the original opening, this having been 1.49m wide and 1.40m high, again with splayed reveals. The spring beam openings between the bob loft and middle floor windows were 0.50m high and 0.66m wide. The size of the cylinder door opening at ground level can be inferred from the locations of the quoins making up its southern reveal and a cut-out in the masonry indicating the location of its lintel. Although the level of the base of the doorway was somewhat uncertain given the extensive loss of stonework from its cill, the doorway was 1.86m wide and around 2.2m high. Given that the chimney was attached to the boiler house and not the engine house, the openings in this elevation were symmetrically- placed, so the size of the cylinder doorway could be inferred with a fair degree of confidence. Most of the lintels had either failed or were on the point of failure (Figs 30, 32, 33, 43, 47). The collapse of the gable masonry had occurred recently, truncating the upper part of this elevation (Fig 28, 31, 46), though archive photographs indicated its original form. Partial racking of the forward section of the western wall had occurred, leading to some deformation, bulging and cracking, though this had not advanced to a point where failure was likely, and it was thought that repairs to this wall might not require significant interventions.

Internally, the stonework was in much poorer condition than externally, as the failure of timber cills and lintels had led to localised collapses and loss of masonry (Figs 32 and 33). Wall sockets indicated the positions of many of the original floor joists. Full access was not allowed to the interior of the building prior to its scaffolding, but Sharpe and Massie's 1991 report indicates that the majority of the problems with this building were concentrated in the rear (northern) wall, much of whose internal face had been lost to collapse. On the external elevation of this wall the two lower openings (the cylinder door and the middle floor window) had coalesced through collapse (Figs 28, 32, 49). A further area of concern was the racking of the leading edge of the western wing wall, which, in 1991, had been thought might require remedial attention over and above repointing and crack stitching.

Although most of the fabric of the originally large boiler house had been lost, a very small section remained attached to the engine house on its south-eastern corner. Chapple's Shaft had been plugged and fitted with a 150mm breather pipe. To its east were the reasonably well preserved but somewhat overgrown remains of the granite-constructed surface balance bob mountings.

It was concluded that the building would require some major works to avert further collapse and to restore a level of structural stability which would ensure its survival as a landmark feature of this historically very significant former mining landscape.

The following works were proposed by MBA in 2010:

- Reconstruction of the lost inner wall facings on the rear (northern) wall using material recovered from rubble on site.
- Reconstruction of lost elements of the rear wall using new oak lintels and rubble recovered from site.
- Replacement of all lost or failing lintels using new hardwood (preferably green or air dried oak).
- Full replacement of all failed pointing using an approved lime mortar.
- Re-bedding of wall capping courses in an approved lime mortar to prevent water ingress to the wall heads.
- Stitching cracks in the fabric of the walls using helicoil stainless steel bedjoint reinforcement.
- The installation of steel tie bars to secure the southern ends of the wing walls (to the east and west) to prevent further racking.
- Clearance of rubble, rubbish and vegetation from the area surrounding the engine house and within the area formerly occupied by the boiler house, including the surface balance bob loading followed by minor consolidation works (not undertaken).
- Removal of existing fencing and replacement with chainlink fencing on concrete posts.

The conservation of the pumping engine house proved more problematic than the whim engine house, given that the original timber lintels over wall openings had all almost completely rotted out, resulting in the loss or destabilisation of considerable areas of walling, particularly within the interior of the building. Making the building safe for the masons to enter required the design and construction of a particularly complex scaffold structure, which would support fragile or unstable masonry without imposing any additional loads on the structure as a whole. The resultant design was free-standing, the section constructed to give access to the interior being hung from bridge beams supported by the external scaffolding. In addition, a buttressed structure was constructed on its northern side, and this was used to support bridge beams running through the wall opening into the engine house to support the remaining masonry in the upper part of this elevation (Fig 51). Extendable supports were added on the eastern and western sides of the building to help to hold potentially unstable masonry in place until it could be either rebuilt or repointed. The resultant scaffolding structure was very strong, and prevented any further masonry collapse, but in places made the masons' work fairly difficult, so closely-set were the standards, bridge beams and cross pieces, especially on the northern elevation where substantial collapse had already taken place. The extremely unstable remains of the upper section of the gable wall (Figs 28 and 31) were photographically recorded and demolished as an interim safety measure.

Given that the mortar on this building had a distinctive pinkish hue (Fig 35, 36 and 41), a number of pointing panels were trialled before a sustainable competent matching mix was found. The fist mix trialled used a reddish sand with marble chips to mimic the fragments of lump lime found in the original pointing, but this was rejected as being entirely unsuitable in appearance, and because it would have been almost impossible to use in any other than large masonry joints. A second mix, based on that previously used on the chimney and whim engine house using CLS 11 sand mixed with 10% brick dust mixed 5:2 with NHL 3.5 hydraulic lime to attempt to produce a suitable colour was then trialled (Fig 37). However, this had a hue somewhere between pink and orange, and was felt likely to be obtrusive if adopted. An alternative blended sand was sourced (a 50/50 mix of CLS 22 and CLS 34 mixed 5:2 with NHL 3.5 hydraulic lime) and a further trial panel installed (Fig 53). It was agreed that this was a far more acceptable match to the original, and was adopted as a result. The building was 100% repointed in this mix, all necessary rebuilding being undertaken with a suitable conservation grade lime-based gauging mix (utilising a BS1200 white quartz sand in the mix), the majority of the work utilising stonework recovered from rubble piles in and around the building.

Where this was found not to be suitable, additional granite was sourced from stockpiles deriving from buildings demolished along the CPR road link corridor and stockpiled at South Crofty.

Two slender steel tie rods fitted to pattrass plates were installed to tie the structure together at the heads of the eastern and western walls (Figs 60 and 61). A mat of Cotoneaster growing on the bob wall head had been *in situ* for long enough for a deposit of soil and organic material to have built up, and as it was felt by the archaeologist that, as there was the potential for Buddleia seeds to lodge and grow here, this mat of material and soil was removed and the wall top joints re-pointed. Vegetation was also removed from the erection steps (Figs 40 and 52) and from the head of the bob wall.

The most difficult work was focussed on the northern elevation of the building, where the rotting of lintels had resulted in the failure of substantial areas of formerly supported stonework and the resulting coalescence of the ground floor cylinder doorway and the middle floor window, the reveals of much of the stonework to the sides of these openings having also collapsed (Figs 28 and 32). Only the external faces of the stonework between the middle floor and upper floor window had survived, as also above the upper floor window and the gable peak. Where lintels survived, they were rotten and in some places, no longer providing more than token support (Fig 54). It was clear that it would be necessary to reinstate these lintels and rebuild substantial sections of lost stonework to confer an adequate level of stability to the finished building.

The HE Projects Archaeologist had proposed that all collapsed masonry on this elevation would be reinstated (Fig 64), but budget constraints and the insistence of the structural engineer that this would not be necessary to restoring an appropriate degree of stability to the building have meant that the reconstruction has been partial (Fig 65). The reveals of both the cylinder doorway and middle floor window have been reinstated from measurements taken from the surviving opposite reveals, whilst the lost stonework between the openings was reconstructed as a ragged-sided gap. The lost internal facing masonry between the middle floor and upper floor window levels was rebuilt onto new oak lintels (Fig 56 to 58, 62 to 63) and the gable peak was reinstated, again on replacement lintels (Fig 65).

The loss of facing stone from the internal northern elevation had been severe in places, exposing the wall core, some of which was found to be loose (Figs 49 and 54). During the building works, one of the masons rashly dislodged a large cantilevered stone from the area between the two spring beam openings, with the result that a large panel of masonry collapsed (Fig 55). As a result, the spring beam openings had to be reconstructed from the record drawn up by the site archaeologist. Although the spring beam openings had originally been spanned by a single lintel, in view of the precarious nature of the stonework above and the risk of the collapse of the reveals to the top floor window if a like for like approach was taken, a single lintel was installed over each opening and the resultant loss of original masonry was minimised (Fig 57).

On the other elevations, all lost or failing timber lintels were replaced in oak and collapsed or collapsing stonework above them reinstated (Figs 30, 33-34, 47-48, 56, and 59). Badly corroded iron lintels over a small opening on the eastern side of the building were replaced in steel. Further corrosion of all exposed original metalwork was prevented by the application of a two coat epoxy paint (Fig 66). Sections of incorporated ironwork which had jacked the stonework (Fig 39) were removed, the gaps being infilled with small stone. All window cills were repaired in a cement-based screed, as originally constructed.

The eastern wall of the condenser housing adjacent to the southern wall of the engine house had survived and was repointed and capped; the western wall had presumably collapsed into the shaft or had been demolished when the shaft was originally capped

some years ago (the shaft was over-slabbed prior to the building contract). The remains of the surface balance bob loading were part-covered in vegetation, and, as they retained their massive granite topstones, were considered to be stable enough not to require consolidation. The low remains of the southern wall of the boiler house were also pointed and capped.

6.1.3 Pumping engine house chimney SW 66490 40617

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The now freestanding chimney is constructed of a mixture of granite and mine waste and stands to 14m high and is 3.0m in diameter at ground level (Fig 67). It has completely lost its upper brick section, and is now truncated at its granite drip ring (Fig 68). Inspection suggested that the chimney was in good condition, requiring little in the way of conservation work beyond re-pointing and the provision of lightning protection.

A mortar test panel based on 5 parts of CLS 11 sand and 2 parts of NHL 3.5 hydraulic lime was installed on the chimney near its base at an early stage in the project (Fig 69). This was left to cure and then inspected for colour and texture match with the original pointing. The chimney was then fully scaffolded and inspected in detail. Much of the pointing was found to be in fair condition, though it was decided to take the opportunity to replace almost all of it.

