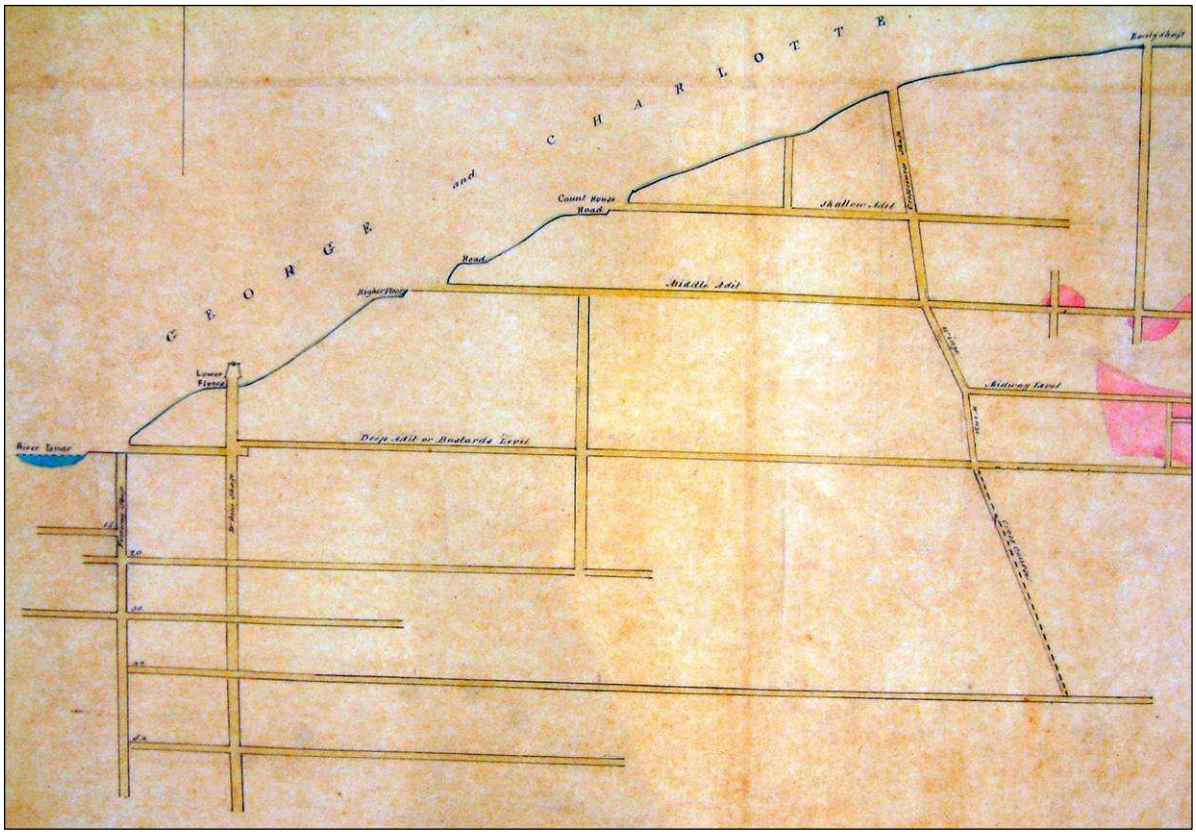
Report No: 2010R122

George & Charlotte Mine, Morwell, Devon

Archaeological Assessment



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CORNWALL COUNCIL

Historic Environment Projects

A Report to Bill Horner

George & Charlotte Mine, Morwell, Devon

Archaeological Assessment

Client	**Devon Historic Environment Service, Devon County Council**
Report Number	**2010R122**
Date	**August 2010**
Status	**Final**
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Checked by	**PGR, RS**
Approved by	**PGR**

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Acknowledgements

This study was commissioned by Bill Horner on behalf of Devon County Historic Environment Service. Within Historic Environment (Projects), Cornwall Council the project manager was Colin Buck. The images reproduced in this report were compiled by the author, and the plans by Carolyn Royall. The report was edited by Pete Rose.

The author would like to thank Rick Stewart, mining historian and George & Charlotte Mine Manager for advice and editing this report.

The views and recommendations expressed in this report are those of the Cornwall Council Historic Environment Projects team 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.

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Cover illustration

An excerpt of a section plan of George & Charlotte Mine (undated - DRO R98E)

Rear cover illustration

A view of Middle Adit (Site 5) showing tramrails and a turntable, used to separate the track from the waste section and the processing dressing floor. C Buck 2005 © HES

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Abbreviations

AONB Area of Outstanding Natural beauty
CC Cornwall Council
CHEP Cornwall Historic Environment Projects
DCC Devon County Council
DHER Devon Historic Environment Record
DHES Devon Historic Environment Service
DRO Devon Record Office
HEP Historic Environment Projects
HSE Health and Safety Executive
NGR National Grid Reference
OS Ordnance Survey
SMR Sites and Monuments Record
SSSI Special Site of Scientific Interest
TMG Tamar Mining Group
TVMHP Tamar Valley Mines Heritage Project
WHS World Heritage Site
WSL Westcountry Studies Library

Summary

George and Charlotte Mine is a medium sized but relatively undocumented historic mine site; it contains surface evidence of a number of shafts, two large water-wheel pits, a number of adits, and mine buildings – all characteristic of copper mines on the steep sided Tamar Valley. This report outlines the history of the site, identifies archaeological remains, assesses their significance, and provides conservation management recommendations. It constitutes an additional site assessment of mine sites on the Devon side of the Tamar Valley, following previous assessments of Devon Great Consols, Bedford United Mine, Wheal Russell Mine and Gawton Mine (Buck 2002, 2003, 2005 and 2006 respectively). These reports resulted in recommendations for shaft fencing, buildings consolidation, landscaping, access and interpretation. Recommendations presented may help to formulate the provision of safe public access around parts of this important archaeological industrial mine site using existing (and newly created) tracks, accessible via Morwellham Quay, with links to the recently formed Tamar Valley Mines Heritage Project mine trails (2009-2010).

George and Charlotte Mine has early mining origins from at least the late eighteenth century, a common factor in many Tamar Valley mines. However, the first decades of the 19th century brought about greater financial speculation and investment, resulting in larger neighbouring mine sett amalgamations. Thus, Devon & Cornwall United Mine (an amalgamation of George & Charlotte and William & Mary Mines), from the 1850s worked both sides of the Tamar and Tavy Valleys, pursuing and working the same lode. Although the mine closed relatively early compared to other mines in the Tamar Valley (George & Charlotte in 1868, and William & Mary in 1872), it was likely that the easily available ore had been worked and processed. However, within the past three decades, George and Charlotte Mine has enabled, for many, an awakening of interest in industrial archaeology and history. From the late 1970s, a small mine railway has been built to provide a short 'taster' tour which goes into the mine and across two of its old shafts.

Since abandonment the site has become generally overgrown and the buildings and structures have decayed to varying degrees, but overall the complex is largely intact. Surviving components include water wheel pits, mine shafts, mine adits, mine buildings, dressing floors and shaft pumping mechanisms.

George and Charlotte Mine is a component part of the World Heritage Site within the Cornwall and West Devon Mining Landscape. This report describes, identifies and prioritises the historical and building resource, as part of short, medium and long term objectives that reflect the individual sites' importance and significance within the World Heritage Site. This report intends to ensure that the site's special qualities and importance are preserved and enhanced by any landscape and building conservation proposals (minimising any adverse impact upon the archaeological resource). This archaeological report will guide the site owner on the effective prioritised conservation of the archaeological resource present within the mine, as well as providing guidance on mitigation of potential impacts.

All of the mine is privately owned. Access will be at the discretion of the landowner (partly Morwellham (Lister) and Lord Bradford's Tavistock Woodlands Estate). However, it is fundamental to note that parts of this mine is deemed to be a working mine in the eyes of Her Majesty's Inspectorate of Mines (HSE), and is subject to the same legislation as a working mine.

1 Introduction

1.1 Project background

Simon and Valerie Lister (owners of Morwellham) and the Tavistock Woodland Estates (owned by Lord Bradford), are the surface landowners of the former George and Charlotte Mine sett (SX 4532 6992 - centered), DHER No's 5467 and 22888 – SX46NE/510). The site (see Fig 1), is east of Morwellham Quay, and immediately north of New Quay. It is bounded by a loop in the River Tamar partly to the south but predominantly to the west.

Historic Environment Projects was commissioned in April 2010 by Bill Horner (Devon Historic Environment Service), to undertake an archaeological assessment survey of George and Charlotte Mine, to outline the mining history and identify archaeologically sensitive areas. It is anticipated that this report will also address the following:

- Recommendations for the protection and conservation of important archaeological remains and their settings.

- Health and safety aspects of the site relating to public access. Parts of the central core of the mine are subject to working mines legislation.

- Recommendations for the provision of low-key public amenity use where appropriate, incorporating limited access (taking onto account working mines legislation).

Mine sites to the south and north west of George and Charlotte Mine have previously been assessed, the project brief was provided by the David Wilson Partnership and the Devon County Archaeological Service (DCAS) *'Archaeological Assessment and Management Survey of Russell Mine, Gawton Mine, New Quay, Tavistock-Bere Alston Railway'* (24/11/05) - see Appendix 10.1. This report is based on the same brief. The requirements of this project have been set out in a Project Design by the Historic Environment Service, Cornwall County Council (Buck 2005, 23/9/2005).

2 Aims

The main objectives of this report are to:

- Undertake historical and cartographic research and field survey of George & Charlotte Mine to a level sufficient to provide the Devon County Archaeologist with the accurate location of archaeological features within the project area.
- Produce a record at an appropriate level of detail of those structures, sites etc which are likely to be affected by works.
- Produce a report outlining the findings of the assessment survey and to provide the Devon County Archaeologist with a total of four copies of the same.

This, in turn, will provide the Devon County Archaeologist with information to:

- Understand the development history of the project area within its local, regional and national context.

- Understand an assessment of the nature, extent and quality of survival of historic and archaeological features within the project area.

- Take into account short and long-term management recommendations for the site and its components, including any requirement for further evaluative survey, excavation or information gathering, statutory or other forms of protection.

- Take into account guidance on the means by which the effects of undertaking the provision of increased public access and other necessary shaft/adit safety works and building consolidation can most appropriately be mitigated.

3 Methods

3.1 Desk based assessment

During the desktop assessment historical databases and archives were consulted in order to obtain information about the history of the site and the structures and features that were known to have existed on it. The main sources located and consulted are summarised as follows (refer to Section 8.0):

- Historical documents, maps, plans and other published material held by the Devon Records Office (Exeter), principally the Duke of Bedford's Collection
- Historical documents, maps, plans and other published material held by the West County Local Studies Library (Exeter)
- Devon's Historic Environment Record (DHER)
- Devon Historic Landscape Project (English Heritage and DCC Environment Directorate project)
- West Devon Borough Council (WDBC) Listed Buildings database
- Published histories of local industrial archaeology (see Section 8.2)
- Information on mining operations held by organisations such as the Tamar Journal of the Friends of Morwellham, Trevithick Trust, WWW.TVIA etc
- Statutory and other planning designations for the site
- Rectified aerial photographs held by the NMR/CCC and recent DCAS aerial photographs were of little use due to extensive woodland cover from the early 19th century.

Documentary research and fieldwork have been slanted towards the industrial development of the project area, with the majority of site management recommendations being applied to industrial sites. Nevertheless, sufficient background research has been undertaken to be able to summarise the pre-industrial history of the landscape within the project area (see Section 4.5.1).

3.2 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 and 2nd edition 1:2500 Ordnance Survey maps), and other documentary sources. These images were also used as part of the fieldwork map base during the field survey component of the project.
- Field recording followed established formats and was based on a mixture of photography (digital), and annotated sketch and measured recording (see HES Tamar Valley Mines assessment Project Design – Buck 23/9/2005). Detailed field work was undertaken on 25/10/2005.

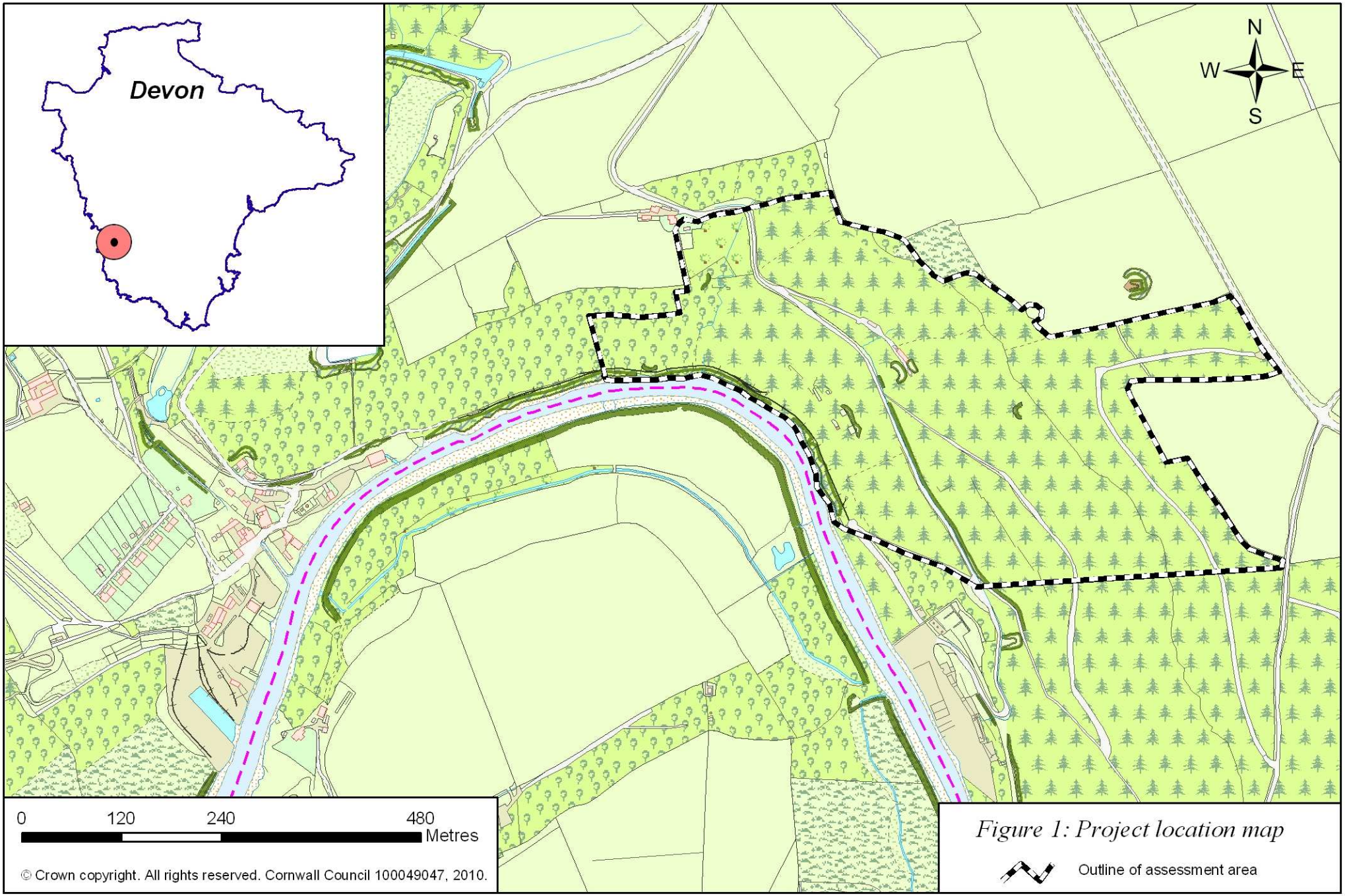
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Figure 1: Project location map
Outline of assessment area

4 Background

4.1 Location and setting

The deep, steep sided valley of the River Tamar cuts through a rolling, cultivated landscape, flanked to the west by the distinctive granite ridge of Hingston Down and to the east by the granite uplands of Dartmoor. The Tamar Valley is considered to be one of the most attractive areas in the south-west. The lower and broader part of the valley from Cotehele southwards (and from the junction of the River Tavy with the Tamar eastwards) has wide expanses of reed bed and mud flats, which attract a variety of wading birds. Upriver from Calstock the meandering valley narrows and the Devon side is particularly scenic with its steep and rocky wooded outcrops opposite Gunnislake; further north at Bishop's Rock, the river meanders through Tavistock Woodlands. The setting of the mine, close to Morwellham has allowed many thousands of people to experience (via a narrow guage railway), in a small way the nature of hard rock mining, within the steep, wooded valley hillsides of the Tamar Valley.

George & Charlotte Mine (SX 453 699), lies on the east bank of the River Tamar immediately east of Morwellham within the parish of Tavistock Hamlets, Devon. It is located below the tidal limit, approximately 1.0km down stream from Morwellham and 6km from Tavistock. The study area has been defined in Fig 1, and includes an area of Tavistock Woodlands Estate ownership (owned by Lord Bradford) and part ownership by the owners of Morwellham Quay. Its buildings are hidden in a dense blanket of mature trees and ivy between the medieval woods shown as Sheepridge and Maddacleave (see Figs 8 and 9). The setting is incredibly tranquil and picturesque. Vehicular access is not direct but is via the original cart track through the woods from a northern direction via the B3257. An alternative footpath to the existing public footpath from Morwellham (sited above the main core of the mine), also provides access directly to New Quay.

This report essentially focuses on (and brings to a higher prominence), the important historical heritage that can still be found over a century after these related industries and mines folded, a result of which has been its inclusion in the World Heritage Site for the Cornwall and West Devon mining landscape (Area 10).

4.2 Designations

4.2.1 Statutory

- County and District planning constraints for this site include designation of the entire project area as an Area of Outstanding Natural Beauty (Tamar Valley AONB), one of only 32 sites in the country; this supersedes the previous designation of Special Area of Great Landscape Value (SAGLV).
- There are no Listed building designations within the project area
- There is a Site of Special Scientific Interest (SSSI) designation for nationally important sites along the River Tamar banks on either side of this site, for the nature conservation of Estuary birds and Waders.
- There is a Special Area of Conservation (SAC) designation as an important European site within the tidal limit of the River Tamar for wading birds and other similar habitats.

4.2.2 Non - statutory

The Cornish Mining World Heritage Site (WHS) seeks to demonstrate the international importance of the developments within mining and allied technologies which took place within Cornwall and West Devon during the last half of the 18th century and into the 19th century, establishing beyond doubt the contribution of this region to the development of the modern,

industrialised world.

The World Heritage Site Management Plan 2005-2010 (2005, 12), statement of Outstanding Universal Value states that: '*The Cornwall and West Devon Mining Landscape was transformed during the period 1700-1914 by early industrial development that made a key contribution to the evolution of an industrialised economy and society in the United Kingdom, and throughout the world. Its outstanding survival, in a coherent series of highly distinctive cultural landscapes, is testimony to this achievement'*.

The formal WHS bid to UNESCO for World Heritage Site status was submitted to UNESCO in February 2005 by the Cornish Mining World Heritage Site Bid Partnership and has now been approved. This demonstrates the far reaching effects of the technological changes on the society, economy and landscape of the area, and identified a number of areas within Cornwall and West Devon where the results of these processes are still well-preserved.

The WHS areas, representative of the period of Cornish dominance of the mining world (c.1700-1860), include the project site within the Tamar Valley Area and Tavistock (Area 10). World Heritage Site status will increase the likelihood of a further round of statutory designations of mining related sites (i.e. mine sites with significant buildings, harbours, foundries, mine settlements etc).

4.3 Geology and Lodes

The published geological map of the area (Geological Survey Sheet 337 (Tavistock), 1994) indicates that the site is underlain by the Kate Brook Slate of Upper Devonian geological age ('killas'); *'The most important mineral area is a belt of country 12 miles long from east to west, and 4 miles broad, extending from the edge of the Dartmoor granite, westwards across the Gunnislake and Kit Hill granites. The lodes of tin and copper which nearly all course about east and west, have yielded also large quantities of mispickel and pyrite…The district has been more prolific in sulphide ores than in tin, and large yields of copper with much pyrite and mispickel have been obtained from nearly all the mines on the east of the Gunnislake granite from Devon Great Consols southward to Gawton Mine..'* (Dines and Phemister 1956, 623).

Figure 4 (Symons 1848 mining map), focuses on the two east/west lodes within the project area. However, this map also shows (not reproduced in this report), a total of three north-south cross-courses intersecting the two lodes on the western side of the mine sett (George & Charlotte), the central section and the eastern side of the mine sett (William & Mary). The western (and main) part of the site was named *'Huel George & Charlotte'*, the eastern part *'William & Mary old mine'*. Both are described: *'Main Lode, coursing about E. 10º N. and underlying south, extends for about a mile from the Tamar, 300 yds. N. of New Quay, to the Tavy, 500 yds. E. of Broadwell. George and Charlotte Mine is on the western end and William and Mary Mine on the eastern, but the workings are separated by about 100 fms. of unexplored lode'* (Dines 1956, 676).

In the mid 19th century both mines were amalgamated to form Devon and Cornwall United, which is the mine name under which it is described by Dines (1956, 676), '*George and Charlotte Mine plans are incomplete, but show the lode was opened up by three adits* (Deep, Middle and Shallow adits) *on the eastern slopes of the Tamar valley and by six shafts… Veinstones in the dumps consists of quartz and dark green chlorite with chalcopyrite and much pyrite. The lode is heaved 5 fms. left by the crosscourse on which Crosscourse Shaft is sunk and is heaved about 10 fms. right by another east-dipping crosscourse that passes through Deep Adit Level 25 fms. W. of Ley's Shaft (Dines 1956, 677).*Also of geological interest is 'Childrenite' (*pers comm*. Rick Stewart).

4.4 Landscape characterisation

In 2005, Devon was systematically assessed by Historic Landscape Characterisation (HLC) in which each parcel was assigned to one of a number of HLC Zones according to its predominant historic landscape character. The landscape characterisation within the project area consists of four zone types (see Fig 11): the predominant landscape characters are Ancient Woodland (although this has mostly now been removed and planted with conifers), and the mine itself, which is described as 'Industrial: Disused'. Two smaller characterisation areas are; Farmland: Post-medieval at the north west corner (also bounding the site entirely on its north, east and west sides), and Plantation and Scrub at its eastern side – following a lode outcrop which still shows evidence of 18th century working, which was never enclosed for this reason after 1828 when much of Morwell Down was turned into rectangular fields. The study area has a predominantly west facing topography, probably always wooded given its steep valley sides.

