Joint Support Unit (JSU), Corsham

A Characterisation Study Of The Quarries, Their 20th-Century Defence Uses And Related Above-Ground Infrastructure

ENGLISH HERITAGE

oxfordarchaeology

November 2008
Issue No: 5
OA Job No: 3748
NGR: ST 384525

QUALITY ASSURANCE

Client Name:	English Heritage
Document Title:	Joint Support Unit (JSU), Corsham: A Characterisation Study Of The Quarries, Their 20th Century Defence Uses And Related Above-Ground Infrastructure
Issue Number:	Fifth draft
NGR	ST 384525, 169610
OA Job Number:	3748
Invoice code:	COBMODCO
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Date:	November 2008
Document file location:	Projects on server 1/ Corsham Characterisation Study/ Report
Graphics file location:	Projects on server 1/ Corsham Characterisation Study/ Geomatics

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GLOSSARY

ADTN *(abbr.)* - Automatic Dial Telephone Network

BAC *(abbr.)* - Bristol Aeroplane Company

BSA *(abbr.)* - Birmingham Small Arms Company

Burlington - Codename for 3 Site used between 1961-1963

CAD Corsham *(abbr.)* - Central Ammunitions Depot Corsham

CCC *(abbr.)* - Command and Control Centre/ Corsham Computer Centre

CDCN *(abbr.)* - Controllerate of Defence Communications Network

CDI Fan *(abbr.)* - Corsham Depot Inlet Fan/ Clift Drift Intake fan

CGWHQ *(abbr.)* - Central Government War Headquarters

Chanticleer - Codename for 3 Site used between 1969-c.1987

COI - Central Office of Information

Comcen - Communications Centre

DCSA *(abbr.)* - Defence Communication Services Agency

DE *(abbr.)* - Defence Estates

EH *(abbr.)* - English Heritage

HER *(abbr.)* - Historic Environment Record

HMSO *(abbr.)* - Her Majesty's Stationary Office

HPA *(abbr.)* - Heritage Partnership Agreement

GDC *(abbr.)* - Ground Defence Control

GIS *(abbr.)* - Geographical Information Systems

GL *(abbr.)* - Goods Lift

JSU Corsham *(abbr.)* - Joint Service Unit Corsham

MAP *(abbr.)*- Ministry of Aircraft Production

MDF *(abbr.)* - Main Distribution Frame

ML *(abbr.)* - Machine Lift

MOD *(abbr.)* - Ministry of Defence

MSLP *(abbr.)* - Main Surface Loading Platform (Tunnel Quarry)

NATO *(abbr.)* - North Atlantic Treaty Organisation

NMR *(abbr.)* - National Monuments Record

OS *(abbr.)* - Ordnance Survey

Peripheral - Codename for 3 Site used between 1987-199?

PL *(abbr.)* - Public Lift

PNCC (abbr.) - Primary Network Control Centre

PSA *(abbr.)* - Property Services Agency

QOC *(abbr.)* - Quarry Operations Center

RAF *(abbr.)* - Royal Air Force

RNSD *(abbr.)* - Royal Navy Storage Depot

ROC *(abbr.)* - Royal Observer Corps

Stockwell - Codename for 3 Site used between 1959-1961

Subterfuge - Codename for 3 Site used between 1954-1959

TARE *(abbr.)* - Telegraph Automatic Relay Equipment

TASS *(abbr.)* -Teleprinter Automatic Switching System

Turnstile - Codename for 3 Site used between 1963-1969

UKLF *(abbr.)* - United Kingdom Land Forces

UKMVO *(abbr.)* - UK Warning and Monitoring Organisation

VS Apparatus - Voice Frequency Apparatus

3 Site - Area used as the Central Government War Headquarters within Spring Quarry referred to under the codenames of Subterfuge, Stockwell, Burlington, Turnstile, Chanticleer and Peripheral

JOINT SUPPORT UNIT (JSU), CORSHAM, WILTSHIRE

A CHARACTERISATION STUDY OF THE QUARRY TUNNELS, THEIR 20TH-CENTURY DEFENCE USES AND RELATED ABOVE-GROUND INFRASTRUCTURE

SUMMARY

MOD Corsham is a multi-layered site which encompasses historic components, above and below ground, relating to 19th and 20th century industrial and military heritage. To provide an understanding of these developments English Heritage has commissioned Oxford Archaeology to complete a Characterisation Study aimed at achieving an holistic understanding of the site, and the relationship between the different entities through the course of its development. The study is predominantly map-based and this report accompanies a GIS database which includes the body of information. This will provide a context into which current and future development can fit whilst sustaining its distinctive attributes. MOD Corsham will, as part of a Private Finance Initiative in partnership with Defence Estates, the MOD and Inteq, be provided with new facilities both below and above-ground. This Characterisation Study is part of a broader English Heritage project, including an Artefacts Study and future Values Study, that will provide an understanding of MOD Corsham's historical development.

The history of the below-ground Study Area commenced in the 19th century with the quarrying of a labyrinth of mines including Tunnel, Spring, Clift, Groundstone, Sands, Copenacre and Pickwick quarries. The majority of these were converted for military use in the 20th century, thus removing much of the quarrying remains, but simultaneously creating areas of high survival particularly in the East and West Lungs of Spring Quarry. The advent of the Second World War and the increased awareness of the new threat of aerial attack signalled the most extensive phase of development within the Study Area. Tunnel Quarry was converted for ammunition storage and opened as part of the Central Ammunition Depot in 1938, Browns Quarry with RAF Rudloe Manor became in 1940 the Fighter Command Centre for No.10 Group, Spring Quarry was converted as a Ministry of Aircraft Production (MAP) factory in 1943, the west end of Tunnel Quarry was used as South-West Signals Control from 1943 and Copenacre and Pickwick quarries (and in 1945 part of Spring Quarry) opened as a Royal Navy Storage Depot. Clift (which includes Browns No.4), Groundstone and the East and West Lungs were used for ventilating these operational sites. Above-ground, a military landscape developed from the 1940s predominantly consisting of welfare facilities to service the establishment.

Following the end of the Second World War the quarries, with the exception of the MAP factory that largely proved to be a failure, continued in military use. Browns Quarry was converted to the Headquarters of the Controllerate of Defence Communications from 1977, but it is the conversion of Spring Quarry that is of particular interest. In 1961 conversion work was completed in the north section of Spring Quarry when it became the Central Government War Headquarters, evidence of the mutual distrust between the East and West. From here the Prime Minister and a nucleus of ministers and senior officials could conduct the survival and restoration phases of the Cold War. This vast nuclear bunker could accommodate 4,000 staff for 30 days divorced from the outside world. It was known under various code names such as Burlington and Subterfuge but today is referred to as 3 Site.

The Characterisation Study provides an holistic understanding of the historical development described above, and the relationship between different areas and entities both below and above-ground. This work is primarily based on map regression which was verified through a limited site survey, as well as aerial photography in analysing the above-ground built heritage. The approach taken was to produce 'Key Feature' maps of the quarries at significant stages of their development to illustrate prominent characteristics and components. Common features were colour coded to ensure continuity between the Key Feature maps and subsequent characterisation, for example lifts. These maps provided a base layer of information to inform the characterisation, which was mainly undertaken according to function and operation. In establishing typologies, it was important that these were capable of transcending different spaces and periods, both below and above-ground. For example 'command' includes the Prime Minister's office and the South-West Switching Centre, and 'welfare' comprises Barracks, Hospitals and Dormitories. Characterisation was also used to provide greater understanding of the overall development of the Study Area, such as the key phases of development. Finally, maps illustrating the survival of quarry features were produced, such as areas of the MAP factory which remain following the construction of 3 Site.

The same approach was used for the above-ground infrastructure to ensure correlation between the above and below-ground entities. In general the above-ground resource was developed from the 1940s to service the development of the quarries, although this was less extensive because of the need to ensure the secrecy of the below-ground activity. A Key Feature map was produced of the Study Area and characterisation according to function was completed, although it was not possible to establish which bodies operated exact structures during its historic development. Much of the analysis for the above-ground site was through aerial photographs, as fewer cartographic resources were identified than for the below-ground resource. A phasing map was completed of extant buildings, which also records the date each structure is first identified on aerial photographs. Prior to the 1940s, the landscape was predominantly rural with identifiable quarry features such as slope shafts, which are illustrated on the OS 1st Edition map. No cartographic resources were identified of the belowground resource for this period, however based on the site assessment maps were produced to illustrate the areas of high quarrying preservation.

1 INTRODUCTION

1.1 BACKGROUND TO THE STUDY

1.1.1 Oxford Archaeology has been commissioned to complete a Characterisation Study ('the study') of MOD Corsham ('the site') by English Heritage (EH) in partnership with Defence Estates (DE), the Ministry of Defence (MOD) and Inteq. This study has been prompted by a Private Finance Initiative (PFI) to provide new facilities both below and above ground, the project is entitled '*Corsham 09*'. This study is set within a broader project design (English Heritage 2007) including photographic recording, an artefacts study and a values study aimed at providing further understanding of the historical development of the site to inform its future development. The Artefacts Study took place in conjunction with this Characterisation Study, and its findings are presented in two separate stand alone volumes including a report and catalogue (Bennett 2008a and 2008b). This work focused on the Cold War artefacts, and its findings, where relevant, are incorporated within this report.

1.2 OUTLINE SITE DESCRIPTION

1.2.1 MOD Corsham is located in the rural landscape of Wiltshire, *c*.5 miles to the south- west of Chippenham (Fig.1). It encompasses an underground complex of 286 acres, and an above-ground overlying infrastructure including four MOD operational sites: Basil Hill, Rudloe, Hawthorn and Copenacre (Fig. 2). The majority of the below-ground areas under MOD operation are no longer active (although managed by a mines manager), with the exception of the Command Control Centre (CCC) and the Primary Network Control Centre (PNCC). Copenacre and Pickwick quarries have reverted to their original function and are actively quarried by Hansons, whilst a western section of Spring Quarry is used for data storage by Corsham Media Park. Geographically, the extent of the quarries below-ground is beyond that of the above-ground military infrastructure (shown on Fig. 2), and therefore the Study Area includes the wider civilian landscape (as explained in 14.2.5). This also facilitates an understanding of the wider social context of the industrial and military development.

1.3 PLANNING AND DEVELOPMENT CONTEXT

1.3.1 At present the Study Area below ground has no statutory protection, and the existence of the Cold War facility was classified information until 2004. Above ground, there are a number Listed Buildings within the Study Area; these are geographically illustrated in Figure 5, and described in the gazetteer. These are largely domestic buildings dating from the 17th and 18th Centuries and their protection is not related to any industrial or military function.

1.3.2 It is intended that the project will lead on to a conservation-based management agreement for the whole complex, as EH considers that the current means of heritage protection (listing and scheduling) are not appropriate tools for managing the historically sensitive areas and artefacts in the Corsham underground. It is therefore proposed to develop a draft Heritage Partnership Agreement (HPA) pending the legislative process envisaged following the White Paper 'Heritage Protection for the 21st Century' (March 2007). The overall aim of the HPA is to establish an agreed approach to managing change, allowing the development of the quarries for commercial and operational purposes whilst protecting their special historic interest (English Heritage 2007, Section 9.2).

1.4 HISTORICAL OVERVIEW

1.4.1 The industrial development of the site commenced with the construction of Box railway tunnel in 1841, which in exposing Bath stone led to extensive quarrying. The resulting vast labyrinth of interconnecting quarries and tunnels provided the resource and infrastructure for the later military use of the site. Those quarries included within this study are: Tunnel,

Spring, Clift (including Browns No.4), Groundstone, Copenacre and Pickwick (these are shown on Fig. 5). The key phases of their military development as described below are illustrated in Figure 3.

1.4.2 During the 1930s rearmament period, huge areas of the site were requisitioned by the War Office from *c*.1935 and adapted by the Royal Engineers. Tunnel Quarry was the first to open in 1938 becoming with Ridge and Monkton Farleigh quarries part of the Central Ammunition Depot (CAD). At the west end of Tunnel Quarry, the South-West Signals Centre opened in 1943 as one of three signal centres in England at this time. In 1940 Browns Quarry came into operation as the No.10 Group Fighter Command Centre, and in 1943 industrial operation recommenced in Spring Quarry under the Ministry of Aircraft Production (MAP). The central area of the quarry was used by the Bristol Aeroplane Company (BAC) for manufacturing aircraft engines, whilst that to the west housed the BSA Barrel Mill Company and the Parnell Turret Company. Clift and Groundstone quarries as well as the East and West areas of Spring quarries were used for ventilation.

1.4.3 This manufacturing largely proved to be a failure and closed in 1945 allowing space at the south of Spring Quarry for Royal Navy storage, which since 1939 had already been utilising areas of Pickwick Quarry. It is the central area within Spring Quarry, lying to the north of the Navy storage area which is of particular historical significance. This area, now known as 3 Site, was completed in 1961 to operate as the central seat of government during the survival and restoration phases of nuclear attack. From 1979 part of this complex (Area 2) was used by the RAF as a Quarry Operations Centre (QOC), and the site was maintained through the 1980s until it was decommissioned in the early 1990s. It was declassified at the end of 2004, as a result of the decision to develop MOD Corsham, thus providing the opportunity for this study.

1.4.4 The growth of the above-ground military infrastructure developed as a result of the conversion of the below-ground resource. For example Tunnel Quarry required the transport network and operational buildings to deal with the movement of ammunition, as well as welfare facilities to accommodate the men and their families. Aerial photographs from 1940 illustrate the huge construction project above Tunnel Quarry, which by the mid-1940s extended to the south in response to the conversion of Spring Quarry. The hostel blocks in particular were numerous (see Fig. 13) extending beyond the perimeters of the Study Area to Chippenham, some evidence of these remain within the Study Area as described in 7.3.7 and 10.3.8. Much of the infrastructure remains extant and continues in use by the MOD, particularly those features connecting the above and below ground entities such as lifts and shafts.

2 AIMS AND OBJECTIVES

2.1.1 The aim of this Characterisation Study is to gain a holistic understanding of the development of the site and the relationship between different areas and entities through the course of its development. At a broader level this includes for example the relationship between the above and below-ground areas, or the operational connection between different quarries. The study also aims to understand the development of the individual components within the site, such as the functional use of areas within 3 Site.

2.1.2 Characterisation has been developed by English Heritage as a tool with which to understand historical development through spatial analysis. At Corsham, this has allowed the various components of the site, both above and below ground, to be placed in relation to each other and their surroundings. The focus of characterisation is on providing context, an understanding of the historical continuity into which current and future development can fit, whilst sustaining its distinct attributes and sense of place. Characterisation has been used in managing our historic environment in England since 1994, and more recently has been employed at modern military sites with the first examples at Bletchley Park, the historic dockyards at Devonport and Portsmouth, former RAF Upper Heyford and RAF Scampton.

2.1.3 Characterisation is a map-based approach used to understand a site at different levels and to set it within its historical, cultural and social context. The use of Geographic Information Systems (GIS) allows the layering of spatial information, and the digital linking of maps, aerial photographs and databases. In doing this it is possible to view 'slices of time' in a site's history, such as the operation of the quarries between 1940-5; this is particularly useful for sites such as Corsham which have a layered historic development.

2.1.4 The product of the Characterisation Study is a GIS resource with this accompanying report produced to MAP2 standards. The majority of detail of this study is included within the GIS, with key maps included within this report. There is a vast quantity of material relating to the site in various locations, and is hoped that this study will provide a starting point for the cataloguing and archiving of this resource.

3 OUTLINE METHODOLOGY

3.1.1 The detailed methodology for this project is provided within Appendix I of this report. Overall the project took the following approach:

i. Phase 1: Scoping - this included a desk-based assessment of all resources and meetings with key stakeholders and experts. This work enabled a definition of the Study Area, which was agreed by English Heritage.

ii. Phase 2: Mapping and Data Interpretation - key cartographic sources of data were selected, these were digitised and related to the National Grid. This enabled a clear illustration of the relationship between the above and below-ground resources, and provided a base-layer in GIS which facilitated the site survey. The rapid below-ground survey was undertaken over a period of 4 days, to verity the results of the cartographic survey.

iii. Phase 3: Analysis, Synthesis and Conclusion - the main body of the GIS was undertaken at this phase, the approach taken was to produce the following digital maps of the different components of the Study Area:

- Key Feature Maps (Figures 10, 12, 16-18 & 20) - these illustrate the prominent characteristics and components of the above and below-ground areas.
- Characterisation Maps (Figures 8-9, 11, 13, 19 & 21) - these characterise the functions and primary operation for the above and below-ground infrastructures.
- Historic Remains Survival Maps (Figures 6, 14 & 15) - these illustrate areas of high survival and potential survival for the above and below-ground features.
- Additional Maps (Figures 3 & 15) - these were completed to illustrate key events or to provide greater understanding of the site, for example showing the key phases of development.

iv. Phase 4: Presentation of conclusions and results - the findings and conclusions of the study are included in this report which is structured according to the key phases of development in the following format:

- Part 1: Pre-19th Century History;
- Part 2: 19th-Century and Early 20th-Century Quarrying;
- Part 3: The Second World War;
  Tunnel Quarry: The Central Ammunitions Depot;
  Spring Quarry: The Ministry of Aircraft Production Factories;
  Copenacre, Pickwick and Spring Quarries: Royal Navy Storage Depots;
  Tunnel Quarry: The South-West Signals Centre;
  Browns Quarry: No.10 Group RAF Fighter Command Centre *and* ; CDCN Headquarters;
- Part 4: The Cold War
  Spring Quarry: 3 Site.

3.1.2 Each part begins with an overall summary and each section is further subdivided into:

- Historic context;
- Function and key features;
- Survival.

4 PART I: PRE-19TH CENTURY HISTORY

4.1.1 Archaeological features, Listed Buildings and Parks and Gardens are geographically illustrated in Figure 5 and described below.

4.2 PREHISTORIC PERIOD (500,000 BP - 43 AD)

4.2.1 There are no recorded sites or finds of Palaeolithic origin within the Study Area. Evidence for the Mesolithic period is given by the discovery of a Mesolithic adze at Drewitts Hill (**OA 16**), but this is an isolated find and cannot be used to demonstrate significant activity in this area during the Mesolithic period. Similarly, there have been few archaeological finds from other prehistoric periods, with only one find of Neolithic date, a flint axe (**OA 14**), one of the Bronze Age, a palstave (**OA 15**), and an isolated Iron Age posthole (**OA 1**) found during an archaeological evaluation east of Hudswell.

4.3 ROMANO-BRITISH PERIOD (AD 43-410)

4.3.1 At the eastern extent of the Study Area, two archaeological investigations (**OA 1**) have revealed evidence of a possible Roman settlement. An excavation in 1942 revealed a Roman inhumation within a stone coffin, along with a rubbish pit, coins, stone tiles and 2nd-3rd century pottery sherds, whilst an evaluation in 1999 recorded a Roman settlement at the same location.

4.3.2 There have been no recorded archaeological discoveries of the Roman period in any other part of the Study Area, but this may be in part due to the lack of archaeological activity carried out. It has been suggested by the NMR that the Bath freestone quarries in the western extent of the Study Area (**OA 9**) may have been worked during the Roman period, but this has not been proved.

4.3.3 Two undated square enclosures at Lower Rudloe (**OA 11** and **OA 12**) may indicate Roman or earlier enclosures, but cannot be dated without archaeological investigation. The Roman road from Bath to Silchester runs along the southern boundary of the parish, which suggests archaeological deposits of the Roman period may be present along this route.

4.4 THE MEDIEVAL PERIOD (AD 410-1550)

4.4.1 Little is known of the area in the immediate post-Roman period. The area contains the line of one major early-mid Saxon feature in the shape of the Wansdyke, a major defensive bank and ditch which lies to the south of Corsham. It traditionally marked the boundary between the kingdoms of Mercia and Wessex.