Three original openings into the chimney were found, to the north, south and east. That to the north was relatively small, measuring 1.27m high by 0.4m wide under a granite lintel, the opening being blocked with a brick panel for the lower 0.67m; it had brick reveals and sheet iron inner lintels and was found to be blocked with rubble 1.4m in from the outer face of the chimney (Fig 71). The function of this opening is uncertain. It may have been for access to the interior of the stack during ash cleaning operations, though it is paired with another opening to the south, this measuring 1.1m high and 0.4m wide. This again has a granite external lintel and sheet iron inner lintels, but is blocked by a panel of brickwork 1.0m in from the face of the stack (Fig 72). This, too, might have been an ash-cleaning opening, the access originally being from within the boiler house. The opening to the east where the boiler flues had led into the stack was considerably larger than the other two and had lost its lintel, leading to instability of the masonry over its location (Fig 73). The failing stonework was propped as a matter of urgency and was repaired once the scaffolding had been struck. The opening as found measured 2.0m high and was up to 1.5m wide, extending the full distance into the interior of the stack (1.0m). The opening was reinstated at 0.76m by 0.76m based on information on the size of the original suggested by flanking brickwork (Fig 72). This was capped with a second hand granite lintel measuring 1.15m by 0.12m which had been sourced by CORMAC and, on the advice of the site archaeologist, the opening was then blocked in with a two course depth of site-salvaged bricks to prevent the theft of the accessible exposed section of the lightning conductor tape, the bricks being tied into the chimney masonry using sections of stainless steel dowel (Figs 74-75).

All of the original pointing was hacked out to an average depth of 50mm, repointed using the approved mix and textured using a brush once it had cured appropriately. Some of the pointing applied by the less experienced members of the team was tamped up too early or too late, giving a less than satisfactory texture and appearance, and was subsequently replaced on the instructions of the site archaeologist and project manager.

The upper section of the interior of the chimney had lost most of its pointing, as well as some of the rough masonry and brickwork which formed its inner face (Fig 68). The segmented shaped granite drip ring had been set on a single course of header bricks, possibly a decorative band but more likely a levelling layer; the drip ring was found to be in good condition, and did not need lifting and resetting. The top joints of the drip ring were pointed, as were the accessible more weathered vertical joints within its inner face (Fig 76).

The basal section of the interior of the chimney had been found to be filled with rubble, most of this consisting of the collapsed brick capping section. The original intention had been that the copper lightning conductor for this chimney would be attached to the external face of the chimney. However, it was pointed out that this would make it exceptionally vulnerable to theft and it was agreed that it would be installed inside the chimney. This raised a problem, in that the basal 5m of the chimney was filled with rubble. An attempt was made to remove this by raking the material out through the flue opening. This was partially successful, but left several metres of material dangerously hung up inside the chimney and this approach was abandoned. A mole drill was therefore eventually used from the top of the scaffolding to make an adequately-sized opening down through the remaining rubble fill. The lightning conductor tape was led down the inside of the chimney and earthed via a series of mats buried in the ground to the east of the chimney.

6.1.4 Bryophyte relocation area

An area of rare metallophyte bryophytes had been identified on open ground immediately to the east of the primary ore bins at South Crofty. As the bins were to be demolished and this area of ground substantially disturbed during this process, the substrate on which the bryophytes were growing was scraped up and transported to the Cook's Kitchen site for re-location under the instructions of the site ecologist. This area was shown as bare ground on all archive mapping, and as only minimal surface preparation was required (the removal of a thin layer of vegetation and topsoil) no archaeological watching brief was deemed to be required.

6.1.5 New Cook's Shaft headframe SW 66449 40964

This highly visible landmark structure (Figs 77-79) was used as the principal ore and waste haulage shaft on the mine during most of the 20th century, and also provided man riding facilities following the abandonment of Robinson's Shaft due to its insuperable stability issues. The present headframe is unique in Cornwall, being composed of two separate headframes set back to back (Fig 79), the older section to the south dating to the early 1960s, the newer north section (which was used for hoisting) dating to the 1980s. Each was equipped with its own electrically-powered winding engine. South Crofty closed in 1999, and despite repeated attempts to reopen the mine, these efforts have not yet borne fruit, and the headframe had not been maintained in any significant fashion since the closure of the mine. The principal access to the mine in any reworking will be formed by an extended version of the decline tunnel started some decades ago from the base of the Red River Valley, so New Cooks Shaft has effectively become redundant, apart from as a maintenance access.

The South Crofty site is soon to be traversed by the Camborne Pool Redruth Link Road, intended to provide an efficient transport route connecting industrial estates to the north of Carn Brea with the A30, relieving pressure along local roads and through the settlements of Pool and Tuckingmill. As a result, the majority of buildings on the redundant South Crofty site are currently being demolished, removing many landmark structures from the local skyline. Historic Environment Projects undertook a detailed pre-demolition photographic survey of the mine buildings in 2013.

However, so significant a landmark was the New Cook's Shaft headframe deemed to be that arrangements were made between the site operators and Cornwall Council for its retention and conservation as a monument to mining within this important part of the Cornubian orefield.

Exposed to the elements (including warm damp air rising up the shaft) for many years, the headframe had deteriorated significantly in places, its galvanised coating having deteriorated to the extent that a few structural members had corroded and would need replacement (Figs 97-99). The headframe also include some redundant features such as partial sections of walkways in the lower part of the southern headframe (Fig 92), a

failed roller shutter door giving access to the conveyor house (Fig 83) cabling and hoses, together with other features relating to the operation of the shaft (see for example, Figs 80-84, 89-91), and the conveyor leading from the skip hoisting tippler station in the northern headframe to the coarse ore bins to the west (Fig 79). The conveyor structure was demolished in early 2013, leaving only a small section protruding from the base of the headframe, together with the vibrating feeder under the headframe (Figs 81, 85-88).

Following the craning off of the towering sheave wheel maintenance gantry which topped the headframe, the installation of a comprehensive temporary lightning protection system and the construction of an all-over sheeted scaffold structure which in itself became a highly-visible temporary local landmark (Figs 93, 95-96), the whole of the headframe was inspected in detail. Those elements of its steelwork which had corroded to the point of actual or anticipated failure were marked up for replacement on a like for like basis. The handrails on the southern headframe western boomstay (raker leg) were not only redundant, but would theoretically allow future unauthorised access up the headframe. They would also prove difficult to paint, and were removed and not replaced, though the associated step plates were left in place. The remains of the conveyor were also demolished, leaving the vibrating feeder in place (Figs 87-88, 122, 126). Also removed were the corroded roller shutter door to this structure (Fig 83), the conveyor man's cabin (Fig 85) and various redundant electrical cables, compressed air and water pipes. A temporary cover was built over the shaft opening to prevent any materials falling down it, the sheet cladding around the lower part of the headframe was cut away and the whole area was enclosed within a temporary security fence.

The remaining headframe components were grit blasted to remove surface corrosion and to provide a key for the four coat paint system which was to protect it from the elements once the work had been completed (Figs 104-106). This process revealed some further areas where the existing steelwork had corroded beyond acceptable levels (Figs 97-99). These were plated, patched or replaced (Figs 107-108), dependant on the severity and extent of the corrosion. The grit blasting and subsequent painting was necessarily a slow process, and continued slowly down the headframe until mid-September 2013, painting being undertaken on the completed scaffold lifts, beginning with the sheave wheel platforms (Figs 101-102, 109-112, 116-119, 122).

At an early stage in the project there had been some suggestions that the sheave wheel maintenance gantry (Fig 94) might not be re-set on top of the headframe, in part due to the budget being inadequate to cover the costs of reinstatement. Historic Environment argued that this important element of the headframe should be re-set if at all possible – such features are now exceptionally rare in Cornwall (the only examples being at Victory Shaft, Geevor and at New Cook's Shaft, South Crofty). In addition, the gantry formed part of the well-know profile of the headframe – the considerable additional height it conferred to the headframe also made this landmark feature visible from a far wider area of the surrounding landscape. In the event, funds to undertake the work were identified, the gantry was sheeted over, grit blasted and painted using a mobile access platform, and, following the stripping of the overall scaffold structure (Fig 113-114), the gantry was re-located on the 7th October 2013, the occasion being taken for a small-scale topping out ceremony attended by the project partners and the local Cornwall Councillor (Figs 127-132).

The final works undertaken at the headframe were the removal of the temporary shaft cover, the reinstatement of the sheet steel cladding to the lower part of the headframe (Figs 120, 132-133), the installation of permanent lightning conductor protection and the enclosure of the headframe with a permanent security fence (Fig 136). It is anticipated that public access to the shaft and headframe will be assured in any future redevelopment of the South Crofty site.

With the exception of some minor elements of the headframe (such as the handrails up the western bracing leg of the southern headframe, some redundant cabling, temporary timber structures and elements of the enclosed conveyor structure which formerly transported ore hoisted at the shaft to the adjacent primary ore bins), all elements of the headframe have been retained and conserved.

6.1.6 Security fencing

At Cook's Kitchen, the engine houses and chimney were originally to be enclosed within two discrete security fences; these were subsequently amalgamated into a single L-shaped enclosure (Figs 20, 135).The line of the fencing at the eastern end was designed so as to include the remains of the whim boiler house within the fenced area. To the west, part of the fenceline cut through the site of the former large boiler house attached to the eastern side of the pumping engine house, which has been completely demolished for at least a century. Pre-works levelling over this site during the emplacement of a geotextile and hardcore layer off which to build stable scaffolding had not revealed any evidence for building foundations.

The security barrier consisted of a tall panel of chainlink fencing topped with two strands of barbed wire set on crank-topped cast concrete posts concreted into the ground. All excavation for the posts was carried out using hand tools, though preliminary ground levelling along the fenceline was undertaken using a wheeled excavator. The ground to the north of the whim boiler house was found to be made up of dumped cinder and ashes, whilst to its south west, a large dump of soil, concrete, stone and general rubbish had been created, butting up to the whim loadings. This had become vegetated with scrub and brambles (the majority of this dump of material remains in position, partly obscuring the whim loadings, which were not conserved during this work programme). On the north eastern side of Chapple's Shaft, a bund of rubble was cut through, revealing some timbers and ironwork, though none of this appeared to be associated with the former operation of the shaft.