Although predominantly now an agricultural and wooded sloping landscape, in the mid-nineteenth century (see Figs 7 and 8), the remains of George & Charlotte Mine to the north of New Quay, Morwellham Quay to the west, the Tavistock Canal portal, and Gawton Mine to the south all demonstrate dramatic and long term changes to the landscape character and nearby communities (many newly built), of the Tamar Valley as a result of the exploitation and export of the mineral lodes by these 19th century mines to feed the market demands of the industrial revolution.

The general topography of the site (as shown on Fig 1), is predominantly wooded and steeply sloping from the east down to the River Tamar, which turns from an easterly direction (from Morwellham), to the south east towards New Quay and Gawton Quay. The landscape above the site is predominantly open (formerly enclosed from Morwell Down after the 1830s), characterised by large fields and stone hedges. The lower steeper sides of the valley near the river are often occupied by strips of mature deciduous woodland (as shown in Figs 1-4), with the higher side (owned by the Tavistock Woodlands Estate), planted with conifer. George & Charlotte Mine includes both forms of woodland, symptomatic of changing 20th century attitudes to the financial potential of woodland, and differing forms of woodland management. The west facing setting of the site provides a wonderful opportunity to view the vista of the wide expanse of the tidal River Tamar as it proceeds to the south towards Plymouth.

4.5 Historical Background

4.5.1 General historical development

The Devon Sites and Monuments Record has no sites of prehistoric date within the George and Charlotte Mine project area. However a general summary of prehistoric and medieval sites in the Tamar Valley has been given in Buck (1998, 5-6). This has been summarised below:

Neolithic axes have been found at Tavistock, Bere Ferrers, and Buckland Monachorum. At Heathfield (Beacon), between the parishes of Lamerton and Milton Abbot, a Bronze Age barrow cemetery has been located. Earthwork defensive enclosures of probable Iron Age date are found overlooking the Tamar at Furzeleigh (or Dunterton), opposite Cartha Martha Woods on the Cornwall side of the Tamar and there is a similar feature in nearby Dunterue Wood. Other Iron Age enclosures include Ramsdon Camp in Milton Abbot parish, Northcott Wood in Northcott parish, and an earthwork enclosure at Berra Tor in Buckland Monachorum parish (five miles to the south east). The recent confirmation (by geophysical means and trench excavation) of the former Roman fort at Calstock (the largest yet in Cornwall), has certainly opened up a discussion of the possible relationship between metallic mineral extraction in the River Tamar and the Roman Empire.

The Tamar Valley itself is likely to have been occupied in the prehistoric era, due to its

preferred, more fertile, lowland sites, and utilisation of the river as a means of transport, for trade and as a source for food (trout, salmon and lampreys). Later medieval and post-medieval settlements are likely to have hidden or destroyed much archaeological evidence for prehistoric occupation.

Domesday Book and medieval place-name evidence indicate a typical medieval farming landscape with settlements largely confined to the lower ground and the uplands left as open pasture. Medieval farming settlements are evidenced from documentary sources and from field evidence for strip-based field systems; they appear to have been small co-operative hamlets (of 3-6 farmsteads). Examples on the Devon side of the Tamar are in similar locations to those in Cornwall, as, for example a medieval strip field complex to the south of Dunterton. The farming landscapes on both sides of the Tamar now largely consist of single farms, some of which are the remnants of former medieval hamlets.

Near the general project area (see Fig 1), the only medieval settlements are those of Morwell Barton (north of the project area) and probably Morwellham. Tavistock - the medieval stannary town - would have provided administration through the Abbey and the stannary court. It is likely that the land within the project area would have been owned by Tavistock Abbey (who also owned Morwell Barton). This would have continued from the medieval period, up until the Dissolution in 1539, when the lands were transferred to the Russell, later Duke of Bedford family. Since the 1960s, some of these lands were transferred to the ownership of Lord Bradford. It is likely that Tavistock and Buckland Monochorum were the area's centres for social and market needs from the 19th century onwards.

Mining activity in the Tamar Valley is by no means confined to the post-medieval period. Although tin appears to have been worked in Cornwall since the Bronze Age, during the 12th century the alluvial gravels of Dartmoor and possibly the Tamar Valley were of major national economic importance. Documentary evidence from the late 13th century and early 14th century attests to lead/silver mining in the Bere Alston and Lopwell districts that appears to have continued sporadically for some years.

On both sides of the Tamar Valley, alluvial and shallow ore extraction proceeded sporadically until the early 18th century, when there was renewed interest in the copper ore resources of this area. Furthermore there is documentary evidence for copper mining in the 18th century (most in the first and last quarters) at many sites in the Tamar Valley (Patrick 1983). Copper ore was located using the traditional method of costean pits/trenches, and through excavation of the back of the lode using openworks into the valley sides. The outcropping back of the lode (oriented east or east-south-east), was followed up the steep sides of the hill by sinking 'shallow' pits, openworks and shafts for as long as the lode was found. Adits were also driven along the lode for access, drainage and to remove the ore and waste rock at varying heights from river level to nearly the top of the valley slope.

Copper ore was exported (mainly from Impham Quay, New Quay, Morwellham and possibly Gawton Quay – all on the Devon side of the Tamar), to the Bristol and Swansea smelters (after being dressed locally). Through archaeological fieldwork, a single site (Site 23) in the project area has been found that mirrors this early technique of ore extraction for costean pits, and an early example of a likely 18th century lode back working. A mid 19th century leat has been definitely located (Site 1), supplying water to power water wheels (Sites 2 and 10) for flat rods and winding/pumping shafts etc.

The Gardner Map of 1784/6 (Fig 2) is the first relatively detailed map that shows the form of the landscape towards the end of the copper boom of the 18th century. Of note, is the 'upland' track that leads from the 'Waggon Lane' (later to become the route for ore wagons from Devon Great Consols to ore quays at Morwellham, Gawton, New Quay and Impham Quay prior to the construction of the Devon Great Consols railway in 1858), down to Impham and

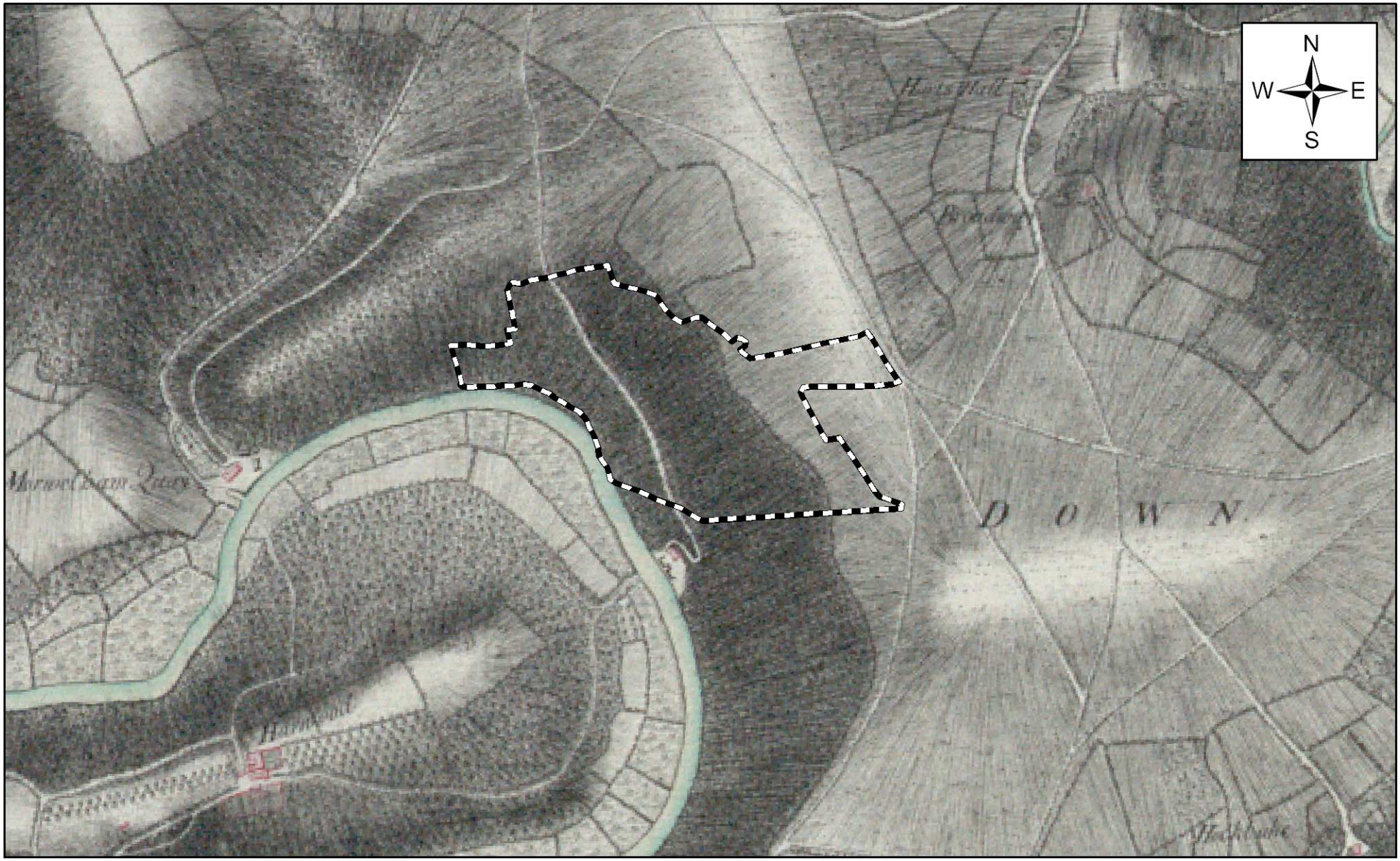

Figure 2. Gardner Map (1784-1786)

(MAPS K.TOP XI 80-80a. By Permission of The British Library)

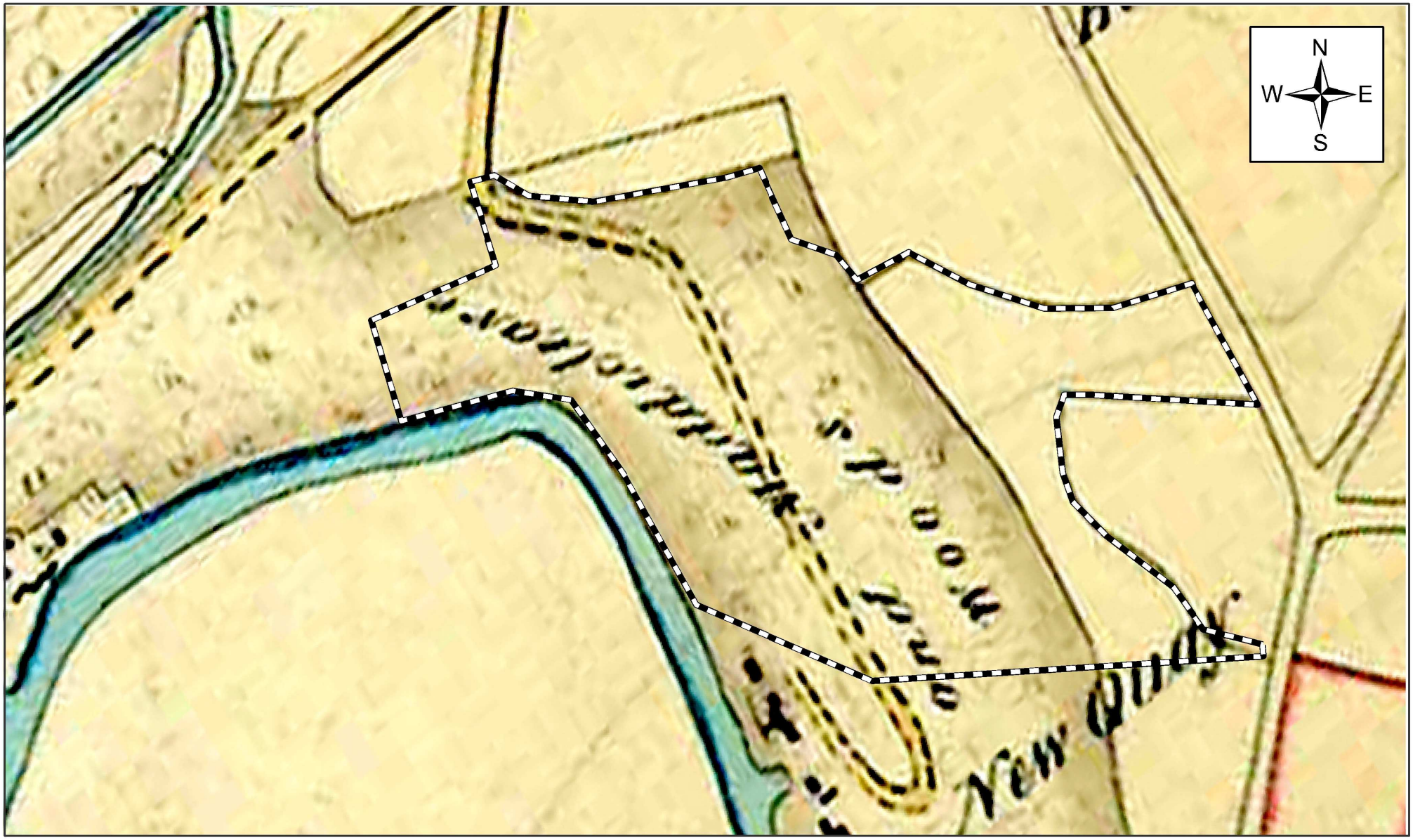

Figure 3. Tavistock Parish Tithe Map (1843) (Index Map)

(DRO/Tavistock Tithe Map)

Morwellham Quays. The map also shows a long looping track from 'Waggon Lane' down to New Quay next to the River Tamar through dense woodland. Mine works appear to have taken place mainly within the steeply sloping sides of the valley, and so are not shown in detail. However the post - medieval field systems up to the edge of the wooded slopes can be plainly seen, with enclosure of Morwell Down starting after 1828, when a local enclosure Act was passed (9 George IV).

The 1843 Tithe (Index) Map (Fig 3), and Symons 1848 lodes and setts map (Fig 4), replicates the detail of the earlier 1784/6 map. The Tithe Map in particular shows the distribution of woodland, parallel to the River Tamar, along the steep sides of the valley and the location of post-medieval settlements and their associated field system making inroads into the surrounding woodland. Level ground from the top of the valley sides eastwards appears to have been farmed from the early years of the medieval period. The distinctive west/east thin line of wooded areas (for example the long lode outcrop working of Site 23 in the north east of the project area), stretching from the steep valley slopes up to the north/south spine road to Bere Ferrers, had already formed (see Buck 2003, Bedford United and Buck 2006 Bedford Consols/Gawton Mine), forever changing the landscape of the area. These workings, many likely to be a century old by this date, appear to have reached their full eastern extent by the late 18th century. However, the presence of occasional charcoal burning platforms (Site 32), along the steep sides of Maddacleave Wood perhaps gives a general indication of an industry that preceded the small 18th century mines, and later 19th century amalgamations.

The 1786 map shows two settlements in the Tavy valley, both north of the later site of William and Mary Mine (SX 46256 70097). Hartshall at SX 46034 70491 (later named Hartshole on the 1843 Tithe map and Old Hartshole on the later 1904 OS map), before it disappeared to form a new site to the north (SX 46103 70837, Devon HER No. 5134, also named Hartshole). The second site is named Broad(way) on the 1784 map (Fig 2), but is shown and named incorrectly on the later 1843 Tithe (index) map as Romansleigh. The site is named Broadwell on the 1848 and subsequent maps (SX 46172 70239). The site of Sheepridge Wood Cottage is first shown on the Bedford Estates survey map of 1867 (Fig 7).

4.5.2 George & Charlotte Mine

A Glossary of Mining Terms is produced in the Appendix (Section 10.3).

In the 18th century small copper mine setts were being leased from the Duke of Bedford's Estate. They were being worked by relatively small numbers of people who were locating the surface outcrops of the lodes by digging regular shaped pits, and then working out the lode outcrops both at surface and underground, following them up through the steep sides of the valley. The names of these small setts are often difficult to reconcile with the place names of later 19th century maps, nor do they appear on Gardners Survey map of 1784 (Fig 2). However attempts have been made to locate these 18th century documented sites where they are within the boundary of the project area.

William and Mary Mine, working the same lode as George and Charlotte to the north east in the Tavy Valley – a distance of nearly a mile), was perhaps an older 18th century prospect, referred to by Kahlmeter in 1725 (a Swedish engineer, who visited the mine - his text published in 2001 by Justin Brooke*)*. He noted the mine was worked on three (adit) levels (since 1719) up the western bank of the River Tavy on the same lode by three different companies.

The later **George and Charlotte Mine** sett (sited between Sheepridge Wood and Maddacleave Wood), prior to its amalgamation in the later mid 19th century with William and Mary mine is mentioned as **Providence Mine** in the 18th century (pers comm. John Goodridge), dated to 1718. A mine is also shown on this site by an old Bedford Estate map dated to 1766. Site 23 may relate to this 18th century mine sett. Documentary evidence for at least three small 18th

century copper mines to the south east of the mine (near New Quay – Buck 2006, 7)) have been identified by John Goodridge (*pers comm*) in Maddacleave Wood: (**Maddacleave Works** 1717, **The Dimond** 1719 and **Two Brothers** 1734). A large lode back openwork (south east and upslope of New Quay), has been identified during field surveys, which may relate to the 18th century mine setts (Buck 2006 (Gawton), Site 4).

George and Charlotte Mine (either named after the sixth Duke of Bedford and his wife or from King George III and his consort Queen Charlotte in 1766), is first mentioned in documentary sources from 1775 (see Booker), then in 1799 when it is listed as being a copper producer by Amber Patrick (Tamar Journal 1983, Vol 5, 40). In October the following year eight shares were put up for sale (Brookes, 1986, Tavistock Hamlets Mines Index). *'In 1775 the estate records of the Duke of Bedford, who as the 'Lord of the soil', was entitled to dues on any minerals mined in the area, mention a small amount of copper ore produced at George and Charlotte'* (Booker in an undated pamphlet – Morwellham Quay'. However, the opening of the Tavistock Canal (constructed since 1803), in 1817 allowed the export of copper ore (and import of coal etc), from and to the Tavistock mines (via the water wheel powered incline railway north of Morwellham), would come to greatly influence this site. The mine and 'Holming Beam' (possibly Site 23), was purchased by the Tavistock Canal Company in 1806 for £3,779 (no doubt under the direction of John Taylor, the famous engineer - Booker, 1971, 139). However, Holming Beam was abandoned in 1810, and George & Charlotte was still not working in 1815 (Lysons 1822, Magna Brittanicae). It is highly likely that the copper ore from the adjacent mines were sampled and exported from Morwellham/New Quay, even before the canal incline was built. A leat (Site 1) from the canal was also constructed to feed not only the mine, but also New Quay and Bedford Consols (later Gawton) Mine.

To date, there appears to be no further documentary evidence of the small mining setts described above (often following a single lode), until the end of 1846 when, within the project area, the old 18th century underground workings were reopened (128 shares at £2 per share), and amalgamated into the sett of **George and Charlotte Mining Company**. This was a cost book company for the sett measuring a mile on the course of the lode and 400 fathoms from north to south. *'The adit, from which large returns were said to have been made, was driven about 90 fms. from the river (Tamar)…A good course of ore was found in Deep Adit Level at the end of 1846'* (Brookes 1986). In July of the same year, the Duke of Bedford leased the mine for 21 years (from Lady Day 1845 at 1/20th dues for copper and tin (excluding Royal metals and William and Mary Mine). However, work at the mine stopped after 1846. *'The lease, together with a fresh lease for William and Mary Mine, passed into the hands of the Devon and Cornwall United Mines Company some time before December 1851, and was surrendered in April 1864'* (*op cit*).

'After the workings had been suspended for some time, a new cost book company was formed to work this mine … work began about May 1850, and by September a shallow adit had been driven east to a point where a cross-course intersected the lode' (*op cit*). Several tons of inferior quality was raised from a drive to the south, with only £5 showing in the accounts at the end of November. In October 1851 the mine changed to **Devon and Cornwall United Mines**.