4.4.2 Corsham is mentioned in 1001 as *Coseham* meaning Cosa's Place, but is likely to have earlier origins. It is reported in the courtroll of Ethelred the Unready (978-1017) that the King stayed in Corsham (www.corshamtown.co.uk/history), and the Bath freestone quarries are thought to have been mined during the later Saxon period (**OA 9**).

4.4.3 Corsham is mentioned in Domesday as *Cosseham* (Ekwall, 1980, 123), and is listed as having quite a large population, and two mills; one probably at Lodbrook Water near Thingley Bridge, and one possibly near Court Farm, Thingley (www.wiltshire.gov.uk/community/getcom.php).

4.4.4 The Study Area contains a large number of medieval settlements, some of which went on to form the basis of post-medieval and modern villages (**OA 3**, **OA 4** and **OA 7**), whilst others have been deserted (**OA 5** and **OA 6**). In addition, an archaeological excavation carried out at Monks Conduit House in the early 20th century (**OA 2**) recorded a medieval church, whilst a medieval deer park was recorded in AD 1300 at Park Lane (**OA 8**).

4.5 Post-Medieval Period (AD1550+)

4.5.1 Corsham is shown on all of the 16th and 17th-Century county maps, although only as a village. It is not certain when Corsham gained the status of a town, but the large number of 17th, 18th and 19th-century Listed Buildings within Corsham and the surrounding area (**OA 100-157**), highlights the development of the area during the post-medieval period.

5 PART II: 19TH AND EARLY-20TH CENTURY QUARRYING

5.1 SUMMARY

5.1.1 The below-ground Study Area is a result of the quarrying of Oolitic stone from the mid-19th and early-20th centuries. Much of the evidence of this industrial activity has been lost to 1940s development although distinct areas of industrial remains survive. The highest level of survival is within the East and West Lungs as illustrated in Figure 6; of these, the West Lung retains the highest level of historic remains with unique evidence of quarrying activity and artefacts. The level of survival within East Lung is medium, as it was consolidated during the 20th Century, affecting the industrial heritage. Areas which were developed for military use including Spring, Tunnel and Browns quarries retain the layout of the original quarries. The Royal Engineers utilised and adapted the existing infrastructure; for example pillars were reinforced, the railway platform in Tunnel Quarry extended and access points strengthened.

5.1.2 Others areas which were not visited as part of this study but potentially contain quarrying remains are the eastern section of West Lung, the south-west area of Spring Quarry (now used as Corsham Media Park) and the intermediate area known as Thorney Pits. Groundstone and Clift quarries (including Browns No.4 Quarry) were not developed for MOD use (although Groundstone was used for ventilation to Tunnel Quarry), therefore these potentially contain industrial remains. Discussions with cavers however suggests that these do not have the level of survival evident within West Lung. Paradoxically, the 20th-century military use of the mines, whilst destroying the industrial heritage in some areas, resulted in high survival in others. The survival of East and West lungs is attributed to their use as ventilation which meant that they were left undeveloped.

5.2 HISTORICAL CONTEXT

5.2.1 Oolitic limestone had been industrially quarried in the locality of the Study Area since the beginning of the 18th Century, largely instigated by Ralph Allen who capitalised on the reserves at his estate at Combe Down. The industry expanded in the 19th Century with quarries opening in the Bradford-upon-Avon and Chippenham areas including Ridge, Eastlays, Elm Park, Brockleaze and Monks Park. This was facilitated by an improved transport system, with the construction of Avon Navigation (1797), Kennet and Avon canal (1810) and Great Western Railway (1862). At this time Corsham Station became an important connection point with stone exported to USA and Canada. Within Wiltshire it became one of the largest industries and by 1864 100,000 tons of stone per year were being dispatched from Corsham station alone (Perkins et. al 1979). By 1885 there were 12 firms operating in the Corsham area, seven of which amalgamated under the Bath and Portland Stone Firms Ltd. which by 1900 were producing 3,000,000 cubic feet of stone a year (McCamley 2007).

5.2.2 The 'Golden Age' of quarrying at Corsham dates from 1850-1910, which was instigated by Brunel's construction of Box Tunnel. This opened after fourteen years of construction in 1841, revealing the industrial potential of the Study Area. Endless seams of Oolitic limestone were evident and at the eastern end a secondary tunnel was driven into the hillside next to Box Tunnel to serve the stone quarry. The significant characteristic of the stone is that it is a freestone, so that it can be sawn or squared up in any direction quite independently of the alignment of the joints. Spring Quarry was the largest and most important of the Corsham quarries, producing fine quality, soft stone in large blocks, ideal for masonry. The inter-connecting quarries of the Study Area developed in a haphazard way with roads and tunnels joining in an ad-hoc fashion, this in part due to the multiple ownership of the quarries. The quarries are poorly documented but some information is tabled below (Unverified Author (The Heyday of Stone quarrying)).

QUARRY	DATE OF COMMENCEMENT	OWNER(S)	NUMBER OF WORKERS BELOW-GROUND IN 1894
Tunnel	1844	Yockney & Co.	86
Hudswell	Unknown	Bath Stone Co.	Unknown
East Lung	1840	Unknown	Unknown
Spring	1840s	W.S Pictors & Son	12
Sands Quarry	c.1890	Lucas & Allard & Corsham Quarrying Co.	21
Thorney Pits	Unknown	G.J Kidston	Unknown
West Lung	1840s	Northey	Unknown
Clift Quarry	Unknown	Bath Stone Firms Ltd.	43
Groundstone	Unknown	Unknown	Unknown
Picwick	Unknown	Marsh Son & Gibb	Unknown
Browns Quarry	Unknown	Unknown	Unknown
Browns No.4	Unknown	W.S Pictors & Son, Randell & Son, S. R Stone, Marsh & Co. and Bath Stone Firms Ltd.	6
Copenacre	Unknown	Marsh Son & Gibb and Lucas & Kinner	Unknown

5.2.3 The industry began to decline from about 1910, partly as a result of impositions placed by the USA against the importation of stone, but also as a result of the development of other materials such as concrete. There were seven mines still in operation within the Corsham area in 1935 but the Second World War finally marked the end of an era of quarrying (MVP Media unknown date). From the mid-1930s the War Office began requisitioning many of the mines. The high survival of industrial remains and artefacts within West Lung illustrates this abrupt end to stone quarrying.

5.3 FUNCTION AND KEY FEATURES

5.3.1 **Above-ground** (Figures 7 & 8)

5.3.2 The active quarries within the Study Area are identified on the OS First Edition (1873-1885) and are highlighted in Figure 7, these include: Hudswell (later part of the north-east perimeters of Tunnel Quarry), Seven Shaft, Spring, Thorney Pits and Clift as well as various unnamed quarries (Fig.7). By the OS Second Edition (1898-1900) Copenacre and Hartham Park quarries are also operational and the tramway system has further developed.

5.3.3 ***Access/ Transport*** is the most striking feature of the above ground landscape, the growth of quarrying necessitated the construction of infrastructure to transport the raw material.

Plate 1 - First Edition Ordnance Survey map (1873-1885): illustrating quarrying features (© Ordnance Survey)

This resulted in the construction of railways and tramways to carry the stone from the quarries to the wharves and the Great Western Railway (GWR). Within the Study Area the linear features of tramroads link up to the broader transport infrastructure (Fig. 8). To the east these extend from Hudswell and Spring quarries following the east/west alignment of the Great Western Railway (GWR). To the west they align and connect with the road running between Pickwick and Box.

5.3.4 Ventilation is illustrated through the evidence of air shafts which are identified and highlighted on historic mapping. This also serves to demonstrate the geographical extent of the below ground workings. For example, the air shaft to the north at Travellers Rest illustrates that whilst no quarry is marked on the historic OS maps there were below-ground workings (as illustrated by the outline of the below-ground Study Area.)

5.3.5 ***Welfare*** is poorly illustrated, with the only provision being Seven Shaft cottages, near Spring Quarry. These are retained within the 1940s military landscape, just to the south of the Main Surface Loading Platform and Basil Hill Road. They were likely to have been miners' accommodation, but the rows of terrace houses commonly associated with mining landscapes such as Combe Down are not evident within the Study Area.

5.3.6 **Below-ground** (Figure 6)

5.3.7 Key feature and function maps have not been produced for the below-ground quarrying operation of the Study Area, because it was not possible within the parameters of this study to plot the location of surviving cranes, rail tracks, working platforms or assemblages of tools. No detailed historic mapping was identified of the Study Area prior to military use, and little primary documentary information was located during the archive research. The areas predominantly characterised by 19th-century and early 20th-century quarrying remains are however illustrated on the survival map (Fig 6).

5.3.8 ***Extraction*** in the Study Area was carried out by the pillar and stall method, with no regular planned distribution of roof support but dictated solely by the run of stone fit for sale. This meant that where the stone was particularly good, it was extensively robbed, leaving pillars of different sizes. From *c*. 1840 cranes were used in transporting blocks of stone which were managed by a quarry ganger who was paid by cubic feet of stone brought to the surface. Wire ropes would probably have been used to carry the stone to a working platform and

Plate 2 - West Lung: crane (© English Heritage DP024174)

then to a wheeled cart or narrow-gauge railway waggon. Initially, quarried stone was hauled to the surface on waggons pulled by horses, and the waste 'gobbing' was left behind and stacked into the empty galleries to the sides of the haulage way. As the working face extended further, cranes would be moved deeper into the mine. The quarries were entered by steeply inclined slope shafts, up which trolleys were drawn by a cable-powered steam engine or electric winch.

5.3.9 ***Access/ Transport*** was dramatically improved when Randell and Sanders put a railway line into Tunnel Quarry, reducing transportation costs. The branch led to a platform over half a mile inside the mine and one hundred feet below ground; later this made it an ideal option for the transportation and storage of ammunition. It is known that by 1887 there were 60 miles of underground railways in Corsham alone (McCamley 2007). Within Tunnel Quarry main haulage ways such as the East Service tunnel at the south of Tunnel Quarry, and the Northern Service tunnel were constructed (and continued in use for transporting ammunition as shown in Fig.10). The latter connected to Hudswell Drift as shown in Figure 7.

5.3.10 Spring Quarry is divided into three major sections separated by geological faults; the main eastern section comprises over half the available area with two smaller areas to the north-west and south-west roughly equal in size. Despite the size there was only one slope shaft entrance to the quarry, located at the eastern extremities of the workings (McCamley 2007).

5.3.11 ***Ventilation*** within Spring Quarry was through ten air shafts located at intervals around the southern and western perimeter workings (McCamley 2007). The exact location of air shafts within the remaining quarries is not known, although it is probable that the Royal Engineers in converting the quarries to military use reinforced those existing.

5.4 Survival

5.4.1 *Developed areas*

5.4.2 The striking character of the below-ground military Study Area is the extent to which it still retains the appearance of a mine. Many walls remain as exposed stone faces which have not been rendered or painted; the surviving tool marks depict the use and development of working tools, from the wedge pickers of the 18th and 19th centuries to the Samson stone cutters of the 20th Century. Chug holes and Lewis slots are visible throughout; the latter being used to leap-frog cranes into new positions, whilst chug holes once held the bearings for the crane.

5.4.3 The Royal Engineers worked within the existing extent of the mines when converting them for military use, making use of the extant infrastructure and strengthening it as required. The overall layout was therefore retained with each mine operating as a separate entity. Access and transport features within Tunnel Quarry were retained and strengthened such as the haulage ways, the access from Box Tunnel entrance and the railway platform which was reconstructed and extended. It is the East and West Lungs however which most effectively characterise the quarrying activity, the latter in particular is a rare untouched survival of 19th-century mining remains.

5.4.4 *East Lung*

5.4.5 East Lung retains considerable evidence of its quarrying history, but its industrial remains have to an extent been compromised by re-engineering during the construction of the MAP factory and 3 Site. A central loading area remains extant with cranes visible behind piles of backfilled stone rubble. Quantities of later waste are also visible dating from the military occupation of the site, earning the area the title 'The Deads' as it was used as a dumping ground during the 20th Century. The height of the floor level clearly illustrates this point as debris has been compacted over the primary floor surface resulting in the burial of the original fabric.

Plate 3 - East Lung: reconstructed wall lining passageway (© Oxford Archaeology)

5.4.6 The basic layout of the 19th-century quarry is retained, including passage ways, but these are wider than typical of this period and now laid with concrete. They are lined by exhausted material and expanses of backfill, but are primarily constructed from 20th-century brick and concrete fabric with a clear stratigraphic sequence of events. Rubble forms the base layer, overlain by cut stone and bricks within the top layers which have been removed during the deconstruction of the MAP factory for 3 Site. Carvings within the stone date this work from the late 1950s. In some areas, walls have been constructed from the painted brick of the MAP factory, and the shuttered concrete of 3 Site illustrating that the area continued to be used during these phases (for ventilation). There is a distinct lack of 19th-century graffiti in comparison to West Lung, which is likely to be a result of this later if limited use.

5.4.7 *West Lung*

5.4.8 The level of survival within West Lung is remarkable and both the historic fabric and artefacts survive *in situ*, creating a time capsule of 19th-century quarrying history. The exact layout of the area has been retained with narrow paths containing narrow-gauge metal tracks winding their way around stone pillars, leading to loading levels and deep pits of stone. Here cranes survive, some with stone still dangling from hooks, and surrounded by assemblages of tools. Other cranes are hidden behind backfill, presumably too time consuming to remove. Saws, pincers, spades and jadding irons are left *in situ* as the quarrymen placed them on

Plate 4 - West Lung: breakfast bar
© Oxford Archaeology)

the ground expecting to return. Wooden barrows and rail tracks used for transporting stone lie forgotten, whilst breakfast bars (barrows filled with water) are hidden within backfilled stone waste, with thin paths revealing their location.

5.4.9 Graffiti carved in or written in pencil on the stone elevations provide an added social dimension to the space; strings of numbers indicate the calculations of stone and profit, and dates and times transport the reader back to a particular time: '*War Commenced Sept 3rd 1939/ ? and Townsend loaded block out September 8th 1939*'. Others provide an insight into the men working within the mines, with caricatures of faces and areas of origin: *J White, Brixton* smoking a pipe and *Shackle Pot Neddy* with a hook for a hand. Elsewhere figures, often women, have been artistically carved into the walls. All these survive in good condition and it is likely that many more lie hidden. Many of the wooden artefacts are decaying with time, the wooden components of some cranes have given way, and barrows and carts lie rotting. Rail sleepers have disintegrated to equally-spaced holes in the ground, easily damaged under foot.

5.4.10 Above-ground

5.4.11 Today, the Bath stone structures within the Study Area, for example the old Barrack Block and Regimental Institute are the most telling symbols of the industry. Within the current military landscape there is little evidence of the early industrial history, with the exception of earthworks in an open wooded area just to the south of Basil Hill Road. Here at the top of an earth mound are what appear to be the remains of the Slope Shaft to Spring Quarry, and just to the south it is possible to see the foundation of buildings that were once Seven Shaft cottages. The Slope Shaft is evident on the 1940 aerial photograph but has disappeared by that of 1946, by which time it is an open area with a cluster of structures to the west. Seven Shaft cottages remain extant on a 1967 aerial photograph. Whether they remain occupied at this date is not known, although it is considered unlikely.

6 PART III: THE SECOND WORLD WAR

6.1 SUMMARY

6.1.1 The advent of the Second World War signalled the most extensive phase of development within the below-ground Study Area encompassing Tunnel, Spring, Browns, Copenacre and Pickwick quarries (Fig 3). Operationally they functioned as separate entities as illustrated in Figure 10 but dictated by the change in military threat with the Second World War. Tunnel Quarry stored ammunition as part of the Central Ammunition Depot (CAD) from 1938 and also encompassed the South-West Signals Centre, which was a secure defence communications area. Spring Quarry was used as a Ministry of Aircraft Production (MAP) factory from 1942 mainly by the Bristol Aeroplane Company (BAC) but also the Parnell Turret Company and BSA Barrel Mill. Browns Quarry from 1940 was a secure underground centre for the No.10 Group RAF Fighter Command and Copenacre and Pickwick quarries served as navy storage depots from 1939 and 1942 respectively. Groundstone Quarry with Browns No.4 (part of Clift Quarry) were largely undeveloped, functioning only as ventilation for Tunnel Quarry. The remainder of Clift Quarry was not developed, and no information has been identified relating to Sands Quarry.

6.1.2 The survival of historic remains relating to the military use of the site is variable. Tunnel Quarry has been little altered since its operation with most of the key features surviving in good condition. The central north area of Spring Quarry was used during the Cold War as the Central Government War Headquarters resulting in the loss of many historic features, although the overall plan of the site was retained with its associated infrastructure such as access/ transportation, ventilation and plant. The area to the south of the quarry was used by the Royal Navy from 1945 for storage, which had the effect of preserving much of the structural fabric of the factory. The area to the west is used by the Corsham Media company, whilst other areas of Spring Quarry are inaccessible and therefore the extent of survival is uncertain. Browns Quarry served as the Headquarters for the Controllerate of Defence Communications Network (CDCN) from 1977, resulting in the stripping in full of the lower-level former wood-panelled operations room. Elsewhere, the layout of the area has been retained, but the 1940s fabric has been replaced by that of the later 20th century.

6.1.3 Copenacre and Pickwick quarries are situated to the northeast of the main Study Area and less is known about their use and survival. Both have reverted to their original use as active quarries and therefore it is unlikely that a high level of below-ground remains survive. Above-ground, much of the infrastructure relating to Copenacre survives, as do some of the operational buildings above Spring, Tunnel and Browns quarries (Figs. 12 & 15). Welfare structures account for the significant loss within the above-ground areas, predominantly the Hostel Sites, but also facilities such as the Test Plant and Laboratory. Infrastructure directly relating to the below-ground operation of the site, such as ventilation and access shafts, were retained but reinforced to meet the changed threat to a nuclear attack in the Cold War.

6.1.4 With the exception of the MAP Factory in Spring Quarry, the quarries continued in military use following the end of the war. Tunnel Quarry including the South-West Signals Centre, Copenacre and Pickwick quarries continued with the same operation but Browns Quarry took on a second role from 1977, as described above. The continued or second use of an area is explained within this section because such developments are more easily understood within their original context. However, the use of Spring Quarry as 3 Site is explained within the Cold War section of this report as this operation is clearly contrasting to that of the MAP factory.

7 Tunnel Quarry: Central Ammunition Depot

7.1 Historic Context

7.1.1 During the First World War little use was made of underground facilities but there was an increased awareness of the new threat of aerial attack. This is shown in the use of Ridge Quarry in 1915, located two miles from Tunnel Quarry, for TNT and cordite storage. It was abandoned shortly after the war, but illustrated how successfully the area could be utilised and paved the way for such expansion in the next World War. In the 1930s the War Office began investigating underground sites, and attention was drawn to Tunnel Quarry. It was in many ways ideal with 45 acres of storage space directly connected to the GWR main branch line which entered a side tunnel at the east portal of Box Tunnel. Proximity to a railway line was one of the principal locational factors, as it was a complex task ensuring the right quantity of ammunition arrived and departed from the correct space. In August 1935 outline approval was given for the purchase of Ridge and Tunnel quarries, and these with Monkton Farleigh were collectively known as the Central Ammunition Depot (CAD).

7.1.2 The threat of war caused acceleration of the re-armament programme and Tunnel Quarry commenced receipt of Army ammunition from factories on the 1st July 1938. The conversion work was undertaken by the Royal Engineers, with the clearance of an estimated 2 million tons of stone debris, facilitated by the installation of a temporary railway for the transportation of material.