Some of the fence post pits were examined prior to the placing of the posts. To the south east of the whim engine house, large stones and lumps of concrete were encountered, indicating that the ground in this area had been both built up with modern dumped material to a depth of at least a metre and had subsequently been landscaped. To the north east of the building, further deposits of (probably redeposited) cinders and ash were encountered – again, this deposit appeared to be at least one metre in depth. Over the site of the pumping engine boiler house, further deposits of cinder were found, mixed with broken brick and fire reddened stones. These may have derived from elements of the demolished boiler house, but no *in situ* masonry was encountered, suggesting that the building had been totally demolished down to its foundations.

A second security fence, this time on galvanised steel posts, was erected around New Cook's headframe in order to secure both the headframe and shaft from unauthorised access (Fig 136). The majority of the fence run (to the east, south and west) was bolted down to the concrete pad surrounding the headframe. To the north, the original ground levels sloped down to the nearby mine roadway and were built up in reclaimed material revetted by large blocks of site-won granite. The fence posts in this area were concreted in place. There were no archaeological implications to this work.

7 Conclusions/discussion

The landscape of west Cornwall, and particularly that between Camborne and Redruth, was largely shaped by industry. Of the more than 2000 engine houses constructed in Cornwall, a large number were sited here, a significant number of the engines they contained representing the very latest and most complex technology of the day. Fortunately, this extraordinary landscape to the north of Carn Brea was captured by

early photographers just before the almost complete collapse of the Cornish mining industry. In recent decades, however, almost all of these physical indicators of this exceptionally important period during Cornish history have been swept away. The engine houses at Cook's Kitchen were amongst the tiny number which survived of the hundreds which had worked here, yet, had the current project not been undertaken, they would have been reduced to shapeless heaps of rubble within a few decades through unchecked deterioration. That potentially very unwelcome loss has been averted through the work undertaken in 2013.

New Cook's Shaft headframe at South Crofty was also a rare survivor of a type of structure which had once been commonplace – every winding shaft in Cornwall – perhaps 5000 in total - would have had a headframe of some form or other over them, some large some small. Now less than ten survive in the whole of Cornwall. The New Cook's Shaft headframe is not only the largest and most complex of those that survive, but is also one of the most iconic, a highly visible marker of the site of the last tin mine to work in Cornwall during the 20th century. It would have been easy for it to have been lost – swept away with the ore bins, the mill and the other buildings at South Crofty which have recently been demolished to make way for the new distributor road. That the headgear has been conserved – not to serve a working mine, but as a monument to the former importance of mining in this industrial heartland of Cornwall (and perhaps to keep that spirit alive in the hope that it may once again flourish) - is an indicator of the recognition that it is just as important to understand and celebrate the history of a landscape as it is to plan for its future.

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8.3 Websites

http://www.heritagegateway.org.uk/gateway/ English Heritage's online database of Sites and Monuments Records, and Listed Buildings

9 Project archive

The HE project number is **146229**

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

1. A project file containing site records and notes, project correspondence and administration.
2. Electronic drawings stored in the directory ..\Historic Environment (CAD)\CAD Archive\Sites S\South Crofty and Cooks Kitchen 2013
3. Digital photographs stored in the directory ..\Historic Environment (Images)\SITES.Q-T\South Crofty and Cooks Kitchen 2013
4. English Heritage/ADS OASIS online reference: cornwall2-170594

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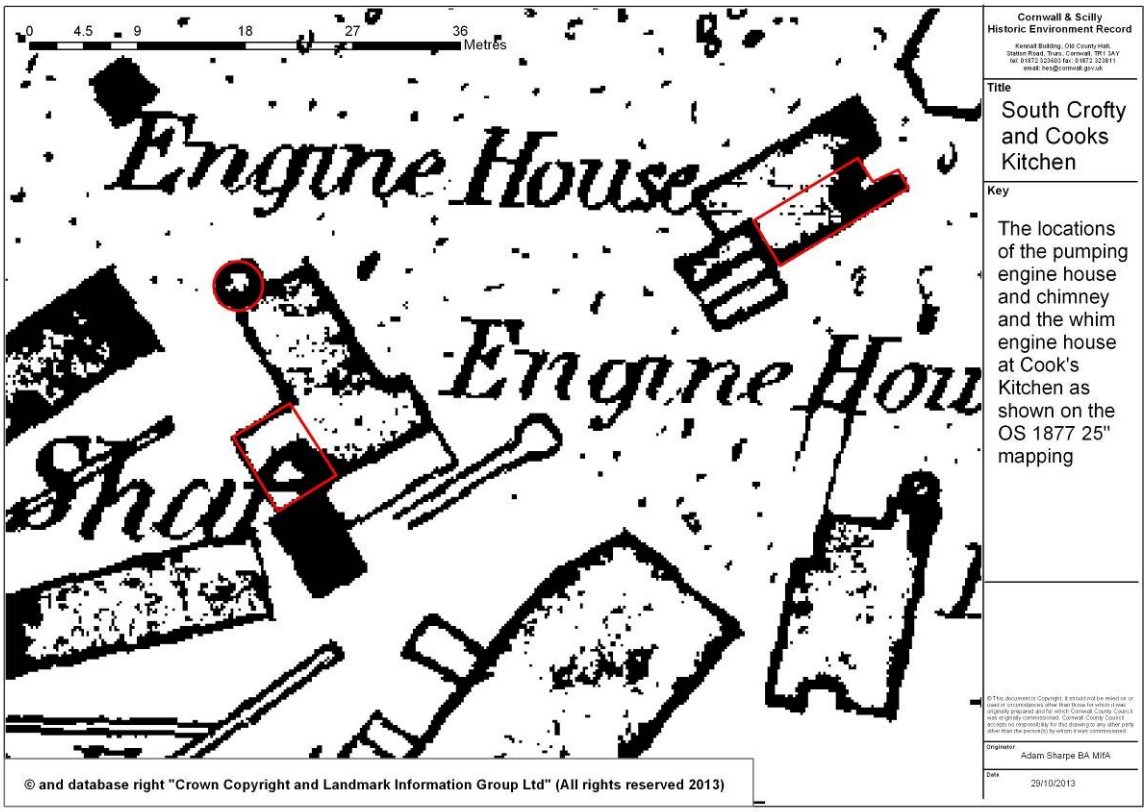

Fig 3. Structures at Cook's Kitchen circa 1877, showing those conserved in 2013.

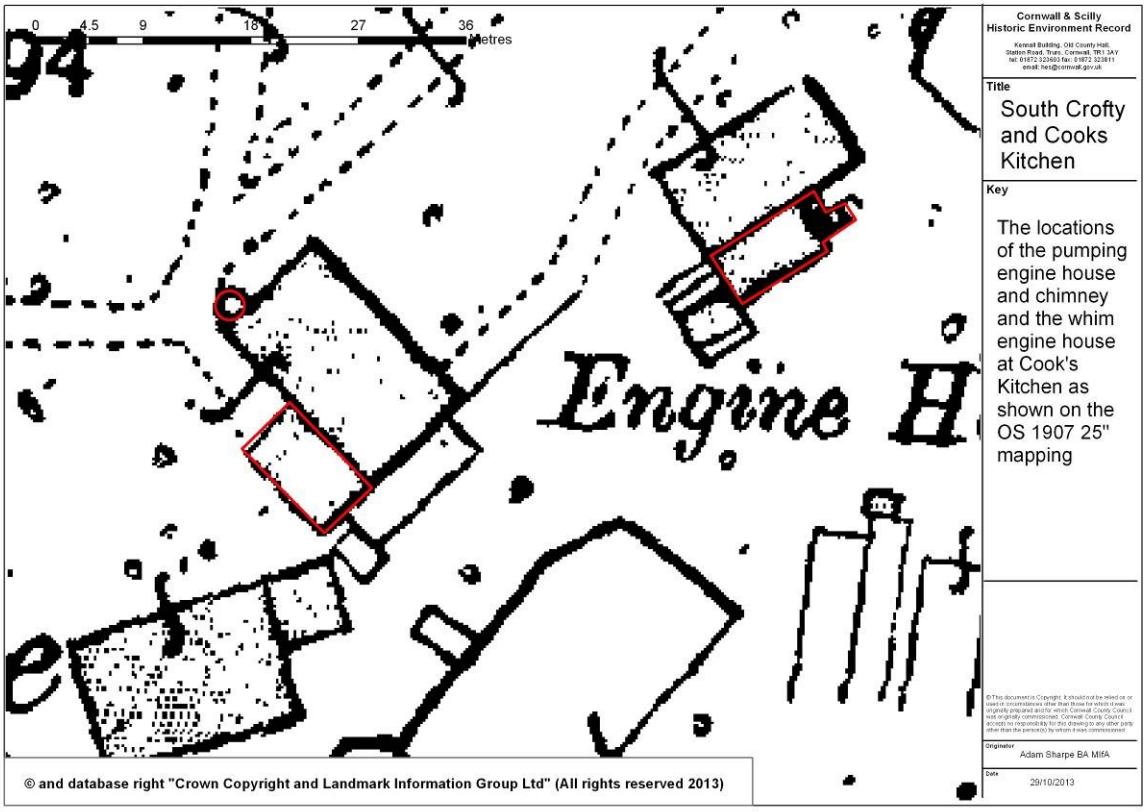

Fig 4. Structures at Cook's Kitchen circa 1907, showing those conserved in 2013.