This new company amalgamated the two setts of William and Mary and George and Charlotte with the port of New Quay, as well as Harewood Mine, on the west bank of the Tamar (in Cornwall – held from Sir John Trelawney), a combined sett of 1200 fms. in length. *'The two mines on the Devon side of the river were being worked in the autumn of 1852 through Whim (Site 16) and Emily (Site 29), Shafts. An engine was erected at Albert's Shaft* (presumably sited in Cornwall) *a year later (the engine and boiler purchased in August for £1128.15), and in January 1854 Harewood Shaft was 36 fms. deep from surface… In August 1855 66 people were employed, and by June 1858 the number had risen to 130, though it fell to 100 in 1862. In June 1856, owing to a leakage in a leat carrying water to the machinery, a landslide took place near Morwellham Quay,*

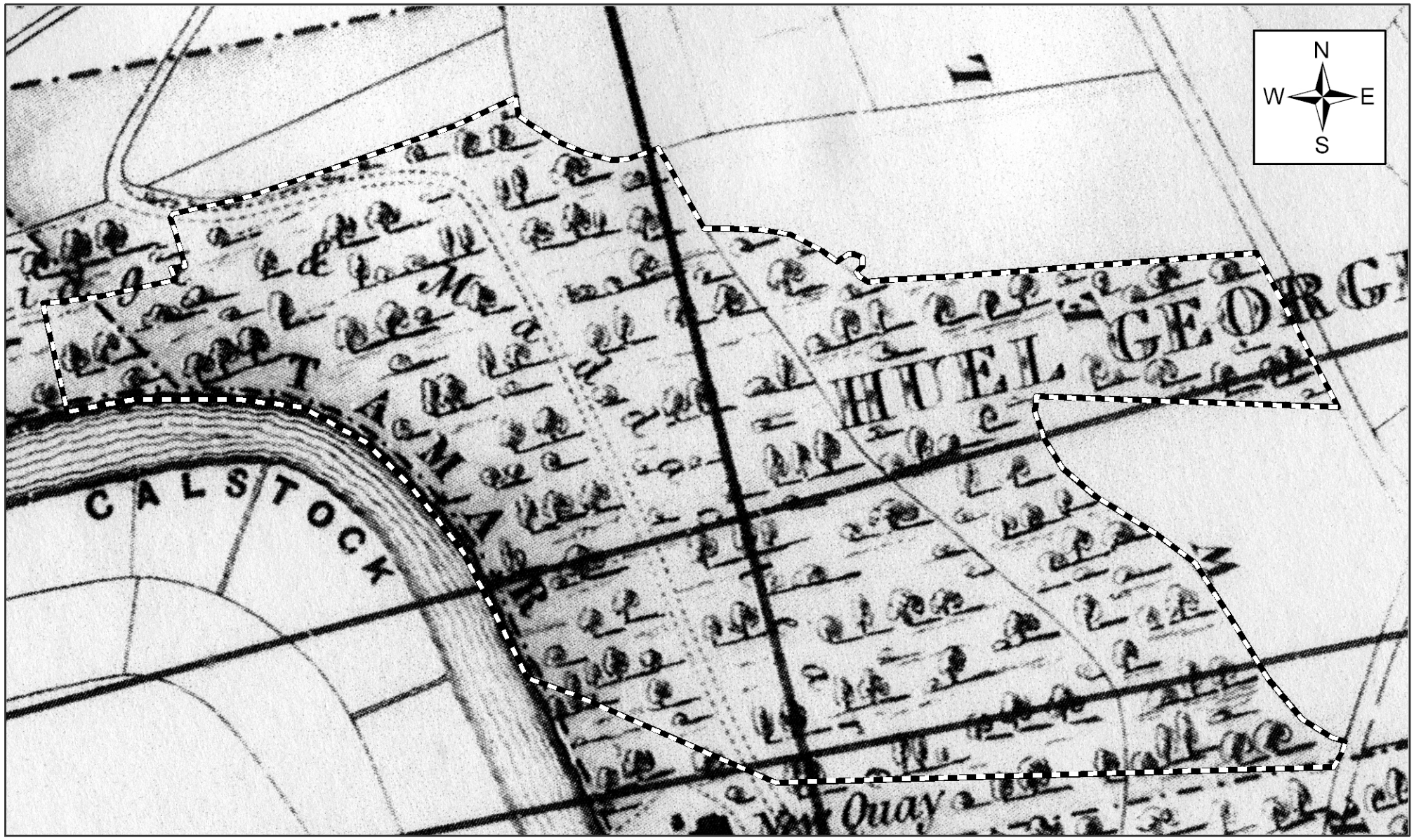

Figure 4. Symons' mine sett lodes map of the Tavistock District (1848)

(CRO ME 2462 - scale 6 inch - 1 mile)

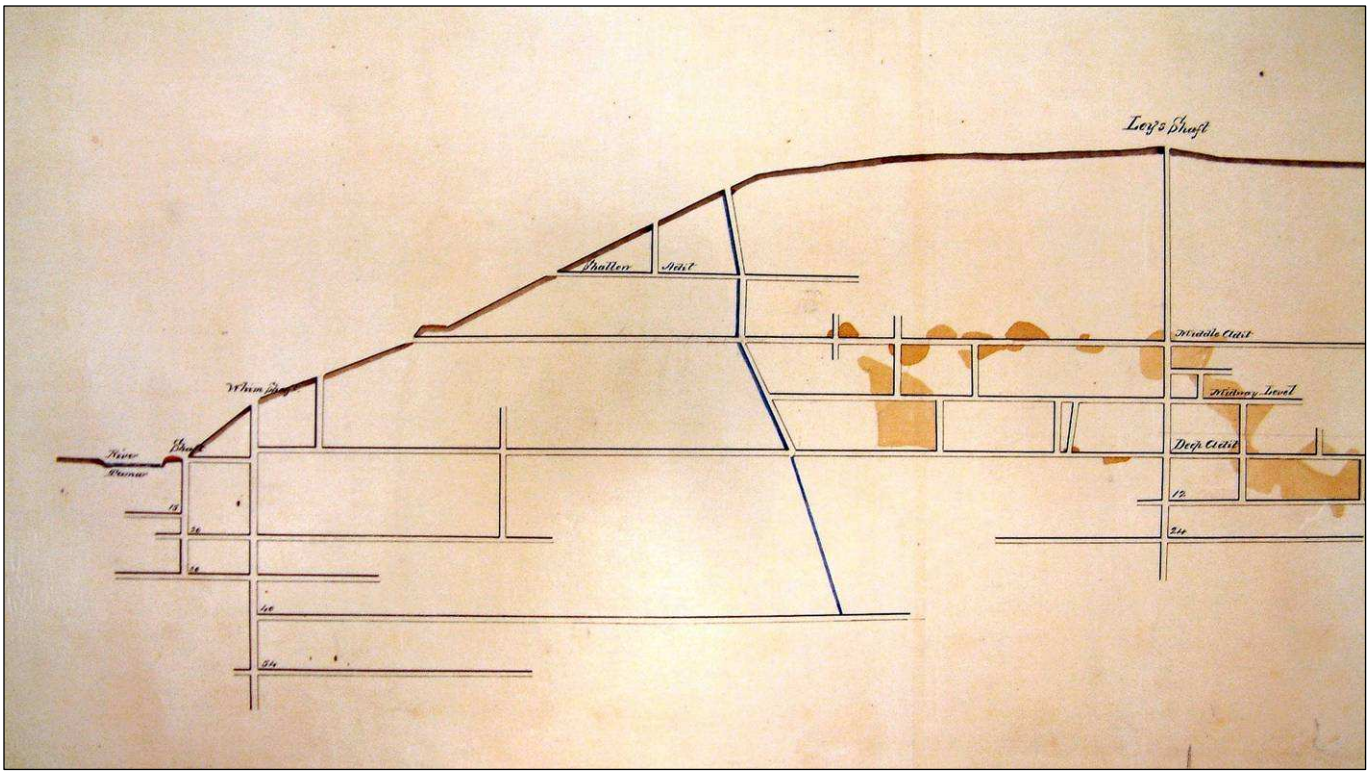

Fig 5 An excerpt of a section plan of George & Charlotte Mine (undated - DRO R98D)

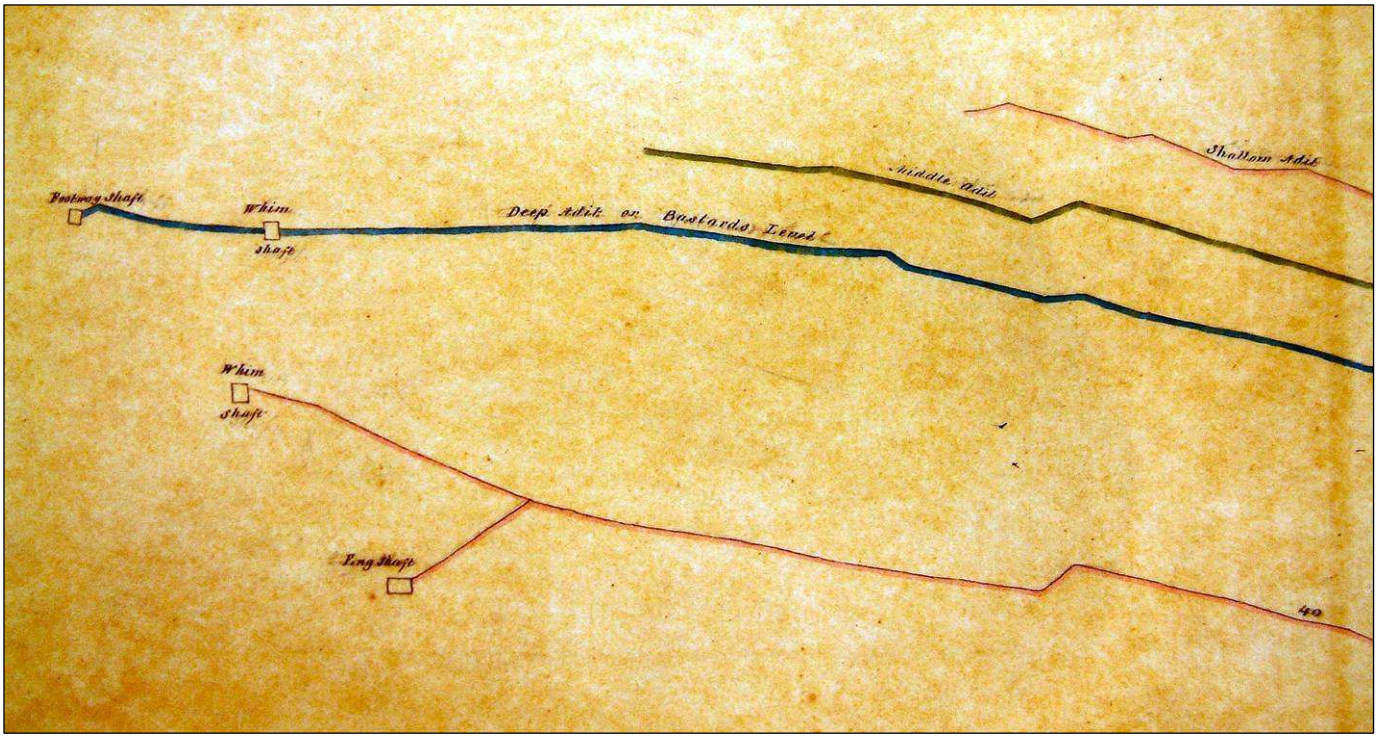

Fig 6 An excerpt of a plan of Devon & Cornwall United Mine (undated - DRO R98E)

Figure 7. Tavistock Parish (Div. 1) Lodes/shafts map (1867)

(Tavistock Parish [Div. No. 1] - DRO/T1258M/E11 - 3 chains - 1 inch)

Figure 8. Bedford Estates Survey Map (1867)

(Tavistock Parish [Div. No. 1] - DRO/T1258M/E11 - 3 chains - 1 inch)

by which a large piece of coppice, large trees, stones etc were thrown across the river, and prevented any vessel from passing… (In 1858) a special meeting was called to consider the Harewood sett, and empowered the committee to sell it, together with the engine at Albert's Shaft' (*op cit*). In June 1859 £158.10s was spent on a (presumably much smaller), 12" hauling engine. However, in July of the following year the company's accounts record that a steam engine and materials were sold for £476.12s (*op cit*).

At the end of 1865 cross cuts were being made at the 24 fm. level east and west of Ley's Shaft (Site 30). Ley's ended up being 34 fathoms below adit (83 fathoms below shaft collar), and Engine Shaft (Site 11) near the railway to 46 fathoms under adit (40 fathoms from surface). In 1866 a mining correspondent stated; *'It may not be generally known that one of the most interesting 'points' which has ever 'come off' is daily expected. An immense body of ore was discovered at George and Charlotte, in the deep adit, which enabled the mine to pay dividends, and the huge excavations caused by its removal have been familiarly named 'Devil's kitchen'. A long and expensive cross-cut has been put out, with a view to undermining his Satanic Majesty's cooking department, which cross cut is now near the desired object … However, no extension of the deposit was found, and in October 1868, the mine was put up for sale*' (*op cit*). This entire episode has been interpreted as being a 'puff', whereby stock brokers would put about rumours of incredible finds to increase stock value and interest – which was happily reported by the Mining Journal (for increased sales no doubt) – (Barton 1964, 41). The machinery included: 20" whim steam engine (auctioned on 17/10/1868, presumably not sold and auctioned again on 27/7/1871), 12" portable steam engine with hauling gear, three water wheels (45' x 5'), (40' x 4'), (27' x 8'), 155 fms. of pumps, 600 fms of rods, and account house furniture (op cit). It is quite likely that the 20" whim steam engine was used at Ley's Shaft, and the 12" portable steam engine used for shaft sinking etc rather than a specific shaft (*pers comm*. Rick Stewart).

'The company had returned a net loss of £27,135 (although from 1857 – 1868 nearly 17, 200 tons of copper ore was produced, realising £66,000)*. From this mine miners from Morwellham would often take a short cut underground into the workings of the adjoining William & Mary mine in the Tavy Valley'* (Booker 1971, 141). Unfortunately, both of the 1840s maps (Figs 3 and 4), do not show any surface workings, and the mine sections are undated (Figs 5 and 6), although the shafts, adits and levels are shown.

Figures 7-8 (1867 shafts, lodes and survey maps) from the Bedford archive shows the extent of the surface plan mine workings. The mine's leats, waterwheels, mine buildings, flat rod routes, adits and shafts can all be seen in detail as well as their working relationships. The front cover and Figs 5 and 6 show (undated) abandoned mine sections and plans, indicating the working levels, adits, shafts and winzes along the lode workings. Details for the William and Mary Mine have not been shown.

The Bedford Estates 1868 Report on the Mines (T1258M E 44a-b) by Gilson Martin (dated 31st Dec), showed that the mine's first lease (dated 11/4/1864) from the Duke of Bedford ran for 21 years, 4076 shares having been issued, with dues reduced to 1/18th. The lessees were John J. Gervis and Josh Pley. The area of the Sett was 220 acres (66 of which was woodland-but *'the remainder in arable and pasture')*. Two cottages are rented from the estate with six shafts in use and four abandoned and protected.

By 1868 the mine had closed down (described as George & Charlotte in the Bedford Estates survey). It had recently only employed 9 men and boys with no women and girls. *'This company was formed in 1851, the outlay has been £29,173 in addition to its receipts of £61,438 for ores. There has been a dividend of £2038, which leaves a net loss of £27,135, but Mr Paull says that that loss is more attributable to mismanagement on the part of the company's officers, than to the poverty of the ground. The mine is washed and drained by three large waterwheels and one steam engine. The ores are carted to New Quay a distance of about one mile. The water is very foul and some provision for cleaning pits must be made.*

The company suspended operations in October last and the sett and machinery were sold by private contract, many of the old shareholders retired from the concern but some of the largest and most influential ones still retain their interest and are endeavouring to raise capital to carry on the mine. Mr Paull believes that with good management the prospects are very fair for future profit' (The Bedford Estates 1868 Report on the Mines, DRO T1258M E 44a-b).

Accordingly, a company of the same previous name was restarted in the spring of 1869 by a cost book company formed largely of Tavistock shareholders. '*Reporting this fact a correspondent noted in March that the lode in the 34 fm. level west of the engine shaft was about 6' wide and worth a ton of copper per fathom. The local opinion was that all the mine needed to make it profitable was good management. The back of the 34 fm. level was being stoped in March 1869. In July the concern was described as a new company, and in August George Down called for debts, evidently about the time he lost the pursership. At this time there was a debit balance of £84.2s.2d. The working continued until May 1871, when the mine was offered for sale by tender as a going concern. The shares were listed in the Mining Journal from March 1869 to June 1872'* (Brookes 1986). It is possible that this company focussed its efforts at the William & Mary side (Tavy Valley), of the mine sett.

This last working appears to have produced 109 tons of sulphurous iron pyrites, and from 1869 to 1871 sold 271 tons of copper ore for £770.1s. Production returns for Devon and Cornwall United Mines start in 1852 when 98 tons of copper ore were sold for £475.80. No detailed returns are given for 1856 – 1861. The peak production years were from 1862 to 1867 when 1105 to 2920 tons of copper ore per annum was sold for £4167 - £9912 (Burt, Waite, Burnley 1984, 36).

The surface plan of George & Charlotte Mine (Copper disused) is shown in detail on Figures 7 - 8 (1867 Bedford Estate Maps), and Figs 9 - 10 (OS 1884 and 1904 maps respectively). The main centres of operation follow the single main lode. Likely 18th century remnants of the lode working are shown on Fig 18 (Site 23) extending westwards from the site of the Counthouse (Site 19), with later 19th century shafts (Sites 29 and 30), used for pumping out the inclined lode using flat rods powered by a water wheel (Site 2 as shown on Fig 8), and possibly a small steam engine for either Emily and/or Ley's Shafts (Sites 29 and 30). The 19th century centre of the mine was focused at the lower part of the site (SX 45273 69906), which contained another water wheel (Site 10), shallower shafts, adits, and the main dressing floors. As the mine closed a few years or so after the 1867 Bedford estate map, the detail shown on Fig 8 is more detailed than the later OS 1884 map, when the mine had been abandoned for some time. However, one must assume that the easily 'winnable' copper ore had been removed over a century before, and the miners by the late 1860s were concentrating on seeking new lodes rather than continuing old drives, that had already become exhausted.

'The chief mining setts are in the midst of very fine scenery adjoining the River Tamar which of course is much defaced by them although everything is done to make the surface works as sightly as possible and also that they should not be extended further than can be avoided, still to look at these mining operations as a lover of the beautiful only it would I think, seem a great pity that such a strikingly picturesque district as that of Morwell Rocks and its vicinity should have been in any way disturbed when nature had done so much for it – in a commercial point of view there can be no doubt but that the Duke's mines have proved to be a most complete success and fortunately the richest deposits of ores have been found where the surface land is very poor and commanding but a small rent for agricultural purposes' (Report on Mines from the Bedford Estate Collection (excerpts) 1868/9-DRO Ref: T1258M E44a-b). Gilson Martin, Bedford Estates Office, Tavistock, 31 December 1868.

It was not until over a century later (1977), that Bob Le Marchant, mine manager of Morwellham, put forward a planning proposal to create a new access near River Tamar level close to Footway Shaft (Site 34), to utilise an old mine adit (Deep Adit-Site 33), for a

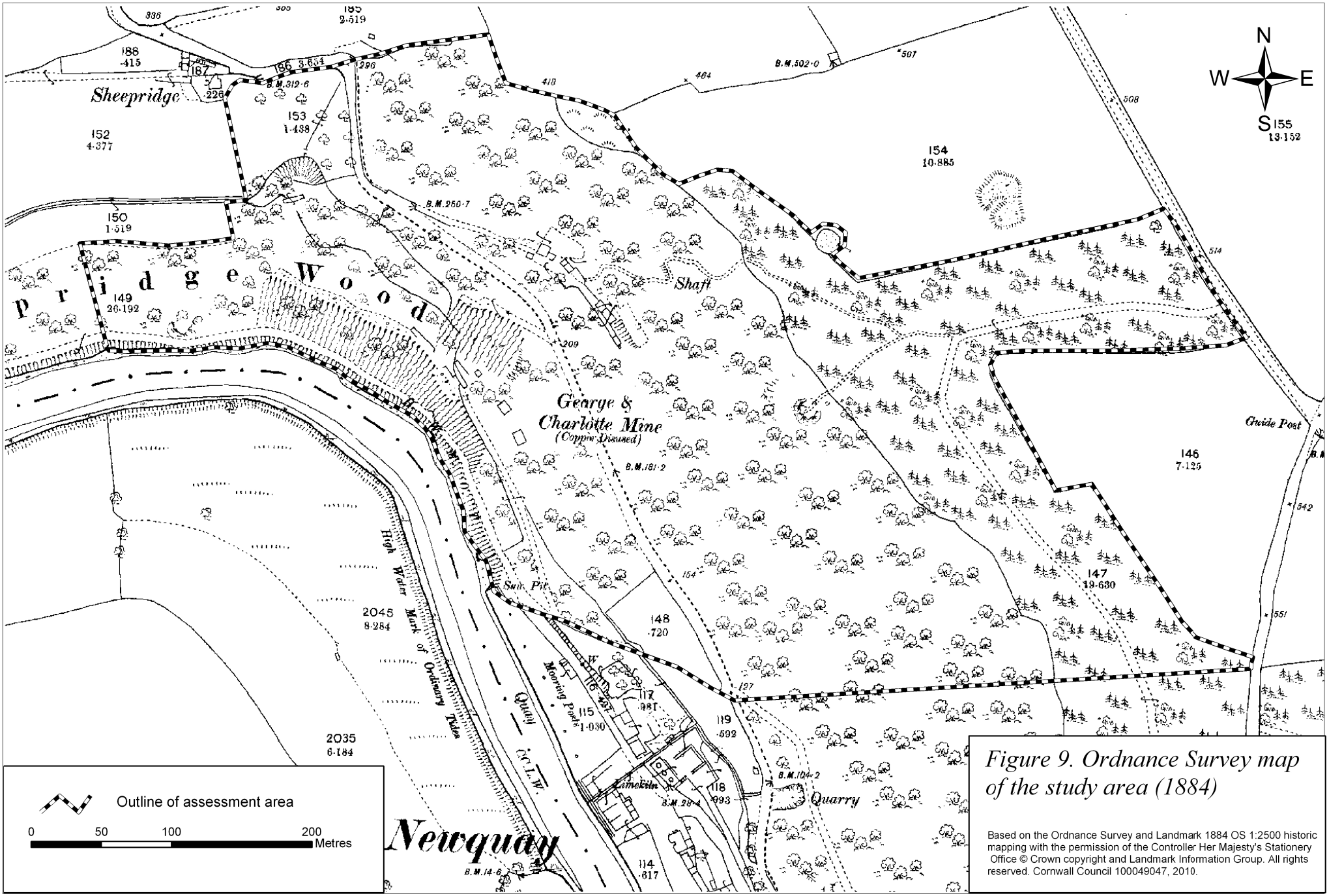

Figure 9. Ordnance Survey map of the study area (1884)

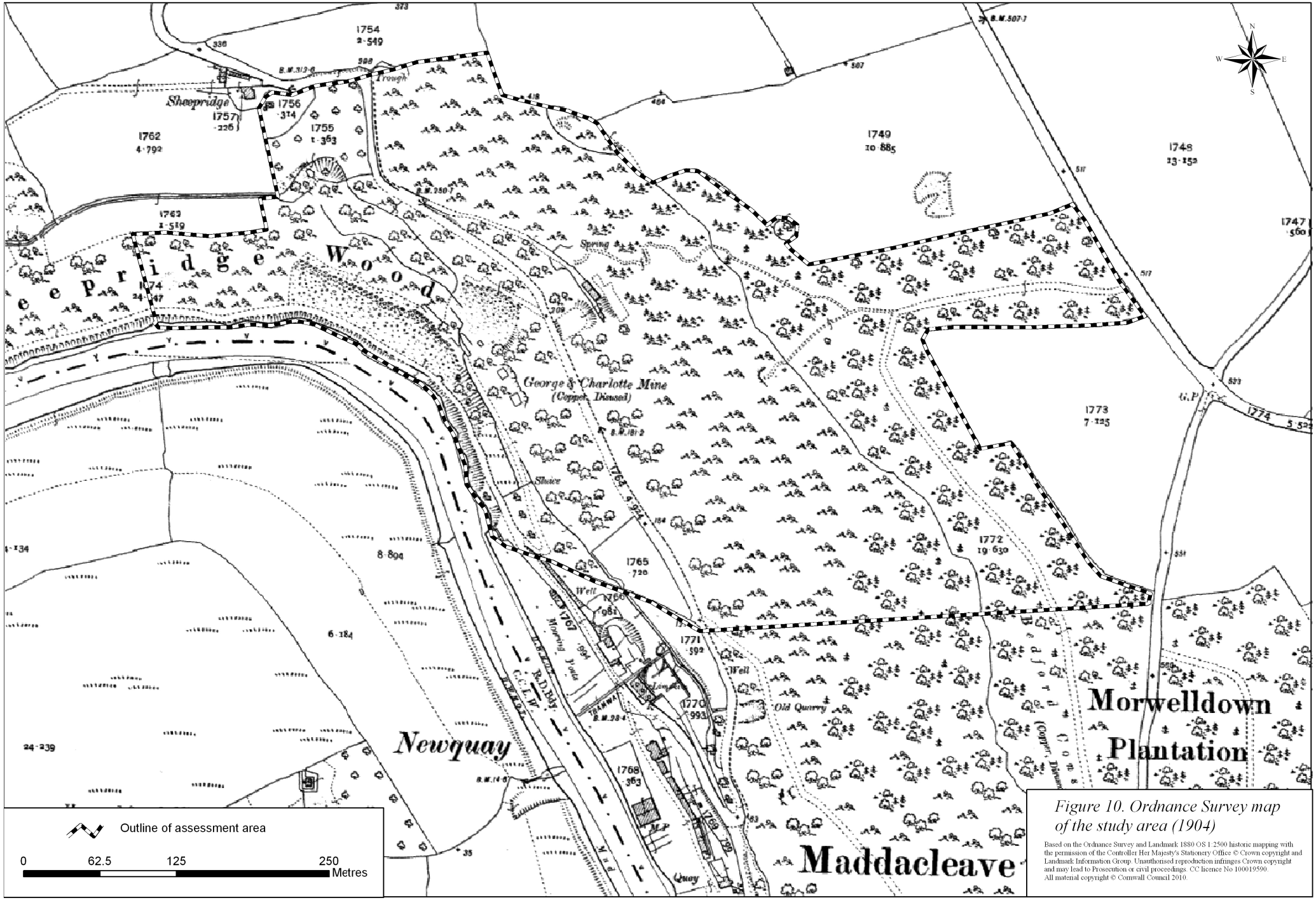

Figure 10. Ordnance Survey map of the study area (1904)

prospective underground narrow gauge railway to inform and delight visitors to Morwellham Quay (Site 37). This work was quickly undertaken with labour from a job creation scheme. Following additional excavation in 1985/6 to create a single route under the mine, the railway still runs today and is a big attraction for the thousands of visitors to Morwellham and George and Charlotte Mine, experiencing in a small way the character of the wet, dark, adits, an underground water wheel and narrow lode working.