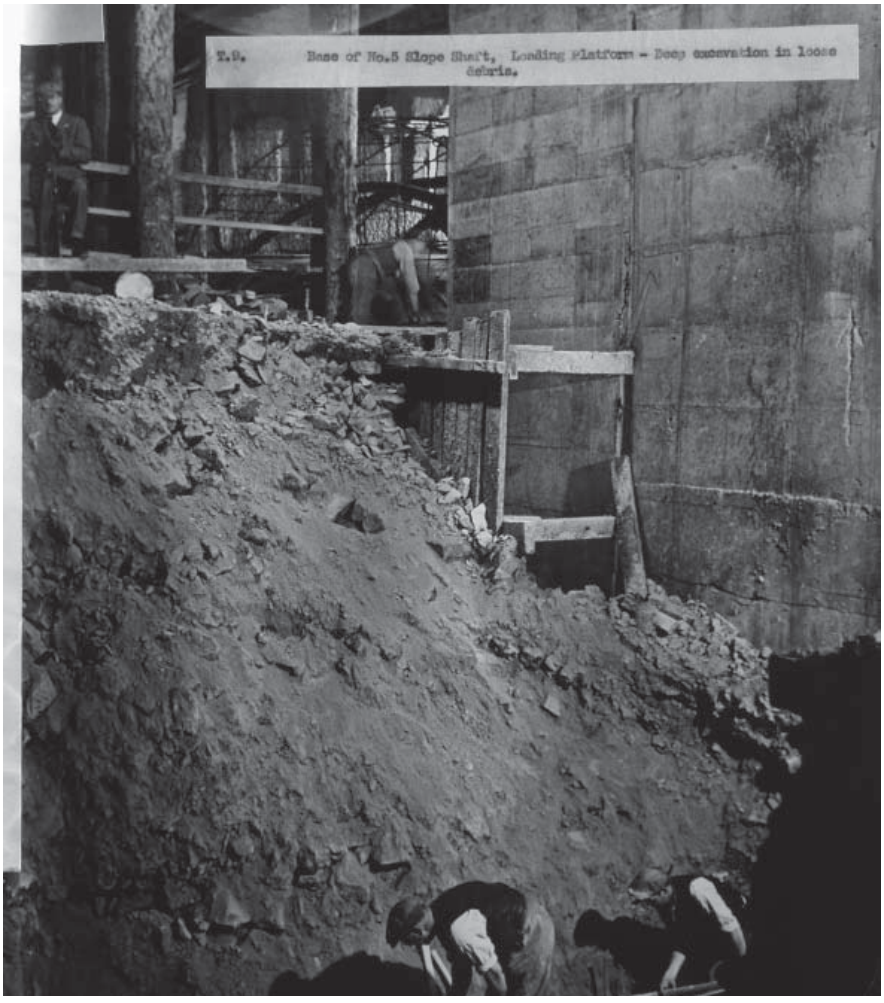

Plate 5 - Tunnel Quarry: clearance of stone debris by the Royal Engineers (© Nick McCamley)

Until October 1936 no surface buildings existed at the Corsham site except for a wooden hut at the side of Pockeridge Drive. Above ground, the rural landscape changed dramatically with a significant construction programme reflecting the massive conversion works below-ground. The pre-war function of CAD was to maintain the reserve stock; following the outbreak of war this role increased to supplying locally-administered Home Command ammunition dumps. As early as 1945 disposal arrangements were put into force in anticipation of the large-scale returns from the Mediterranean, and this was the principal activity of CAD following the end of hostilities (McCamley 2007)

7.1.3 By the late 1940s the post-war sentiment was changing to one of anxiety about the communist expansionism, highlighted by the 1948 Berlin Airlift. The invasion of South Korea in 1950 led to a massive re-armament programme and renewed interest in Tunnel Quarry. It was also the period during which the West sought to avoid conflict through nuclear deterrence or Mutually Assured Destruction. In part this strategy was adopted to allow for a reduction in standing armed forces and reductions in conventional armaments. The last box of ammunition passed through the Main Surface Loading Platform at Tunnel Quarry in 1962 (located within the current Basil Hill site as illustrated in Fig.12), although it stayed under the ownership of the MOD, whilst Monkton Farleigh and Eastlays were put up for sale.

7.2 Function and key features

7.2.1 **Below-ground** (Figures 9 & 10)

7.2.2 ***Storage*** was the primary function of Tunnel Quarry; it was divided into 10 districts by concrete blast walls, with ventilating and emergency escape corridors between, each with *c*.3 acres of floor space (5 acres gross). The layout was determined by the wedge shape of the existing workings, the standard-gauge railway sidings and the flooding during the winter of areas of the mine. No. 1 District was earmarked as a hospital but was not developed due to a severe geological fault. It was later used by the RAF as the South-West Signals Centre (Section 8). The quarry is bounded by the Northern Service Tunnel, orientated in a southwest/northeast alignment, and the East Service Tunnel at the south of the quarry.

7.2.3 ***Access/ Transport*** is via four incline shafts which radiate from the full-gauge mile- long underground railway which had two platforms. A further shaft (No.6 shaft) is located at the west of the quarry. No.1 shaft was thought to have been used in constructing the storage depot but was not converted for permanent use. Throughout the mine the original stone pillars were reinforced, with the exception of an unsuccessful experimental area in District 9, where a series of parallel concrete walls were built 20 feet apart and the intermittent stone removed. Concrete was pumped around the mine to render the walls which were painted white, the floor was converted in spark-proof asphalt, now pitted with the evidence of dropped ammunition.
Conveyor belts run into each of the districts terminating at either the main east or main west haulage service tunnels, which replaced an earlier rope haulage system. The high routes were each provided with two parallel conveyors known as 'high' and 'low' belts.

Plate 6 - Tunnel Quarry: railway (© English Heritage AA030780))

Plate 7 - Tunnel Quarry: conveyor belt running along service tunnel (© English Heritage AA030798)

This ensured that receipts and issues could be made simultaneously from adjacent districts.

7.2.4 Ammunition arrived at the site by road or rail and because of the varied size of ammunition (up to large 18" Howitzer shells), different types of transportation were required. A main point of access was via the Main Surface Loading Platform where lorries could load or unload, and ammunition was transported down the incline shafts on conveyor belts. The slope shafts below-ground connect with the conveyor belt system, with two slope shafts (Nos 3 & 4) feeding directly into Districts 10 and 11. Hudswell lifts at the northeast of the quarry were installed to provide an alternative route for receipts and issues. Two-foot gauge wagons were used along the North Service Tunnel (Hudswell Drift) which connected to the lifts, some fitted with wrought-iron securing loops to hold large shells. The railway however was the main point of access for the ammunition, and connected with the GWR line above-ground and conveyor belts running either side of the platforms below-ground. Steam locomotives were not compatible with ammunition storage and therefore the War Department acquired three Hunslet diesel shunters to transfer main-line trains between the underground station and the reception sidings at Thingley Junction (2km to the east of Corsham). These locomotives were maintained within the Loco-shed, which includes an inspection pit and turning circle.

Plate 8 - Tunnel Quarry: Hudswell Lift (© Oxford Archaeology)

7.2.5 ***Ventilation*** was paramount within Tunnel Quarry to ensure the ammunition was not kept in damp conditions. Drainage water was generally not a problem, flowing into a large natural watercourse underneath Box railway tunnel known as 'The Lake'. By controlling humidity levels, the storage life of ammunition could be increased from three to ten years. From 1944 an improved ventilation system was installed, focused on a massive 160 degree CDI fan (Central Distribution Inlet), which was the main air intake for Tunnel Quarry, drawing in air from adjoining Clift Quarry. The latter quarry effectively worked as a 'cold sink', as air drawn from the outside would lose its moisture content in the quarry before reaching Tunnel Quarry, and then it could be warmed up to a suitable temperature. The CDI fan communicates with a main east/west ventilating passageway. Concrete overcast ducts connect the airway to subsidiary extractor fans and heater batteries at the south end of each district. The heating and distributing of air in this way was intended to maintain a constant 'stable' atmosphere of 65°F and 80% humidity (McCamley 2007).

Plate 9 - Tunnel Quarry: CDI fan (© English Heritage AA030776)

7.2.6 ***Plant*** is limited within Tunnel Quarry with the Power Station and Switch Board to the north of the station platform the most prominent features. This was driven by the necessity for a secure electricity supply against enemy action; two 650 horse power and 400 KV generator sets supplied by Rushton and Hornsby were installed in a 150-feet long specially constructed chamber which was achieved by lowering the floor by 10 feet. To the rear, a switch room controls power across the ammunition depot. Other measures were put in to ensure the defence of Tunnel Quarry, especially following the construction of the MAP factory within Spring Quarry. Paths connecting to external western areas were secured with metal grates and at the west entrance to the main gallery (through PNCC) substantial concrete walls with loopholes were installed.

Plate 10 - Tunnel Quarry: Rushton and Hornsby generator (© English Heritage AA030810)

7.2.7 ***Welfare*** and ***Administration*** are limited characteristics of Tunnel Quarry, as these were mainly located above-ground. A Barrack Block was fitted out for 300 soldiers including a canteen and dormitories, but this fell into

Plates 11 & 12 - 1940 and 1946 aerial photographs illustrating extensive above-ground construction (© NMRC)

disuse in 1943. A CAD branch office was constructed in *c*.1942, which included a telephone exchange, teleprinter room, medical rooms and chaplain's office with communication provided by Lansom tube.

7.2.8 **Above-ground** (Figure 12)

7.2.9 The Study Area's landscape dramatically changed as a result of the construction of Tunnel Quarry. The early Ordnance Survey maps (Figs 7 & 8) depict a rural landscape with little evidence of industry with the exception of quarry entrances and transport features. Prior to 1936 no above-ground service buildings existed with the exception of a wooden hut on Pockeridge Drive which served as a shelter for the Pay Officer (McCamley 2007). In the earliest aerial photograph coverage in 1940, an extensive construction programme is evident to the north of Box Tunnel orientated around the existing road layout of Park Lane, Spring Lane and Hudswell Lane. Architectural embellishment has been afforded to some buildings such as the Barrack Block and Regimental Institute directly to the south, but the structures are predominantly simple rectangular pitched-roof buildings. By 1946 the construction programme is largely complete (including extensive construction above Spring Quarry) with a high concentration of buildings to the north and south of Box Tunnel. The wider rural landscape has also been affected by the construction of accommodation sites that extended as far as Chippenham.

7.2.10 ***Welfare*** is the predominant characteristic of the military landscape, including the two-storey Barrack Block and a Sergeants Mess to the east is in a similar style. Evidence states that these were disguised to look from the air like a monastery, whilst others claim they were disguised as a school. Pockeridge House was converted to Officers Quarters, and a Gym and Store, Medical Centre, Pavilion and Sports Field further add to the recreational facilities. The Hostel Sites and Married Officers Quarters however are the most striking characteristic, and are evident even at the very edge of the existing settlement of Corsham. It is thought that these were predominantly used by MAP factory workers.

Plate 13 - Tunnel Quarry: barrack block (© Oxford Archaeology)

7.2.11 ***Maintenance*** and ***Administration*** structures characterise the core area just to the south of what is now Basil Hill Road, including the Tunnel Quarry Offices and Machine Shops.

7.2.12 ***Experimental/ Laboratory*** areas include the Hudswell Laboratories situated to the north-east, which were used for the examination of large-scale ammunition and employing 300 men and women.

7.2.13 ***Transport/ Access*** features are limited to the Main Surface Loading Platform (MSLP) where the four slope shafts met; from here the ammunition would be transported by road. A standard-gauge railway would have entered at the eastern entrance to Box Tunnel, transporting ammunition from here to the mile-long below-ground platform. Within the wider landscape this infrastructure was improved with the construction of Thingley sidings (2km to the east of Corsham). From here, full train loads of outward-bound ammunition were assembled prior to dispatch to ports.

7.3 SURVIVAL

7.3.1 **Below-ground** (Figure 14)

7.3.2 Tunnel Quarry has a high level of survival and the structural fabric of the quarry remains intact, as does the main infrastructure. The only remaining evidence of the ammunition consists of a small number of empty boxes and artefacts in Area 7, and overall the quarry's chief characteristic is of vast empty expanses. Historic fixtures and fittings such as original doorways and signage stating '*Telephone Here*' and '*First Aid*' add to this character. Elsewhere, next to the Hudswell lift, wagons tell the story of the type of ammunition transported (such as those fitted with wrought iron hoops mentioned in 7.2.4) and the surviving tracks along the North Service Tunnel leading up to the lift clearly illustrate the operation of the area. Many of the conveyor belts remain extant within the storage districts running along the main access points and transport features. In some areas, the belts have been removed but the platforms remain extant illustrating the alignment and the relationship of the belts to the transport/ access features. Those that were removed were placed within the (now closed) Monkton Farleigh museum.

7.3.3 Other access/ transport features such as the railway tracks and platforms survive, as does the Control Office above the platform used to operate the conveyor belts. The railway access at the east end leading to Box Tunnel has now been blocked, although an adjacent buffer survives. A decontamination area is also situated in close proximity to the these railway features. The slope shafts leading up to the MSLP above are extant and within these some of the conveyor belts survive. The rope haulage system has been removed but the winch remains above the Hudswell lifts, as do the lifts with the original doors. The ventilation infrastructure remains intact with fans and associated engines extant, the CDI fan in particular is an impressive artefact. Key features such as the Loco Shed with turning circle and inspection pit, the Power Station and switchboard all remain extant. The massive generators and switchboard remain in good condition, as do the two Bromware Air Compressors.

Plate 14 - Tunnel Quarry: ammunition transporter (© Oxford Archaeology)

7.3.4 The below-ground Barrack Block is now in poor condition with significant health and safety issues. It is largely an empty shell but some original fixtures and fittings survive in particular the original 1940s kitchen and canteen area. The barracks were put into a second use by the RAF as underground security offices and some evidence of their occupation remains such as shelving. The CAD Branch Office now exists as empty rooms only but remains in good condition.

7.3.5 **Above-ground** (Figure 15)

7.3.6 The overall layout of the Second World War infrastructure survives with many of the structures remaining in use. Prominent surviving buildings are the Bath stone buildings of the Barrack Blocks, Regimental Institute (now Building 113) and the Power House. Pockeridge House which functioned as the Officers' Mess also continues in use. Just to the south of the Power House

Plate 15 - Tunnel Quarry: main surface loading platform (© Nick McCamley)

the Main Surface Loading Platform survives, as do the fixtures and fittings within this, including the lifts and conveyor belts, and the functional operation of this structure is easily understood.

7.3.7 The Hostel Sites are no longer extant with the exception of a small number at the north end (and just to the south) of Westwells Road (at the very north west edge of the MOD Rudloe site as defined in Figure 2). It is also possible to see evidence of their foundations as earthworks within the surrounding fields. The Married Officers Quarters are also extant at the northeast of the military landscape and continue in use. Further welfare structures that remain in use are the Pavilion and playing field to the northeast and the Gym as well as part of the Hospital and Dental Centre.

7.3.8 The significant loss is in the Hudswell Laboratories which were extant in the 1967 aerial photograph but appear to have fallen into disuse, and have since been demolished. The exception to this is the Marston shed and a few minor structures which remain extant.

8 TUNNEL QUARRY: SOUTH-WEST SIGNALS CENTRE

8.1 HISTORIC CONTEXT

8.1.1 The South-West Signals Centre began operation in 1943 continuing under various titles until the 1980s; it is situated at the west end of Tunnel Quarry in an area originally designated as District 1 (illustrated in Fig.10). At this time it was one of three main signals centres in operation with 'Central' at Leighton Buzzard and 'North-West' at Haydock. These were the focal points at which all teleprinter circuits in the area were connected on a switchboard, and carried main junction circuits to the other switching centres (provided as demanded by the circulation of traffic to and from the area). This gave the advantage that a station could be connected, via intermediate switchboards, to another station thus avoiding re-transmissions. The centre was responsible for all traffic emanating from the terminals, and the South-West Signals Centre was connected to other centres via junction circuits.

8.1.2 In June 1949 the Unit was handling 2,400 messages daily, with an average monthly total of 57,000. In 1960 the communications centre changed over to TASS (Teleprinter Automatic Switching Centre) circuits with 35 tributaries connected, and at this time the name changed from South-West Signals Centre to South-West Communication Centre. In 1961 it was further renamed RAF Hawthorn and became a station in its own right. In 1965 it ceased to be a station, coming under the umbrella of RAF Rudloe Manor and in this role saw a steady growth of its communications for over a decade. In February 1973 the Unit was formally named Communications Centre Rudloe Manor, and in 1976 a dual-suite Elliott 4120 computer was installed, which formed the backup to TARE (Telegraph Automatic Relay Equipment) for the Royal Airforce Movement Network (RAFAN). In 1977 it was re-titled Number 6 Signals Unit, and total responsibility was transferred to 6 Signals Unit in 1981 with the installation of a INCOTEL MX 350 messages switch computer (McCamley 2005 & 2007).

8.2 KEY FEATURES AND FUNCTIONS

8.2.1 **Below-ground** (Figure 16)

8.2.2 During the desk-based assessment historic mapping of the area was only identified from 1962.

8.2.3 ***Communications*** is the prominent characteristic of the facility; it is known that in the early 1940s there were two sections, the teleprinter section and PRPX area contained within the main traffic hall. As technology and requirements developed this was upgraded for example from VF (Voice Frequency) Apparatus to TASS (Teleprinter Automatic Switching System) Exchange to ADTN (Automatic Dial Telephone Network) exchange.

8.2.4 ***Plant*** such as battery and power rooms were required to drive the communications equipment located within the centre of the facility.

8.2.5 ***Access/ Transport*** was provided within the South-West Signals Centre by a conveyor belt running around the wall. A received signal was slipped into an envelope and put on the conveyor for onward routing. Access from above-ground was via a lift.

8.2.6 ***Welfare*** facilities encompassed the majority of the southern area of the Centre and included a NAFI canteen, rest rooms and drying rooms.

8.2.7 **Above ground**

8.2.8 The above-ground infrastructure was largely to service the CAD and MAP factories, and no structures were identified directly relating to the operation of the South-West Signals Centre with the exception of the lift identified on Figure 12. It is thought that the staff were

accommodated in the many hostels within the Study Area and surrounding landscape (McCamley 2007).

8.3 SURVIVAL

8.3.1 At the time of the survey, rooms within what is now the PNCC were being fitted out for ongoing communication operations, and access was not possible. The layout of the areas has been retained but observations suggest that all the equipment has been removed, and at present it is an empty shell awaiting the next installation of communications equipment.

9 Browns Quarry: No.10 Group RAF Fighter Command Centre (with Rudloe Manor) and CDCN Headquarters

9.1 Historical Context

9.1.1 Browns Quarry developed as a small independent quarry at the northwest of Tunnel Quarry, connected by a long narrow heading (depicted in Fig.10). It came into operation in 1940 under No.10 RAF Fighter Group and was responsible for air defence of the western region. Following the expansion of RAF Fighter Command at the start of the war, No.10 Group was formed at Rudloe Manor (Fig.5 OA129) on 15th June 1940 to cover the south-western area of the UK. At this time it was one of four sectors in England but the number of squadrons, airfields and aircraft changed almost weekly throughout the war and more sectors were added. The Group HQ was at Rudloe Manor House together with the Western Area HQ of the Observer Corps. Various temporary buildings were constructed in the grounds. These included an Operations Room pending the completion of the protected underground Operations Room and Filter Room at Brown's Quarry. No. 10 Group was disbanded on 2nd May 1945 and the underground facilities became disused.