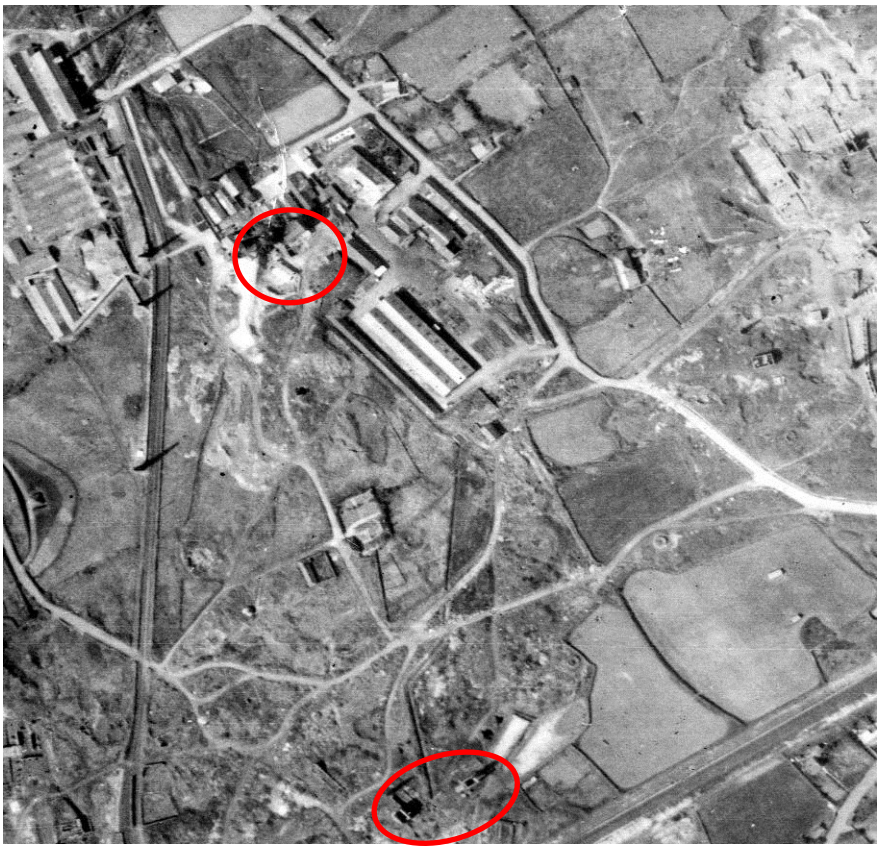

Fig 5. South Crofty and Cook's Kitchen (circled) in 1946. © English Heritage (NMR) RAF Photography.

Fig 6. Cook's Kitchen (foreground) and South Crofty (background) in 1986. Historic Environment Record image ABP F7/135.

Fig 7. South Crofty (foreground) and Cook's Kitchen (background) in 1986. Historic Environment Record image ABP F7/19.

Fig 8. South Crofty (foreground) and Cook's Kitchen (background) in 2003. Historic Environment Record image ABP F62/18.

Fig 10. The Chapple's Shaft whim engine house from the east prior to works.

Fig 9. Chapple's Shaft whim engine house from the south prior to works.

Fig 12. The internal elevation of the eastern wall of the whim engine house prior to works.

Fig 11. Detail of the partly-infilled plug doorway of the whim engine house.

Fig 13. The internal elevation of the southern wall of the whim engine house, showing patches of remnant original plasterwork. Few of these could be saved.

Fig 14. The whim engine house from the south east prior to works. Note the ivy which had begun to be established on the building and the tie rod through the chimney.

Fig 15. The whim engine house from the west prior to the start of works. Ivy covered the broken wall end of the return from the bob wall to the northern wall.

Fig 16. The scaffolding erected on the whim engine house. The brick section of the chimney was judged to be in good enough condition not to require re-pointing.

Fig 17. Work under way on the whim engine house, as seen from the South Crofty site to the north, from where it is a fairly prominent structure.

Fig 18. Conservation works having been completed to the whim engine house, the scaffolding was gradually dismantled.

Fig 20. The conserved whim engine house from the west.

Fig 19. The conserved whim engine house from the north west, showing the internal elevation of the eastern wall.

Fig 22. The internal elevation of the bob wall following conservation.

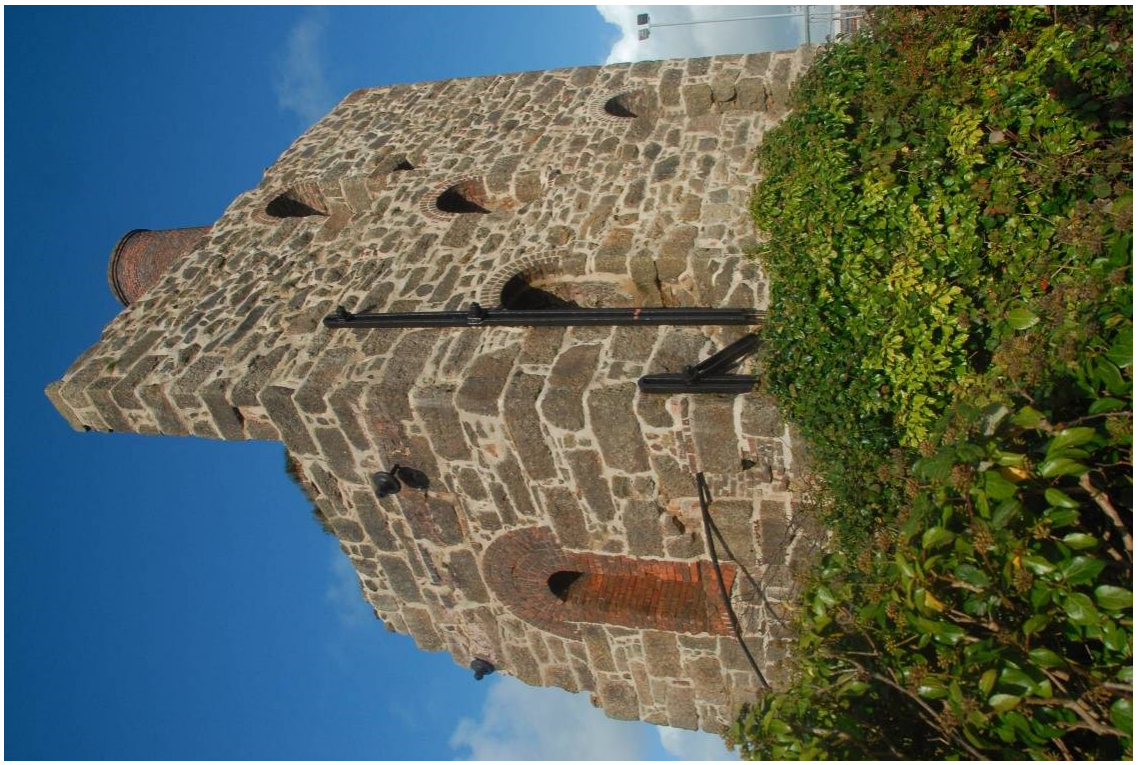

Fig 21. The conserved whim engine house from the south west.

Fig 23. The lower part of the south-western corner of the conserved whim engine house, showing the finished pointing and painted ironwork.

Fig 24. The original boiler plate pattrass and tie rod inserted through the chimney of the whim engine house, cleaned, painted and pointed in.

Fig 25. The internal elevation of the southern wall of the whim engine house following repointing.

Fig 26. The conserved whim engine house as views from the west on completion of works.

Fig 27. From the south east, there appeared to be few structural problems with the Chapple's Shaft pumping engine house. Note the tie rods and pattrass plates.

Fig 28. From the north west, it could be seen that the cylinder doorway and middle floor window on the northern elevation had coalesced due to the loss of lintels and supported stonework. The gable peak had also been lost

Fig 29. Chapple's Shaft pumping engine house from the south west, showing its relationship with the whim engine house (right) and chimney (behind).

Fig 30. Clear indications of the problems experienced by this building in the form of failed timber lintels and the loss of supported stonework.

Fig 31. The upper section of the bob wall (south wall) of the engine house showing the upper pattrass plates and the very poor condition of the inner face of the gable to the northern wall.

Fig 32. Looking up at the internal elevation of the northern wall of the engine house showing the catastrophic loss of stonework which had occurred on its inner face owing to the failure of timber lintels.

Fig 33. The upper section of the north-eastern internal elevation of the pumping engine house, showing the paired lateral tie rods, the massive loss of stone from the northern wall (left) and the results of the collapse of the lintel over the boiler house door (right).

Fig 34. The upper section of the western wall of the engine house internal elevation, showing the effects of the failure of the lintel over the window.

Fig 35. The noticeably pink-hued pointing originally used on the pumping engine house. The grey mortar to the right represents the original gauging mortar.

Fig 36. Remnant scribed pointing on the western side of the engine house was evidently used in part to disguise the poor quality of the stonework use in the build.

Fig 37. The pointing test panel showing a variation on the original mix, but incorporating 10% brick dust. This was judged to be unacceptably pink.

Fig 38. A sawn-off putlog left in the wall of the engine house. Note the generally poor quality and small size of the stone used in the construction.

Fig 39. Incorporated pieces of rusted ironwork have jacked the quoins in this wall end severely. The ironwork was removed and the space filled with mortared stone.

Fig 40. Vegetation growing on the erection step on the head of the eastern wall of the engine house.

Fig 41. A sawn off remnant timber in the wall above the erection step at the head of the side walls of the building. Note the poor quality original masonry in the lower part of this walling.

Fig 42. One of the blacksmith-made wrought iron pattrasses linking the tie bars through the engine house. The original function of the wooden plug inside the pattrass is unclear.

Fig 43. A granite lintel over the boiler house door which had sheared through, possibly as a result of stresses resulting from the racking of this wall.

Fig 44. This panel of brickwork appears to have been used to infill the space left by the replacement of an originally longer lintel with a shorter one.

Fig 45. The cantilevered lintel over the former middle floor window, again a shortened replacement for a longer original was used, the gap also being made up with brick.

Fig 46. A view of the northern elevation of the engine house from the nearby chimney, giving an impression of the poor state of the gable masonry.