4.6 Archaeological summary

4.6.1 Thematic outline of archaeological resource

This section gives a thematic outline of the archaeological resource within the land ownership project area, summarising information in the site inventory (Section 7.0) to provide a concise overview, cross referenced to the inventory by site number.

- 18th century lode outcrop working (Site 23) and costean pits in the upper part of the site. It is likely that evidence for 18th century lode outcrop working in the lower part of the site has been destroyed/infilled by the later 19th century mine.
- **George & Charlotte Mine/Devon & Cornwall Utd Mine (c1844 - 1871)**: the western section of the overall mine site accessed via adits from the River Tamar, with William and Mary Mine accessed via adits from the River Tavy.
- **Key/well-preserved sites:** there no significant building remains, with the exception of the Mine Captain's House (Counthouse), a Listed building (Grade II* - Site 19). Other significant mining remains include intact water wheel pits (of variable quality (Site 2-infilled, and Site 10 – visible). There are other remains of mine adits (Site 5 – Middle Adit, Site 21 Shallow Adit, Site 33 Deep Adit, and Site 36 New Quay Adit Trial). All of the mine's main shafts appear to be visible: Site 11 Engine Shaft, with a good example of a small balance bob masonry pit; Site 16, Whim Shaft; Site 24 Air Shaft; Site 25 Crosscourse Shaft; Site 26 a mine shaft; Site 27 a possible shaft; Site 29 Emily Shaft; Site 30 Ley's Shaft, and Site 34 Footway Engine Shaft.
- **Other sites with visible remains:** landscape remains include the site of the water wheels (Sites 2 and 10), leats (Sites 1 and 4), the 'cut and fill' techniques of making ground available to site many of the mine buildings (Sites 7-9, 15, 18, 20, and 22). There are denuded remains of the former site of the Stamps dressing floors (Sites 5.2 and 14), and associated spoil heaps (Sites 17). The low masonry remains of some mine buildings (Sites 8, 9 and 18) can be seen, although covered in ivy, together with long lines of (upslope) retaining walls, built to form building platforms.
- **Woods, plantations and woodland management:** occasional evidence of charcoal burning platforms (Site 32), with visual evidence of coppicing. Growth of deciduous woodland in and around the former mine site, with later 20th century conifer plantations higher up the valley.

4.6.2 Devon Historic Environment Record sites

These sites within (bolded) and close to the study area have been identified from the Devon Historic Environment Record:

- **George & Charlotte Mine (5467, 22888)**
- **William and Mary Mine (22889)**

- Mine Captain's House/Counthouse (37385) Listed Grade II
- Leat from Tavistock Canal to Gawton Mine (via New Quay) (19378)
- Mine leat (19388)
- New Quay Sawpit and Trial adit (19381)

4.7 Site significance

This section summarises the local, regional and national significance of George & Charlotte Mine. It also examines the wider context of the study area as part of a medieval settlement (Morwell Barton), with attached woodlands owned by Tavistock Abbey, which from the 18th century onwards re-focussed to industrial themes.

The mines of George and Charlotte and (to the south) Bedford Consols (later forming Gawton Mine-Buck 2006), are mine sites on the West Devon side of the Tamar Valley that both contain evidence for 18th century mining, both documentary and physical extant remains, as evidenced by open adits and lode back openworks. It is quite rare to find so many examples of the early years of copper mining, the steep slopes of the valley and dense woodland having preserved these features. As a result, these are of national importance.

George & Charlotte Mine demonstrates to a degree the overall survival of a coherent 18/19th century copper mine complex with its range of related site components. Some of the mine buildings are partially extant and other ground level features (wheelpits/dressing floors etc), are simply covered with years of vegetation and earth/leaf build up. The primary use of water as a power source for water wheels can be seen at two sites, a theme that has been replicated at many Tamar Valley mine sites. The opening of the Tavistock Canal in 1817 provided a significant water source for a number of mines to the north (primarily South Bedford Consols and Devon Great Consols, Buck 2002), and to the south, to this mine, New Quay and Gawton, part of a planned water management scheme possibly designed by John Taylor, the 19th century engineer. Again, from this respect the site is important in a national context.

As part of the Tamar Valley Historic Mining Project, the revised Tamar Valley AONB Conservation Management Plan (TVAONB 2006) includes a Significance Matrix (Table 3.4). George and Charlotte Mine has been graded as Regionally important in terms of its historic landscape value and for the quality of its archaeological sites and documented history. In addition, this site has been graded as Locally important for its Community and Access components (significance to local people and to visitors from outside the area (as a result of the Morwellham train trip). This includes the cultural values placed on the site by the local community and also the potential value of the site for recreation. George and Charlotte Mine is a small part of a select list of sites in West Devon that have World Heritage Site status.

In terms of the wider context of the study area and its historic land use, Sheepridge and Maddacleave Woods, a major part of the landscape around the project area, is historically associated with Morwell Barton Manor, a medieval ecclesiastical settlement owned by Tavistock Abbey. Morwellham Quay was this medieval settlement's link to the river (always a major trading/industrial thoroughfare) and was a Tavistock borough and Abbey port from the 12th century, busy not only importing products, but exporting metallic ores, at different times throughout its existence. The dissolution of 1539 saw the former abbey lands transferred to the ownership of the Russell (Duke of Bedford) family and in the early 1960s to the Earl of Bradford, the existing owners. There is some evidence for woodland management in terms of hedge boundaries and of course numerous charcoal platforms. The field pattern around Morwell Barton and the enclosure of Morwell Down to the east and south east (see Fig 2), can

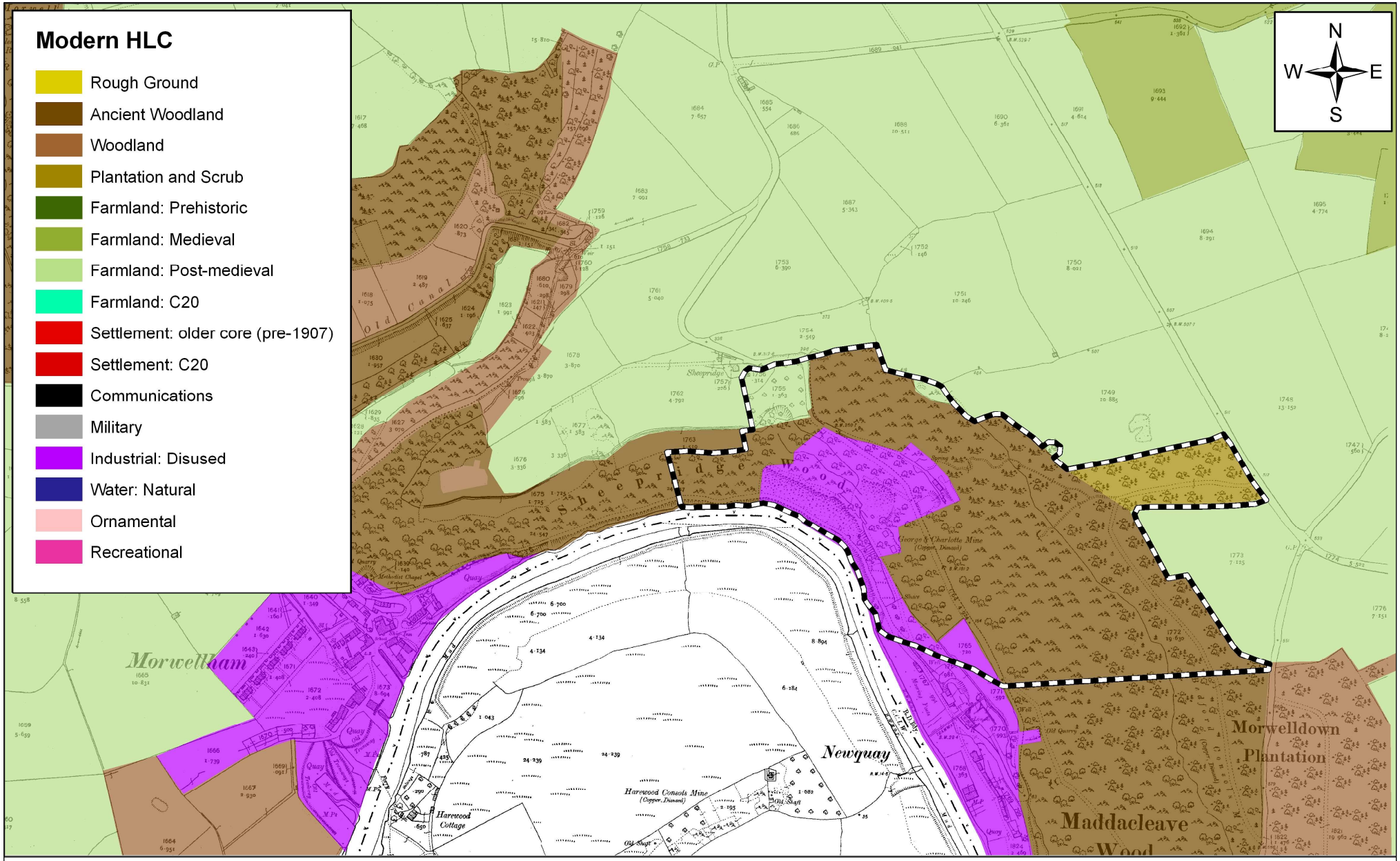

Figure 11. Historic Landscape Character 1904 map background

be seen to be part of a broader picture of agricultural expansion in the 18th and early 19th centuries.

4.7.1 Statement of Significance

Within the setting of the World Heritage Site, George and Charlotte Mine retains coherent remains of typical small Tamar Valley 18th century lode back openworks, and later mid 19th century water powered copper mining enterprises. Although individually, the sites have a mainly medium significance, their contextual character rating is high due to the number of related mining remains.

5 Management Recommendations

5.1 General Recommendations

The following management recommendations form a broad range of building conservation guidelines, site management and maintenance guidelines, WHS management policies, archaeological potential and recommendations for further archaeological interventions, all of which should be taken into account during the project implementation stage.

5.1.1 Archaeological management plan

- A long-term conservation management plan for the surviving archaeological remains is required and has been prepared by the TVMHP (2006).
- The integration of site management plans into an overall WHS plan is needed.
- Investigation of suitable Environmental Stewardship schemes are recommended to offset any management costs of the long-term impact of preserving archaeological features.

5.1.2 Building consolidation

Specifications for all works should be agreed by the Devon County Historic Environment Service (Agri-Advice team). These should be in line with the principles of good conservation practise set out in *'A Guide to Conserving Historic Mine Buildings in Cornwall'* (Sharpe, Johnson and Lewis 1996), English Heritage general principles and guidelines (Ashurst 1989, Bereton 1991), and the WHS Management Plan policies.

- The consolidation of some structures is considered an urgent priority, if further collapse (and loss of the buildings), is to be avoided. A list of these sites can be seen in Section 7.2.
- Sites and structures should be considered for consolidation/enhancement on the basis of their historical importance, significance and condition.
- Detailed building survey should be undertaken to provide a record of condition prior to any structural consolidation works and provide information (i.e. dimensions and building type/materials) for consolidation contractors. This would best be undertaken using a reflectorless Total Station Theodolite or EDM (Electronic Distance Measurement), enhanced where necessary by conventional manual survey.
- The existing Environmental Stewardship scheme is recommended to offset any management costs of the long-term impact of preserving archaeological features.

5.1.3 Possible further work

- Detailed 3-dimensional digital survey (EDM) and high quality photographic survey of

surviving structures are needed to provide a record of condition, an aid in interpretation and a basis upon which consolidation works can be carried out on those features where structural stability works will permanently affect their current condition. Alternatively, existing accurate measured survey drawings can be used (surveyed in the mid 1980's). These are held by the Morwellham Trust archive.

- Detailed landscape and building survey should be undertaken to understand the relationship between structures and improve interpretation of sites (especially where public access merits detailed accounts or where contamination remediation works will affect archaeological features).
- Vegetation and tree clearance could be used to safeguard existing sites and to enhance surviving remains. It has already been recommended that this work be undertaken before any building consolidation works commence.
- Archaeological monitoring and recording may be needed during any geotechnical works (shaft plugging/fencing safety works etc), in addition to archaeological recording and historic buildings consultancy.
- It is important to ensure that a dialogue is set up for the continued managed preservation of archaeological and ecological sites (perhaps utilising Environmental Stewardship Schemes).
- Thought should be given to the improvement of public access through the surface remains of the mine. It is hoped that a number of well-routed circular walks(from the new existing footpath created as part of the TVMHP would enable visitors to the area to access the majority of mine and ore quay sites in the locality of the project area using existing tracks and railway routes.
- The inclusion of all sites in published material (TVAONB guidebooks/leaflets-histories/web sites etc) is recommended. These should include detailed maps derived from research and surveys.
- The form of any future survey, excavation or analysis could be linked to a research agenda with the aim of answering key questions on aspects of historic mining and the associated industrial landscape.

5.1.4 Interpretation themes

The provision of site interpretation via an appropriate medium is an important aspect of enabling the history and character of the area to be communicated. The following points represent key historical themes of the landscape:

The following points represent key historical themes for George & Charlotte Mine:

- Use of the woods in the wider rural context as part of a medieval ecclesiastical settlement.
- Changes in land use as mineral lodes (north and south of the project area) were discovered and then exploited during the early years of the 18th century through adits and lode back working.
- First signs of industrialisation as copper mining operations (Impham Valley, Maddacleave Wood), were financed by 18th century industrial entrepreneurs, using water power for mineral dressing and smelting.
- The export of mineral ores through nearby riverside quay sites in the 18th century (Morwellham, Impham Quay, New Quay etc) to other parts of the country as part of an organised industrial ore export operation.

- The resurgence by the mid 19th century of copper mining in the Tamar Valley, re-opening and deepening lodes that were worked in the previous century, following increases of the world copper price and the success of other mines in Cornwall and West Devon. Renewed interest and expansion of Tamar Valley quay sites for importing/exporting mine materials and products.
- The decline of mines in the area (and so mineral related business for quays), prior to the turn of the 20th century as the copper lodes were worked out and world market prices fell. Consequently there was a dramatic decline of the business for large and small ports along the River Tamar, as they once again changed back to serving only local agricultural needs.
- Consequential decline in employment in the entire Tamar Valley, as all related secondary mining industries failed.
- George and Charlotte's Mine Captain's house was re-used for domestic occupation, and has continued to this day.
- From 1978, Morwellham Quay exploited George & Charlotte Mine for the idea of utilising an underground railway train along a short section of an adit (Site 37), to permit visitors to learn of the mining techniques and experience the underground atmosphere.

The key element for interpretation at George & Charlotte Mine is its character as one of a number of small water wheel powered copper mines in the Tamar Valley in the 18th to 19th centuries, and its role in the wider network of trade, industry and economy of the south west.

The approach to site management and conservation works to present and interpret the site needs to take into account two potentially contradictory elements:

- Retaining the sense of an abandoned site, returning to 'nature' (reflecting the demise of the particular socio-economic context which led to its development).
- Ensuring that appropriate sites, areas and views are sufficiently open (and conserved) to enable the complex overall and key components within it to be safely accessible and understandable. The removal and management of obscuring trees and dense vegetation will be an important part of this philosophy.
- Once specific public access routes both to/from and within the site are determined, a limited number of site information boards can be erected at appropriate locations. The creation of historical informative web sites and related leaflets with detailed booklets are part of the Tamar Valley Mining Heritage Project Interpretation Strategy.

5.2 Individual structures or site components

An historical background analysis, condition survey, significance rating, conservation recommendations and impact assessment for individual buildings, earthworks, and structures is described in the site inventory (Section 6.0) and summarised in Section 7.0. Appropriate conservation strategies for shafts and other mining features are detailed below.

5.3 Safety works to mine openings

5.3.1 Policy in relation to safety works to mine openings (WHS)

- Generic World Heritage Site Management Plan Policies and site specific Conservation Management Plans have been produced as a guide for all works effecting the historic components of mine sites.

- Any proposed safety works to surface mine openings needs to take into account that this mine is deemed to be a working mine, and so subject to HSE requirements. Consultation for any proposed safety works to the mine will need to be carried out with the Mine

Manager (Rick Stewart).

- Mine shafts, outcrop workings, prospecting features, adits, and openworks are important archaeological sites and monuments.
- Shafts often have key mine components located adjacent, near or within their mouths. These components may be buried and invisible at surface today.
- Shaft capping or plugging should only be carried out where there is a direct threat to the safety of the public that cannot be addressed by other means, or where the stability of historic structures is at risk.
- Engineers should always take the known archaeological significance of sites into account when designing shaft safety treatment programmes.
- Non-intrusive methods of excluding the public from mine shafts should be used wherever historically significant sites are involved.
- Planning Policy Statement 5 (PPS5) should form a model for the involvement of archaeological constraint in the process of land reclamation or shaft safety works.

All measures taken to ensure public safety (fencing, hedging, grilling, or capping) will result in some measure of disturbance to the shaft head and its surroundings, but plugging, capping and backfilling are obviously the most destructive. In circumstances where plugging or capping are considered to be the only options on the grounds of public safety, particular care must be taken to minimise damage to nearby archaeological features and to ensure an adequate record of features destroyed or damaged during such works is made through the commissioning of an archaeological watching brief during works.

Summary

- Treatment of mine shafts must be sympathetic to the archaeology and appearance of the landscape.
- There should be avoidance, where possible, of capping/plugging – this is archaeologically destructive and difficult to reverse.
- The use of protective fencing is more in character with the landscape and is a traditional technique for this site.
- Consultation with the local interest underground access groups (Plymouth Caving Group and Tamar Mining Group), should take place before previously open shafts are proposed to be sealed or permanently fenced.

5.4 Archaeological Potential below Ground

Contingency funding should be made available as part of any proposed works to allow for an appropriate level of archaeological recording if shallow mining features are revealed during the course of the works programme. However detailed consultations with the Devon County Archaeologist (HE Agri-Advice) should take place at every stage of the project where below ground archaeological features are likely to be affected.

5.5 Further Archaeological Work: Historic Buildings Consultancy and Recording

A project brief for a Historic Buildings consultancy and archaeological recording should be

developed with advice from DHES (Agri-environment Advice). Provision should be made for a suitably qualified archaeologist to be present to record (and if necessary survey), the archaeological features of the site affected by the building conservation works in line with the general and specific recommendations contained within this report. A copy of the archaeological record produced during such a Historic Buildings consultancy and archaeological recording should be deposited in Devon's Historic Environment Record.

An archaeological recording and historic buildings consultancy during all of the site works may be able to minimise any further below ground site impacts, but also record any visible/disturbed archaeological features and to record the nature and extent of the building conservation works.

5.6 Statement of likely COSHH Hazards

The mines within this southern part of the Tamar Valley area are highly mineralised, and particularly in this area were amongst the 19th century's principal producers of tin, silver lead and fluorspar. Residues from the mining activity (especially upriver from Devon Great Consols but specifically from Ding Dong Adit near Gunnislake and perhaps other smaller adits), have resulted in un-vegetated spoil tips and local soils which are highly contaminated with Arsenic (ranging from 120 to 52,600 μg/g), Arsenic and Tin. However, simultaneous exposure to the environment can also be from a number of other elements present in the mining waste at highly elevated levels, including copper, lead, zinc, antimony, molybdenum, tin, selenium and mercury.