9.1.2 By 1950 a re-organisation of the air defences under Operation Rotor called for six Sector Operations Centres (SOC) to replace the previous Group HQs. Browns Quarry was selected to be the new Southern SOC, where the Second World War Operations Room was re-activated. Experience soon proved that the SOC level and function was unnecessary and was slowing proceedings down, so by 1954 all six SOC's had become redundant. From 1937 the Western Area HQ of the then Observer Corps (later Royal Observer Corps) was located at Rudloe Manor, re-titled Southern Area HQ in 1953 with the additional role of warning and monitoring for the Home Office. The UKWMO (UK Warning and Monitoring Organisation) re-located to the now vacant SOC where it remained until moving to Lansdown in Bath in 1969; the original ROC function stayed at Rudloe until it too moved to Lansdown in 1996. After this vacation the SOC/Filter Room area was completely stripped of all fittings and fixtures leaving the bare stone and brick shell that remains today.

9.1.3 The remaining, larger part of Brown's Quarry was refitted and re-equipped to form the HQ of the Controllerate of Defence Communications Network (CDCN), which transferred there from RAF Medmenham in Buckinghamshire in 1977 as part of the rationalisation of Army, Navy and Air Force communications. Historic mapping was not identified of this later operation, but the existing infrastructure and layout was used and equipment updated for the new function. The CDCN provided communications overseas and within the UK for the three services and certain other Government departments using automatic and manual communication switches, interconnected by a mix of Satellite, HF Radio, Tropospheric Scatter, Radio Relay and landline communications (Jenner pers comm).

9.2 Key features and functions

9.2.1 **Below ground** (Figure 17)

9.2.2 During the desk-based assessment, historic mapping of the area was identified only from 1940.

9.2.3 ***Communications*** is the most prominent characteristic of Browns Quarry predominantly located within the southern half of the quarry. This includes for example Teleprinters, Plotters, Lansom Exchange, Filter Room and Signals Room. The most prominent feature within this was a wood-panelled hexagonal Operations Room with a plotting table at

ground level. This is located in the western division of Figure 17, and was overlooked by two mezzanine floors accommodating the controllers and radio operators. The Operations Room was responsible for nine fighter airfields in the West of England and Wales which were home to 19 squadrons and 113 aircraft. The group commander who sat in the gallery would scramble appropriate squadrons to intercept the enemy based on information given to him from Fighter Command headquarters at RAF Bentley Priory in Stanmore, Middlesex. The Operations Room was split into two with a Filter Room to the south and an Operations Section to the north. Information would be sent to the Filter Room which would then be displayed on the plotting table, whilst the battle was conducted from the galleries above. All information entering the Control Centre went to the Filter Room where conflicting data was reconciled. This was then shown on the plotting table in the Operations Room, for the information of the commander and controllers seated in the galleries above.

9.2.4 The key feature of the later use of the quarry by CDCN is an area containing the BT Exchange, which is located in the eastern 'Operations, Teleprinters/ Plotters' section of the 1940s map. This allowed lines to come for the provision of TASS and TARE, and was the management hub for the network. Battery and maintenance rooms are located in adjacent areas.

9.2.5 ***Plant*** was required to operate the 1940s communications, evident in the Battery Rooms at the east. Evidence of the batteries remains on the current floor surface, which may have also been reused by CDCN.

Plate 16 - Browns Quarry: main distribution frame (© Oxford Archaeology)

9.2.6 ***Access/ Transport*** is via a lift at the north of the site. It is understood that this was not installed when the RAF first occupied the quarry, and employees entered via the lift at the South-West Signals Centre (Fig. 16).

9.2.7 ***Welfare*** is concentrated to the northeast of the quarry including facilities for airmen and women such as First Aid, Cloakrooms and WCs. It is probable that those areas such as the WCs were reused by CDCN, although a full survey was not completed.

9.3 Survival

9.3.1 **Below-ground**

9.3.2 The layout of Browns Quarry was retained following its conversion for use by CDCN, as well as the infrastructure such as access/ transport routes but the rooms have been refitted resulting in the loss of earlier fixtures and fittings. The 1940s operations centre served no secondary function and was gutted in 1969. The only surviving evidence is a sign at the entrance stating: '*Home Office Sector Operations Centre*'. Exposed brickwork, breeze blocks and girders remain, with no evidence of artefacts relating to the functional operation.

Plate 17 - Browns Quarry: sign at entrance to operations area (© Oxford Archaeology)

9.3.3 The remaining areas were used by CDCN but these are now largely empty rooms retaining

basic fixtures and fittings such as carpets, doors etc. Some artefacts are extant such as planning boards and small exchanges detailing their connection points. The most significant survival is the very extensive BT facilities which comprise the CDCN exchange, which has live circuits some of which appear to be active. This is mostly thought to date from the mid/late-1950s to late-1960s, with later additions. The Main Distribution Frame (MDF) is also thought to be from about the same date (Bennett pers comm). Various related documentation and artefacts are also extant within this room such as telephone books, files and maintenance equipment. There are also adjacent maintenance and battery rooms which retain their fixtures, fittings and artefacts.

9.3.4 Above-ground

9.3.5 Rudloe Manor is a 17th-Century Grade II listed building which is now under private ownership (Andy Quinn pers comm). It was not possible to get access to the site but it was possible to see military buildings extant within the grounds (most appear to be prefabricated structures) which are thought to have had a secondary function as a school (Quinn pers comm).

10 Spring Quarry: Ministry of Aircraft Production Factories

10.1 Historical Context

10.1.1 The advent of aerial warfare during the First World War brought with it the increasing demand for the mass production of fighters and bombers of standard design. During the 1930s rearmament period aircraft production built up, and is inseparably linked to the Second World War aircraft production effort. New factories were constructed using public funds, owned by the Government, but run by private companies to boost production of (initially) aero-engine components. To organise the increase in output, new ministries were created to supervise production; these included firstly the Ministry of Supply, the Ministry of Air Production (MAP) in 1941 and in 1942 the Ministry of Production (Smith 2004). At this time MAP required a site to house the airframe and engine production facilities then located at Filton under the Bristol Aeroplane Company (BAC). Spring Quarry was identified and conversion work began in 1942, although from commencement the project was thwart with problems.

10.1.2 It was soon realised that the movement of the entire engine production line from Filton to Corsham would entail an unacceptable disruption in production at a time when the big bomber programme was accelerating. It was decided that the undercarriage and turret-building capacity would be retained at Filton and the engine facility was reclassified as a shadow rather than a dispersal scheme (the Shadow Scheme was the name given for the construction of new factories for the manufacture and assembly of aero-engines, aircraft and associated equipment assisted from Government Funds). The project was characterised by indecision and escalating costs. By 1942 the following allocation of space was confirmed, although the BSA and Dowty works were not constructed (illustrated in Fig. 9).

COMPANY	MANUFACTURING	LOCATION
Bristol Aeroplane Company (BAC)	Development works	Northern half of main (east) quarry
Bristol Aeroplane Company (BAC)	Centaurus engines	Southern section of the main (east) quarry
Parnell Company	Frazer-Nash turrets and vane oil motors	South-west quarry
Birmingham Small Arms Company (BSA)	Oerlikon gun barrels	South-west quarry
Dowty Company	Undercarriages for Halifax & Lancaster bombers	North-west quarry

These factories involved a huge influx of workers that raised issues of accommodation, transport and secrecy. Hostel sites and married quarters were constructed that also included recreation facilities to keep the workers self-contained. Sites in the Corsham area are illustrated in Figure 13 but others extended as far as Chippenham. Train and bus were used to transport workers and manufacturing material, including finished engines that went to underground stores or a main factory complex. Rail was also improved with the construction of Lacock and Thingley sidings and a new line joining the main line to the branch at Thingley Junction (2km east of Corsham). Efforts were made to disguise the above-ground infrastructure that was increasingly conspicuous in the rural landscape, as confirmed by RAF surveillance flights.

10.1.3 By 1942 the threat of invasion had evaporated and the German bombing offensive had reduced, making the threat to industrial capacity limited and therefore undermining the very principle on which the construction of the underground factories was based. Furthermore, Spring Quarry suffered badly from flooding which affected plant areas and was not conducive to the manufacturing process. The first engine was produced in 1943, but from the beginning

of 1945 production was reduced and eventually ceased in April. In total, the BAC was only in operation for 18 months, and despite being equipped for a monthly output of 260 engines, never exceeded 42 engines per month. In contrast, the BSA under-ground production of gun barrels was successful and made a significant contribution to the war effort, producing half of Britain's entire output of Hispano and Polsen barrels. The termination of production at Spring Quarry enabled the Royal Navy to use the redundant space for storage, which added to the space already being used at Copenacre and Pickwick quarries. The quarry had also already been identified for another function as early as 1943 by the War Office Crossbow Committee (Crossbow was the allied attempt to counter German V1 and V2 bombers), who requested that the Parnell area was kept at their immediate disposal.

10.2 Function and key features

10.2.1 **Below ground** (Figures 18 & 19)

Plate 18 - Spring Quarry, MAP Factory: passenger lift 2 (© Oxford Archaeology)

10.2.2 ***Access/ Transport*** features had to be multiplied within the quarry because the layout was dictated by geological faults, necessitating the location of the factories in three separate entities as described above. Three goods and machinery lifts were installed rather than one as originally planned. Within the BAC works, access from above ground was provided by four slope shafts, two goods lifts, one machine lifts and two passenger lifts. A further slope shaft, goods lift and public lift were located in the area to the west. Within the BAC factory the machine lift and goods lift 3 are located in close proximity to 'the deep' areas (sunken areas used to inspect engines) and it is likely that these were used for movement of manufacturing materials. It is thought that goods lift 3 was used to bring the finished engines to the surface. The proximity of goods lifts 1 and 2 to the canteens shows that they may have been used for the transportation of food. It is known that goods lift 2 was nicknamed the 'cabbage lift' (Quinn pers comm). The passenger lifts would have been the main point of access for workers, as well as two escalators installed within slope shafts A and C (Bennet 2008b Object 394).

Plate 19 - Spring Quarry, MAP Factory: escalator (© Mark Bennett)

10.2.3 Construction plans for the factories were based on those used for the above-ground sites but had to be adapted to the restrictions of the below-ground resource. The rural location meant that the basic infrastructure required to operate a factory such as power was non-existent. Gas was supplied via specially-laid compression mains for operations such as heat treatment, and electricity was installed via two separate feeders requiring the construction of 31 sub-stations. Steam was provided by two boiler houses which were fed by coal via a conveyor belt down a slope shaft (probably C). The restricted head room within the quarries meant that conventional factory lighting

was not possible, and a specially-designed system based around the location of each piece of machinery was required (McCamley 2007).

10.2.4 ***Manufacture*** is the prominent characteristic of Spring Quarry, each area being divided according to its function within the process. In contrast to Tunnel Quarry, brick is the prominent building material, and was used in the reinforcement of the existing infrastructure and the sub-division of the areas. The areas within the BAC section of Spring Quarry are larger to the south, which includes the vast Machine and Fitting Shops. Here is situated the unusually named 'Power Egg Shop' whose name derives from the fact that it took a long time to change an aircraft engine with another of the same type. Therefore manufacturers were encouraged to make them interchangeable with integrated power plants or 'power eggs' therefore reducing the time an engine was immobile to about an hour. The central-northern section contains much smaller divisions of the manufacturing process such as enamelling, etching and polishing, situated within the centre of this area.

10.2.5 The south-west operational area used by BSA Barrel Mill and the Parnell Turret Company is also characterised by manufacture, although the divisions of space are much smaller without the large open machine and fitting shops. The manufacturing process did not require the same volume of space as that needed for the aircraft engines. This is particularly true of the area occupied by the Parnell Turret Company which housed small manufacturing units such as welding and press shops, and swarf brushing and crushing. This work necessitated the movement of huge quantities of material, the extraction of fumes and the facilities for a large workforce.

10.2.6 ***Experimental/ laboratory*** areas are situated to the north-east of the quarry, which were used for development work. A Test Plant was also constructed above ground as illustrated in Figures 12 and 14 and described in 10.2.16.

10.2.7 ***Ventilation*** systems within the east and west sections of the quarries acted independently. The area used by the BAC had 12 fans, 4 extract shafts (E1-E3 and E1A), two blower shafts and 1 airshaft inlet; fan E1A was specifically designated for the removal of fumes from the heat treatment area. The western area occupied by BSA Barrel Mill and the Parnell Turret Company had a blower shaft, exhaust shaft and two fans. Incoming air was heated by large radiators fixed across the airways on the discharge side of each fan, and the temperature controlled by thermostatic valves. Massive butterfly doors in the suction side of the airways allowed the extract fans to be sealed in the event of enemy gas attack, whilst all the inlet fans could be shut down remotely (McCamley 2007). In the BAC area massive floor-to-ceiling air drifts define the perimeter of the quarry, and sub-floor airdrifts run predominantly east to west below floor level.

Plate 20 - Spring Quarry, MAP Factory: butterfly doors to fan (© Oxford Archaeology)

10.2.8 ***Storage*** of material on arrival and for finished products prior to dispatch is concentrated to the east and west of the BAC factory. Goods came inward from Goods Lift 1 at the west, which is located close to the Raw Material and Jig and Tool Stores. The Finished Parts Store is situated to the eastern edge of the quarry, close to Machine Lift 1 and Slope Shaft A.

10.2.9 ***Welfare*** was a huge consideration in the construction of the factories. Three canteens are located within the BAC area and one dining room/ kitchen area. The smallest canteen within the south-west area of Spring Quarry could accommodate 1,300 of the Parnell workers. The chairman of the BAC employed a professional artist, Olga Lehmann, to decorate the canteens with floor to ceiling murals. In total there are about 50 scenes. These impressive pieces were very much of the period and typify quintessential England of horse racing, cricket and boxing. Other illustrations such as that of a clergyman being boiled alive by Africans are more controversial. Murals of dinosaurs were also painted in the eastern Operatives Canteen.

Plate 21 - Spring Quarry, MAP Factory: Olga Lehmann mural, horse racing (© English Heritage AA025635))

Plate 22 - Spring Quarry, MAP Factory: Olga Lehmann mural, clergyman (© English Heritage AA027640)

10.2.10 ***Communications*** takes up very limited space within the factories; the only area designated within the BAC works is a GPO telephone exchange to the north-west which housed a large manual switch-board.

10.2.11 ***Administration*** is concentrated in the north-west area of the BAC works, and accounts for a small area within the western section of the quarry only.

10.2.12 **Above-ground** (Figures 12 and 13)

10.2.13 The Second World War above-ground construction programme to the south of Box Tunnel took place after that of Tunnel Quarry to the north. The landscape is characterised by open fields with the small settlements at Westwells and Moor Green to the south. Evidence of the industrial landscape remains extant, in particular to the south of Basil Hill Road where the original Spring Quarry entrance is visible, as are tracks between it and Westwells and from Greenhill to the Box Tunnel entrance. By 1946 this picture had dramatically changed to an extensive military landscape characterised by groups of regular rectangular building. These are constructed around the existing road layout, with the exception of Westwells Road that post-dates the OS 1st Edition and was probably built to provide access to the new infrastructure.

10.2.14 ***Welfare*** was a dominant characteristic of the above-ground Study Area, with the provision of massive hostel sites and married quarters for workers. These sites were instigated by the need to house large numbers of workers in close proximity to the underground factories. The hostel sites (and life in the factories) are described in Derek Williams' (2004) first-hand account of Spring Quarry. He occupied the hostel at Thorney Pits that included a large communal dining hall within the main complex, a theatre-cum-dance floor, a rest room and shops. As described in Section 7.3.7 to the north of Box Tunnel and just to the south of Westwells Road it is possible to see the remains of a small groups of huts which are thought to have been hostel sites. It is not known which hostel sites were used by which workers, but it is thought they were constructed for use by MAP factory employees.

10.2.15 ***Access/ Transport*** is an important feature, both for moving parts of the manufacturing process and people. Lifts for personnel and goods provided connection to the below-ground, and large coach parks were required for those bussed in daily.

10.2.16 ***Experimental/ laboratory*** areas were also required above ground, as the testing of parts was too dangerous to be carried out in a confined space. The Test Plant consisted of six huge concrete dynamometer buildings for full-load engine testing.

Plate 23 - MOD Rudloe: former hostel hut (© Oxford Archaeology)

10.2.17 ***Administration*** was mainly contained below ground within Spring Quarry as evident by the small allocation of space above ground for this function.

10.3 Survival

10.3.1 **Below-ground** (Figure 14)

10.3.2 Only the area occupied by the BAC is discussed in this section, as access was not possible to the western areas. The area used by the Parnell Turret Company and BSA Barrell Mill is now used by the Corsham Media Company for data storage. Discussion with the owner suggests that evidence of the military use of this area does survive but is not extensive. The area designated for BSA Barrell Mill, but not occupied, (the central division of the western area) is now inaccessible because of the quantity of asbestos dumped here following removal from the BAC factory. The area designated for Dowty within West Lung was not constructed, but only the western half of this area was accessible during the site assessment. The East Lung as described in section 5.4.4 is characterised by 19th-century quarry workings. There is a concrete path providing access to this area which overlies the original floor fabric, running along both sides of this are short walls. These are constructed in part from the fabric of the BAC MAP factory following its demolition for the construction of 3 Site. At the east of East Lung the MAP factory high and low water pumps survive which controlled the water levels within Spring Quarry, as does a culvert at the working face of Box tunnel which discharged water between the tracks of Box Tunnel.

Plate 24 - East Lung: general view (© Oxford Archaeology)

10.3.3 The second military phase of operation of Spring Quarry was as 3 Site during the Cold War. This occupied the majority of the BAC area to the north, but did not include Machine Shops 7 and 8 and the areas to the south of these. Within 3 Site, evidence of the MAP factory survives as this utilised the existing infrastructure of the factory. A comparison of the key feature maps (Figures 18 and 20) shows that the overall plan of the quarry was maintained, with the retention of the existing roads and areas. The latter were adapted and further divided to meet the new functional requirements of 3 Site (as illustrated in Figure 20). Access points were also maintained including two public lifts (PL1 and PL2), a machine lift (ML1) and a

goods lift (GL1) as well as two escalators within emergency exits A and C. Significantly, the mechanisms of transport survive, particularly the now unique escalators. The ventilation system continued in use but was adapted to meet the requirements of a nuclear bunker, and therefore artefacts such as fans survive (as described in Section 13.2.9). Ventilation shafts were made nuclear-resistant above ground by the addition of concrete reinforcement and earth embankments. A comparison of the functional characterisation illustrations (Figs. 19 & 21) demonstrates that the areas used for plant were retained. These include the sub-stations throughout and the plant area at the western perimeter.

10.3.4 Following the closure of the MAP factory the area to the south was occupied by the Royal Navy for storage, which has had minimal impact on the structural fabric. This area is characterised by large open spaces with sunken areas for engine inspection and raised concrete beds, indicating the position of former machines. It is a basic space with stone walls and pillars reinforced by brick, reflective of a working factory with no need for architectural embellishment or the decor of the welfare areas. The Royal Navy's use of the space is evident by wire fencing and gates used to separate areas, rows of shelving and the insertion of small prefabricated stores and offices. The walls and pillars were also painted white, resulting in the loss of any graffiti, although in places etchings on the rock are visible. No manufacturing artefacts survive, although some factory signage is extant: *Smoking Permitted Here* and *All Staff To Wear Helmets In This Area When Overhead Crane Is In Operation*. Road signs are also extant here and throughout 3 Site; roadways are named as *Avenues,* indicating the influence of American culture at this time.

Plate 25 - Spring Quarry, MAP Factory: machine bed (© Oxford Archaeology)

10.3.5 Some welfare facilities continued in use within 3 Site; the washrooms retained their primary wartime fixtures and fittings, and the location of the hospital was also retained at the north (within Area 10 of 3 Site). The fixtures and fittings within this however are thought to have been replaced during the construction of 3 Site. The Olga Lehmann murals survive in excellent condition within Area 2 of 3 Site, previously an Operatives Canteen, and used from 1979 by the RAF. Some have been truncated by the construction of breeze block walls dating from 3 Site, but the majority survive intact. This area also retains some of the layout of the canteen with the original raised areas and railings that date from the Second World War. Further murals by Lehmann, showing dinosaur scenes, are extant within the former canteen located just outside 3 Site, to the south-east of Slope Shaft A. This area was left untouched because it served as a buffer zone to the bunker, and retains many of the original fixtures and fittings including the serving area and signage. A pocket of survival from the MAP factory also remains extant, consisting of the 'View Room' and its machine beds (the View Room is shown on Fig.18 to the south of Slope Shaft A).