Fig 47. Precarious and barely supported loose masonry where a lintel had rotted out completely.

Fig 48. An arch failure in the masonry over a failing lintel.

Fig 49. The internal wall skin adjacent to the spring beam opening was found to have been completely lost.

Fig 50. An original brick external cill characteristic of the window openings on the pumping engine house.

Fig 51. The complex scaffolding applied to the engine house. The internal scaffolding was suspended from the external scaffolding, whilst the two were braced against the walls to prevent any further movement of them.

Fig 52. The brick facing to the wall adjacent to the erection step.

Fig 53. An example of the new pointing which had been allowed to cure for several weeks, showing its finished colour and texture.

Fig 54. The internal elevation of the panel of masonry between the spring beam openings incorporated some large, cantilevered stones given the loss of the inner wall skin.

Fig 55. A collapse of the masonry panel between the spring beam openings occurred when one of the masons dislodged a large stone in this area. The extent of the ensuing collapse underscored the fragility of this part of the building.

Fig 56. Installing one of the new lintels over the middle floor window – an awkward job given the weight of the oak timbers and the amount of scaffolding within the space nearby.

Fig 57. The reconstructed panel of masonry around the spring beam openings. As is evident, an unavoidable further collapse of masonry over this area occurred during this work.

Fig 58. The internal elevation of one of the reconstructed spring beam openings.

Fig 59. One of the new external lintels over a middle floor window opening prior to the completion of the repointing of the surrounding walling.

Fig 60. The pattrass plate on one of the new tie rods bracing the wing walls above bob wall height on the southern elevation.

Fig 61. The new tie bars were drilled through the quoins at the leading edges of the walls, as seen here.

Fig 62. A telehandler was used to deliver materials to the scaffolding. Here, the new top floor window lintels are being delivered to the top lift of the scaffolding.

Fig 63. The new oak lintels installed over the bob loft (top floor) window.

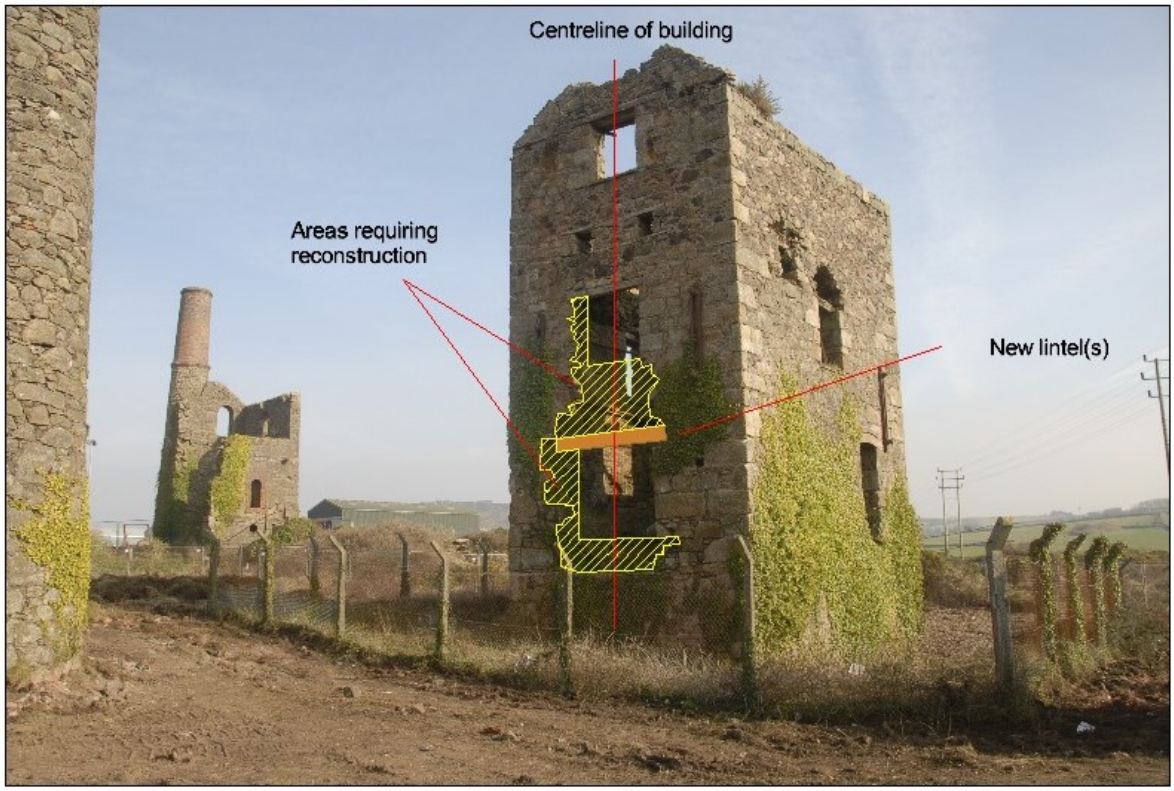

Fig 64. The HE Projects recommended reconstruction of the openings in the southern elevation of the pumping engine house. This approach was unfortunately rejected on cost grounds.

Fig 65. The completed works to the north elevation of Chapple's pumping engine house. Compare with Figure 28.

Fig 66. The completed works to Chapple's pumping engine house from the south east. Compare with Figure 27.

Fig 67. The free-standing pumping engine house chimney at Chapple's Shaft, Cook's Kitchen prior to works. The whole of the original brick capping has been lost.

Fig 68 (below). The moulded segmented granite drip ring now forming the upper part of the chimney, showing the brickwork which had been used to line part of its interior.

Fig 69. Applying a pointing text panel to the base of the chimney during the early stages of the project.

Fig 70. Salvaged bricks retrieved from the interior of the chimney, subsequently used in repairs to the flue opening.

Fig 71. The northern opening to the chimney, historically part closed with the lower brickwork panel.

Fig 72. The southern opening into the chimney, in this case found to have been closed off one metre into the chimney by a brick panel.

Fig 73. The eastern (flue) opening into the chimney as excavated and subsequently propped to prevent any further collapse of masonry.

Fig 74. The reconstructed flue opening, utilising a re-used granite lintel and a recessed panel of site-won salvaged brick to close off access to the lightning conductor tape.

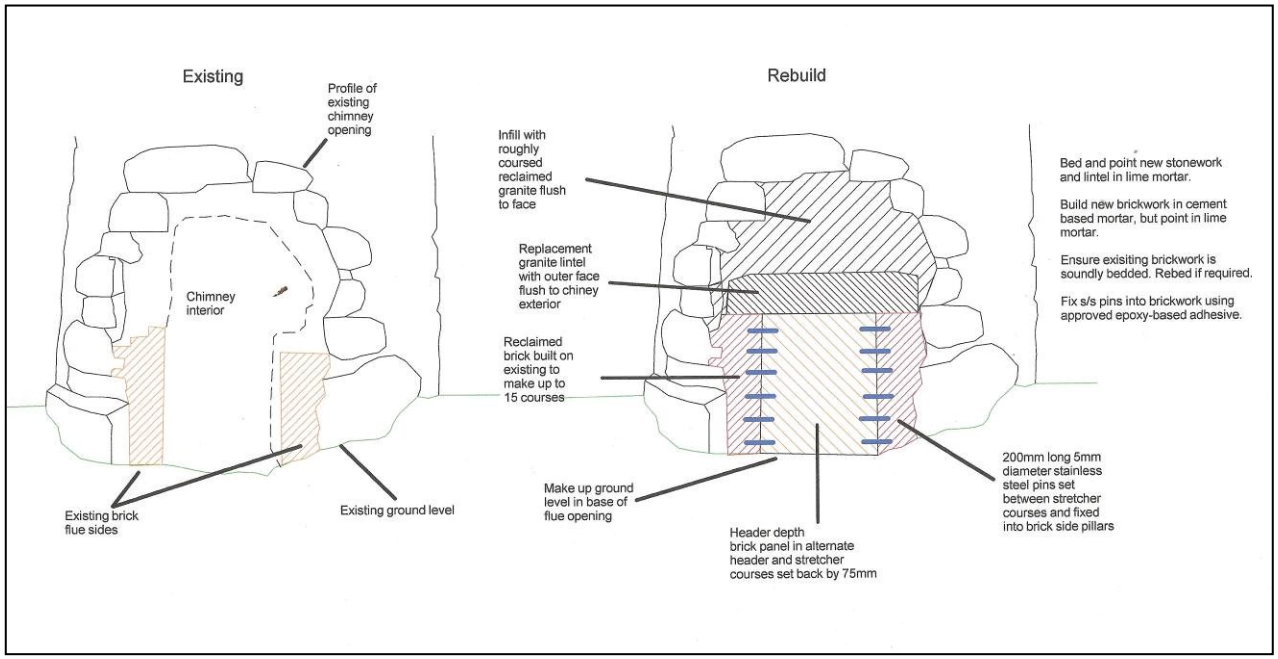

Fig 75. Detail of the method for rebuilding and infilling the flue opening to the chimney.

Fig 76. The upper section of the conserved chimney.

Fig 77. South Crofty as seen from the western edge of the Red River Valley, showing the prominence of the New Cook's Kitchen Shaft headgear in the landscape.

Fig 78. South Crofty as seen from Tuckingmill, showing how the ore bins, conveyor and headframe at South Crofty dominated the view.

Fig 79. New Cook's headframe from the west before works, showing the now-removed conveyor to the primary ore bins.

Fig 80. The surface shaft station at New Cook's Shaft from the south, showing considerable complex detail, as well as the original low sheet steel level cladding.

Fig 82. New Cook's Shaft headframe from the south west prior to works.

Fig 81. New Cook's Shaft headframe from the north west prior to works, showing the enclosure covering the conveyor.

Fig 83. The eastern side of New Cook's Shaft headgear at ground level, showing (right) the defunct roller shutter door giving access to the end of the ore conveyor.