Note:

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

6 Site Inventory

6.1 General comments:

- Refer to Figure 18 (Site Inventory map) to locate these sites within the project area.
- All identified structures and sites are located by a 10-figure grid reference. In most instances these relate to a point at the centre of the feature/structure. If the feature covers a large area, the NGR is an eight or six number grid reference. Linear features (flues etc), are given NGR at either end where possible.
- The site inventory cross-references these sites with Devon's Historic Environment Record Number (Prefix DHER).
- As a general comment relevant to all sites, specifications for all building conservation work should be agreed with the Devon County Archaeologist and the Devon WHS Planning Advice Team who should ensure that an archaeologist records and advises on the work that is carried out.
- On a general note, clearance of vegetation and trees from this site will be necessary in order to ascertain the degree of structural weakness, rebuilding and repointing necessary to make this a safe building accessible to members of the public. Prior to consolidation works (using lime mortar), it may be necessary to carry out a detailed check of the existing survey of the

entire site (with the existing remains), especially if structural components and rebuilding needs to take place.

6.2 Site Inventory

George & Charlotte/Devon & Cornwall United Mine DHER 5467, 22888

Site 1 Leat (Tavistock Canal to Gawton Mine via New Quay)

SX 44867 70265 to SX 45398 69694 DHER 19388

Background

Historically, the Tavistock Canal was in use by 1817. The project engineer John Taylor, was also a mining engineer and had interests in many mines close to or cut by the Tavistock Canal project. One of these was George and Charlotte Mine. It is possible that he was involved in the creation of the new leat (at least for the benefit of George and Charlotte Mine as the mining company was owned by the Canal Company from 1806). Thus, the date of the leat may date to when the water was available from either the southern end of Tavistock Canal, or perhaps from the southern side of Morwell. The New Quay lime kiln (water wheel powered) incline plane was built in late 1825. Thus the leat to supply the water may be of a slightly earlier date (ie from 1817).

The 1867 and OS maps (Figures 7-10 incl), are the earliest maps that show in detail a leat from the Tavistock Canal tunnel portal, running around the south side of the Morwellham access road, and then due east to George and Charlotte Mine. From here it (ultimately) fed two water wheels before it continued towards New Quay. The sluiced feed from the latter (main waterwheel), continued as the tailrace, feeding into the Tamar. A sluice feeds the New Quay reservoir pond (Buck 2006, Site 8.3), before it continues along the side of the valley and goes under the main access track into the quay (Buck 2006, Site 11.1). It then continues along the side of the valley to power another waterwheel a mile away near Bailey's Shaft (Bedford Consols (later renamed Gawton Mine) Buck 2006a, Site 24).

However, analysis of Figs 7 and 8 (OS maps), also shows an additional parallel leat from the vicinity of the wheelpit (Site 2). A hypothesis therefore, is that the second leat (Site 4) is later (between 1867 and 1884), than this leat.

Survey

Evidence of the leat is best seen in the steeply wooded sides of the Tamar Valley (SX 45172 69981). Part of the leat's course has been utilised to form a new footpath from Morwellham to New Quay (see forthcoming TVMHP archaeological recording report). In places it is 0.5 to 0.8m wide at its base, with the downslope bank 0.5 to 0.7m high, and the upslope bank 0.9 to 1.3m high. The leat is likely to have been sluiced before it fed the small header pond (Site 10.3) next to the central mine's water wheel (Site 10), the remainder of the water feeding into the leat proceeding towards New Quay, close to the mine track to New Quay (Site 13.1). Where the leat goes across the waste rock from Middle Adit (Site 5), at SX 45266 69925, revetment walling has been built for a height of 1.5m and length of 6.0m.

Recommendation

Refer to standard recommendations given for long term preservation of earthwork features in a working woodland environment (See Section 10.1).

Site 2 Wheelpit SX 45153 70016

2.1 Balance bob pit SX 45161 70017

Background
The construction of this wheelpit, and its tail race leat feed (Site 1) to the mine appears to be of later date than the original leat construction. It may date to the Devon & Cornwall United Mine tenure from 1851, which focussed on opening up new deeper shafts to access the lodes eastwards towards William and Mary Mine in the Tavy Valley. The wheel would have been of either 40' or 45' diameter, and functioned to power flat rods (perhaps latterly in 1867), to pump/wind Ley's Shaft (as shown on Fig 8, the Bedford Estates map, Site 30). It may be the case that these rods first worked Emily Shaft (Site 29), before the lode extended further eastwards to Let's Shaft. The tail race leat (Site 1) from the water wheel then joined with the original leat, to supply water to the mine's second water wheel (Site 10).

Survey
The wheelpit is visible on its west and south sides only, the remainder of the external walls (and interior), are obscured by earth, stone and water build up. The south west corner masonry is 1.9m high above ground level, and a width of 2.0m visible. It is approximately 11m long. There is a flat area of ground (3.0m wide), south of the wheel pit that would have sited masonry loadings and the crank pit where the main power shaft was connected to the flat rod (transfer of round to horizontal motion), and further to the west, a vertical rock face approximately 7.0m high and 5.0m wide (of uncertain function).

2.1 A masonry feature at the south eastern end of the wheelpit has been interpreted as the balance bob pit outer walls. The flat rod would have travelled over the balance bob onto a trellis structure to support the moving flat rod as it traversed the hillside up to the shaft. The masonry is 1.0m wide, 1.3m deep (on the north side) and approximately 5.0m long. Additional walls and further architectural details are obscured by fallen material from the hill slope to the east.

Recommendations
As a feature of archaeological and historical interest to this mine, the wheelpit should be cleared of earth and stone, vegetation removed (stumps treated), that are growing out of the walls which should then be repointed and the walls capped with lime mortar. Water will need to be managed around the feature (or perhaps utilised to turn a replica water wheel on the site – with perhaps a short length of flat rod to show its alignment up the hill).

Site 3 Header pond SX 45145 70020

Background
This feature is shown on both of the Bedford Estates 1867 survey maps (Figs 7 and 8). However, it is not shown on any other archive maps. The header pond would have formed a reservoir of water from at least one, if not two further small leats uphill (see Fig 8 – the 1884 OS map), from the north and east. A sluice sited between the header pond and the water wheel inlet would have carefully managed the water flow to achieve efficient rotation to power the flat rods at an efficient speed.

Survey
As shown on Figs 7 and 8, the rectangular shaped header pond is sited above and next to the wheelpit. There is no obvious sign of the reservoir pond at ground level, although it would

have been infilled with earth stone and water.

Recommendations
None, although it is recommended that the site is not disturbed.

Site 4 Mine Leat/water wheel tail race SX 45118 70012 to SX 45268 69902 (DHER 19388)

4.1 Vertical rock cut SX 45134 70016

4.2 Wheelpit Tailrace SX 45271 69883 to SX 45299 69765

Background
This secondary leat (fed via a vertical rock cut (Site 4.1), is shown on the OS 1884 (and subsequent OS maps). The route of this later leat is parallel to the earlier leat, but higher up the valley side, although it may well have joined the earlier leat (at SX 45262 69934), when it turned downwards. The reason for this additional leat is unclear, but perhaps it provided a faster (or additional), head of water for the mine's other water wheel (Site 10).

The tail race water from the central mine water wheel (Site 10), appears to combine with the main leat and then head towards New Quay (after going in an underground channel under the mine track from the mine to New Quay). However the later 1884 OS map (Figs 9 and 10), shows an additional section of tail race built from the point where it would go under the track, to perhaps feed water to the New Quay Saw Pit (Buck 2006, Site 1) water wheel. Figure 10 also shows that a sluice had been built from the main leat to also feed the water wheel saw pit (SX 45327 69780).

Survey
Evidence of the leat is best seen in the steeply wooded sides of the Tamar Valley (SX 45218 69996). Trees are growing along and inside the leat in places. It is 0.6 to 0.9m wide at its base, with the down slope bank 0.5 to 0.8m high, and the upslope bank 1.0 to 1.5m high.

4.1 The east-west oriented vertical rock cut averages 1.2m at its base (2.0m across its top edge), with the north side of the opening approximately 5.5m deep, the south side 3.7m deep.

4.2 There is little surface evidence of the wheel pit tail race, as shown on Fig 9).

Recommendations
Refer to standard recommendations given for long term preservation of earthwork features in a working woodland environment (See Section 10.1).

Site 5 Middle adit SX 45281 69946

5.1 Higher dressing floor SX 4527 69950

5.2 Balance-bob pit SX 45282 69943

Background
Middle Adit is shown on the front cover abandoned mine plan, Figure 5 and labelled on Figs 7 and 8. It extends past Ley's Shaft (Site 30) towards Downs Shaft (SX 45916 70076).

'… the lode was opened up by three adits on the eastern slopes of the Tamar valley and by six shafts. Deep Adit level from the river bank, and Middle Adit Level, 28 fms. higher … both extend to 340 fms. E. of the river… The sloping shown on the plan is confined between Middle Adit and 12 fm. levels and extends 60 fms. E. and 90 fms. W of the shaft (Crosscourse Shaft – Site 25)*, but is*

Fig 12 Middle adit (from entrance) after removal of rock/silt build up (Site 5) C Buck 2005© HES

Fig 13 Balance bob box next to Engine Shaft (Sites 11.1 and 11)

patchy, less than 25 per cent of the area having been removed' (Dines 1956, 677).

Near the adit portal, there was the *'Higher Floors'*, as labelled on the front cover abandoned mine plan (DRO R98E). Waste rock (transported via tramway from the working levels), would have been disposed of down slope (see Fig 8), and the ore rock primary dressed (by hand 'bucking', with hammers), on the *'Higher Floors',* at the flattish area to the south and west side of the adit portal. In the last decade, the adit portal has been cleared and tram rails set in the floor.

Survey
The excavated floor of the adit now reveals an opening 0.9m wide at ground level and 1.7m high. A padlocked steel gate measuring 0.9m x 1.5m has been set into the portal entrance to restrict access. During the past decade, the Tamar Mining Group have removed a great deal of earth and stone from the floor and mouth of the adit, and then installed a tramway (see Fig 12) within the adit and a turntable (now removed) outside the portal, and tramway out to a spoil heap to the east, to illustrate how the material was separated and then processed. Surveys, finds description and an archaeological record of this excavation should be found at the Tamar Valley Industrial Archaeology website, as recorded by Robert Waterhouse.

The adit water drained under the turntable (in 2005), to a trench and outflow to the south, into the large spoil heap that descends steeply down slope to the centre of the mine. The tramrails have been built to extend from the turntable outside the portal (see rear cover photograph), to the east across the higher dressing floor (formed by the construction of a 1.7m high masonry retaining wall approximately 8.0m long). A slight rounded cut out masonry feature close to the north side of the adit portal has been interpreted as a mechanical fan/bellows feature which would have pumped air into the adit via a long trunking fixed to the wall (*pers comm* Rick Stewart).

Next to a low retaining wall south west of the adit portal is a masonry feature that resembles a balance bob pit (Site 5.2), now infilled with silt from the adit water and leaves etc. This is approximately 5.0m long, 2.0m wide and 0.4m above ground level (on the south side). Thus, there is likely to have been a need for a flat rod power source within the adit, perhaps for winding, pumping or the fan/bellows.

The Higher dressing floor (Site 5.1) is visible as a flattish compacted hard floor of stone, very close to surface over an area to the south and west of the portal. There may have been timber sheds/corrugated iron structures to keep the rain off when the ore was being manually broken up by men, women and boys – although this would not have survived.

Recommendations
Much effort by volunteers has been expended to clear out the adit, and to install the tramrails and outside turntable. With additional work this site could prove to be an interesting exhibit for members of the public to discover whilst walking around the surface features of the mine, a counterpoint to the underground features shown in the railway trip.

Site 6 Site of Powder House SX 45330 69897

Background
The mine would have had its own powder house to store the fuse and gunpowder, sited away from general activity and not far from where it was needed – i.e. the main working adits. The building is shown on the 1867 maps only (Figs 7 and 8).

Survey
There is no visual evidence of this building, although its flat site upon which it stood can still be seen.

Recommendations
None, although it is recommended that the site is not disturbed.

Site 7 Mine building SX 45284 69892

Background
A building is shown on this site on the 1867 maps (Figs 7 and 8), and the later OS maps (Figs 9 and 10). There are no buildings labelled on the mine plans, therefore this has an unknown function (as well as Sites 8 and 9), although it may simply have been a crib hut (a place for shelter during snack/meal times).

Survey
The site is set in an area that has been excavated from the hillside to form a flattish site, and the construction of a vertical masonry wall (0.45m high), on the upslope north east side. There are remnants of all four walls. The building is small (internally 2.2m x 3.0m and a maximum of 1.7m high). There is a possible doorway in the east side, with the remnants of a window sill in the south west wall. The north west wall has remnants of the gable wall, with the other walls approximately 1.5m high (maximum).

Recommendations
As a building of archaeological and historical interest the feature should be cleared of vegetation, trees removed (and stumps treated), that are growing out of the walls which should then be repointed and the walls capped with lime mortar. Consolidation specifications should be agreed with the Devon County Archaeologist.

Site 8 Mine building (possible Carpenters Shop) SX 45302 69867

Background
A building is shown on this site on the 1867 maps (Figs 7 and 8), and the later OS maps (Figs 9 and 10). It is thought that this may possibly have been the mine's Carpenter's Shop. However, there are no buildings labelled on any map that has been viewed. This building has a distinctive shape, and may have been divided into two halves. Alternatively, it may have functioned as a dressing floor building.

Survey
The site is set in an area that has been excavated from the hillside to form a flattish site, and the construction of a high vertical retaining masonry wall (approximately 6.0m high), on the upslope north east side (which extends also to include Site 9). There are remnants of all four walls, but the building is densely overgrown with growing and fallen trees, and the walls obscured by ivy. The plan form of the building is shown in detail on Fig 8. The east and west walls are approximately 1.5m high, and the north wall 2.0m high. Internally it is approximately 4.7m from east to west and 3.8m from north to south.

Recommendations
Refer to Site 7.

Site 9 Mine building (possible Smithy) SX 45312 69848

Background
A building is shown on this site on the 1867 maps (Figs 7 and 8), and the later OS maps (Figs 9 and 10). It is thought that this may possibly have been the mine's Smithy. However, there are

no buildings labelled on any map that has been viewed, therefore this building has an unknown function (as well as Site 8). Alternatively, this may have functioned as a general store building – a track from the building leads to the main mine track south to New Quay.

Survey
This building is also set in an area that has been excavated from the hillside to form a flattish site, and the construction of a high vertical retaining masonry wall (approximately 6.0m high), on the upslope north east side. The building has more extant remains of all four walls than Site 8, but the building is also densely overgrown with growing and fallen trees, and the walls obscured by ivy. The plan form of the building is shown in detail on Fig 8. The east and west walls are approximately 1.5m high, and the north wall 3.0m high, with a probable central window. The south wall is more extant on the south east side (3.0m above ground level), but the east gable wall has collapsed (with evidence of a central window). The west wall had a doorway in its south end, the wall is now only 1.8m above ground rubble level.

Recommendations
Refer to Site 7.

Site 10 Waterwheel pit SX 45269 69892

10.1 Winding drum pit SX 45265 69889
10.2 Site of Crank housing SX 45271 69896
10.3 Header pond SX 45273 69906

Background
This feature is clearly shown on all archive maps, although the best detail is shown on the 1867 survey map (Fig 8). The water wheel appears to have mainly functioned to provide a power source to pump up water from Engine Shaft (via flat rods - Site 11), sited to the south east, and to also wind up ore from Whim Shaft (Site 16), sited to the north west. The wheel would also have been of 40' or 45' diameter (see Section 4.5.2), fed by the main leat (Site 1), and later an additional head of water provided by another leat (Site 4). The construction date of the water wheel is not known, however it may originate in the mid 1840s, when George & Charlotte was formed, primarily to wind from Whim Shaft (Site 16). As the mine's working levels deepened (and Engine Shaft (Site 11) was cut), it is likely the water wheel would have needed to be increased in diameter to also pump from the latter shaft (*pers comm*. Rick Stewart).

Survey
The 'wheelpit' is extant, although it is partially infilled at either end. The walls are approximately 12.0m long, visibly 4.0m deep (to rubble level), and 2.0m wide. A sycamore tree is growing out of its centre, and it is choked with vegetation and rubble, whilst the masonry is obscured by dense ivy and smaller sycamore trees are also growing from the top of the masonry walls. The north west end of the wheelpit masonry wall has collapsed at its west and east ends, whilst the south west wall has collapsed at its east and west ends. The central section of the wheelpit is constructed of granite stone and large killas, however the end sections are constructed of smaller killas (which has collapsed at the north end side). This may suggest a primary and secondary stage of development. However, this feature remains an impressive structure.

10.1 The wheelpit would have had a winding drum (set in a pit/slot) on its eastern side (as shown on Fig 8 - close to the Header Pond), to wind from Whim Shaft (Site 16, to the north west). This is evidenced by a slight depression on the north side of the north end of the wheelpit (4.0m long, 0.7m wide and 0.6m below surrounding ground level), bounded on its east

(upslope) side by a 1.5m long retaining wall.

10.2 On the western side of the wheelpit there is likely to have been a crank housing to transfer the circular motion of the crank on the wheel to a flat rod to pump Engine Shaft (Site 11), the flat rod going over the balance bob pit to the shaft pump rod.

10.3 On the north eastern corner of the wheelpit (north of the winding drum), a small header pond can be seen on Fig 8. However, this is not visible now at ground level.

Recommendations
As a feature of archaeological and historical interest the wheelpit and associated structures (Sites 10.1 and 10.2), should be cleared of vegetation and rubble etc, trees removed (and stumps treated), that are growing out of the walls which should then be repaired where necessary, repointed and the walls rebedded/capped with lime mortar. Consolidation specifications should be agreed with the Devon County Archaeologist.

Site 11 Engine Shaft SX 45284 69844

11.1 Balance bob housing and mountings SX 45285 69846

Background
Fig 6 shows the shaft in plan only (the section line is further to the north – following Main Lode), where it was cut to the 40 fm. level. *'Engine Shaft, 80 yds. S.E. of Whim Shaft, is vertical, lies south of the lode, and is connected to the 40 fm. Level by a crosscut N.E., 20 fms. in length'* (Dines 1956, 677). The shaft is not shown on any section plan. The shaft appears to have pumped water from the underground working levels by flat rod powered by the nearby water wheel. Whim Shaft (Site 37), would have wound ore up from the same 40 fm. deep working. Figure 13 shows the balance bob box housing and mountings which would have counteracted the weight of the pump rods in the shaft. The flat rod would have passed over the top of the balance bob structure and then connected to an angle bob sited at the northern edge of the shaft. Discovery and excavation of the shaft (with explosives), has been described by Bob Le Marchant (1980, 24 – 26).

Survey
The mine shaft is open, has extant stone collar walls, and is grilled at a depth of 3.0m below ground level. The stone collar extends to bedrock at a depth of approximately 5.8m below ground level. The safety grill is constructed of railway rail and 5mm thick steel (in 0.15m square sections). Set against the east face of the shaft is a 6″ rusty steel water pipe, fed by a nearby square header tank (see Site 12 description for function). The shaft at surface is approximately 1.6m x 1.6m, and surrounded by low timber post and wire fence (0.7m high).

11.1 On the north west side of the shaft is a very good example of the masonry for a balance bob housing and mountings; however, it is obscured by ivy and vegetation (see Fig 13). The walls are approximately 2.2m high and 0.5m thick, the 'box' end being 3.0m x 4.0m. On the south and west sides the 'box' walls are approximately 1.5m above the height of the nearby 'slot' walls. The 'slot' mounting masonry is approximately 5.0m long, but infilled with vegetation.

Recommendations
As a feature of archaeological and historical interest the shaft and balance bob pit, should be cleared of vegetation and rubble etc, trees removed (and stumps treated), that are growing out of the walls which should then be repointed and the walls capped with lime mortar. Consolidation specifications should be agreed with the Devon County Archaeologist. There is no doubt that the shaft should be adequately fenced (and re-grilled), but after clearance and

conservation, this small complex would prove to be very interesting for members of the public, especially if site interpretation could illustrate the mechanisms that operated.

It should be noted that this shaft opens directly onto the course of the underground railway. Thus, any activity in this area may have a direct impact on the existing tourist route. It is recommended that the Mine Manager (Rick Stewart), is consulted concerning possible conservation project specifications. In addition, following a recent site assessment by HM Inspector of Mines (2010), it has been recommended that the mine shaft be fenced with a 1.8m high steel palisade (*pers comm*. Rick Stewart).

Site 12 Braithwaite header tank SX 45271 69884

Background
The late 1970s underground railway experience (see Site 33), also contains a reconstruction of a water wheel that is sited lower in Whim Shaft (Site 16), next to the railway tour route. The water wheel is activated by allowing water to fall (via the pipe set in the shaft (Site 11) from the Braithwaite Header tank), onto the wheel to force it to turn. The water flow into the pipe is actuated by the engine driver, during the underground tour. The plastic covered steel Braithwaite header tank (installed in the mid 1980s), is filled by a 6" water pipe further up the valley.

Survey
The plastic covered steel Braithwaite header tank is of modern construction (1980s) and is approximately 2.1m wide, 2.6m high and 4.0m long.

Recommendations
None – this functional feature enlivens the underground experience of mining.

Site 13 Mine Tracks: Morwellham to New Quay (via G & Ch Mine)
SX 45016 69918 to SX 45332 69720

13.1 G & Ch Mine to New Quay SX 45273 69879 to SX 45332 69720

Background
A mine track ran from Morwellham to New Quay (via George & Charlotte), as shown on Figs 7 – 10. Site 13.1 is a section of mine track from the lower dressing floors (Site 14) to the northern quay of New Quay. The historical background section of the mine (Section 4.5.2), does state that it used New Quay to assay and export its copper ore – presumably a cheaper alternative than Morwellham.

Survey
The main mine track from Morwellham to New Quay is still extant (part is a public footpath). The section of track running through the George & Charlotte mine sett, has essentially been used as the outside route of the Morwellham underground experience railway line, since its inception (early 1980s?). Within the last five years a new footpath route has been created from Morwellham to New Quay, by creating a new route higher up the hillside than the mine's buildings and shafts (see forthcoming TVMHP recording report by C Buck). The track from the mine to New Quay is still also extant, but the track is much more obscure and infilled. However, it could be re-instated and used for members of the public that have viewed either the surface archaeology of the mine to go to New Quay, or vice versa (or perhaps people who could leave the train at its turn around site, to see the surface features having experienced the

underground experience.