Plate 26 - Spring Quarry, MAP Factory: serving bar within former canteen (© English Heritage DP024144)

10.3.6 Significantly, the GPO telephone exchange was maintained within Area 1 of 3 Site although this later became unfit for use because of water ingress. The extent of survival here is unknown as access was not possible, although visual inspection from a distance suggests that it is in very poor condition. Elsewhere in 3 Site, pockets of wartime fabric survive which are clearly indicated by the use of painted brickwork. For example, a group of structures are evident near Public Lift 1 including a control room and a carving in the wall states*: Wanted a clock to check operator's time*. Pockets of wartime graffiti survive throughout 3 Site, depicting popular culture of the period, such as Disney characters and memories of the people once working there: *In Memory of the Duck Sals, also Claude and Bevin Boy and Doris and Lofty and Jim Pop February 7th 1945* (this was probably inscribed at the time of closure).

10.3.7 **Above-ground** (Figure 15)

10.3.8 The significant loss above-ground is that of the hostel sites, although a few examples from Hostel Site No.2 survive to the west of Public Lift 1. Outside the current MOD area it is possible to see evidence of hostel sites as earthworks in fields. The Test Plant is also no longer extant; this and the hostel sites are evident on a 1967 aerial photograph although by this time they had evidently fallen into a state of ruin.

10.3.9 Otherwise, much of the Second World War layout of roads and buildings survives, as does much of the infrastructure to facilitate the operation of the below-ground establishment, which continued in operation (as 3 Site). Access/ transport features such as lifts, and ventilation features such as shafts survive. Some of these have been reconstructed to ensure the Cold War facility was nuclear-protected (as described in 13.2.33).

Plate 27 - Spring Quarry, MAP Factory: goods lift 4 (© Oxford Archaeology)

Plate 28 - Basil Hill: air shaft (© Oxford Archaeology)

11 Copenacre, Pickwick and Spring Quarries: Royal Navy Storage Depots

11.1 Historical Context

11.1.1 The Second World War necessitated more secure storage facilities for the Royal Navy, and from 1939 Pickwick Quarry was used as a temporary store for naval ammunition. The events of the war, in particular the 1940 bombardment of Coventry and Woolston, which destroyed the Fleet Arms stores, necessitated an extension of these facilities. Previously, unprotected dispersal stores had been used which were becoming increasingly vulnerable as illustrated by the bombings raids of 1942. The site at Copenacre was further extended in 1942 when it officially opened as the Royal Navy Storage Depot (RNSD). Following the end of conflict the Fleet Arms storage was moved, but the storage of naval electronic equipment expanded enormously, necessitating the use of the southern area of Spring Quarry from 1945.

11.1.2 During the Cold War the Royal Navy remained an important, if declining, power (Cocroft WD 2004). The change to nuclear threat in the Cold War saw further expansion of the Navy's occupation, with the extension of Copenacre in 1954. This was followed by the transfer of headquarter staff from London to Corsham following the Government policy of dispersal from the capital. An important function of RNSD Copenacre at this time was the testing and calibration of electronic equipment that was also located outside the Study Area within the Monks Park depot. By 1969, RNSD Copenacre was the sole place for testing, storage and issue of all electronic equipment for the navy. The 1990s saw a reduction in importance of the site when radar, sonar and communications test facilities were moved to RNSD Exeter and only slow-moving items were stored at Copenacre. The site was closed in 1995 and the ventilation and access shafts were securely bricked up, but the MOD continued occupying the above-ground offices (Whalley 1995 and McCamley 2007)

11.2 Function and Key Features

11.2.1 Below ground

11.2.2 Access was not possible to Copenacre and Pickwick quarries as they are now actively mined by Hansons. Desk-based assessment did not identify any detailed historic mapping of Copenacre and Pickwick quarries, although general maps showing the layout of those areas extended by the Royal Navy were identified. These illustrated the location of pillars only and did not provide an indication of the location or key features of functions. This information was added to the GIS.

11.2.3 Secondary sources show that there was a strong functional relationship between the different quarries of the RNSD with receipts centralised at Spring Quarry, from where slow-moving stock was transferred to Copenacre and faster-moving items to Monks Park where testing and calibration also took place.

11.2.4 ***Storage*** was the main function of the quarries and Spring Quarry was subject to only minimal changes; shelving was added to the existing space and a small number of prefab offices added for monitoring the movement of receipts and withdrawals. Video footage of Pickwick and photographs of Copenacre shows similar features with the same stackings shelves and prefab offices. The character is also very similar with painted stone and brick walls, additional pillars constructed from brick and the small prefab offices painted cream and blue.

11.2.5 ***Access/ Transport*** to Spring Quarry is thought to have been via goods lifts 2 and 3. From the 1960s the Royal Navy use of Spring Quarry would have taken place at the same time as 3 Site and therefore only those access points south of the nuclear facility could be used (Whalley 1995 and McCamley 2007).

11.2.6 Copenacre already had two access shafts, one within the middle of the workings, and a second Hartham Park shaft which was accessed some distance from the quarry by a long narrow drift which connects through to Pickwick Quarry. The latter was used for an emergency exit, the central shaft regraded and enlarged and a completely new shaft and two lifts added. Two lifts were installed at Copenacre as well as a travelator to the west for the larger objects.

Plate 29 - Copenacre: travelator (© Oxford Archaeology)

11.2.7 ***Experimental/ Laboratory*** facilities were located at Copenacre which were used for testing. These include large baths of water for submersion and drying rooms complete with lamps suspended from the ceiling. In such testing areas floors were covered with a special asphalt compound beneath which lay a mat consisting of steel-reinforced mesh.

11.2.8 ***Ventilation*** at Spring Quarry was via the existing infrastructure installed for the BAC. At Copenacre, ventilation was taken from a large air shaft and warmed and then blended with cold air to maintain a steady temperature of 65 degrees. Copenacre suffered from severe water ingress evident by corrugated iron along the ceilings to catch the water, which was then directed into drains (Whalley 1995).

11.2.9 ***Welfare*** facilities at Copenacre are evident in photographs including washrooms complete with fixtures and fittings. No additional welfare facilities were added to Spring Quarry.

11.2.10 ***Plant*** was required at Copenacre to facilitate testing including rows of boilers and generators, rotary converters and mercury-arc rectifiers. No additional plant was added to Spring Quarry to service the storage depot (Whalley 1995)

11.2.11 **Above ground** (Figure 12)

11.2.12 The allocation of Copenacre as the new Headquarters entailed the construction of an above-ground infrastructure to service the below-ground facility.

11.2.13 ***Access/ Transport*** features at Copenacre include two lifts and a travelator which were protected from aerial bombardment by concrete reinforcement. No new access/ transport features were added above Spring Quarry, as the Royal Navy used those existing.

11.2.14 ***Administration*** was provided by the construction of additional office blocks at Copenacre. In the 1970s, above Spring Quarry the Royal Navy Codification Authority and Agency occupied buildings just to the northeast of Goods Lift 3 (Quinn pers comm).

11.2.15 ***Welfare*** was provided at Copenacre by a canteen constructed in the 1940s.

11.3 Survival

11.3.1 Below-ground

11.3.2 Below-ground the Royal Navy were the last occupiers of Spring Quarry, and the shelving and offices they installed remain extant. Photographic evidence of Copenacre suggests that much of the infrastructure of the quarry remains, although mould and fungi caused by lack of ventilation are having a serious impact. Video footage of Pickwick suggest that shelving

for stacking of ammunition remains extant as does some military graffiti. As both Copenacre and Pickwick are active quarries, whether these features remain extant today is uncertain.

11.3.3 **Above-ground** (Figure 15)

11.3.4 The above-ground infrastructure of Copenacre is distinctive because of the concentration of remains extant including the lifts, ventilation shafts and canteen within a small area. Buildings evident on 1946 aerial photographs have been lost around the perimeter of the site including two rows of probable Nissen huts at the east and west of the site.

11.3.5 The 1970s Royal Navy Codification Authority and Agency structure above Spring Quarry is extant.

12 PART IV: THE COLD WAR

12.1 SUMMARY

12.1.1 The Cold War resulted in a new and significant phase of activity at Corsham. In the late 1950s the north area of Spring Quarry was converted as the Central Government War Headquarters, which came into operation in 1961. Today the government refuge is referred to as 3 Site, but various code names were adopted during its operation. These are tabulated right and reflect changes in political policy at this time.

CODE NAME	DATE USED
Subterfuge	1954 - 1959
Stockwell	1959 - 1961
Burlington	1961 - 1963
Turnstile	1963 - 1969
Chanticleer	1969 - 1987?
Peripheral	1987? - 199?

12.1.2 The primary purpose of the facility was to direct the survival and restoration phases following the commencement of a nuclear attack on the UK. It had the capability to survive independently from the outside world for 30 days, therefore communication was of paramount importance and large areas were dedicated to this. The bunker was designed to accommodate the Prime Minister and a nucleus of Ministers and Senior Officials as well as 4,000 staff. Many areas were divided into small offices in which the chosen few would work and live. Shut off from the outside world, all welfare facilities had to be contained below ground, and vast areas were also dedicated to plant and the storage of necessities to sustain life. A huge array of artefacts were stored within these areas some of which remain. A separate study of the artefacts has been undertaken and this work is assimilated within this report (Bennett 2008a & 2008b).

12.1.3 The striking feature of 3 Site is the immense planning involved in its construction, illustrating the intensity of the political stand-off at this time. The facility is also remarkably basic, with none of the comforts of Whitehall. The extent of its survival is remarkable because 3 Site was never operational, with the exception of Area 2 which functioned as the Quarry Operations Centre from 1979. The condition of the eastern half of 3 Site is significantly better than that of the west; the latter suffers from damp and was abandoned following the division of the site roughly in half under the 1970s Chanticleer phase of operation. Secrecy from Soviet detection was of paramount importance and above-ground construction was therefore minimal. The major modification was to the infrastructure relating to the below-ground facility, such as shafts and lifts, which were later nuclear protected.

12.1.4 Within the Study Area, Browns Quarry and the South West Signals Centre continued in operation during the Cold War, as described in Part III of this report. The latter was used by the ROC Sector Control until 1969 and from 1979 CDCN occupied Browns Quarry (see Section 8). The South West Signals Centre functioned as RAF Hawthorn from 1961, and in 1973 the Unit was formally named Communications Centre Rudloe Manor. Tunnel Quarry also continued in operation until 1962, and Copenacre Quarry and the southern section of Spring Quarry remained operational as a the Royal Navy Storage Depot, the latter separated by a buffer zone from 3 Site.

13 3 Site: Central Government War Headquarters

13.1 Historic Context

13.1.1 The role of 3 Site was not static but adapted to the changing political environment of the Cold War, and the development of policies in response to the threat of nuclear attack. The effects of the hydrogen bomb (H-bomb) were beginning to be understood following its first test by the Americans in 1952. These effects, and particularly the impact of radioactive fall-out were detailed in the 1955 Defence White Paper which stated that if '*...such weapons were used in war they would cause destruction, both human and material on an unprecedented scale. It would be a struggle for survival of the grimmest kind*'. The Strath Report under Padmore, a leading civil servant within the Treasury, was instrumental in organising '*a machinery of government to take the country through the attack and survival periods'.* In 1951 Spring Quarry was first identified as the site for Subterfuge acting as an *'alternate seat of government if London became unusable*'; at this time it was proposed that a core of 6,000 would operate from the citadels in London (Fox 2006).

13.1.2 By 1954 the realisation of the scale of destruction caused by the H-bomb was becoming increasingly apparent, and it was realised that the use of the citadels would not be viable. It was also assumed that attack would be by aircraft, and radar would give ample time for the Prime Minister to depart for Corsham. However from the 1960s, with the development of missiles, this became increasingly unlikely. The revised role of Subterfuge was as a fully-manned site with support staff and a reserve nucleus of Ministers and senior officials ready to act as the central government if necessary. Only a very small team headed by the Prime Minister would stay in London from where they would, hopefully, leave at the last moment. The new strategy would be dictated by the scale of the damage and the paralysing effect of fall out. Subterfuge would be concerned only with important strategic matters; its role was not to direct the war, as the destruction would be so massive that there would be no war to direct. Instead, Subterfuge would be concerned with the survival and restoration phases that would follow the destructive phase (Fox 2006).

13.1.3 This meant that until central government could be organised on a larger scale most functions of government, which could not be done by the nucleus or regional headquarters, would cease. From 1957, the concept of regional government was expanded to create a government machine that would rely on the Regional Commissioners. These would act as the effective central government authority for all home defence and internal matters being guided only from 3 Site if communications permitted. At this time it was envisaged that the ultimate source of authority would be the War Cabinet, which was expected to consist of 'the Prime Minister and five other Ministers with the Chiefs of Staff and others attending as necessary'. The site would be able to operate for 30 days divorced from the outside world, with a nominal maximum figure of 4,000 which was based on the site's capacity, not the number of staff thought necessary (Fox 2006). A list detailing the positions of those chosen for 3 Site are detailed within a Telephone Directory of the period which has now been decommissioned and is summarised in 'The Secret State' (Hennessy 2003).

13.1.4 By 1965 the Python concept had replaced the original idea of a single nucleus with that of several smaller teams which would be scattered about the country. This envisaged a core complement of *c*.600 ministers and military chiefs assembling in eight smaller more manageable and widely dispersed groups. In 1968 'care and maintenance' to all home and civil defence activities was introduced, and in 1969 the codename Turnstile was replaced with Chanticleer. About this time, possibly as part of the wholesale reduction in civil defence expenditure from 1968, the site was dramatically reduced with only Areas 8 to 16, 21 and 22 being retained for use (Fig.22). Plans at this stage are vague but imply that the site would accommodate 1,000 staff with at least two Python groups, including eight ministers.

13.1.5 In 1982 a study called 'Project Albatross' considered the future feasibility of using the site, but little action was taken as a result of this. The site continued to be maintained throughout the 1980s, although by this time, there was an increased focus on the Regional Government Headquarters. It is thought that 3 Site was planned to be used in the 1980s, but was abandoned in the early 1990s. By 1991 plans were being made to remove all the stores and with the end of the Cold War the site was finally decommissioned in 2004 (Fox 2006).

13.2 Function and Key Features

13.2.1 ***Below-ground*** (Figures 20 & 21)

13.2.2 The Cold War use of 3 Site utilised the existing infrastructure from the BAC factory, as described in Section 9. At this time Britain was still suffering from the economic impact of war, and government policy was to utilise existing sites. In many ways, Spring Quarry was an ideal location. A comparison of the Key Feature maps (Figs. 20 & 21) shows that the overall plan of the quarry was maintained with the retention of the existing roads and areas. The latter were adapted and further sub-divided to meet the new functional requirements of 3 Site. Access points were maintained including two public lifts (PL1 and PL2), a machine lift (ML1) and a goods lift (GL1) as well as two escalators within Emergency Exits A and C. This existing infrastructure was surrounded by a 6ft-thick concrete blast wall with air vents. The ventilation system continued in use, but was modified to ensure the bunker was nuclear protected.

Plate 30 - East Lung: venturi tubes

13.2.3 The key fact is that 3 Site was never actively used, and much of it is characterised by empty areas subdivided into small empty rooms. Each area (with the exception of Area 10 which is located next to the Stores in Area 9), contains a storage area, housing equipment and fittings which would have been distributed had the site become active. Artefacts visible today, such as the beds within the hospital, have been placed there for display purposes only. Plant was installed and maintained to the east and west, and fixed artefacts were put in the catering and communication areas. These areas are visually impressive because the artefacts they contain help to communicate the immense scale of the establishment.

13.2.4 As described above, in 1970 3 Site was subdivided roughly in half as part of the Chanticleer phase of Cold War planning. The physical evidence of this is evident in the deterioration of the western half of 3 Site, and the infilling of openings situated across East Main Avenue (running east/ west across 3 Site). Additional doors were added at this time including 79 Door and M62 door at the north; these were required because from 1979 the RAF took over Area 2 as a Quarry Operations Centre (QOC). The area is characteristically different to others in 3 Site as it appears not to have been fully converted to office use, perhaps because it was allocated to organisations of less significance within the operation of 3 Site (e.g. - Board of Trade and the Inland Revenue).

13.2.5 The 40,000 square foot area of the QOC (identified in Fig, 22) was manned by a staff of 600 RAF personnel. The function was twofold: to defend 3 Site and the local area through a 'Ground Defence Control Centre' and to provide a headquarters for the RAF police throughout the UK (Steve Fox pers comm). This area is a self-contained bunker accessed via its own decontamination area and air-lock doors (Object 267 Bennett 2008), which also provide the current access to 3 Site. The QOC contains Defence Stores, Armoury, Accommodation areas, Hospital, Kitchen and Messing Area as well as its own telephone network and National

Alert Receiver Station (Objects 248-273 Bennett 2008b). Although this is a separate bunker, these areas are described within the functional descriptions below.

13.2.6 ***Access/ Transport*** to 3 Site was via the existing infrastructure of the MAP Factory, including public lifts 1 and 2, emergency exits A & C, goods lifts 1 and 3 and machine lift 1. It is probable that in the event of nuclear fallout every available means of entering the facility would be used, when considering the logistics of transporting 4,000 staff below ground. Additional access points were via Emergency Exits 'A' to the north-west, 'C' Door to the south and 'W' door to the west. Later '79' Door and 'M62' door were put in at the north of the facility following the use from 1979 of Area 2 by the RAF. Of course there were other access points within the quarries, particularly the current access through PNCC.

13.2.7 The means by which 4,000 people would have been secretly transported to 3 Site is uncertain, especially considering the catastrophe in which they would be travelling. The initial scheme envisaged a fleet of 200 coaches ferrying staff from London. Later this changed to a convoy of trains departing from Kensington to a check-point station, from where they would be taken to the site (Fox 2006). It is possible that staff could have entered via the opening next to Box Tunnel, which is supported by the fact that there are decontamination units next to this (now blocked) opening. The Prime Minister would have stayed in London until all chance of averting war was gone. He and the inner circle would then travel via helicopter to Corsham.

13.2.8 Once inside, transportation would be via electric vehicles that remain in use today (Objects 157-166 Bennett 2008b). A washing and parking area is situated within Area 11 as well as a Workshop and Tool Store (Objects 167-168 Bennett 2008b) for maintaining the vehicles. Signage denoting Areas is found throughout 3 Site dating from the 1960s (Object 458 Bennett 2008b). It is thought that those detailing road names (e.g. - East Second Avenue) survive from the MAP Factory as these are also extant within the area to the south of 3 Site (Object 459 Bennett 2008b).

13.2.9 ***Ventilation*** to 3 Site is via the East and West flanking Lungs, which were used as air-supply reservoirs and served by air-supply shafts. There is an under-floor duct system that takes air from the Lungs and distributes it throughout 3 Site. Within the Lungs it is possible to see venturi tubes within the floor to ceiling ducts. The latter dating from the MAP Factory contain ventilation holes which it is thought would be blocked with bungs if air became contaminated. Wooden bungs are extant which fitted into the holes but the exact operation of this is uncertain. The adaptation of the existing MAP Factory ventilation is evident throughout 3 Site. A large floor-to- ceiling duct known as the North Drift runs round much of the north side of 3 Site, which distributed air aided by the existing MAP factory fans, with internal roadways acting as return ducts.