Fig 84. The surface shaft station at New Cook's Shaft from the west prior to works.

Fig 85. The conveyor enclosure in the northern end of the headframe following the removal of its cladding but prior to the removal of the last remains of the conveyor.

Fig 86. The headframe conveyor enclosure from the north west prior to works.

Fig 87. The remains of the conveyor, showing the vibrating feeder and hopper (left) and suspended electromagnet (right).

Fig 88. The vibrating feed mechanism which delivered ore drawn up by the skips in the north headframe to the conveyor leading to the primary ore bins.

Fig 89. The status indicator for the north winder installed in the headgear.

Fig 90. One of the few surviving notices in the headframe, in this instance adjacent to the conveyor enclosure. Like the North Winder status indicator, this was retained.

Fig 91. Looking up the eastern side of the headgear, showing the hopper feeding the conveyor (near the base of the headgear), the original cladding, the walkways and the skip guides in the upper section of the north headframe.

Fig 92. Looking up inside the south headframe, showing some of the redundant walkways (left and right).

Fig 93. Scaffolding erection under way on the headframe.

Fig 94. Detail of the sheave wheel maintenance gantry on the south headframe prior to its removal.

Fig 95. Scaffolding erection on the headframe at an advanced stage. The sheave wheel maintenance gantry had been craned off by this stage, and had been stored on the ground adjacent to the headframe.

Fig 96. The fully sheeted scaffolding over the headframe, intended to reduce the noise impacts from grit blasting and to provide protected conditions for the subsequent painting activities.

Fig 97. Corroded diagonal bracing members in the older south headframe. This steelwork was replaced.

Fig 98. Some of the advanced corrosion to the steelwork was clearly evident in advance of grit blasting.

Fig 99. A badly corroded area on the web of a steel joist below the sheave wheel platform in the south headgear.

Fig 100. This bracing member was cut off short and a bodged fixing created when the newer north headgear was constructed up against the older south headgear.

Fig 101. The built up steelwork construction north headgear sheave wheels prior to works.

Fig 102. The older south headgear sheave wheels with their cast single piece rims prior to works.

Fig 103. The central area of the headframe once scaffolding had been erected, but prior to grit blasting. Much of the steelwork was found to be in good condition.

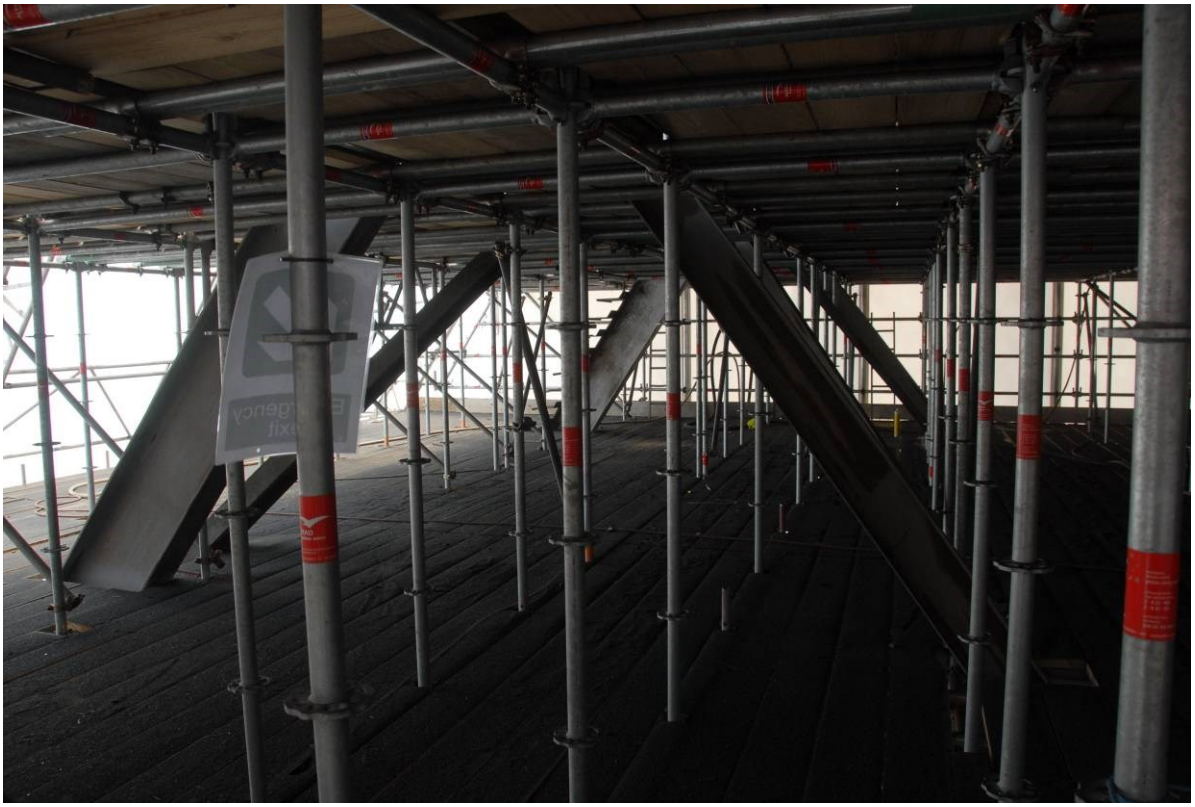

Fig 104. Within the south headframe following grit blasting. Recording this activity was impossible, given the high levels of noise and dust.

Fig 105. The upper sections of the skip guides following grit blasting.

Fig 106. One of the south headframe raker legs showing (lower left) the grit blasted surface, (centre) the undercoat and mid coat) and upper right, the first of the paint top coats.

Fig 107. A plated patch on an area of corrosion on the web of a section of structural steel.

Fig 108. A box section patch repair to one of the horizontal supports for the south headgear sheave wheels.

Fig 109. The south headgear sheave wheels grit blasted and undercoated.

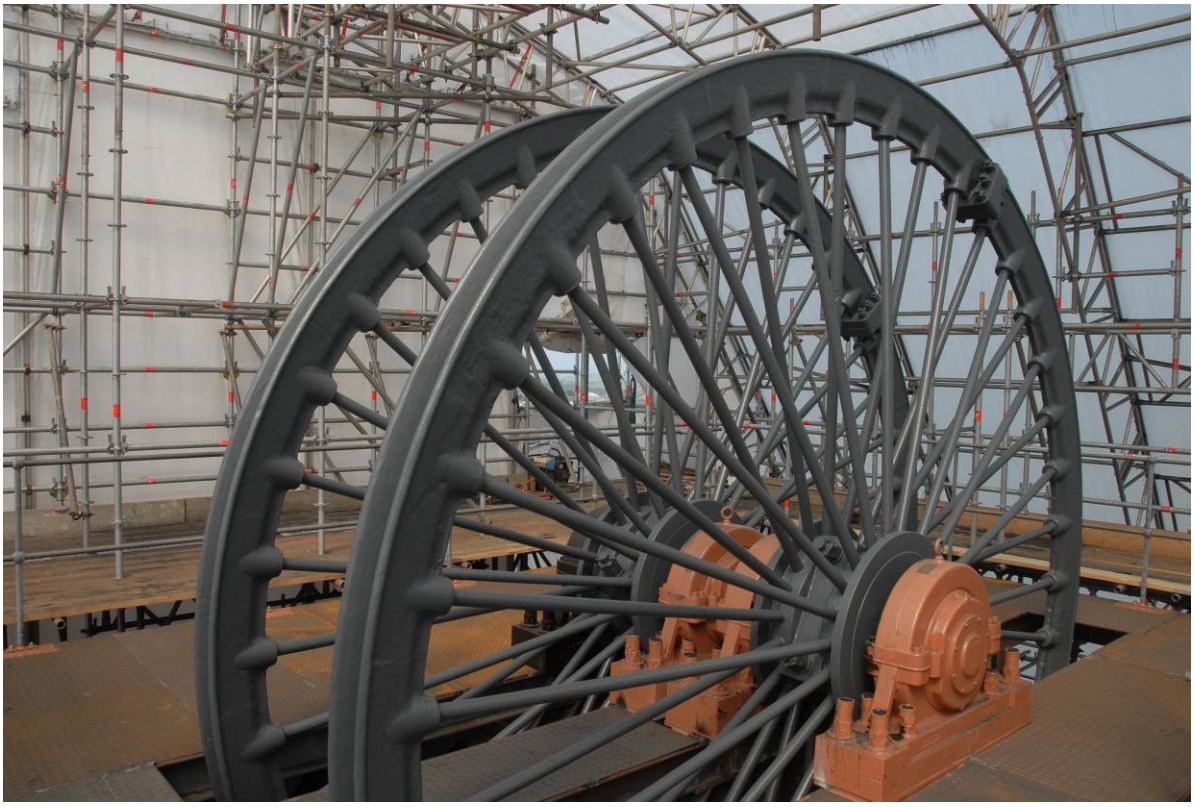

Fig 110. The south headgear sheave wheels in their grey top-coated finish.