Recommendations
Slight ground clearance to re-establish the route of Site 13.1.

Site 14 Lower Dressing floor SX 45241 69914

Background
The lower dressing floor also undertook manual dressing of the copper ore (from Whim Shaft and perhaps the lower adits in the early years of the mine's development of the lode). These floors are shown and labelled on the front cover illustration. Figs 8 and 9 show the structures that existed at the time. However, there may have been a small stationary engine (as mentioned in the historical background section - Section 4.5.2), which powered a small ore crusher, although manual means of breaking ('bucking') the ore may well have predominated.

Survey
The ground is flat in places, but its character is mainly one of a large spoil heap cascading down the hillside. There is little evidence of any other dressing floor buildings (apart from Site 15, as shown on Figs 8 and 9), with the exception of a long stone retaining wall (3.2m high at its maximum height for a length of approximately 15.0m), which has collapsed in places, and a small building at its north end. There may have been a flat rod power source (from the water wheel Site 10), for turning other dressing floor machinery (although there is little site evidence of this). Water from the leat above could have been used for the ore dressing.

Recommendations
None, although it is recommended that the site is not disturbed. If funds permit, the long retaining wall should be conserved.

Site 15 Mine building (dressing floor) SX 45239 69923

Background
A building is shown on this site on the 1867 maps (Figs 7 and 8), at the north end of the long retaining wall (Site 14). This small building has an unknown function but was highly likely to be related to ore dressing.

Survey
The building has a visible south side wall which is 1.0m above ground level, with a doorway at its east end. The site is set in an area that has been excavated from the hillside to form a flattish site, and its east (upslope) wall is the long retaining wall (Site 14). The building is small (internally 2.2m x 4.0m).

Recommendations
As a building of archaeological and historical interest the feature should be cleared of vegetation, trees removed (and stumps treated), that are growing out of the walls which should then be repointed and the walls capped with lime mortar. Consolidation specifications should be agreed with the Devon County Archaeologist.

Site 16 Whim Shaft SX 45284 69844

Background
Both the front cover and Figs 5 and 6 shows the shaft in section and plan, where it was cut to approximately the 60 fm. level. *'Whim Shaft … about 80 yds .from the river, is on the underlie to*

Fig 14 Powder house (from east) (Site 18) C Buck 2005© HES

Fig 15 18th century lode back openworks (Site 23) C Buck 2005© HES

64 fms. below Deep Adit level, which it meets at about 10 fms. depth… The workings from Footway and Whim Shafts are all below Deep Adit level (see Site 34 for fuller description of stoping)*'* (Dines 1956, 677). The shaft appears to have been quite important to the mine; it was possibly the earliest shaft and the main shaft to wind up ore from the George and Charlotte side of Main Lode (as shown on the section plans). Discovery of the underground features of a 10' water wheel and surface slot (perhaps an angle bob), during the late 1970s in this shaft have been described by Bob Le Marchant (1980, Vol 3, 24 – 26).

Survey
The mine shaft is closed, has partially extant stone collar walls, and is capped with timber at a depth of 2.0m below ground level (measured from the north side of the shaft). The stone collar is partially collapsed on the north, west and east sides. The capping obscures the visible depth to bedrock. The shaft is not fenced and is rectangular and is 2.2m square.

Recommendations
There is no doubt that the shaft should be adequately fenced, but after clearance and conservation/rebuilding of the stone collar wall, this important shaft would prove to be very interesting for members of the public, especially if site interpretation could illustrate the winding mechanisms that operated.

Site 17 Mine waste dumps SX 451 699

17.1 Processed waste SX 45228 69893

17.2 Waste rock SX 45159 69936

Background
The mine waste dumps are shown on Figs 7 – 10 in two main areas. Firstly down slope of Middle Adit (Site 5) for the material brought out of that (upper) working, secondly, west of the lower dressing floor (Site 14). Material would have been brought up Whim Shaft (Site 16) and separated and processed on the dressing floor. Fig 8 shows this in quite good detail.

Survey
The processed waste is smaller in size and weight, resulting from the manual 'bucking' of the ore (see Site 14), and would have been located relatively close to the site where the ore was being processed (i.e. immediately north west of the ore floor – Site 17.1). The larger sized waste material would have been taken by tramrail further along the side of the valley (Site 17.2). When viewing the spoil heap it is possible to see where these different stages of the dressing process caused different waste sizes of rock.

Recommendations
None, although it is recommended that the site is not disturbed.

Site 18 Powder House SX 45276 70015

Background
The mine would have had its own powder house to store the fuse and gunpowder, sited away from general activity and not far from where it was needed – i.e. the main working adits. Site 6 is likely to have been a Powder House for use in the nearby Middle Adit (Site 5). This building (Site 18), is not far from Shallow Adit (Site 21), and is shown on the 1867 maps only (Figs 7 and 8). A photograph of the building is shown in Fig 14.

Survey
This building is rectangular and set in an area that has been excavated from the hillside to form a flattish site. The building has extant remains of three of the walls, but the tops of the walls are overgrown with ivy. Internally the walls are higher than externally as it has been cut into the hillside. The plan form of the building is shown in detail on Fig 8, with a winding track shown from the doorway to 'Counthouse Road' as labelled on the front cover reproduction of a mine section. The south west wall formerly had a central window, but is now 2.4m high on its south side internally. The north wall is 2.3m high internally, whilst the east wall is 1.9m high. The south east wall and doorway is missing. In plan the building is 5.0m long and 2.7m wide, the walls are 0.55m thick.

Recommendations
As a building of archaeological and historical interest the feature should be cleared of vegetation, trees removed (and stumps treated), that are growing out of the walls which should then be repointed and the walls capped with lime mortar. Consolidation specifications should be agreed with the Devon County Archaeologist.

Site 19 Counthouse SX 45374 69937 (DHER 37385)

Background
The Counthouse/Mine Captain's House is shown shaded in red on Fig 8, the 1867 Bedford Estates Map, as being habitable. From the map evidence it can be seen that two fields upslope of the house had been formed and cleared for use as a garden, and probable allotment and grazing area for animals (probably chicken, pigs and goats etc), in the mid 19th century. South of the house was another small building, which probably was an animal outhouse (hen house/piggery etc), and outside toilet.

It seems likely (as there does not appear to be a detailed site plan of this mine), that this complex of buildings housed the mine's administration, Mine captain's House, Smithy and Carpenter's Shop. The whole of this complex of buildings however, is private – with no public access. It is therefore deemed to be outside of the study area. However, the main habitable building is Listed Grade II. The Listing description is given below:

George and Charlotte Mine. Mine Captain's house, used as game keeper's house, now house. Probably c18, enlarged early-mid c19, with later c20 alterations. Granite and slatestone rubble with slate roofs with gabled ends. Plan formed by accretion, one long range built into side of hill; early building may have been originally 2-room and central passage plan with rear lateral stack, taller building attached to left of single depth plan. Range to right of 2 storeys and 3 windows, 12-pane sashes under eaves, ground floor right and left 16-pane sash with brick segmental heads, central door with segmental head in c20 porch. Straight joint to left to taller 2-storey block with 2 windows, has at ground floor 16-pane sash and 2-light casement with brick segmental heads, slate apron to casement to right, first floor has 16-pane sash and 4-pane casement. Left gable end has single-storey lean-to, right gable end blank, set into slope of ground with timber lintel in wall at lower ground floor left. Interior not inspected (Listing text).

Survey
Access into this site was not attempted as it is a private dwelling.

Recommendations
None – the building is statutorily protected being Listed Grade II.

Site 20 Site of Mine building (Miner's Dry ?) SX 45330 69980

Background
A rectangular shaped building with annex on its east side is shown on Figs 7, 8 and 9. The building had gone by 1904 (Fig 10). It seems likely (although there does not appear to be a detailed site plan of this mine), that this building housed the mine's Miner's Dry. An area has been cleared upslope of the building, perhaps as a store yard. The whole of this complex of buildings however, is private – with no public access. It is therefore deemed to be outside of the study area.

Survey
Access into this site was not attempted as it is private property.

Recommendations
None.

Site 21 Mine building SX 45360 69981

Background
This small building is not far from Shallow Adit (Site 21), and is shown on the 1867 maps only (Figs 7 and 8). Its function may be related to the operational working of the adit, or simply site toilets.

Survey
This building is small and rectangular. It is set in an area that has been excavated from the hillside to form a flattish site. The building has extant remains of two walls, but the tops of the walls are overgrown with ivy. The plan of the building is 2.6m wide and 3.0m long. The south west wall survives to a height of 1.0m, but the south wall is only 0.7m high. The north wall has been robbed, only the earth cut being visible.

Recommendations
Refer to Site 7.

Site 22 Shallow Adit SX 45374 69969

Background
Shallow Adit is shown on the front cover abandoned mine section, Figure 5 and labelled on Figs 7 and 8. It is sited just above *'Count House Road'*, and extends under Air (Adit) Shaft and Cross Course Shaft (Sites 24 and 25 respectively), eastwards towards Emily Shaft (Site 29 - the mine section is likely to be incomplete). The adit has been cleared by the Tamar Mining Group up to as far as Crosscourse Shaft (Site 25).

'… the lode was opened up by three adits on the eastern slopes of the Tamar valley and by six shafts... Shallow Adit Level, 200 yds. E. of the river and 14 fms. above Middle Adit, has been driven 76 fms. east'. (Dines 1956, 677).

It is likely that the upper section of the lode through which this (shallow) adit was cut, was mined in the preceding century (Site 23). *'The Tamar Mining Group (TMG) have excavated approximately 120 yards during the period 1999 to 2004, up to a 'run-in' at Crosscourse Shaft'* (pers comm. Rick Stewart).

Survey
The adit site was not visible during the site survey, as the site is within private ownership.

Recommendations
None, although it is recommended that the site is not disturbed.

Site 23 Lode back openwork SX 45385 69965 to SX 45555 69932

23.1 Costean Pits SX 4555 6993 to SX 4572 6996

Background
The surface lode back mining and exploratory costean pits are likely to date back to the 18th century (see Section 4.5.2). This is the only part of the site which appears to have relatively good evidence of early mine workings (see Fig 15). Both extend eastwards up the side of the valley. The location of the costean pits and subsequent narrow lode excavation (see Fig 18 for the extent of Site 23), shows that the lode was heaved by a north-south crosscourse (see Fig 4), further to the east. *'The lode is heaved 5 fms. left by the crosscourse on which Crosscourse Shaft* (Site 25)*, is sunk and is heaved about 10 fms. right by another east-dipping crosscourse that passes through Deep Adit Level 25 fms. W. of ley's Shaft* (Site 30)*'* (Dines 1956, 677).

Survey
The steep section of the narrow lode outcrop (Gunnis), is demonstrated to good effect from Site 21 up to Site 26 (possible shaft). The minimum width of the narrow openwork at its base is 0.8m, originally at its top surface edge to 1.5m width (but now collapsed back to 4.0 – 5.0m width), and a depth of 5.0m in places from surrounding ground level. However, the openwork (inclining to the north west), has been infilled in many places within the last century, by earth, stone and vegetation. The waste dumps are mainly on the down slope east side of the gunnis.

23.1 Although there are smaller circular costean pits around the edges of the main gunnis, the larger and longer pits/trenches are sited within the strip of woodland extending to the main road adjoining the east side of the project area. A track (extant nowadays), runs parallel and to the south. These numerous pits and trenches are approximately 7.0m long, 1.0 to 1.8m deep (some filled with water after rain), and averaging 0.5m at the base and up to 1.0m wide at ground level. The long rectangular pits are approximately 4.0 to 5.0m apart. These trenches and pits were initially searching for the back of the lode, and some larger pits shallow mining the top of the lode.

Recommendations
None, apart from retaining the site of the feature.

Site 24 Air (Adit) Shaft SX 45418 69962

Background
Both the front cover and Fig 5 shows the shaft in section; however, it is not shown on any plan. It is sunk to a depth of approximately 15 fm. to meet Shallow Adit Level (Site 22). The shaft would have been cut to mainly provide air, ventilation and access to Shallow Adit.

Survey
This small mine shaft is located on the east side of an overgrown forestry track, and on the same alignment as the openwork. The mine shaft is open to a depth of approximately 3.5m below track level, when it is choked. The bedrock is visible to surface level, and it has an insufficient metal pole and rope barrier. The shaft in plan measures 1.0m x 1.8m.

Recommendations
There is no doubt that the shaft should be adequately fenced (and perhaps grilled to permit a degree of visual access).

Site 25 Crosscourse Shaft SX 45427 69970

Background
Both the front cover and Fig 5 shows the shaft in section. It is not shown on plan, where it was cut to Deep Adit Level, the crosscourse extending to a lower depth. However, this shaft is sited approximately 60 fms above Deep Adit Level, thus giving the total shaft depth to be a minimum of 60 fms., although it is not known if the shaft was later deepened to follow the crosscourse lower than Deep Adit. *'Crosscourse Shaft, 90 yds. E. of Emily Shaft, is sunk on a crosscourse, underlying about 20° E., to Deep Adit Level …Midway Level (see front cover), between Middle Adit and Deep Adit extends 40 fms. E. and 105 fms. W. where it meets Crosscourse Shaft… A crosscut south from Shallow Adit Level at Crosscourse Shaft intersects a lode 5 or 6 fms. S. of Main Lode. This has been driven on eastward for 30 fms. and has also been picked up in a crosscut south from the 24 fm. Level, 70 fms. W. of Ley's Shaft* (Site 30)*, and driven on for about 5 fm.; no other work appears to have been done on it'* (Dines 1956, 677).

The shaft would have been important to the mine when it was being cut (to remove the mineralization from the crosscourse heave), but the shaft would have been quite crooked/inclined etc – so difficult to use for winding/pumping etc.

Survey
The mine shaft is choked at a depth of 2.5m below ground level, and is 1.4m x 2.2m in plan. There is a dilapidated post and three strand barbed wire fence surrounding the shaft.

Recommendations
There is no doubt that the shaft should be adequately fenced and a shaft warning marker added.

Site 26 Possible Shaft SX 45459 69969

Background
This collapsed feature, which resembles a shaft, is not shown on mine plans nor abandoned mine sections. It may have been a later re-working, or collapsed earlier working – as it is on the course of the earlier gunnis.

Survey
The mine shaft is mainly choked at a depth of 2.5m below ground level, except that the eastern side is choked at a deeper depth of 4.5m. The feature is 1.5m x 1.5m in plan. There is a dilapidated post and three strand barbed wire fence surrounding part of the shaft. The shaft is sited just below an overgrown track (former hedge line - Site 28).

Recommendations
There is no doubt that the shaft should be adequately fenced and a shaft warning marker added.

Site 27 Possible Shaft/Lode back pit SX 45509 69960

Background
Refer to comments in Site 26. This feature may equally be a lode back pit or shallow shaft in the older 18th century gunnies.

Survey
The mine shaft is mainly choked at a depth of 2.0m below ground level. The feature is 3.8m x 3.8m in plan. The south, west and east sides of the feature are cut into bedrock, whilst the north side is open into the gunnies alignment. There is no fence surrounding the feature.

Recommendations
If finance is available, this could be a site that merits further investigation (either desk based or fieldwork), to confirm whether this is a shaft or pit etc. If there is any doubt, the feature should be adequately fenced and a shaft warning marker added.

Site 28 Site of former hedge SX 45426 70020 to SX 45795 69342

Background
Figs 7 to 10 show a line from the NGR references given above. When compared with Fig 2 (1784 Gardner Map), this can be seen to be an old hedge line which formerly marked the boundary between Morwell Down and the steep Tamar Valley woodland. It is highly likely that mining operations (Sites 23, 27, 29 and 30), and the construction of mine access tracks, followed by mining closure, resulted in land to the east of the hedge line (within the study area), being cultivated with woodland (now conifers – managed by the Tavistock Woodlands Estate).

Survey
This former hedge line has been removed in previous forestry operations (approximately 20 years ago), in order to create a forest access route across the landscape.

Recommendations
None. However, it is recommended that the practice of removing former hedges to create new access routes, is stopped. Appendix (10.2) contains recommended guiding principles for the management of archaeological and sensitive features within the context of a working woodland environment.

Site 29 Emily Shaft SX 45531 69987

Background
The front cover and Figs 7 to 10 show the shaft in section and plan. Figs 7 and 8 also show the site of the shaft within its surrounding spoil mound. '*Emily Shaft, vertical to Middle Adit level, which it meets at 48 fms'* (Dines 1956, 677). It may well be the case that as the main lode was worked from west to east under the side of the Tamar Valley, that from the early 1850s (as Devon and Cornwall United Mine), after the large water wheel was erected (Site 2), that this shaft may have been the first recipient of the flat rod power source (for winding and perhaps pumping). After the lode went further eastwards, the flat rods were moved to Ley's Shaft (by the mid 1860s – see Fig 8 and Site 30). Thus, in the early 1850s this shaft appears to have been quite important to the mine; and at that time may have been the main shaft to wind up ore from Main Lode (as shown on the section plans). Furthermore, it is likely that of the few steam engines used on this mine (in the early 1850s), this shaft may have sited either the 20" Whim engine or 12" portable engine with hauling gear (see Section 4.5.2).

Survey
The mine shaft is closed, and has a partially extant stone revetment collar wall around it's (north and west side: 1.0 to 2.5m high). There is a wide choked depression within the waste rock debris enclosed by the revetment wall, which extends approximately to field ground level. There is a high spoil mound on the north side of the shaft, and the latter is partially (and poorly) fenced.

Recommendations
The shaft should be adequately fenced and a shaft warning marker added.

Site 30 Ley's Shaft SX 45659 70018 (out of study area)

Background
Figure 5 and Figs 7 to 10 show the shaft in section and plan. Figs 7 and 8 also show the site of the shaft within its surrounding spoil mound, and in addition, the route of the flat rods from the large waterwheel (Site 2), to the western side of the shaft is shown, whilst Fig 8 also shows detail of the long angle bob pit on the west side of the shaft, which transferred the horizontal motion of the flat rod to a vertical motion to pump the deep workings up to adit level. *'The chief shaft appears to have been Ley's … sunk on the underlie to 34 fms. below Deep Adit Level which is 83 fms. below the shaft collar… From Ley's Shaft there are no levels shown above Middle Adit Level though there are some old openworks on the back of the lode'* (ie Site 23 - Dines 1956, 677). After the lode went further eastwards, the flat rods were moved to Ley's Shaft (by the mid 1860s – see Fig 8 and Site 30). Thus, by the mid 1860s this shaft appears to have been quite important to the mine; as the main pumping shaft to un-water the deep working levels, as they extended eastwards, with a strong likelihood that it was also used to wind up ore using a small steam engine.

Survey
This site was not surveyed as it is located in a privately owned field. However, it can be seen that the shaft has a large circular spoil mound (as shown on mapping). The Tamar Mining Group (TMG), has confirmed that the shaft needs to be re-fenced, but that it is of great interest as it '*is one of the deepest accessible shafts in Britain, also that a pile of masonry rubble on its east side may be possible remains of a house for the 20" whim steam engine*' (*pers comm*. Rick Stewart).

Recommendations
The shaft should be adequately fenced and a shaft warning marker added.

Site 31 Stone outcrop SX 45516 69866

Background

Figs 9 and 10 show a round shaped feature, linked by a track from the nearby road at the NGR reference given above.

Survey

This outcrop juts out from the valley side and commands a spectacular view of the bends of the River Tamar, and specifically of Morwellham Quay. In the Victorian period, high landscape viewpoints were popular – especially for Sunday walks and painting hobby pursuits. However, within the past few years, the tops of trees are starting to obscure the view.

Recommendations

It is recommended that a few selective trees could be felled to once again return the site to its former panoramic glory.

Site 32 Charcoal burning platforms (Woodland areas)

Background
Charcoal burning platforms are likely to have been distributed around the steeply sloping sides of Sheepridge and Maddacleave Woods from the medieval (and/or post medieval) period.

These can be seen to a much greater degree in landscapes occupied by old deciduous mature trees than those that have been planted with conifers. Presumably ground landscaping for the conifer plantations have destroyed evidence for them.

Survey
The platforms measure approximately 4.0 to 5.0m long (along the slope), and 2.0 to 3.0m wide. They are cut into the hill slope giving a rear face approximately 0.5 to 0.7m high (dependant on the slope). They are distributed across the side of the hill from a quarter of the way up the slope to the steepest slopes.

Recommendations
Haulage and woodland management vehicles should not disturb these features. Refer to standard recommendations given for long term preservation of earthwork features in a working woodland environment (See Section 10.1).

Site 33 Deep Adit (Bastard's Level) SX 45185 69798

Background
Deep Adit is shown on section on the front cover abandoned mine plan and Fig 5, whilst Figs 6 to 8 show the site in plan. It is sited just above the River Tamar, and extends past Whim Shaft (Site 16), an internal shaft (or winze), the bottom of Crosscourse Shaft (Site 25), and past Ley's Shaft (Site 30) towards Downs Shaft (the mine section is likely to be incomplete, so it may have finally connected all the way to the Tavy Valley – see Section 4.5.2). It is likely that this adit was the main water drain for the mine, and access for materials etc.

'Below Deep Adit the 12 fm. Level extends for 8 fms. W. and 60 fms. E. and the 24 fm. Level for 45 fms. W. and 55 fms. E. The stoping shown on the plan is confined between Middle Adit and 12 fm. levels and extends 60 fms. E and 90 fms. W. of (Counthouse) shaft, but is patchy, less than 25% of the area having been removed'. (Dines 1956, 677).

See Site 37 for a description of the workings related to the construction of the Morwellham underground railway.

Survey
The adit roof is approximately 2.0m high and 1.8m wide. The adit roof, near the portal entrance is constructed of timber and supported partly by old re-used railway lines, for a length of approximately 30.0m (see Fig 16). Thereafter the adit roof and sides are the original rock face

Recommendations
None.