13.2.10 Airflow within 3 Site was originally split east/ west with two Compressors Units at the eastern and western extremities. Two Sulzer Refrigeration Compressors are located at the east of Area 10, and it is believed that a further two are located within Area 19 to the west. These Air Conditioning Units supplied warm, dry and dehumidified air (Objects 179-181 Bennett 2008) taking in and exhausting 84,000 cubic feet of fresh air per minute (cfm), and if all the fans were running 428,000 cfm of air was recirculated around the site (Fox 2006). Also within Area 19 are two chilled water buffer tanks that were used to supply chilled water to the

Plate 31 - 3 Site, Area 10: Sulzer compressor (© Oxford Archaeology)

(now decommissioned) boiler house, and from here it would be distributed throughout the bunker. There is also a redundant water chilling plant to the west of Area 1 below Emergency Exit 'A'. From here, water would have been distributed around the north-east area of 3 Site.

13.2.11 ***Communication*** was paramount to the operation of 3 Site, as its primary function was to communicate to the outside world in the survival and restoration phases. The scale of the system installed at Corsham was massive and only matched by that in and around Whitehall. The main means of communication was via telegraph carried on private wires or on rented GPO trunk lines. This was supported by standard telephone calls through the same means. A dedicated spur to the GPO's Backbone radio system was also installed, and a specially dedicated radio tower was the only above-ground structure constructed directly relating to the operation of 3 Site. Circuits were necessary not only to British connections but also overseas to allied and commonwealth governments, NATO centres, British embassies etc. The Main Telephone Exchange (Area 8) provided connections to the public trunk network and to the various military networks via the South-West Signals Centre (see Section 7). The scale of the communications network is illustrated by the fact that it was thought 1,000 staff would be required to operate the system (Fox 2006).

13.2.12 The main concentration of telecommunications equipment are within Area 8: The Main GPO Exchange, and Area 21: Government and MOD Communications Centre (Comcen). There is also a minor component of recent fibre network in Area 2: The Quarry Operations Centre, and a GPO Exchange in Area 1. The equipment survives *in situ* in different levels of condition, and has been used to various degrees at different times. For example DSCN employees remember Area 21 being staffed. Much of the communications equipment would have been connected or partially connected and regularly tested, ready to operate in the event of nuclear fallout.

13.2.13 Area 8 (Object Numbers 1-250 Bennett 2008b) is a telecommunications facility known as 'Woodlands'; it was established and maintained by the GPO connecting to the national telecommunications network through major cables. It is divided into nine areas that contain large manual switchboards, automatic telegraph and telephone switching and comprehensive transmission facilities. The artefacts are a largely complete *in situ* range of equipment, including related artefacts such as telephone books and documentation. These artefacts are not individually rare but have a high group value, much of it surviving in good condition (Bennett 2008a).

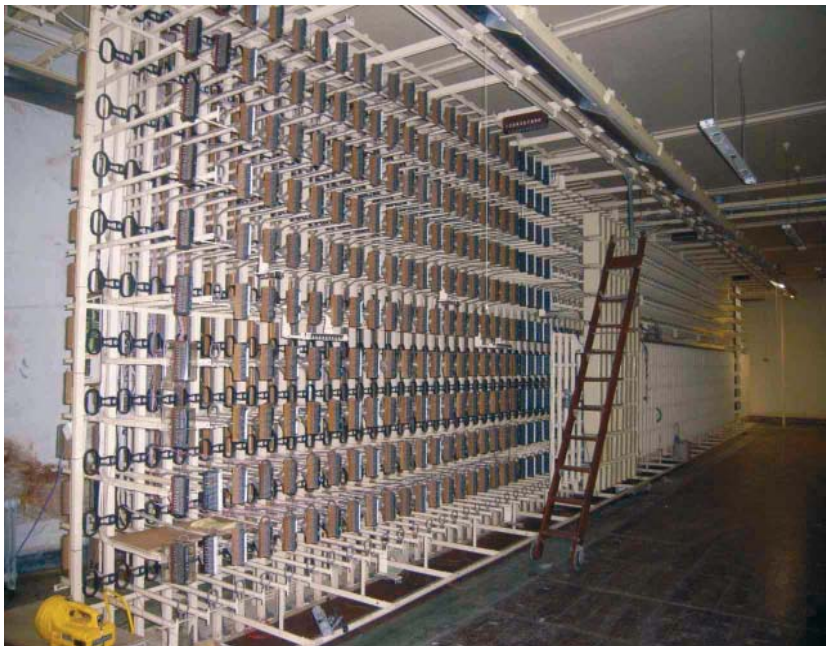

Plate 32 -3 Site, Area 8: main distribution frame (© Mark Bennett)

13.2.14 The Exchange in the Manual Switch Room (Object 18 Bennett 2008b) comprises two multi-position boards and is visually impressive, surviving in excellent condition. A Directory Enquiry Desk (Object 53 Bennett 2008b) is situated adjacent to this, with a comprehensive set of 1988 Directories and Yellow Pages. The Main Distribution Frame (MDF) (Object 19 Bennett 2008b) is another substantial feature although these are sparsely populated. An Optical Fibre Transmission Equipment Rack (Object 3 Bennett 2008b) in the MDF area is thought to date from the 1990s, and illustrates that equipment was still being updated at this time. The area also contains the necessary operational plant, including Air Compressors (Object 105 Bennett 2008b), an Air Handling Unit (Object 104 Bennett 2008b), a TRS (Telephone Repeater Station) and TGH Power Room containing a motor alternator (Object 108 Bennett 2008b) and regulatories (Object 110 Bennett 2008b), as well as a stand-by generator for the whole area (Object 244 Bennett 2008b).

13.2.15 Area 21 houses the highest density of telecommunications equipment surveyed, and is impressive because of the complexity, range and quantity of artefacts. It is known from plans located on site that the Foreign and Commonwealth Office, Army, Navy, RAF and the Cabinet Office all had divisions within Area 21. This area is almost certainly unique in the United Kingdom. The artefacts consisted of standard 1950/ 1960s equipment, whilst others were less common and unknown to the survey team, although of those surveyed none were thought to be rare (Bennett 2008a). The majority are contained in their original packaging and whilst many survive well, the damp environment of Area 21 has seriously affected the condition of others. The artefacts (Objects 183 - 251 Bennett 2008b) include a large number of teleprinters (Object 184 Bennett 2008b), Perforators (Object 186 Bennett 2008b), Reperforators (Object 185 Bennett 2008b) with an extensive range of support infrastructure including a large Local Area Telephone and Telex Exchange (Object 209 Bennett 2008b).

Plate 33 - 3 Site, Area 21: communications equipment in original packaging (© Mark Bennett)

13.2.16 Area 1 also contains a GPO Telephone Exchange, which is thought to have been retained from the MAP factory. Access was not possible due to health and safety restrictions, although if artefacts do remain *in situ* they are likely to be in very poor condition. Area 2 functioned as the QOC from 1979 under the RAF. As a largely self-contained secure bunker, it required its own telecommunications equipment, and a telephone network based on an optical fibre network (Object 260 Bennett 2008b) remains extant.

13.2.17 In the event of nuclear attack on the UK it would have been necessary for the Prime Minister and others to broadcast to the outside world via the BBC's emergency centre at Wood Norton. The BBC Studios were installed within Area 16 (Object 365-367 Bennett 2008b) comprising two rooms: the Broadcaster's Room (The Studio) and the Technical Broadcast Room (The Office). The rooms are acoustically treated and contain furniture, a telephone, an I/O tie-line interface connector, private wire and three 'tables' wired for broadcasting purposes.

Plate 34 - 3 Site, Area 16: BBC broadcasting room (© Mark Bennett)

13.2.18 Internal communications were via broadcasts from a Public Address System in Area 15. Part of this dates from the MAP Factory (Object 371 Bennett 2008b), and part from a later system installed for 3 Site (Object 372 Bennett 2008b). The latter remains in working order and speakers are evident throughout 3 Site. Internal communications was also provided via a Lamsom Exchange which connected to a central station in Area 15 (Object 395 Bennett 2008b). This connected to the rooms listed below, with which quick communications were important.

- Area 10: 47;
- Area 13: 2 & 25;
- Area 14: 40 & 63;
- Area 15: 11;
- Area 16: 13, 38A, 45 & 90;
- Area 17: 3;
- Area 18: 32, 56, 85, 124;
- Area 21: 14, 16, 17, 22, 39, 51 & 67;
- Area 22: 3.

Plate 35 - 3 Site, Area 15: lansom exchange, central station (© Oxford Archaeology)

13.2.19 ***Welfare*** was an important consideration within 3 Site as it would have been an entirely self-contained facility; a designated Welfare Officer and two padres would have been provided (Fox 2006). Some of the offices in the areas described within the Administration section below would also have served as sleeping quarters depending on the type of room (designated A- D) (Fox 2006). Type D rooms were dormitories which are located in Areas 4 and 5 and probably Area 3. These are basic open areas with minimal adaptation from the MAP-factory era; raised beds and painted brickwork are evident throughout. The RAF also used Area 3 for dumping because of its close proximity to Area 2, which the RAF later occupied.

13.2.20 The most striking welfare facilities are those of the Kitchen, Canteen and Dining areas, particularly Area 12 but also Areas 6 and 7. It was hoped that fresh food would be supplied,

but in the event that this was not possible standard army ration packs would be used, which were stored in above-ground huts. The original 3 Site kitchens were installed in Areas 12 and 7, but the latter was abandoned and this area is now in very poor condition. In contrast, Area 12 survives in excellent condition, as do the 1950s artefacts contained within it. The range and setting of these is considered to be unique (Objects 137-463 Bennett 2008b). The kitchen is divided into three components: the Bottom Kitchen, Servery and Tea Bar. The Bottom Kitchen is a large-scale catering facility containing industrial-size catering equipment including hot plates, steam ovens, tray steamers, hot plate ovens, ovens, heated cupboards (Objects 275-280 Bennett 2008b), deep fat fryers (Object 282 Bennett 2008b) and three large chiller cabinets (Objects 304-305 Bennett 2008b). The Servery (Object 473 Bennett 2008b) houses two warming cupboards and the Tea Bar contains two STOTT coffee machines (Object 455 Bennett 2008b). Various assorted items are also extant such as crockery, vinegar bottles and salt shakers.

Plate 36 - 3 Site, Area 12: deep fat fryer (© Mark Bennett)

13.2.21 The western half of 3 Site suffers from damp conditions. These have led to the deterioration of Area 7, which was abandoned in the 1970s/ 1980s (Object 383-389 Bennett 2008b). The artefacts here are of the same date as those in Area 12, including large industrial equipment, but much of it has been relocated in the QOC kitchen of Area 2. Here 1960s ovens, hot plates and grills survive (Object 255 Bennett 2008b) as do water heaters, sinks, kitchen racks and a hot cupboard from the 1980s (Objects 256-257, 262 & 265 Bennett 2008b). Area 6 has also been abandoned although the artefacts for baking bread remain intact, largely including dough mixers, bread tins and commercial ovens (Objects 377-382 Bennett 2008b).

13.2.22 To the south of Area 6, an industrial laundry survives. Again, this western area is in poor condition, but the artefacts survive *in situ* including three washing machines and a roller press (Object 397 Bennett 2008b). Other artefacts have been removed and placed within Area 12, including a small range of 1950s industrial equipment, such as a washing machine, wash boilers, spin drier, clothes drier and continuous roller press (Objects 326-333 Bennett 2008b). These laundries would only have been used for 'house-keeping washing', as staff would be expected to wash their own clothes in sinks (Fox 2006).

13.2.23 The Hospital in Area 9 is situated in the same position as that of the former MAP factory. A number of the walls are brick and therefore it is likely that the existing layout was utilised; elsewhere breeze block walls have been added. The walls are painted blue with cream doors and frames; rooms are labelled according to function including a dispensary and treatment room and there is a total of six small wards (Object 441-450 Bennett 2008b). The purpose of the Hospital was to ensure staff were 'fit for work', if seriously ill they would be sent 'elsewhere' for treatment. Structurally the Hospital

Plate 37 - 3 Site, Area 9: hospital room (© Oxford Archaeology)

survives in excellent condition, consisting of largely empty rooms with the exception of those with fixed fittings such as the Sluice Room (Object 444 Bennett 2008b). Several items from the storage areas have however been put on display to create the ambience of a Hospital. A Hospital is also extant within Area 2 of the QOC dating from the 1980s, this includes artefacts such as beds, medical screens, an operating table and stretcher trolley (Objects 259 Bennett 2008b).

13.2.24 Washrooms within 3 Site are dispersed throughout, although mainly to the east. These reuse the MAP Factory facilities, and the original 1940s fixtures and fittings survive *in situ*.

13.2.25 ***Administration*** is a significant component of 3 Site, although the distinction between this and *Command* in some areas is difficult to determine. These areas are characteristically divided into small rooms by concrete breeze blocks with wire meshing running between the top of the breeze block wall and the ceiling. Administration areas include:

- Area 2: Board of Trade, Her Majesty's Stationary Office, Office of Minister for Science, Lord Chancellor's Department, Customs and Excise, Treasury and Inland Revenue;
- Area 10: The Ministry of Transport Offices;
- Area 13: Ministry of Power & Ministry of Agriculture;
- Area 14: War Cabinet, Cabinet Secretariat, Chiefs of Staff Organisation, Prime Minister and other ministers;
- Area 15: Camp Commandant and Establishment Officers;
- Area 16: BBC, Central Office of Information, Ministry of Health, Home Office, Ministry of Housing and Local Government and Scottish Office;
- Area 17: Ministry of Aviation, Ministry of Labour and United Kingdom Land Forces;
- Area 18: Admiralty, United Kingdom Land Forces, War Office and Air Ministry;
- Area 22: Commonwealth Relations, Colonial Office and Foreign Office.

13.2.26 ***Command*** was focused within Area 14, as it was from here that retaliation against nuclear attack would have been conducted. The Prime Minister, War Cabinet and War Cabinet organisation would have been located here (as confirmed by the original documentation of the 3 Site Telephone Directory). Accommodation for the Prime Minister is thought to have been allocated in rooms 34 or 35, and there is a large Briefing Room (Map Room) where the War Cabinet would have met (room 60). An internal bell system connects rooms within the area. Those departments with the most active roles such as Foreign Office in Area 22 would be located in close proximity, in contrast to departments such as the Inland Revenue, which were located on the outer perimeters of Area 2. Area 17, although on the outer area of 3 Site, is however of particular significance as this is distinctive, with an extensive caller system and separate bathroom facilities (Object 390-392 Bennett 2008b). This indicates an area of high status, and official telephone books also place government ministers in this area.

13.2.27 ***Defence*** from 1979 was predominantly based at the QOC, which included offices for Ground Defence Control (Objects 266 Bennett 2008b), the function of which was to defend 3 Site. There is also a Headquarters for the RAF Provost and Security Services UK (Objects 270 Bennett 2008b) which provided command and control for the police throughout the UK. This area houses a nuclear, biological and chemical area with small triangular metal discs with 'ATOM', 'BIO' and 'GAS' used to signify conditions above.

13.2.28 ***Storage*** of items is evident within individual areas, with the exception of Area 10 as this is in close proximity to Area 9, the Main Store. The division of storage in this way allowed items related to the function of individual areas to be quickly installed in the event of the occupation of 3 Site. The location of storage areas where known, has been mapped in Figure

20. A good example is in Area 14 which contains various stationery items (Object 452 Bennett 2008b), or those in Area 15 which contain electrical administration equipment (Object 451 Bennett 2008b). Area 9, the Main Store, retains an impressive array of late-1950s to early-1960s artefacts, mostly housed on metal shelving. This includes bulk paper items, catering goods and photocopiers (Objects 400-440) Bennett 2008b).

Plate 38 - 3 Site, Area 2: mess tins and signs (© English Heritage AA030778)

13.2.29 ***Maintenance*** is located at the east perimeters of the site, where small divisions of areas were used to ensure the day-to-day operation of the site including carpenters, a welding shop and workshops (Objects 146-394 Bennett 2008b).

13.2.30 ***Plant*** was vital to 3 Site, to enable the facility to function for 30 days divorced from the external environment; it is focused at the east and west perimeters of the bunker. Sub-stations are also interspersed throughout the site, in the same location as those of the MAP Factory. Electricity was supplied by an 11-KV ring main fed from the surface which supplied 34 500-KVA transformers, giving a total transformer capacity of 17 MVA. Area 11 extends to massive Lagoon and Water Treatment facilities, including a chlorine-dosing plant (Object 177 - 178 Bennett 2008b). Water would be distributed around the site by a pressurised 250mm diameter main feed from the public supply. If circumstances prevailed that this was unsafe, water would be taken from an underground culvert and treated before being stored in tanks capable of holding 440,000 litres (Fox 2006). A septic water tank and plant ejector are also located at the eastern boundary of the site. The latter would have pumped human and kitchen waste from here to the main surface draining system. To the west, Area 19 contains water tanks, steam boilers, a Power House and office (Object 396 - 178 Bennett 2008b). Standby power would be generated by 4 Mirrless 12-cylinder V-type diesel generators. These were fed with diesel fuel from 12 tanks that could hold 176,000 gallons.

Plate 39 - 3 Site, Area 11: water treatment plant (© Oxford Archaeology)

13.2.31 **Above-ground** (Figure 15)

13.2.32 Military structures above ground relating to the operation of 3 Site were limited for obvious security reasons. A significant addition was a mast situated to the south of Westwells Road for the operation of the below-ground communications infrastructure. This remains *in* situ today. Additional structures are evident on a 1967 aerial photograph although their function and relationship to 3 Site are not known. In the broader Study Area structures dating from the 1960s are visible illustrating urban expansion at this time, although it is known that the MOD tried to resist building in the area (Steve Fox pers comm).

13.2.33 It was necessary to make the existing infrastructure connecting the above and below-ground worlds nuclear-protected. Those that were not used were blocked and capped, for example: Slope Shaft B, ventilation shafts B1 and E2. Others were remodelled to ensure they were nuclear-protected, such as the chimney and coal shaft for the MAP Factory Boiler House and the shaft-head buildings for the lifts. These were made blast-proof by sealing the original openings with five-foot thick concrete walls on massive foundations and building new, concrete access passageways at right-angles to the existing openings. Some concrete head shafts were covered with grass mounds, such as Public Lift 1 which is visible from Westwells Road. Others were completely rebuilt such as Machine Lift 1 which was changed to an enclosed, reinforced-concrete structure with a blast-proof entrance. The two escalator shafts (A and C) were modified; two vertical shafts were sunk in Shaft A from the surface to meet the incline at the highest point of the escalator. Shaft C was in part demolished and enclosed within a huge new concrete edifice. This was then covered over and grassed, leaving gated pedestrian access. The modifications to the existing infrastructure are illustrated on a sketch dated 1957 (Sketch No. XK1/150) (McCamley, N 2007) (Quinn, A pers comm).

13.3 Survival

13.3.1 Below-ground

13.3.2 Overall the striking feature of 3 Site is the extent of survival both in terms of structural fabric and artefacts. It was never operational and (with the exception of Area 2) was not subject to further development, moreover as the site was only recently decommissioned the result is a remarkable level of preservation.

13.3.3 The areas to the east survive in better condition than those to the west, which suffer from damp and were abandoned following the division of 3 Site under Chanticleer. The exception to this is Area 21 which is subject to serious damp, mould and spore issues that are affecting the structural fabric of the area, in particular doors, door frames and ceilings. This is also having a major negative effective on the extensive surviving telecommunication artefacts. Area 9 (Stores) has lost many of its artefacts that in general are not individually significant, but have a high group value. Elsewhere within Chanticleer, areas and artefacts generally survive in good condition, with a remarkable level of survival and preservation; this eastern area is also the most significant in understanding the operation and function of 3 Site.