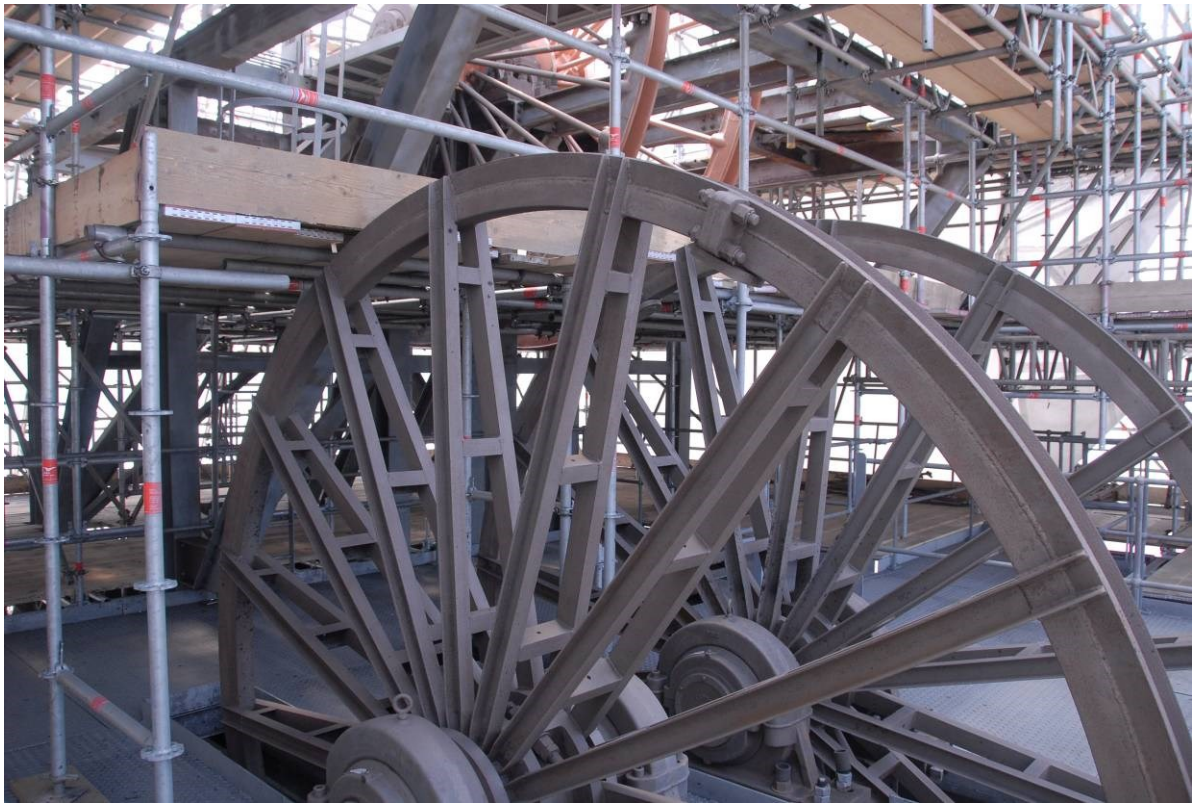

Fig 111. The north headgear sheave wheels following grit blasting.

Fig 112. The north headgear sheave wheels following painting. Note the rope clamp (lower left) used when changing the winding ropes.

Fig 113. Stripping the headgear scaffolding under way, the sheeting having been removed. The sheeted structure in front covers the sheave wheel maintenance gantry, which was being painted at this time.

Fig 114. New Cooks Shaft headgear following the removal of the scaffolding. The grit blasted and painted sheave wheel maintenance gantry is in front, ready for re-erection.

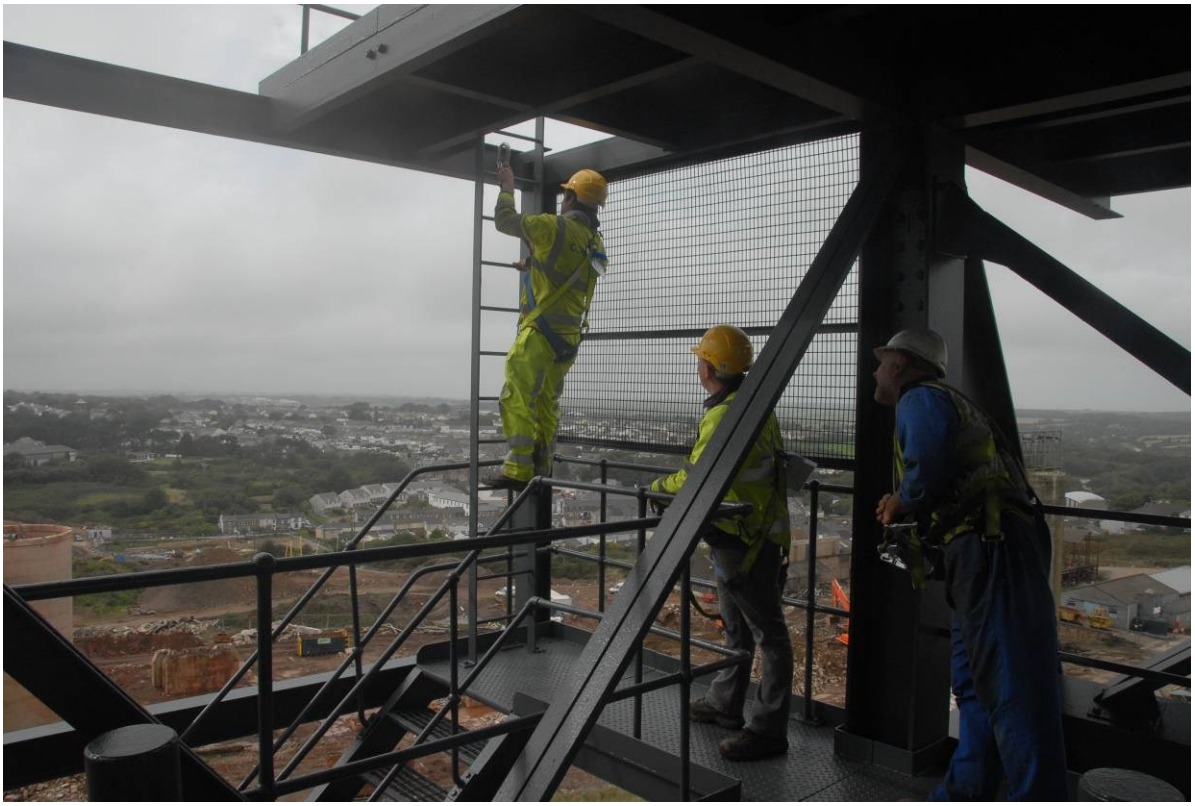

Fig 115. Phil and Kieren climbing up to the north headgear sheave wheel platform to carry out final inspections before the re-installation of the maintenance gantry.

Fig 116. Looking down the headframe from just below the northern sheave wheel platform, showing the wooden buntons (cage guides), which were left in situ.

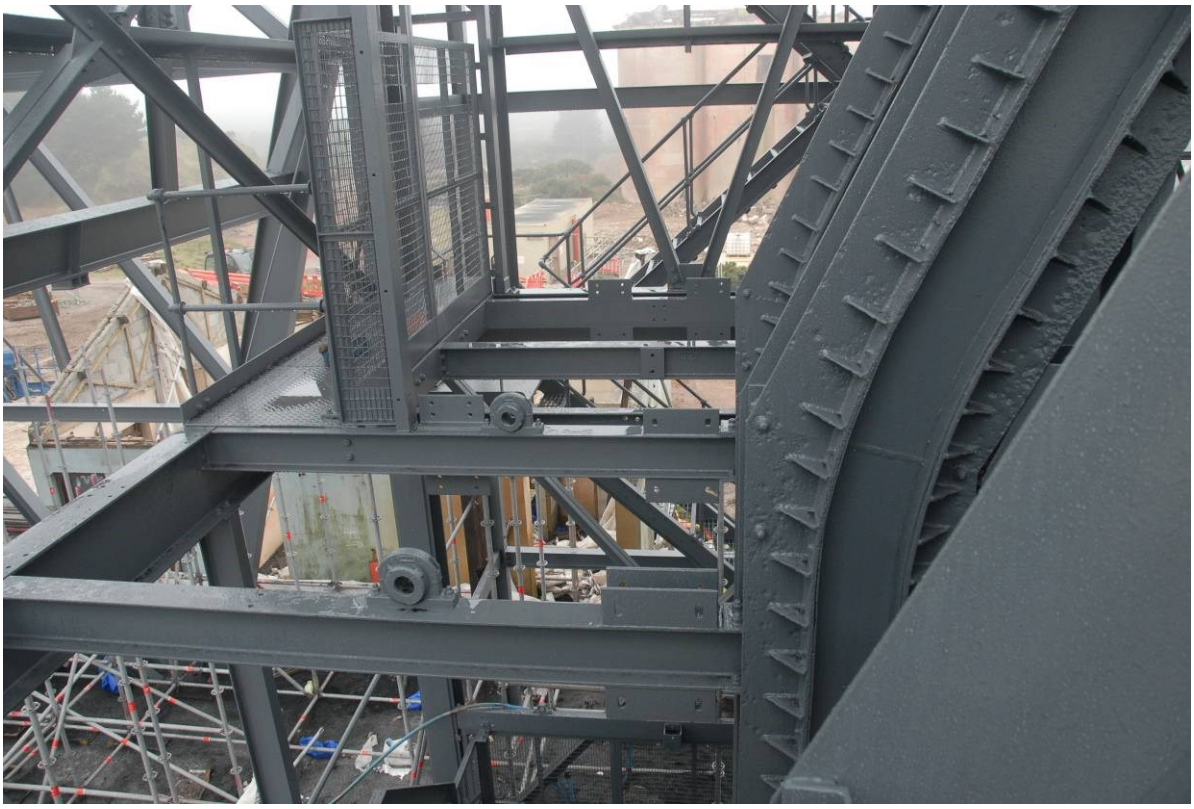

Fig 117. The painted up skip guides and other detail of the complete headframe.

Fig 118. Finished detail in the southern headframe.

Fig 119. Completed work to a walkway in the headframe, looking east towards the Robinson's Shaft site.

Fig 120. The replacement roofing under construction over the conveyor house in the north headframe.

Fig 121. The grit blasted and painted conveyor feed hopper.

Fig 122. New Cook's Shaft surface shaft station from the south on completion of the works. Compare with Fig 83.

Fig 123. The base of the stairway on the western side of the headframe, with the re-sheeted conveyor house to the left.

Fig 124. The re-sheeted conveyor building in the north-western corner of New Cook's Shaft headframe.

Fig 125. A view of New Cook's Shaft surface shaft station from the north east following works.

Fig 126. The conserved feed hopper in the headframe.