Site 34 Footway Shaft SX 45177 69898

Background
The front cover and Figures 5 and 6 show the shaft in section and plan. Figs 7 and 8 also show the site of the shaft close to Deep Adit (Site 33). *'Whim Shaft… is sunk on the underlie to 64 fms. below Deep Adit Level, which it meets at about 10 fms. depth;60 yds. S.W. of this is Footway Shaft sunk to the same depth… The workings from Footway and Whim Shafts are all below Deep Adit Level. From Footway, the 15 fm., 20 fm.,and 30fm. levels extend about 20 fms. W. while the 20 fm., 30 fm., 40fm., and 54 fm., levels block out the ground for 100 fms. E., the 40 fm. extending a further 100 fms. east. No stoping is shown in this part of the mine'* (Dines 1956, 677). The shaft also worked the lode under the River Tamar and into Cornwall (Harewood sett – see Section 4.5.2, in the early 1850s).

Fig 16 New railway route (Site 37) under George & Charlotte Mine via Deep Adit Level (Site 33) C Buck 2005© HES

Fig 17 Footway Shaft (Site 34) between new mine railway routes (Site 37); entry on left (Site 33), exit on right track C Buck 2005© HES

Survey
The shaft is shown in Fig 17. No record has been seen of its excavation and clearance by Morwellham (Bob Le Marchant) in the 1970s, as the railway line runs close by the north side, and returns close by the south side. The shaft is approximately 5.0m from the former entrance of Deep Adit Level. The shaft opening diameter is 0.9m x 1.3m, and is sealed with timber and steel mesh at a depth of 0.5m below ground level. A stone revetment wall appears to have been built from bedrock to ground level, within which it has been capped with timber. Three timber 'head winding gear' posts have been set over the shaft, the posts set in the shaft to a depth of 1.2m. A section of ladder has also been set into the shaft sides – all of which is for public interpretation, as the train goes past the shaft. '*The shaft is completely backfilled, and the current shaft collar is a replica*' (*pers comm*. Rick Stewart).

Recommendations
The shaft appears to have been adequately fenced, although it may be appropriate to add a shaft warning marker.

Site 35 Pump drain lobby SX 45258 69830

Background
This feature has been interpreted to be a pump drain lobby (*pers comm*. Rick Stewart). It connects to Engine Shaft (Site 11), at a point where mine water was pumped up from the 40 fathom level and out through this lobby.

The lobby has been cleared of debris by Morwellham (under the supervision of Bob Le Marchant – former mine manager) in the mid 1980s.

Survey
The 8.0m long pump drain lobby (from the River Tamar), is partially revetted with stone, its top edge 3.0m below track railway level. The portal opening is only 1.5m high and 1.0m wide, inside the steel gated and padlocked portal exterior. Water currently still drains out of the feature.

Recommendations
None.

Site 36 New Quay Adit Trial portal SX 45309 69729

Background

At the junction of the sawpit retaining wall and the north quay track retaining wall is another opening, which is a trial adit portal for George and Charlotte Mine. Presumably, this was a development search for a parallel lode to the south of Main Lode (an east-west lode as shown on Symons mine sett/lodes map (Fig 4). This is not labelled on the 1867 Lodes/Shafts Bedford Estate Map (Fig 8).

Survey

The stone arched adit opening is 1.4m wide and 1.7m high. The adit inside the portal is 1.5m high and 0.8m wide. There is clear water at the floor of the adit.

Recommendations

Given the possibility of increased public access to this site it is recommended that the adit

portal is grilled with a lockable gate. To minimise the effect of this on the appearance of the feature it is recommended that it is fixed into the side walls at a suitable distance inside the adit and the bars painted black.

Site 37 Site of underground railway route

SX 45185 69798 to SX 45287 69798

Background
Deep Adit (Site 33) was cleared of debris and re-timbered by Morwellham (under the supervision of Bob Le Marchant – former mine manager) in the late 1970s. The adit floor was laid with tram rails, which now takes the Morwellham underground railway guided tour. In 1985/1986 the 'Newquay Drive' railway tunnel excavation (through virgin rock), connected the side of Deep Adit (at a point approximately 200m from the portal), to a new railway tunnel portal (SX 45287 69798), via Engine Shaft (Site 11), and a reconstructed underground working water wheel.

Recommendations
The underground railway line is a wonderful opportunity for young and old to fleetingly experience the character of hard rock narrow lode mining. It is hoped that the underground railway will remain in place for many more years to come.

7 Site Inventory summary

This section of the report summarises the information and management recommendations presented in the Site Inventory (Section 6.0). The inventory table (Section 7.1) summarises all of the site recommendations for safety works and cross references these with other known site surveys. The second table (Section 7.2) prioritises consolidation works to masonry structures.

7.1 Summary Management Table of archaeological sites

Cornwall Historic Environment Service favours low-key approaches to health and safety treatment of mine shafts and choked adits. This report has been provided to guide works where they are deemed necessary and to advise the landowners of management of archaeological features and health and safety mitigation measures.

The significance ratings relate to 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.

Site No.	Site name	Page No.	NGR (SX)	Archaeological recommendations
1	Leat (Tav Canal to Gawton via G & Ch Mine and New Quay)	26	44867 70265 45398 69644	Clear vegetation if necessary
2 2.1	Wheelpit Site of balance bob pit	27	45153 70016 45161 70017	Assess structural stability, Consolidate
3	Header pond	27	45145 70020	Clear vegetation if necessary
4	G & Ch Leat	28	45118 70015 45262 69934	Clear vegetation if necessary

Site No.	Site name	Page No.	NGR (SX)	Archaeological recommendations
4.1	Vertical rock cut		45134 70016	Assess hazard, fence if necessary
4.2	Wheelpit (Site 10) tailrace		45271 69883 45299 69765	Clear vegetation if necessary
5	Middle Adit	28	45281 69946	Assess hazard, fence if necessary
5.1	Higher dressing floor		45274 69950	Clear vegetation if necessary
5.2	Balance bob pit		45282 69943	Clear vegetation if necessary
6	Site of Powder House	29	45330 69897	Site to be retained, undisturbed
7	Mine building	30	45284 69892	Assess structural stability, Consolidate
8	Mine building (Carpenter's Shop)	30	45302 69867	Assess structural stability, Consolidate
9	Mine building (Smithy)	30	45312 69848	Assess structural stability, Consolidate
10	Waterwheel pit	31	45269 69892	Assess structural stability,
10.1	Winding drum pit		45265 69889	consolidate
10.2	Site of Crank housing		45271 69896	Site to be retained, undisturbed
10.3	Header pond		45273 69906	Clear vegetation if necessary
11	Engine Shaft	32	45284 69844	Assess hazard, fence/grille if necessary
11.1	Balance bob housing and mountings		45285 69846	Assess structural stability, Consolidate
12	Braithwaite header tank	33	45271 69884 45302 69765	None (in use by Morwellham underground experience)
13	Mine track (Morwellham to New Quay via G & Ch. Mine)	33	45016 69918 45332 69720	Site to be retained, undisturbed
13.1	Mine track (G & Ch. Mine to New Quay)		45273 69879 45332 69720	Site to be retained, undisturbed
14	Lower dressing floor	34	45241 69914	Assess structural stability, Consolidate
15	Mine building	34	45239 69923	Consolidate
16	Whim Shaft	34	45246 69902	Assess hazard, fence/grille if necessary
17	Mine waste dumps	35	451 699	Remove cut and growing trees,
17.1	Processed waste		45228 69893	sites to be retained, undisturbed.
17.2	Waste rock		45159 69936	
18	Powder House	35	45276 70015	Assess structural stability, Consolidate
19	Counthouse	36	45374 69937	Private property
20	Site of Mine building (Miner's Dry)	37	45330 69980	Private property
21	Mine building	37	45360 69981	Private property
22	Shallow Adit	37	45374 69969	Private property
23	Lode back openwork (18C)	38	45385 69965 45555 69932	Assess hazard, fence if necessary
23.1	Costean pits		4555 6993 4572 6996	Assess hazard, fence if necessary
24	Air Shaft	38	45418 69962	Assess hazard, fence if necessary
25	Crosscourse Shaft	39	45427 69970	Assess hazard, fence if necessary
26	Shaft	39	45459 69969	Assess hazard, fence if necessary

Site No.	Site name	Page No.	NGR (SX)	Archaeological recommendations
27	Possible shaft/pit	39	45509 69960	Assess hazard, fence if necessary
28	Site of former hedge	40	45426 70020 45795 69342	Assess hazard, fence if necessary Assess hazard, fence if necessary
29	Emily Shaft	41	45531 69987	Assess hazard, fence/grille if necessary
30	Leys Shaft (out of project area)	41	45659 70018	Private property
31	Stone outcrop	42	45516 69866	Improve viewpoint, assess H & S hazard, fence if necessary
32	Charcoal burning platforms	42	Woodland areas	Sites to be retained, undisturbed
33	Deep Adit (Bastard's Level)	42	45185 69798	Site made safe
34	Footway Shaft	42	45177 69898	Site made safe
35	Pump Drain Lobby	43	45258 69830	Site made safe
36	(Newquay Adit/Trial)	43	45309 69729	Assess hazard, grille if necessary
37	Underground railway	44	45185 69798 45287 69798	Retain

7.2 Masonry structures requiring treatment

A number of structures (not including shafts and adits), identified during the survey will require urgent attention (both large and small). There will be the necessity for archaeological recording, if full consolidation and re-pointing works are to be carried out. However, it is recognised that some of the (few) standing buildings on the mine may not merit full consolidation (given the pressure of funds for works elsewhere on the mine), although the proximity of planned public access to some of these sites will determine the degree of consolidation that is undertaken.

- **Limited works** (shaded) means non-structural works, wall 'capping' and small areas of re-pointing where necessary for structural reasons to preserve the building. These sites do not necessitate a detailed building survey.
- **Structural priority** relates to an assessment of the long term structural competence of the feature and so prioritises works in the short/long term. **1** = urgent need for works (i.e. structural components failing), whilst **3** = less urgent needs for works.
- **Visibility (public access)** relates to proximity of features to existing permitted/adjacent public access. Public access is not related to designated routes – rather general public access throughout the project area.

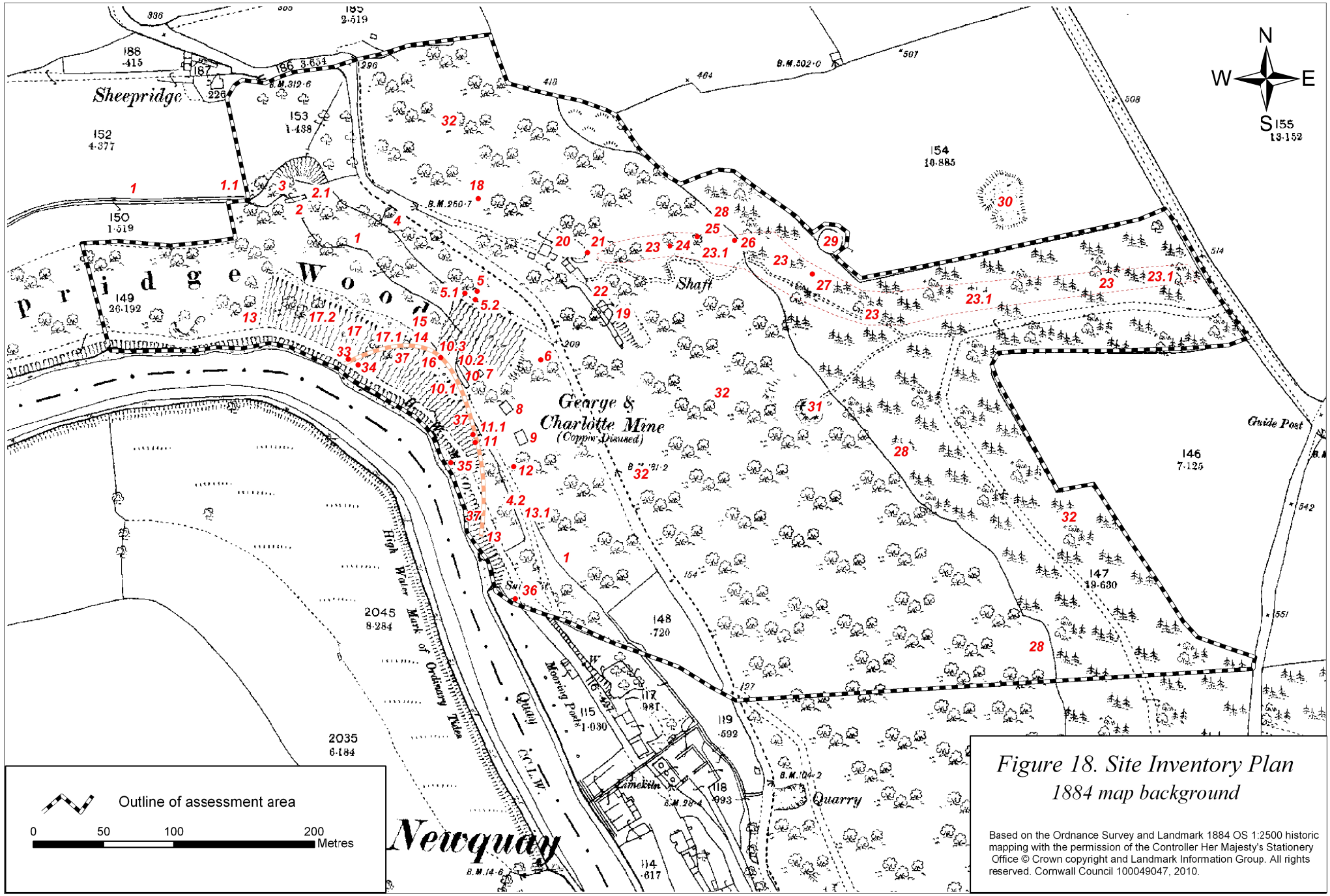

Figure 18. Site Inventory Plan

1884 map background

Site No.	Site name	Limited works (shaded)	Struct. Priority (1 – 3)	Visibility (public access)	Overall priority
2, 2.1	Wheelpit, flat rod balance bob pit		2	M	M
5.2	Middle adit flat rod balance bob pit		3	L	L
7, 8, 9, 15	Mine buildings		2	H	H
10, 10.1, 10.2	Wheelpit and associated structures		2	H	H
11, 11.1	Engine Shaft masonry and balance bob pit		1	H	H
16	Whim Shaft masonry		3	H	M
18	Powder House		2	M	M

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World Heritage Site Bid Partnership, 2005. *Cornwall and West Devon Mining Landscape, World Heritage Site Management Plan 2005-2010*

9 Project archive

The HE project number is **2010039** (George & Charlotte Mine).

The project's documentary and photographic archive is housed at the offices of Historic Environment, Cornwall Council, Kennall Building, Old County Hall, Station Road, Truro, TR1 3AY. A copy of the report will be deposited in Devon's Sites and Monuments Archive as well as a copy of all digital images.

The contents of this archive are as listed below:

1. A project file containing site records and notes, project correspondence and administration (File No. 2010039).
2. Digital photographs are archived in Cornwall's Sites and Monuments Archive (R:/Images/HES Images/Devon/George & Charlotte Mine 2010039).
3. This report is held in digital form at HE CC as: G:\Historic Environment (Documents)\HE Projects\Sites\Devon\George & Charlotte Mine (Assessment) 2010039
4. EH OASIS No. cornwall2-82904

10 Appendix

This is a reproduction of the 2005 TVMHP brief for production of assessment reports for mine sites from Wheal Russell to Gawton (including New Quay and the Bere Alston to Tavistock Railway line). This report has been produced to the same specification in order to achieve report consistency.

10.1 Tamar Valley Mining Heritage Project/Devon County Archaeological Service Project Brief (2005)

THE TAMAR VALLEY MINING HERITAGE PROJECT (TVMHP)

The wooded slopes of the Tamar Valley were once home to the largest metal ore mining operations in the world. In the 18th and 19th centuries, there was not a tree to be seen in the valley – the landscape was one of industry, transport and mining. The Tamar Valley Mining Heritage Project (TVMHP) aims to celebrate the area's rich industrial history as well as to improve access to the beautiful countryside which is now in its place.

The TVMHP is a partnership of several public and private organisations working together to conserve the mining heritage of the Tamar Valley. The lead accountable body is West Devon Borough Council (WDBC) who will be responsible for the financial administration of the TVMHP and the contract resulting from this tender. (www.tamarvalleymining.org.uk for more details).

Currently, the TVMHP is in what is known as 'stage I', where the partnership needs to undertake a programme of survey and strategic work in order to submit a bid for funding to progress the TVMHP to 'stage II'. The outputs from this contract will form a vital component of this work.

The Tamar Valley is a part of the Cornish and West Devon Mining Landscape candidate World Heritage Site bid. This bid is currently being assessed. In furtherance of the objectives of ongoing key strategies and programmes for the Tamar Valley an archaeological assessment and management survey of an extensive area of mining activity on the Devon side of the Tamar Valley is being proposed. This survey will focus on the workings of the Russell Mine, Gawton Mine, Newquay and Tavistock – Bere Alston Railway. The information provided by this survey will be used to inform land reclamation, access, interpretation and management proposals.

It is anticipated that the programme of work will address the following elements:

- The protection and consolidation of important archaeological remains and their settings.
- Interpretation of the site to the public including on-site and written materials.
- Provision of low-key public amenity use where appropriate incorporating limited public access.
- Health and safety aspects of the site relating to public access and environmental pollution.
- Identification and safeguarding of important ecological areas.
- Facilitating support for existing appropriate site uses such as forestry.
- Linking the site into the local economic, social, tourism and recreational contexts.

BACKGROUND INFORMATION

The Sites

The mine sites and New Quay are located on the east bank of the River Tamar between the

A390 to the north and Bere Alston to the south. Most of the sites are privately owned and much of the area is utilised for commercial forestry. The sites show extensive evidence of past mining activity. Numerous old mine shafts, spoil heaps and mine buildings and structures associated with the mining survive within the sites.

Historical Background
Metalliferous mining in the Tamar Valley dates back to at least the medieval period, possibly earlier. Lead and silver were mined from the 13th century, with tin being exploited in the later medieval period. Shallow mining continued sporadically until the later 18th century, when deep mining lead to a boom in tin and copper production.

Although it is perhaps best known for its recent industrial heritage, the Tamar Valley landscape has been shaped by a long history of settlement and industry. It retains a rich and diverse rural and industrial heritage. For example the valley contains significant evidence for prehistoric and medieval settlement activity.

Statutory Designations
All the sites lie within the Tamar Valley Area of Outstanding Natural Beauty (AONB).
Note: Details of other landscapes and natural environment designations are available from the Tamar Valley Countryside Service. A number of buildings within the survey area are Listed Buildings because of their architectural or historic importance. These include both industrial and non industrial buildings. Most of Gawton Mine is a Scheduled Ancient Monument (DV1024). English Heritages Monuments Protection Programme review has identified a number of sites as being of national importance. For the purpose of this management survey, areas that are under consideration for Scheduling should be regarded as if they were scheduled. The site falls within Area 10 (Tamar Valley Mining District with Tavistock) of the candidate World Heritage Site Bid.

CONSULTANTS BRIEF
Introduction
The archaeological assessment will make full and effective use of existing sources information and surface inspection to record the location, extent, nature, quality and potential of the archaeological resource of this historic mining landscape. Areas of archaeological significance and potential and historic buildings and structures on the site will be assessed, including the type, likely date, nature, extent and depth of remains. The survey will consider the historic mining landscape, including associated and ancillary features, and the pre and post-mining archaeology of the area. Following the assessment further field evaluation work may be required in order to further assess the presence or absence of remains, their extent, nature, quality and character before determining appropriate mitigation with regard to reclamation and management proposals.

The Assessment & Survey
The assessment and survey shall consider the areas indicated on the attached plan. The assessment and survey will involve reference to and consideration of:

- Geological maps.
- Historical documents, maps, plans and other unpublished material held by the Mine Records Office, the Devon County Record Office and the West Country Local Studies Library (Exeter), and the Cornwall County Record Office and Cornwall Local Studies Library (Truro).
- Published sources including journals, held by appropriate record offices, local studies centres, libraries or other archives (a list of key published sources is listed in Appendix B).

Note: Many historic records, maps etc will already be accessible through existing published or unpublished sources.

- Information on mining operations held by individual organisations such as the Trevithick Society, other local special interest groups and caving groups. Such sources may be identified through consultation with the Trevithick Society, the Tamar Valley AONB service.
- Records held by the Devon County Historic Environment Record (HER) (Exeter).
- Historic landscape Character mapping for the area, available at the Devon HER.
- Devon County Council Property Practice survey of mine shafts.
- English Heritages assessment of industrial sites as part of the Monuments Protection Programme, together with documentation generated by subsequent filed visits by English Heritage MPP Archaeologists.
- Listed Building records
- Aerial photographs held by the Devon County Council HER and environment Directorate Library (Exeter) and Cornwall County Council (Truro).

Visual inspection of the whole site. Only a surface inspection is expected. The extent and condition of below ground mining features will only be assessed through existing sources of information and surface indicators.

Note: Below ground survey would involve particular survey expertise and health & safety requirements and may form part of recommendations arising from this assessment. Information on the below ground extent of workings and their present condition may be available from a combination of historic records and information from local caving groups.

The consultant is to allow for clearing vegetation to allow inspection of features where it is reasonable to do so by hand. Where tree felling clearance is necessary by machine, the consultant is to refer to the technical team manager.

A black and white and colour transparency photographic record of the salient archaeological features, buildings and structures, a selection of the full range of such features etc. across the site, and features illustrative of potential management issues as appropriate.

A full photographic record of individual features etc. may form part of recommendation arising from this assessment. Any constraints on the above sources should be noted, for example, where primary information is not available or is unreliable or where access to land was not possible.

Client Requirements

The assessments and surveys will be carried out by a professional archaeological Unit or Consultant with appropriate experience in industrial archaeology. The implementation of the brief will be monitored by the Devon County Archaeological Service the Tamar Valley Mining Heritage Project and the nominated World Heritage Site partnership archaeologist. The archaeological Consultant will be responsible for agreeing monitoring arrangements with the above services.

The Archaeological Consultant will submit a statement on its Health and Safety policy with regard to this project, and undertake and document a Risk Assessment prior to fieldwork taking place. The Archaeological Consultant will liaise with the Tamar Valley Mining Heritage Project regarding land ownership and access prior to fieldwork taking place.