Plat 40 - Basil Hill: public lift 1
(© Oxford Archaeology)

13.3.4 In contrast, those areas external to Chanticleer (lying to the west) have not been maintained and are suffering the effects of damp and poor ventilation. Area 1 is the most extensively affected and it was not possible to gain access to this GPO Exchange. To the east of this, Area 2 is suffering from similar but less extensive effects which, although being treated, has caused the collapse of ceilings in places. Areas 3, 4 and 5 are largely empty and, although damp, structurally well-preserved. The Kitchen and Industrial Bakery within Areas 6 and 7 are in poor condition and suffering from damp. The artefacts within Area 6 are *in situ* in contrast to Area 7, many of which have been removed and installed within the QOC in Area 2. An initial inspection suggests that the plant within the eastern and western areas of 3 Site survives *in situ*, although that to the east is in better condition.

13.3.5 Within East and West Lungs the venturi tubes survive in good condition, and have a significant impact in terms of understanding the operation of the site as a nuclear bunker. East Lung has been re-engineered during the construction of 3 Site and graffiti survives on the rock face relating to this later phase. Some reflects popular culture of the day: '*Cliff*

Richard show on 21.12.1958' and a display of paper cuttings portray popular icons such as Elvis Presley. Poignant examples include: '*Xmas 1950 no snow on the ground, maybe hydro bombs*', and a carving of the grim reaper is a chilling reminder of the political and social currents of the day.

Plate 41 - 3 Site, Area 7: depicting poor condition (© Oxford Archaeology)

APPENDIX I: METHODOLOGY

14.1 INTRODUCTION

14.1.1 The methodology for the Characterisation Study was set out in a structured process within the English Heritage Project Design. This is used below in describing the approach taken at MOD Corsham and substantiated with relevant information. Overall, the objectives of this study are based on those set out in the document *Characterising Heritage Places: template project design* (Draft 6, October 2003). Those detailed below are relevant within the context of this study.

- The compilation of baseline historic environment data, derived from an agreed list of sources and an assessment and quantification of previous work;
- A multi-disciplinary approach, which sets buildings, landscapes and the archaeological resource in its fullest possible context - spatial, temporal and social;
- Synthesis, aimed at enabling neutrally-based and fresh insight into the key factors underpinning site character, development and potential;
- An identification of character zones;
- Report, archive and dissemination.

14.1.2 The approach taken in the Characterisation Study is described below in a clearly phased methodology; in practice, many of the elements overlapped and developed during the course of the project. For example, further archive resources were identified through speaking to MOD employees during the site survey.

14.2 PHASE 1: SCOPING

14.2.1 *Desk-Based Assessment*

14.2.2 The first stage of the characterisation process was a desk-based review of the information presently available, and the identification of key stakeholders. An initial meeting was set up with MOD personnel to assess the site above and below ground, and to determine the extent of the archive resource. A CAD plan of the below-ground site was obtained from the MOD, which provided the base-layer mapping for the project. A current above-ground CAD plan was obtained of the Study Area from English Heritage, as well as 1st, 2nd and 3rd Edition Ordnance Survey (OS) maps. Relevant information was meshed electronically to produce a single GIS map containing layers of relevant geo-historical information. Selected primary and secondary sources were then added to this baseline information.

14.2.3 Data held on the NMR (National Monument Record) and Wiltshire Historic Environment Record (HER) (formerly SMR) such as archaeological sites, events and monuments was identified and assimilated. Protected sites for example Conservation Areas, Listed Buildings, Archaeological Sites, Events and Monuments, Scheduled Monuments and Registered Parks and Gardens were identified and assimilated. A database was established for data entry, into which this information was recorded. Additional data such as Aerial Photograph and oblique photographs from the NMR were also assessed, including those previously taken by English Heritage of the below-ground space and artefacts. A report from Mike Evans of the NMR considering the archive resource below-ground at Corsham was also obtained and discussed.

14.2.4 The following sources were reviewed as part of this project, key ones are detailed below, and a complete listing is included within the Bibliography (Appendix V).

- National Archives (formerly Public Records Office);

- Wiltshire Record Office;
- MOD archive at Basil Hill: *c.*600 maps;
- MOD below-ground archive: includes various maps, reports, photographs and primary data recovered from the quarries or donated;
- Site survey: maps survive below-ground, for example a detailed drawing of Spring Quarry within the current map room;
- Published literature: key literature includes Nick McCamley's *Secret Underground Cities (1998)* and *Cold War Secret Nuclear Bunkers* (2003), Steve Fox's *Struggle for Survival Governing Britain After the Bomb* (www.subbrit.org.uk/rsg/features/sfs/) and Peter Hennessy's *The Secret State Whitehall and the Cold War (2003)*. Further sources are listed in the Bibliography (Appendix V);
- Experts: Nick McCamley provided information on the interwar and Second World War history of the site, as well as a number of maps from his personal archive. Steve Fox provided information on the Cold War history of the site, including documents obtained following its declassification. Peter Hennessy provided information on the key areas of significance within the context of Cold War history. Bob Jenner explained the development and function of Browns Quarry. MOD below-ground employees were also a very useful resource, particularly Andy Quinn, and those that worked within the mines during the operation of 3 Site;
- Internet: the Subbrit (http://www.subbrit.org.uk), 28 days later (http://www.28dayslater.co.uk) and BBC (http://www.bbc.co.uk) websites were particularly useful sources;
- Digital sources: two DVDs are available of the site produced by MVP Video Services, these are *Deep, Dark and Dusty* and *Lifting the Lid on Box Hill* (date unknown). Historic film of the site held in the archive below-ground at Corsham was also reviewed and a Pathe film showing the conversion of Spring Quarry. Historic and digital images of the site were also obtained from the MOD archive.

14.2.5 *Defining the Study Area*

REQUISITION STATUS	QUARRY
Areas held on requisition and now partly developed	Pickwick
Areas not requisition and not capable of being developed	Box Quarry
Areas held on requisition and now completely developed	North division of Copenacre Quarry, Tunnel Quarry, Browns Quarry and Spring Quarry
Areas not requisitioned, not developed and not capable of being developed	Sands Quarry (southern section)
Areas not developed but capable of being developed	Southern division of Copenacre Quarry, East Lung, West Lung, Groundstone Quarry and Sands Quarry (north section)

14.2.6 An understanding of the historical development of the site was necessary in defining the Study Area for characterisation, and this was the initial requirement of the brief set by English Heritage. As described, the above-ground infrastructure was largely determined by the requirements of the below-ground operations, and therefore it was the latter which dictated the perimeters of this Study Area. During the data trawl a plan was identified in the MOD above-ground archive of the below-ground area thought to have been drawn up

by the War Office in *c*.1943 providing an overview of the status of requisitioned areas (Fig 4). This includes:

14.2.7 The areas included within the plan also had the advantage of demonstrating the functional relationship between areas; for example Groundstone Quarry provides the ventilation for Tunnel Quarry and East and West Lungs provide the ventilation for Spring Quarry. The area encompassed in this plan also included those areas currently (2008) under the operation of the MOD and within the PFI. The Study Area below ground includes Tunnel, Browns, Spring, Clift, Groundstone, Copenacre and Pickwick quarries with the above-ground associated infrastructure. This plan was used as the basis of the project study area, and agreed at a meeting with English Heritage in November 2007.

14.3 Phase 2: Mapping and Data Interpretation

14.3.1 *Data Selection*

14.3.2 The cartographic sources with the exception of the baseline data described in Phase 1, were paper based. These maps were scanned to create an electronic cartographic archive, which can be used in any future studies of the site. Numerous maps were found for some below-ground areas, in particular Tunnel and Spring quarries, and therefore the task was to identify which of these contained accurate yet detailed information. In some cases, information from two maps of similar date was meshed to achieve this result, particularly for Spring Quarry. Many maps were marked 'proposed' and other maps with useful information were undated, therefore it was necessary to identify how these fitted within the development of the below-ground resource. Key maps were identified which were thought to represent significant stages of the Study Area's development, these were then digitised and related to the National Grid.

14.3.3 Above-ground survival of buildings and features was determined through a map regression study, although cartographic sources were less numerous than the below-ground areas and many were marked as 'proposed'. Relevant information was digitised, related to the National Grid and overlain on the below-ground infrastructure to determine the correlation between the two resources. These maps were cross-referenced to aerial photographs dating from 1940 to 1967, which played an important role in determining the above-ground plan form.

14.3.4 Draft maps of key areas were produced and discussed at a further meeting with the MOD to confirm our findings, and also to establish which areas were inaccessible due to health and safety restrictions. This enabled a targeted approach to be taken during the site survey, particularly as only a limited period was available for this aspect of the project

14.3.5 *Site Survey*

14.3.6 The below-ground site survey was undertaken over a period of four days in December 2007 and concentrated on the following areas: East and West Lungs, Spring Quarry (which includes 3 Site), Browns Quarry and Tunnel Quarry. Essentially, the objective was to verify and enhance the draft maps produced through the desk-based exercise. A rapid survey only was possible of the areas with the aim of gaining an overall understanding of the operation of the site, as well as an appreciation of areas with high survival of historic fabric. It was not possible to gain access to Groundstone, Clift, Pickwick and Copenacre quarries. The site work for the Artefacts Study was also undertaken by Mark Bennett and his team at this time, which was attended by OA.

14.3.7 The above-ground survey confirmed the findings of the map and photographic regression, in particular it was used to determine whether a structure had been rebuilt on the same footprint or whether the original fabric survived. Digital photographs were taken throughout

both site surveys.

14.3.8 *GIS*

FUNCTION	EXAMPLE
Administration	Offices
Command	Prime Minister's room, South-west Switching Centre
Communications	GPO, Lansom Exchange, Tannoy Room, Telephone Exchange
Experimental	Laboratories, testing
Manufacture	Machine shop, welding, view room, heat treatment
Maintenance	Workshops, Washing bay, electrical, mechanical
Plant	Water Treatment, Sewage Works, Sub-stations, Power House
Storage	Ammunition, Finished Parts, Telecoms Equipment
Transport/ access	Lifts, roads, slope shafts, railway
Ventilation	Fans, air drifts, air shafts, sub-floor drifts
Welfare	Barracks, WCs, Hospitals, Canteens, Dorms

14.3.9 The creation of the Corsham GIS had three distinct phases; the first was the collation, sorting and digitising of sources in order to create a set of digital basemaps for the underground quarry system. The range of map sources consulted included current OS Mastermap data, historic OS mapping, aerial photographs, and a large collection of underground plans (primarily sourced from the Ministry of Defence during on-site visits).

14.3.10 Paper copies were scanned, and all versions were geo-referenced and digitised when necessary. However, due to the varying accuracy and quality of each map, only a selection could be successfully referenced with any margin of accuracy. This means that although these plans provide essential information with regards to the characterisation and use of the site, their spatial integrity was often inadequate to digitise directly.

14.4 Phase 3: Analysis, synthesis and conclusions

14.4.1 Following consideration of the archive resource and the site survey, the approach taken was to produce 'Key Feature' maps of the key quarries and areas during significant phases of their development in order to provide a base layer of information prior to characterisation. This method was chosen because consideration had to be given to the two platforms on which this information would be provided: GIS and A3 illustrations within the report. More information is visible within GIS than can be illustrated within an A3 plan, and therefore it was important to provide a means of illustrating information without compromising detail within the report.

14.4.2 *Key Feature Maps* (Figures. 10, 12, 16-18 & 20-21)

QUARRY/ AREA	DATE	FIG. NO.	FUNCTION
Browns Quarry	c.1940	17	No.10 Group Fighter Command
Spring Quarry	c.1943	18	Aircraft Manufacture and Subsidiary Industries
Military Landscape	1940-8	12	Various/ Predominantly Service Buildings
Tunnel Quarry	1945	10	Ammunition Storage
South West Signals Centre	1962	16	Signals Centre for the South-West of England
3 Site	1961	20	Central Government War Headquarters
3 Site (Chanticleer)	1979	21	Central Government War Headquarters

14.4.3 The objective of the Key Feature maps is to illustrate the prominent characteristics and components of areas. The dates are based on cartographic information from Phase 1, with an emphasis on those which were thought to best illustrate the site accurately. For example 1945 was chosen because an accurate map of the site at this date was identified. In some cases few maps of areas were identified, particularly in the case of Browns Quarry and the South-West Signals Centre, and here the dates chosen are that of the only maps located. Key Feature maps of the below-ground are tabulated below

14.4.4 It was important that there was continuity between these illustrations and that they could easily be assimilated within the characterisation. A standard key was therefore established including the elements listed below which are colour coded. For example, access/ transport features are shown in green and ventilation in blue, which follows into the later characterisation according to function.

- *General*: quarry boundary, internal divide and commonly occurring features such as emergency exits;
- *Access/ Transport:* lift shafts, incline shafts, Box Tunnel, road/path ways and features unique to the quarry, such as the conveyor belts and refuge sidings within Tunnel Quarry;
- *Ventilation*: air inlet/ outlet shafts, fan and air drifts.

14.4.5 At GIS level, the dates of the Key Features maps were assimilated so that it was possible to provide an overall view of the operation of the below-ground Study Area at a particular period. For example, the Key Feature maps of Tunnel, Spring, Browns and the South-West Signals Centre are shown as one GIS layer so that a 'slice in time' is provided showing the operation of the quarry between 1940-5. In other examples, such as the 1962 map of 3 Site, the GIS shows the key features of this area, but the remaining quarry is largely shown as non-operational.

14.4.6 Above ground, the same methodological approach was taken with the identification of key features, and the standard key described above used to illustrate the correlation between the above and below-ground entities. Key phases of historic development are:

- 19th and early 20th-Century quarrying;
- The Second World War;
- The Cold War.

14.4.7 Key industrial features are identified on the First Edition OS map (1874), which was the only cartographic source from this period identified. Plans dating from 1941 and 1948 were identified, illustrating the infrastructure above Tunnel and Spring quarries and also depicting the functions of some structures. These were cross-referenced to aerial photographs dating between 1940 and 1967 to determine if structures were built and whether they remain extant today (Fig.12). Structures identified on the aerial photographs but not on the plans were digitised and added to the GIS to ensure a complete depiction of the above-ground resource. This information was overlain on a 1954 OS map as a base layer, which is the closest available cartographic date. Key aerial photographs were integrated into the GIS including:

- 14th April 1946 (106G.UK.1415.4040);
- 6th July 1940 (296902.1625);
- 13th June 1967 (F21 RAF.543.3859.0565).

14.4.8 No above-ground plans of the site indicating the functions of the Cold War structures were

identified, and therefore the functions of the buildings following the commencement of 3 Site in 1962 is uncertain. The aerial photographs show that the Cold War landscape was much the same as that of the Second World War, with the addition of a small number of buildings. An AP dating from 1967 gave the best coverage and additional buildings were recorded and their survival determined.

14.4.9 *Characterisation Maps* (Figures 8-9, 11, 13, 19 & 21)

14.4.10 Characterisation maps were produced showing the function and primary operation of the above and below-ground infrastructure. The same base layer of information as illustrated on the Key Feature maps is shown including: General, Access/ Transport and Ventilation.

14.4.11 In establishing the typologies for the characterisation according to function it was considered important that these were applicable to different areas as they developed through time both below and above ground. This point is illustrated in examples listed below; for example the storage function includes ammunition storage in Tunnel Quarry, Finished Part storage in Spring Quarry and Telecom Equipment in 3 Site. In this way the function categories are capable of transcending the different spaces and periods within the below and above-ground spaces. Characterisation maps within this report include Figures 9, 10, 12, 14, 20 and 22.

14.4.12 Characterisation according to operation was completed, illustrating which organisation operated the site through the development of the quarries. Included within this report is Figure 9. Different areas of the quarries were operational and non-operational throughout its history and therefore these were divided into solid colours showing areas which were operational, and hashed areas for those which were non-operational. This method had the advantage of clearly illustrating areas which were chosen for operation but not developed, such as BSA Barrel Mill and Dowty in the 1940s use of Spring Quarry.

14.4.13 It was not possible to undertake operational characterisation for the above ground, as the historic mapping did not include exact information as to who occupied which buildings. Generally, the infrastructure above Tunnel Quarry is likely to relate to the Royal Engineers and War Office, and that above Spring Quarry, the Ministry of Aircraft Production. Through the later phases of the site, some structures will have been operated by the Royal Navy and Police.

14.4.14 *Historic Remains Survival Maps* (Figures 6, 14 & 15)

14.4.15 Maps illustrating areas of high survival and potential survival were completed for the below-ground phases which were impacted by later development, that include the 19th-century and early 20th century quarrying and World War II. This information is largely based on observations during the survey for which a limited amount of time was available, therefore the lines drawn on these maps are indicative and may not be precisely accurate. This could be achieved through a longer period of survey in which the lines could be mapped to pillar numbers. Survival maps included within this report are:

- Below-ground Study Area: Survival of 19th-Century and Early 20th-Century Quarrying Remains (Fig.6);
- Below-ground Study Area: Survival of World War II Remains (Fig.14).

14.4.16 Further characterisation maps were completed which were thought necessary to illustrate key events or to provide greater understanding of the overall development and survival of the site. These include development maps aimed at gaining a holistic understanding of the phasing of the Study Area, for example the 19th-century and early 20th-century quarry development. Those included within this report include:

- Below-ground Study Area: Key Phases of Development (Fig 3).

14.4.17 A phasing map was completed for the above-ground structures illustrating through map regression and AP survey the dates from which structures were known to be extant and whether these remain survive (Fig. 15).

14.4.18 *GIS*

14.4.19 The second phase was concurrent with the analysis of the historic character of the site, including creating period maps showing the changing function and operations of the site. Each phase of Corsham required specific layouts relating to the changes in use over time. These were digitised from the supplied CAD plan of the main quarries interiors combined with MOD maps for the northern Copenacre quarry. Digitising focused on different types of features. These included: layout plans (below ground), character areas (above and below ground), access and transport features (above and below ground), ventilation features (above and below ground), and military building phases (above ground).

14.4.20 Each layout plan was digitised from a synthesis of corresponding maps. Acknowledging the varying accuracy of these maps meant that the final plans were often an interpretation that was applied to the established agreed-upon base layout. This process provided a mixture of polyline and polygon shapefiles delineating underground areas and zones across the site. The access, transport, and ventilation features focused on digitising of Lift Shafts (points), Slope/Incline Shafts (polylines), Roadways (polylines), Fans and Air Shafts (points), and Air Drifts (polylines). Surface features consisted of archaeological features and Listed Buildings (SMR and NMR data) as well as extant building phases. The extant building phases were digitised from a combination of surface plans, historic maps, and aerial photographs. Character areas were also delineated by using the functions of these buildings. All of these datasets were attributed appropriate data, such as quarry name, feature name, function, operation, date, etc. Also created were supporting shapefiles used for more general characterisations, presentation purposes, or annotation/labelling.

14.4.21 The third phase involved the aggregation of data and meta-data into a single digital project, designed to be accessed and queried through a GIS program as opposed to focusing on the creation of paper-based mapping. This project was digitised and assembled within the ESRI ArcGIS 9.2 suite of software. This enabled the creation of readily accessible shapefiles viewable in most available GIS packages. However the main project file (*.mxd) as well as the figure layouts and supporting symbology data must be viewed within a copy of ArcGIS 9.x.

14.4.22 *The Artefacts Study*

14.4.23 Mark Bennett and his team completed a study of the artefacts within the Cold War areas of 3 Site (Bennett, M 2008). The findings of this work are assimilated within this report (Section 13), for example in the communications operation of the site.

14.4.24 The results of the characterisation study were presented to the steering group in March 2008, and their feedback was assimilated into the final report.