Fig 127. Craning on the sheave wheel maintenance gantry – a delicate operation, carried out with considerable skill by the crane driver.

Fig 128. The final stages of craning on the sheave wheel maintenance gantry.

Fig 129. Bolting down the legs of the sheave wheel maintenance gantry.

Fig 130. The view from the man riding crane basket looking down on the gantry and top platform whilst final fixing down operations were under way.

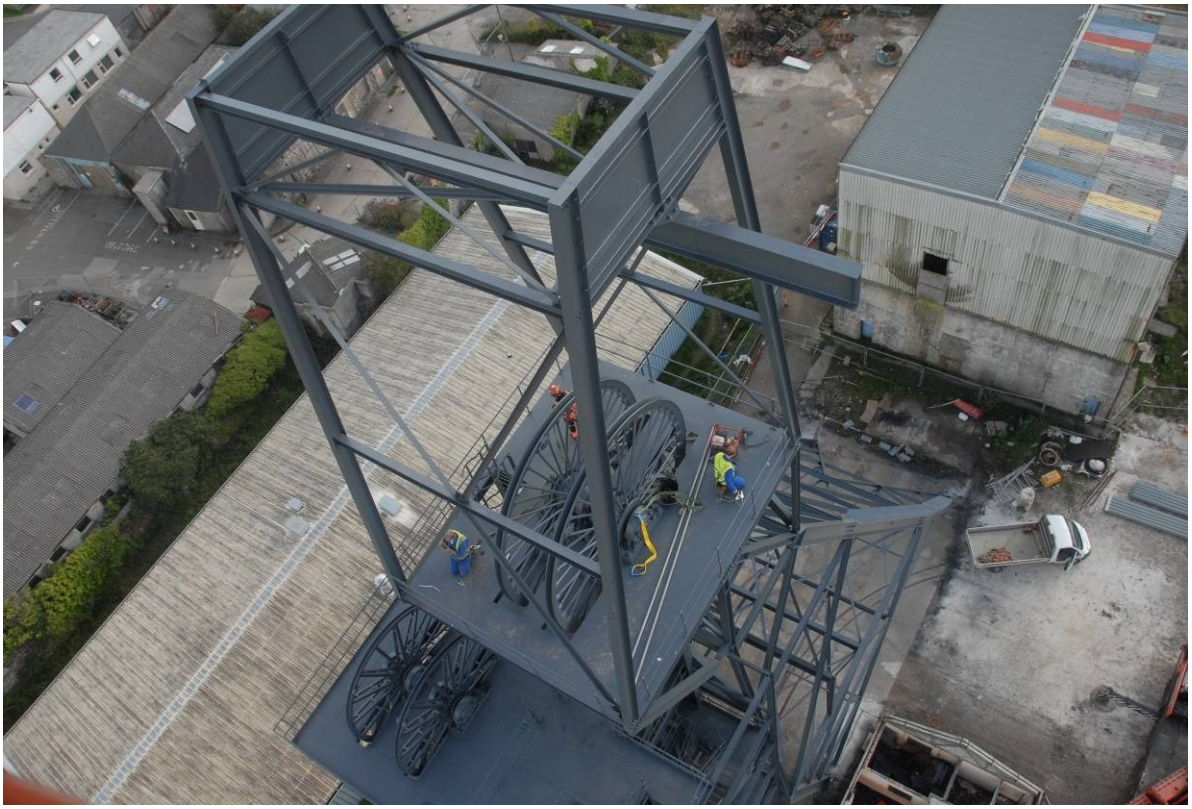

Fig 131. Another view of the completed headframe from the man-riding crane basket.

Fig 132. The completed headframe seen from the crane basket, with the landscape stretching out to Robinson's Shaft and Carn Brea in the background.

Fig 133. The completed headframe from the south east.

Fig 134. The completed headframe from the north east.

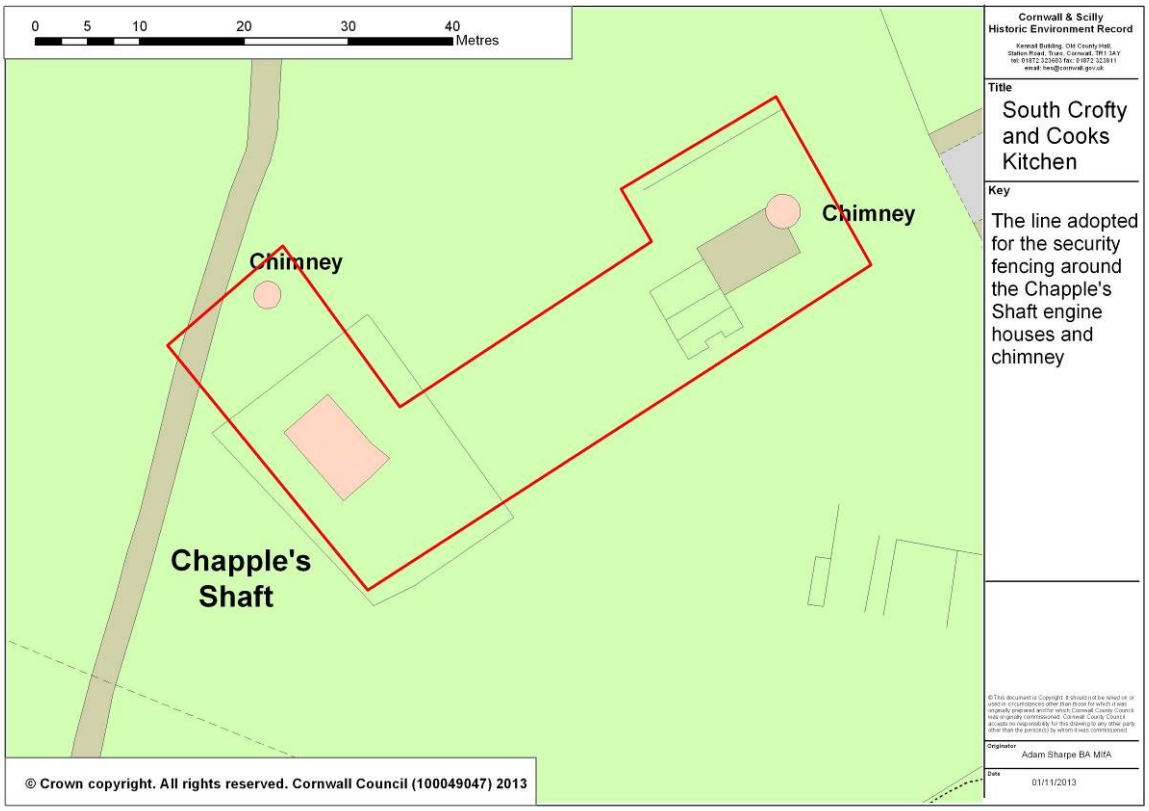

Fig 135. The security fenceline around the structures at Cook's Kitchen.

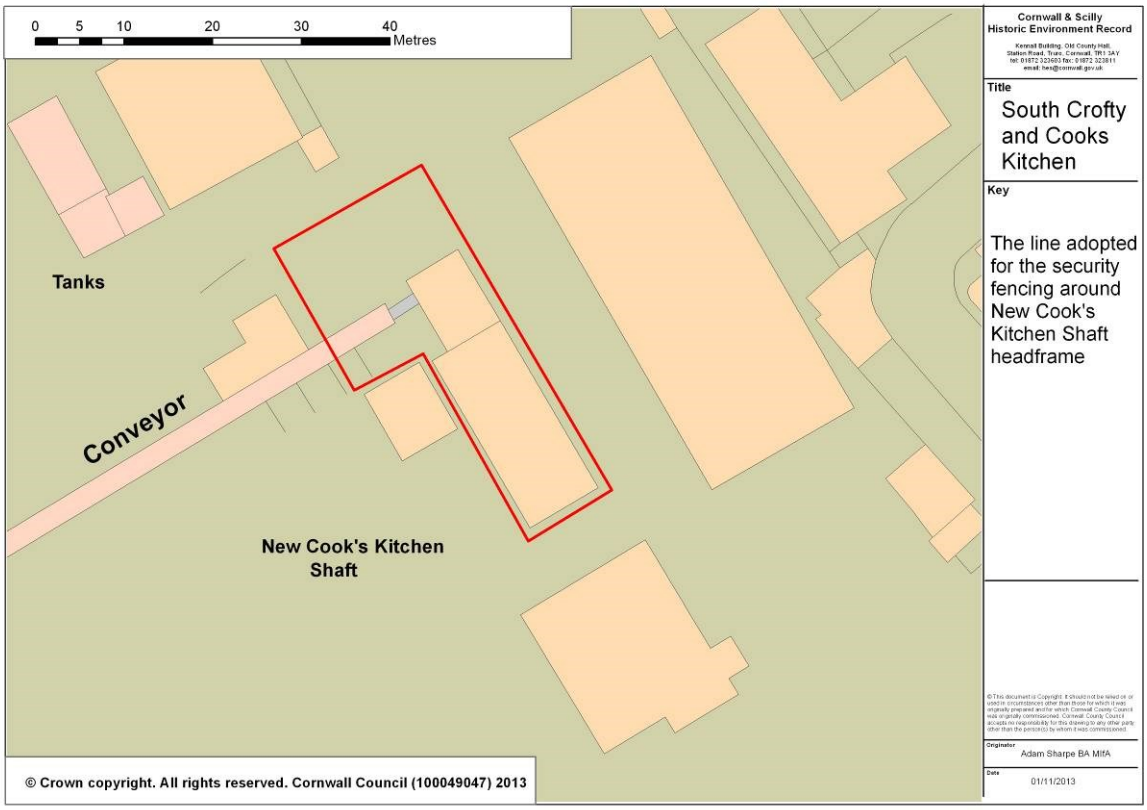

Fig 136. The line of the security fencing around New Cook's Kitchen headframe.