PRESENTATION OF RESULTS
Final Survey

A final survey report with supporting plans, photographs and appendices will be prepared. This will include:

A summary of the history and evolution of the mines and their environs, the range of features visible and an assessment of the archaeological and historic importance of the sites and these features. The local, regional national or international importance of the archaeological resource should be considered with reference to the Secretary of States criteria for scheduling (see PPG16 Archaeology and Planning, 1990, Annex4) and English Heritages Monuments protection programme Step 1 reports for the Arsenic and Copper industries (March 1993).

Gazetteer

- A full gazetteer of individual features, buildings and structures of archaeological and historic interest. For each building/structure etc, the gazetteer will include:
- Survey number (as will appear on accompanying site plans).
- Cross reference to previous survey/database (such as HER, Fredrick Sherrell).
- Title of building/feature.
- National Grid reference (s).
- An indication of the relative significance of the building/feature.
- Historic and documentary background to the building/feature
- Survey description including present condition.
- Management recommendations, in relation to the developing access, interpretation and management proposals being prepared by the TVMHP.

Note: Examples of the required level of recording can be found in Buck, C. 2002 Devon Great Consols Mine Archaeological Assessment Cornwall Archaeological Unit.

- Plans and Photographs
- Areas of archaeological survival, individual surviving buildings, structures and features, and areas of archaeological potential and areas where all archaeology is considered to be absent or to have been destroyed, will be indicated on Ordnance Survey or (OS based) plans at scale of not less than 1:2500. master plans at appropriate scales (e.g. 1:10,000 or 1:25,000) will also be prepared.
- Schematic section plan(s) at an appropriate scale indicating topography in relation to the range of identified features and the former below ground extent of mining.
- All plans to be prepared in paper format and in .dwg or .dxf compatible digital format.
- Reproduction of appropriate historic maps and plans and a selection of appropriate photographs.

Proposals

- Draft Written Scheme of Investigation, covering recommendations for further work relating to development of the site.
- The gazetteer and plans will identify key areas, buildings, structures or other features that are potentially of national or regional importance and should be preserved in-situ.
- The gazetteer and plan will identify areas where the nature, extent or quality of the archaeology is uncertain and can only be verified by further evaluation.

- Management proposals will be prepared in consultation with the rest of the technical projects team, in particular the geotechnical and structural engineering consultants and the project quantity surveyor.
- Full bibliography and list of sources consulted.

Draft and Final Copies of Report
Prior to production of the final report a draft of the text, gazetteer and sample plans will be circulated to the interested parties for comment. These will include, but may not be restricted to; West Devon Borough and Devon County Councils, the World Heritage Site team, English Heritage and the site owners.
A copy of the text and gazetteer will also be provided in digital form to the Tamar Valley Mining Heritage Project for selected incorporation within related management documents.
The gazetteer will be incorporated into the TVMHP site and works database.
Six paper copies and one digital copy (format to be agreed) of the final report and gazetteer are to be produced by the consultant. In addition, a full survey archive will be prepared and deposited with Devon County HER in paper and digital format

PROJECT MANAGEMENT:
The project is managed by the Tamar Valley Mining Heritage Project (TVMHP) steering group. The overall project manager is Tim Selman. Technical projects managed by Pete Leaver of David Wilson Partnership. An archaeologist has been appointed to act in an advisory role for the whole project.
The consultant will need to liaise closely with the rest of the technical team in preparing recommendations, in particular the geotechnical and structural engineering consultants. Geotechnical and mineralogical surveys have been commissioned for Gawton mine. A structural engineer has been appointed to provide advice on protection of the Gawton chimney and on other structures as necessary. An engineer is to be appointed to advice on protection of structures on the Tavistock – Bere Alston Railway.

The consultant will be encouraged to work closely with the landowners, but will take their direction from the project manager. Any differences between the project brief and the owners' aspirations will be resolved by the project manager.

BACKGROUND INFORMATION / CONTACTS
General
The Stage 1 Heritage Lottery Bid documents, including cost estimates and project description, are available to the successful consultant. An electronic copy of the stage 1 bid business plan is attached. Ordnance Survey base maps are available in printed or digital format.

Contacts:
Bill Horner
Devon County Archaeological Service,
Environment Directorate, Matford Offices,
County Hall, Exeter, Devon, EX2 4QW. Tel: 01392-382494,
Email: whorner@devon.gov.uk.

TVMHP manager:
Tim Selman
Tel 01579 351681
Email tselman@tamarvalley.org.uk

10.2 Management of archaeological features in woodland environments

(summarised from Hooley, D., Smallacombe Downs - an EH management plan report)

This text provides general guidelines to enable short and long term conservation of the archaeological resource of Devon Great Consols alongside the ongoing and future exploitation of timber by Tavistock Woodlands.

The management principles are applicable across the entire site wherever archaeological remains have been identified within this report (or are currently known or subsequently discovered). It should be noted that management of specific archaeological site types can vary in extent and frequency. However there is a need for number of short term principles and practical measures to minimise archaeological damage in the current forestry cycle, leading to longer term management objectives. The Tamar valley WHS (Area 10) includes the Devon Great Consols project area, as well as all other Tavistock Woodlands Estate areas owned by Lord Bradford.

All of the mine sites should have an archaeological management plan designed to provide long term protection of the archaeological resource. It is preferable if this is combined with other site constraints (ie ecological etc) to produce an overall management plan with related site plans showing the variety of site significances and different phasing of works. This can then inform and guide the Estates Manager and Tavistock Woodlands.

'…the nature, disposition and intensity of archaeological damage (including both degradation and destruction of archaeological remains) varies considerably through the forestry cycle. The greatest risks and incidents of damage are focussed into relatively short periods during the decades of the overall cycle: these most damaging episodes occur during ground preparation where ploughing is employed, during clear-felling and during brash clearance. More gradual insidious damage of varied intensity occurs through the decades of tree growth' (Section II, 3).

Statutory guidance is given by the Forest Authority*; 'no new planting should occur in areas identified for archaeological conservation'*, with the recommendation that the unplanted area should extend at least 20.0m beyond the outermost recognised feature (Forestry Authority 1995, 4, Guideline 1).

Archaeologically sensitive areas are defined as those shown as archaeological features on the site inventory map (Fig. 38), existing SM areas, or any other known archaeological sites.

Short term conservation of surviving archaeological remains:

- Standing timber within archaeologically significant and sensitive areas (as defined within this report or other known areas not defined in the report), should be felled by hand where appropriate (leaving the root ball in-situ to ensure that the archaeological feature is not affected), and the stump treated.
- There should be a presumption <u>against</u> infilling features (i.e. leats etc.) within archaeologically sensitive areas.
- It may be necessary, (after archaeologically sensitive areas have been cleared of cut branches and trees), to construct a permanent boundary (perhaps by a fence) to restrict access.
- The methodology (and route) of removing cut trees should be agreed with the County Archaeologist and Estates Manager (where the preservation of archaeological features may be compromised).

- Prior to the clearance of trees and brash (and any subsequent boundary fencing), the archaeologically sensitive areas defined above must not be used for creation of timber storage/loading bays, forestry roads, drainage ditches or the passage of vehicles (which should be along pre-designated routes).
- The forestry manager and the County Archaeologist should liaise to ensure appropriate and sufficient timing of actions by both parties necessary to implement the principles of this short-term management plan (and to ensure that forestry workers are briefed on the general principles).

Long term conservation of surviving archaeological remains:

- It is preferable if the management of archaeologically sensitive features is undertaken in a systematic and phased approach – based on an agreed Management Plan framework for a number of years in advance.
- The areas of surviving archaeologically significant features (including the full extent of all Scheduled Monuments), are recommended to be taken out of the existing forestry cycle, and remain unplanted in future forestry cycles.
- Areas to be taken out of the forestry cycle to include a 3.0m wide protective margin beyond the outermost limits of the archaeological feature (as defined by an archaeologist recommended by the County Archaeologist).
- The archaeologically sensitive and significant areas defined above must not be used for creation of timber storage/loading bays, forestry roads, drainage ditches or the passage of vehicles (which should be along designated routes).
- The archaeologically sensitive areas must not have trees felled into them from beyond their boundaries.
- Timber extraction routes must not cross or impinge upon archaeologically sensitive areas except where specifically permitted in the detailed management plan.
- Wind thrown or wind-felled trees which fall within archaeologically sensitive areas should be removed under archaeological supervision.
- The forestry manager and the County Archaeologist should maintain liaison to ensure appropriate and sufficient timing of actions by both parties necessary to implement the principles of this long-term management plan (and to ensure that forestry workers are briefed on the general principles).

Excerpts from:

Hooley, D., 1999, *Smallacombe Downs, Bodmin Moor* (EH woodland management report)

Revised by Colin Buck 8/9/09
Senior Archaeologist
Cornwall Council

10.3 Glossary of mining terms

ADIT A level tunnel (usually driven into a hillside) in order to give access to a mine, and used for drainage or the hauling of broken ore. Deeper adits did not necessarily connect to surface, and were used to carry water back from distant workings to a pumping shaft.

ANGLE BOB A simple lever-based device using which the direction of a reciprocal motion (of pump rods, flat rods) could be changed (for example from horizontal to vertical).

ASSAY HOUSE The mine laboratory, where samples or ore were analysed for their mineral content.

BAL or BALL From Cornish "*Pal*" a shovel, and hence "a digging" = a mine. Generally applied to earlier mines. See also WHEAL.

BALANCE BOB A large counterweighted lever attached to the shaft pump rods and used to offset their weight and thus reduce the work of a pumping engine to lifting water alone. A surface balance bob would be mounted adjacent to the shaft on a pair of plinths or on a masonry support at ground level (balance bob mounting), the attached counterweight - a large box filled with scrap iron or rocks - working in an adjacent stone-lined pit. Other balance bobs would be installed in chambers cut into the rock adjacent to the shaft wall as needed to counterbalance the weight of the pump rods, especially on a deep shaft..

BAL-MAID A woman or girl employed at surface on a mine, generally in the dressing of ore.

BEAM-ENGINE A type of steam-engine much favoured in Cornwall for use in pumping, winding, and providing the power to crush ores preparatory to dressing on Cornish mines. The power from a large cylinder set vertically in an engine-house was transferred via a massive rocking beam or bob to the pumps in the shaft outside. For winding and crushing, the bob was instead attached to a flywheel and crank on a LOADING next to the BOB-WALL (or in the case of all indoor engines, the side wall). In most cases, the engine house formed an integral part of the framing of the engine.

BEDSTONE The granite slab which formed the foundation for the cylinder of a Cornish Engine.

BLOWING-HOUSE An early form of tin smelting furnace, small in scale and using charcoal as a fuel.

BOILER HOUSE A generally lightly-built structure attached to an engine house, and designed to contain the horizontal boilers for a steam engine; the associated chimney stack may be attached to this structure, or built into one corner of the engine house.

BRATTICING Timber partition work in a mine, for instance the LAGGING BOARDS which lined the upper section of a shaft where it ran through soft ground. This is also specific to ventilation.

BUCKING The breaking down of copper ore on an anvil to about 10mm in diameter by bal-maids using small hammers, after which the ore was separated from the waste by hand. This process followed cobbing, in which it had been broken down to about 25mm in diameter, the waste again being hand removed. These processes, through which the majority of the highest quality copper ore was recovered, took place within roofed structures called bucking houses.

BUDDLE A device for concentrating tin ore. In the mid-19th century these most usually took the form of a circular pit with rotating brushes; the tin from the stamps was fed into the centre or side of the pit and was graded by gravity, concentrating the heavy ore near the inlet point. These were often mechanically worked. Earlier buddles were trapezoidal in shape, and manually operated. A variation used in tailings works to treat sands and slimes was the ROUND FRAME: a free-standing, all wooden, mechanically-actuated buddle, whilst a further variation was the dumb buddle or dumb pit, which was not mechanically operated.

CALCINER A furnace and heating chamber in which ores were roasted to drive off impurities such as sulphur and arsenic. These were also known as Burning Houses, later patterns being of REVERBERATORY design. The Brunton pattern calciner, introduced in the mid-19th century, was mechanically powered, and operated on a continuous basis, unlike earlier designs. Other patterns of calciner were also devised, the majority named after their designers (e.g. Oxland, Hocking and Loam).

CAPSTAN A manually or steam-operated winding drum, usually installed on a mine to raise pitwork from the shaft for maintenance or repair.

CATARACT PIT (or cock pit) A sub-floor area within the foundation levels of an Engine house between the Cylinder Plat and the Bob Wall, containing the regulating apparatus, and giving access to cylinder hold-down bolts.

CILL The base of a window or other wall opening.

COFFIN or GOFFEN The narrow excavation resulting from stoping on a lode being carried to or from surface on part or all of a lode. See also GUNNIS, STOPE, OPENWORK.

CONDENSER The cast-iron cylinder set in a tank of cold water immediately in front of the bob wall of an engine house in which the exhaust steam was condensed, creating a vacuum which greatly increased the efficiency of a steam engine. For a pumping engine this equipment was often contained within a pair of masonry walls projecting from the bob wall towards the shaft.

COST BOOK COMPANY A company of unlimited liability into which shareholders either paid 'calls' for further finance or shared any profits. Mines kept a 'cost book' to record expenses/costs/dues/earnings. This system was replaced by the end of the 19th century by limited liability companies.

COUNT HOUSE Properly ACCOUNT HOUSE, but generally shortened. The mine office, sometimes incorporating accommodation.

CULVERT A small tunnel constructed to carry a channel of water.
CYLINDER OPENING The often large, arched opening in the rear wall of an engine through which the steam cylinder was brought into an engine house during the erection of the engine. This opening was generally subsequently closed off with a timber partition and usually incorporated the principal doorway into the engine house.
CYLINDER PLAT The massive masonry base on which the cylinder of a Cornish Engine was bolted down (see also BEDSTONE).
DRESSING The concentration of the tin (copper or other ores) contained in the rock excavated from the stopes of a mine. Carried out on DRESSING FLOORS.
DRESSING FLOORS An (often extensive) area at surface on a mine where the various processes of concentration of ore took place - these consisted of crushing or stamping to attain a uniform size range, sizing (particularly on later mines), separation of waste rock, concentration (generally mechanically and hydraulically on tin mines, manually on copper mines), the removal of contaminant minerals (by calcination, flotation, magnetic separation), and finally drying and bagging for transportation to the smelter. Tin floors in particular were generally laid out down a slope to reduce mechanical or manual handling between stages in the process.
DRIVE (alternatively lode drive or heading). A tunnel excavated on the line of a lode as the first stage of the development of a STOPE.
DRY or CHANGE HOUSE (earlier MOOR HOUSE) The building within which miners changed their clothes before and after going underground. Some were heated by steam pipes connected to the engine boilers. Where there were large numbers of women or children employed on a mine, there might be two drys - one for men, the other for women and children. The pithead baths or showers found in collieries were rarely found in Cornwall.
DUMP or BURROW (alternatively spoil dump, spoil tip). A pile of waste material, usually from a mine or quarry. May contain primary waste (where this could not be disposed of underground) or waste from various stages in the dressing process. TAILINGS LAGOONS stored the extensive slimes from the final stages in the process; in earlier mines these were flushed over cliffs or allowed to wash away in streams or rivers.
EDUCTION PIPE The large diameter pipe through which exhaust steam was drawn into the condenser set outside the bob wall.
ENGINE HOUSE A building designed to contain steam, gas, oil or electric engines on a mine or other works. When forming part of the framework of a beam engine, these were particularly strongly constructed.
FATHOMS Measurement of horizontal or vertical distance at surface or underground (1 fathom is the equivalent of 6 feet)
FINGER DUMP A linear dump of waste material from a mine or quarry, flat-topped to allow material to be barrowed or trammed along it, and often equipped with a temporary tramway track.
FLAT RODS Reciprocating (or very occasionally rotative) iron rods used to transfer power from a steam-engine or water-wheel to a remote location.
FLUE A masonry-constructed tunnel or conduit connecting a furnace to a chimney stack
FRUE VANNER A mechanically-driven, laterally vibrated, inclined rotating belt on which fine tin-containing material in suspension in water was treated by relative density.
GIRDER The massive timber beam set across an engine house just below top floor level to which the parallel motion was attached and on which the spring beams sat.
GOSSAN The upper part of a mineral vein as it breaks surface. The natural weathering of the rock will decompose the metallic sulphides, characteristically leaving a porous rusty Quartz.
GUNNIS A narrow linear excavation left where a lode has been worked, most commonly used when open to surface. See COFFEN
HANG A TACKLE A temporary headframe construction with a winding mechanism to aid in the sinking of a shaft on a lode or to access a lode
HEAD or CROP The richest part of material in a buddle - nearest its feed point.
HEADFRAME The tall construction set over a winding shaft which carried the sheave wheels over which the winding ropes ran. Headframes usually contained ore bins or ore chutes to allow the broken rock in the skips or kibbles to be tipped into trams at surface.
HORIZONTAL ENGINE A steam engine where the cylinder(s) are set on a horizontal bed and the piston rods are attached via a cross-head to a crank and flywheel.
HORSE WHIM Similar to a capstan, but in this case power supplied by a horse walking around a circular platform (PLAT) was applied to an overhead winding drum; frequently used for winding from small shafts on Cornish mines, especially during exploratory work and shaft sinking. The smaller under-gear whims found in some 19th century farms were little used on mines.
JIG A large mechanically or hand-operated sieve set in a tank of water using which ore could be separated by waste. Sometimes constructed in groups within jigging houses.
KIBBLE A large, strongly-constructed, egg-shaped, iron container used for ore and rock haulage in earlier shafts. Superseded by SKIPS.
LAGGING BOARDS The timber planks lining the upper part of a shaft, or where it ran through soft ground.
LAUNDER A wooden or steel trough used to carry water or other liquids; often used to feed water or finely-divided material in suspension around a dressing floor.

LABYRINTH (colloquially "lambreth") A series of interconnected masonry-constructed chambers set adjacent to one another on whose walls the arsenic vapourised in a calciner or arsenic furnace was condensed out. The gas followed a zig-zag path through such groups of chambers, and one end of each chamber would be closed off with a door using which the condensed arsenic could be collected.
LEAT An artificial water-course, built to carry a supply of water to a mine.
LINTEL The horizontal timber or stone support above an opening in a wall or structure.
LOADING The masonry platform in front of an engine-house (or elsewhere on a mine) on which machinery such as cranks, flywheels or winding drums were mounted and on which the reciprocal motion of the sweep rod attached to the beam was turned into a rotative motion.
LOBBY The excavated cutting running up to an adit portal.
LODE A linear area of mineralization underground. In other parts of Britain a VEIN, or SEAM. Generally vertical or near-vertical, and often extending for considerable distances along its strike.
LODE-BACK PIT A shallow shaft dug from surface into shoad or the upper part (backs) of a lode, from which ore could be extracted from shallow stopes to the depth of the water table or just below. Waste material was generally dumped adjacent to the shaft mouth.
MAGAZINE Small strongly built store containing explosives (gunpowder or dynamite); often circular, sometimes with additional enclosing walls to contain the blast of an accidental explosion.
MELLIOR STONE The granite bearing stone in which the upright shaft of a HORSE WHIM ran.
MIDDLES The material in a buddle found between the crop and the tailings, this generally containing enough ore to warrant its re-treatment.
OPENWORK or BEAM. A mineral extraction site open to the surface, and similar to a quarry but usually distinguished by its elongated shape, and steep sides. Generally applied to features broader in extent than a GUNNIS OR COFFIN. A variety is a STOCKWORKS, where an area of ground containing a large number of small parallel lodes was removed wholesale.
OVERBURDEN The topsoil and subsoil removed in the process of opening or extending a quarry, streamworks or mine.
PELTON WHEEL A small enclosed water turbine, working at high pressure and rotational speeds. In use from the later 19th century.
PITWORK The term used to describe the pump rods, rising main, shaft guides (buntons) etc. within a shaft.
PORTAL The entrance to an adit beyond its LOBBY. Often timbered or stone vaulted.
PROSPECTING PIT/FOSSICKING PIT OR COSTEANING PIT A small pit dug in search of minerals, and almost always found in linear groups, often arranged cross-contour, or at right angles to the projected strike of known lodes or deposits of shoad. A COSTEANING TRENCH is a linear excavation cut for prospecting purposes.
RAG FRAME or RACK FRAME An inclined table-like surface on which very fine slimes in slurry form were treated to recover their tin. Large mines would have hundreds of such frames arranged in groups.
REVERBERATORY KILN A design of furnace in which there was indirect contact between the heat from a hearth and ore to be roasted, usually by incorporating a baffle flue.
ROTATIVE ENGINE A beam engine in which the reciprocating motion of the beam was converted to rotary motion via a sweep rod, crank, and flywheel.
SETT The legal boundary within which a mine could extract minerals.
SETT One of a series of stone supports for a tramway, performing the same function as sleepers.
SETT One of the components of timber framing of an adit where it ran through loose ground; also the timber framing of a shaft to which the shaft guides and LAGGING BOARDS were attached.
SHAFT A vertical or near-vertical tunnel sunk to give access to the extractive areas of a mine.
SHAKING TABLE A slightly inclined, mechanically vibrated table on which fine tin (as sands or slimes) in suspension in water was concentrated by relative density.
SHEARS or shear legs. A tall timber frame carrying a pulley or sheave wheel erected in front of an engine house over a shaft and used for the installation and maintenance of PITWORK.
SHOAD or SHODE Ore weathered from the load and moved (in geological time) down slope under the force of gravity. Material reaching a river valley would be to some degree concentrated before redeposition in horizontal beds. These beds of detrital material (placer deposits) were exploited in streamworks.
SKIP A (generally elongated) iron or steel container equipped with small wheels or brackets running on the shaft guides (buntons) and used for rock and ore haulage in later mines.
SOLLAR A timber platform in a shaft, stope or underground working (often between a series of ladders).
SPRING BEAMS The pair of longitudinal timbers extending from the rear of an engine house parallel to and on either side of the BEAM at top floor level. These served to arrest any unwanted excess indoor motion of the beam via catches set onto its rear and were extended out from the front of the house to form the foundation for the bob-plat (the timber platform from which the bearings on the outdoor section of the beam could be serviced).
STACK A chimney on an industrial site, used to carry away smoke or fumes from boilers, furnaces and calciners. Often situated at the end of a Flue.
STAMPS A mechanical device for crushing ore-bearing rock to a fine sand. Heavy vertically-mounted beams (or later iron rods) carrying cast or forged iron heads were sequentially lifted and dropped onto the prepared ore beneath

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