14.5 Phase 4: Presentation of conclusions and outcomes

14.5.1 The findings and conclusions of the Characterisation Study are included within this report, which is structured according to the three key phases of development. Inevitably there are overlaps between these phases, for example Tunnel Quarry continued in use as an ammunition storage depot until 1962 and Copenacre was used as a storage depot until 1995. Significantly, Browns Quarry had a second function following the end of the Second World War as detailed below. Such examples of continuity or secondary use are described within

the context of their primary development as this provides greater clarity in understanding. The secondary use of 3 Site is described within the Cold War section, as this use is clearly in contrast to that of its primary use as a MAP factory. Such anomalies are clearly explained in the Summary section of each Part of this report to ensure cross-referencing within the report.

- *Part 1: Pre-19th Century History;*
- *Part 2: 19th-Century and Early 20th-Century Quarrying;*
- *Part 3: The Second World War;*
  Tunnel Quarry: The Central Ammunitions Depot;
  Spring Quarry: The Ministry of Aircraft Production Factories;
  Copenacre, Pickwick and Spring quarries: Royal Navy Storage Depots;
  Tunnel Quarry: The South-West Signals Centre;
  Browns Quarry: No.10 Group RAF Fighter Command Centre *and*; CDCN Headquarters;
- *Part 4: The Cold War*
  Spring Quarry: 3 Site

14.5.2 Each part begins with an overall summary and each section is further subdivided into:

- Historic context;
- Function and key features;
- Survival;

14.6 MISCELLANEOUS

14.6.1 *Oxford Archaeology personnel*

14.6.2 The historical research, site survey and characterisation for this study were undertaken by Jane Phimester of the Buildings Archaeology department, the GIS and database were completed by Gary Jones of the Geomatics Department. Ianto Wain of the Heritage Management department project managed the study and advice was also given by Julian Munby of the Buildings Archaeology department. Neville Redvers-Higgins, who has been working at Combe Down stone mines for the past seven years, also provided a valuable insight into the 19th-century quarrying techniques.

14.6.3 *Previous Research*

14.6.4 Various studies of elements of the site have been carried out, although this is the first study to assimilate this information and provide an overall understanding of the Study Area. Key published texts as listed in Section 14.2.4 have been consulted and information about MOD Corsham is included within other published sources as listed in the Bibliography (Appendix V). Numerous unpublished sources have also been used, and these are also listed in the Bibliography. This information has been used in the compilation of this report, and all sources even where not directly referenced are listed in the Bibliography. This is to provide an overall point of reference for future studies.

14.6.5 EH has carried out a photographic record of the Olga Lehmann murals, including the dinosaur murals situated at the east of 3 Site. Other photographic and video recording has been carried out by DE, DCSA, BBC Wiltshire, the Guardian and MVP Publishing Services

14.6.6 *Acknowledgements*

14.6.7 Oxford Archaeology would like to thank many people who have assisted in this study including the MOD's Mines Manager and his team, Nick McCamley for his knowledge of the wartime history of the site and in particular for kindly lending us many maps from his personal archive, Bob Jenner for his advice in the use of Browns Quarry, Steve Fox, Mark Bennett and Peter Hennessy for their expertise and advice in the Cold War development of the site, and Will Holborow, John Schofield and Wayne Cocroft from English Heritage for their guidance throughout the project.

14.6.8 *Health and Safety*

14.6.9 Below ground, certain areas were not accessible at the time of the site survey due to a variety of hazards including asbestos, toxic moulds and roof-fall hazards. A Safety Health Environment and Fire (SHEF) Report of February 2007 identified various health & safety concerns in the underground relating to fire risk, management & control of asbestos and biological hazards. As a result, during the site survey it was not possible to access all areas, in particular Area 1 within 3 Site.

14.6.10 *Limitations of Study*

14.6.11 During Phase 1 of the study, limited information was identified relating to Copenacre and Pickwick quarries and none relating to Sands Quarry. In some instances limited information was identified relating to later phases of the Study Area, in particular Browns Quarry and the South-West Signals Centre. Above ground, limited information was identified concerning the operation and function of the Cold War phase. It is however hoped that further sources may come to light as a result of this study. A vast quantity of information was consulted throughout this study, but additional avenues which were not pursued include:

- Archives held at Rolls Royce relating to the wartime operation of Spring Quarry;
- The Royal Air Force museum at Hendon;
- Royal Engineer Archives at Chatham;
- The British Library.

OA Oxford Archaeology
SMR Wiltshire Sites and Monuments Record
NMR National Monuments Record
HS Historic Sources
WS Walkover Survey
AP Aerial Photographs

NEW OA REF.	FEATURE TYPE	DESCRIPTION	SOURCE
1	Archaeological Investigation	Excavation carried out in 1942 east of Hudswell recovered a Roman inhumation burial in a stone coffin, along with a rubbish pit, coins, stone tiles and 2nd-3rd century pottery sherds. An evaluation directly to the east in 1999 recorded an Iron Age posthole, a RB settlement and a WWII structure.	SMR ST86NE300, ST87SE203, NMR 1352417, 207932, 643406
2	Archaeological Investigation	Excavation carried out between 1920 and 1936 at Monks Conduit House recorded a medieval church.	NMR 643419
3	Settlement	Westwells Settlement with medieval origins	SMR ST86NE459
4	Settlement	Jaggards Settlement with medieval origins	SMR ST86NE460
5	Settlement	Hazlebury is listed as a Deserted Medieval Village. A church here is mentioned in Domesday and occurs in the l2th-14th c. It is said to have been destroyed c.1476; there are now no vestiges left. Some years before 1936 a trial excavation, at the highest point in the field called 'Old Church', revealed its foundations. A slight mound marks the site.	SMR ST86NW450, NMR 208022
6	Settlement	Rudloe House - Demolished Settlement with medieval origins	SMR ST86NW468
7	Settlement	Pockeredge Farm with medieval origins	SMR ST86NE457
8	Park	A medieval deer park is recorded in AD1300 at Park Lane	SMR ST87SE466
9	Quarry	Bath freestone quarries worked during the late Saxon and Medieval periods, and possibly during the Roman period. Supplied stone for Malmesbury Abbey.	NMR 208050
10	Quarry	Pickwick Quarry A 19th century underground Bath stone quarry	SMR ST87SE530

NEW OA REF.	FEATURE TYPE	DESCRIPTION	SOURCE
11	Cropmarks	An undated square enclosure at Lower Rudloe	SMR ST87SW606
12	Cropmarks	An undated square enclosure at Lower Rudloe	SMR ST87SW612, NMR 208563
13	Terraces	Cultivation terraces.	NMR 208569
14	Findspot	Neolithic flint axe fragment from Corsham is in Devizes Museum.	NMR 866124, 866305
15	Findspot	A Bronze Age palstave from Box Tunnel (from near the railway tunnel) is now in Salisbury Museum.	NMR 207958
16	Findspot	Mesolithic adze (undated), Drewetts Hill	NMR 866446
17	Site of Building	Site of a Roman villa discovered in 1710 or 1711 in the vicinity of Hazelbury House. The villa was described as being 184 feet long and featuring a tessellated pavement. In 1972, it was reported that stone and tile fragments could be seen concentrated in a small area, with the site of the villa possibly represented by a rectangular terrace cut into the westfacing slope and possibly connected with slight earthwork banks. Air photographs suggest the presence of a square enclosure and a curvilinear enclosure, partially overlapping. A possible rectangular enclosure is also visible.	NMR 207977
18	Aircraft	Aircraft BD939 was Hawker Hurricane Mark IIC, British fighter. It was one of a batch of 600 Hurricane Mark IICs delivered between July and November 1941, by Hawker, Langley and Weybridge plants.	NMR 1367371
19	Military Feature	Second World War observation post forming part of a stop line along the length of the Kennet and Avon Canal.	NMR 1186724
20	Military Feature	Second World War Pillbox forming part of a stop line along the length of the Kennet and Avon Canal.	NMR 1186726
21	Structure	Box Tunnel - east portal	NMR 207950
22	Tunnel	Box Tunnel. Constructed 1836-41 by I.K. Brunel for Great Western Railway	NMR 983885
23	Railway	Brunel's Great Western Railway between London and Bristol, opened as a broad gauge railway on 30th June 1841, the Swindon - Bristol Section being converted to narrow gauge in 1872, mixed gauge in use from Swindon to Paddington. bee	NMR 1359288
100	Listed Building	Milestone about 140m north of junction with lane to Box Hill. Grade II Listed Building.	NMR 316894, SMR ST86NW 2/34
101	Listed Building	6-10 Hudswell Lane. Grade II Listed Building. 17th to 18th century.	NMR 315255

NEW OA REF.	FEATURE TYPE	DESCRIPTION	SOURCE
102	Listed Building	Hudswell House. Grade II Listed Building. Late 17th century, heavily restored in the early 20th century.	NMR 315254
103	Listed Building	Dovecote at Jaggards House. Grade II Listed Building. 17th century.	NMR 315261
104	Listed Building	Entrance gatepiers to Jaggards House. Grade II Listed Building. Early 18th century.	NMR 315257
105	Listed Building	62 and 64 Westwells Street. Grade II Listed Building. Early 18th century.	NMR 315427
106	Listed Building	42 to 52 Westwells Street. Grade II Listed Building. 17th century.	NMR 315426
107	Listed Building	Westwells Farmhouse. Grade II Listed Building. 17th and 18th century.	NMR 315425
108	Listed Building	17 and 19 Westwells Street. Grade II Listed Building. Late 17th to 18th century.	NMR 315424
109	Listed Building	Barn to north east of Pockeridge Farmhouse. Grade II Listed Building. 18th century.	NMR 315359
110	Listed Building	Walls and gates to Pockeridge Farmhouse. Grade II Listed Building. Early 18th century.	NMR 315358
111	Listed Building	Pockeridge Farmhouse. Grade II Listed Building. 17th century.	NMR 315357
112	Listed Building	24 to 28 Corsham Moor Green,. Grade II Listed Buildings. Three cottages, one dated 1669, altered in the 19th century.	NMR 315309
113	Listed Building	The Old Farmhouse. Grade II Listed Building. 17th century.	NMR 315308
114	Listed Building	Overmoor Farmhouse. Grade II Listed Building. 16th and 17th century.	NMR 315306
115	Listed Building	Saltbox Farmhouse. Date 1784.	NMR 317003
116	Listed Building	Drewitt's Mill. Grade II* Listed Building. Late 19th century.	NMR 317002
117	Listed Building	Drewitt's Mill House. Grade II Listed Building. Late 16th and early 17th century.	NMR 317000
118	Listed Building	Mill Cottage. Grade II Listed Building. Mid 18th century.	NMR 317001
119	Listed Building	Milestone on south side about 300m east of Clift House. Grade II Listed Building. Early 19th century.	NMR 317043
120	Listed Building	Fogleigh House. Grade II Listed Building. Built 1881.	NMR 317042
121	Listed Building	West portal of Box Tunnel. Garde II* Listed Building. Built c 1840.	NMR 317041
122	Listed Building	Grove Farm. Grade II Listed Building. Early 18th century.	NMR 316893
123	Listed Building	Barn to north of Mills Platt farmhouse. Grade II Listed Building. 18th century.	NMR 317069
124	Listed Building	Mills Platt Farmhouse. Grade II Listed Building. Later 17th century.	NMR 317068

NEW OA REF.	FEATURE TYPE	DESCRIPTION	SOURCE
125	Listed Building	Mills Platt. Grade II Listed Building. 17th century.	NMR 317067
126	Listed Building	Sewage ventilation stack	NMR 487009
127	Listed Building	Rudloe Park Hotel. Grade II Listed Building. c1875.	NMR 317078
128	Listed Building	Lower Rudloe Farmhouse and attached stable wing. Grade II Listed Building. Mid 18th century.	NMR 317077
129	Listed Building	Rudloe Manor. Grade II* Listed Building. Late 17th century.	NMR 317074
130	Listed Building	Entrance gates and screen to Rudloe Manor. Grade II Listed Building. Mid 18th century.	NMR 317075
131	Listed Building	Barn to south west of Rudloe Manor. Grade II Listed Building. 17th or 18th century.	NMR 317076
132	Listed Building	Willow Cottage. Grade II Listed Building. Late 18th century.	NMR 316891
133	Listed Building	Hilden. Grade II Listed Building. 19th century building incorporating 17th century features.	NMR 316892
134	Listed Building	Hazelbury Manor. Grade I Listed Building. 15th -17th century.	NMR 317005
135	Listed Building	Entrance gates and coach house at Hazelbury Manor. Grade II Listed Building. Later 17th century.	NMR 317006
136	Listed Building	Stables at Hazelbury Manor. Grade II Listed Building. Later 17th century.	NMR 317007
137	Listed Building	Forecourt Walls, terrace and gates to south of Hazelbury Manor. Grade II Listed Building. Later 17th century.	NMR 317008
138	Listed Building	Enclosing walls to north and west of Hazelbury Manor and terrace in West Garden. Grade II Listed Building. 17th century with restoration.	NMR 317009
139	Listed Building	The Granary, south east of Hazelbury. Grade II Listed Building. Some 18th century features, but converted in the early 20th century.	NMR 317010
140	Listed Building	Foxfire Lodge. Grade II Listed Building. c 1855.	NMR 317073
141	Listed Building	Rudloe Cottage. Grade II Listed Building. c 1850.	NMR 317072
142	Listed Building	Widdenham Farmhouse. Grade II Listed Building. Late 17th century.	NMR 317416
143	Listed Building	Milestone on south side opposite RN Stores, Copenacre. Grade II Listed Building. Early 19th century.	NMR 315029
144	Listed Building	Church of St Phillip and St James. Grade II Listed Building. 1866.	NMR 315052
145	Listed Building	The Old School House, Neston Primary School. Grade II Listed Building. 1861.	NMR 315051
146	Listed Building	1 Church Rise. Grade II Listed Building. Originally three cottages dating to the mid 18th to 19th centuries.	NMR 315049
147	Listed Building	The Well House. Grade II Listed Building. Probably 19th century.	NMR 315050
148	Listed Building	Privy in Walled garden to south of Jaggard's House. Grade II Listed Building. 18th century.	NMR 315260

MAP REF	DATE	DESCRIPTION	SOURCE AND FORMAT
STUDY AREA			
1	1889	OS 1st Edition 6"	National Monuments Record Centre
2	1921	OS 2nd Edition (Wiltshire sheet xxv.8)	National Monuments Record Centre
3	Undated (1935?)	Map by Bath and Portland stone company showing area of mine (red) and blue shows mushroom growing area. attached to letter dated 1935.	National Archives (WO 166/9569
4	1940s	All areas to be requisitioned	Basil Hill Archives
5	1941 (7th Nov)	Accommodation sites - characterised according to married and single quarters, also shows towns and villages, roads and railways	National Archives (AVIA 15/856)
6	6.3.1942	General plan showing layout of quarries (includes Clift)	Nick McCamley
7	7.5.1957	Layout plan of quarries	Nick McCamley
8	Undated	Spring, Sands, Westwells, Groundstone & Groundstone and part of Spring quarries	Basil Hill archives
9	Undated (1940s)	Plan showing quarries and area proposed for sale by WO and location of underground crames	Nick McCamley
10	Undated (2nd Edition 1920s?)	OS map (detailing surface buildings)	Nick McCamley
11	Undated	Identification plan and approximate outline of quarries - Corsham	Nick McCamley
BROWNS QUARRY			
12	19.12.1940	No.10 Group RAF proposed siting for alternative operations and western filter rooms	Nick McCamley
13	1940s?	Hand drawn diagram showing functions of buildings	Nick McCamley
14	Undated	Browns Quarry	Basil Hill archives

APPENDIX III: CARTOGRAPHIC SOURCES

15	1954	Browns Quarry	Basil Hill archives
16	1954	Browns Quarry	Basil Hill archives
TUNNEL QUARRY			
17	8.13.1941	Surface buildings. R.E Stores and Offices	Nick McCamley
18	2.3.1945	Tunnel Surface for Block Overlays	Nick McCamley
19	5.9.1945	Tunnel Quarry	Basil Hill archives
20	Undated	Detailed drawing of loading platforms	Nick McCamley
21	11.08.1948	General layout with functions	Nick McCamley
22	11.08.1948	CAD, Corsham - shows above ground buildings with schedule of buildings	Nick McCamley
SPRING QUARRY			
23	1943	Detailed plan showing areas and functions within Spring Quarry	Below-ground (current map room)
24	1941	Detailed plan of quarry showing functions of underground areas (two parts)	Nick McCamley/
25	11.6.1942	General layout of Bristol Aeroplane Factory	Basil Hill archives
26	Undated (1943?)	Below ground plan of Spring Quarry nb - duplication of colour version	National Archives: (AVIA 15/856)
27	1940s?	Detailed map of Telephone Exchange	Nick McCamley
28	29.11.1941	Spring Quarry layout above and below ground (shows lots more buildings than 14 may plan/ below ground less detailed version of other plans)	National Archives: (AVIA 15/856)
29	14.05.1941	Spring Quarry layout of surface works (includes hostel sites 1,2 and 3)	National Archives: (AVIA 15/856)
30	16.7.1941	Area 2d - development	Basil Hill archives
31	6.6.1942	Area 2d	Basil Hill archives
32	Undated (1940s?)	North of Spring Quarry - area thought to be effected by roof movement	Nick McCamley
33	1954	Spring Quarry - detailed drawings of above ground including function	National Monuments Record Centre
34	25.7.1958	Spring Quarry - overall plan	Basil Hill archives
35	1959	Spring Quarry shows burlington area	Basil Hill archives
36	13.6.1960	Proposed layout of roads and sign directions (this shows Burlington area)	Basil Hill archives

COPENACRE QUARRY			
37	August 1955	Below and above ground (includes Pickwick)	Basil Hill archives
38	1999	Copenacre, Topographical Survey, Digital Mapping and Survey of Buildings Internals	Basil Hill archives
39	Undated	Boundary of land to be requisitioned for extension to store	Basil Hill archives
40	Undated (1995?)	Overall plan at time of closure showing general layout and functions	Nick McCamley
41	Undated	Copenacre Quarry (detailed drawing of pillars)	Nick McCamley
42	Undated	Copenacre Quarry (showing admirality)	Basil Hill archives
RAF RUDLOE MANOR			
43	1972	Manor Site 2 - Hawthorn	Basil Hill archives
GROUNDSTONE QUARRY			
44	Undated	Groundstone Quarry, Box (shows areas of rubble etc.)	Basil Hill archives
3 SITE			
45	Unknown	Plan of 3 Site showing function of areas	Below-ground (current maintenance room)
46	Unknown	Book illustrating in detail the layout of each area	Site (below-ground)
47	July 1957	Plan showing outline of 3 Site and changes required to shafts above ground (No. XK1/150)	Nick McCamley
48	Undated (1950s)	Part of 3 Site showing toilets	Basil Hill archives
SOUTH-WEST SWITCHING CENTRE			
49	1962	South-west switching centre, general layout plan	Below-ground

APPENDIX III: CARTOGRAPHIC SOURCES

Vertical Photos

SORTIE NO.	FRAME		NGR		DATE	SCALE	FOCAL LENGTH	FORMAT
Number	Start	End	Start	End	F	01:00	Length	
RAF/106G/UK/1415	4038	4041	ST838694	ST859693	14-Apr-46	9800	20	BW87
RAF/CPE/UK/1821	3021	3025	ST840690	ST858687	04-Nov-46	10000	36	BW87
RAF/540/479	4156	4156	ST864704	ST864704	22-Apr-51	9960	20	BW87
RAF/540/1357	19	20	ST867684	ST862680	18-Jul-54	15000	36	BW87
RAF/540/1357	20	20	ST840698	ST840698	18-Jul-54	15000	36	BW87
RAF/540/1281	3	4	ST849687	ST848695	08-Apr-54	12000	6	BW99
RAF/540/1281	11	12	ST859689	ST858699	08-Apr-54	12000	6	BW99
RAF/106G/UK/377	4265	4269	ST856697	ST841693	13-Jun-45	9600	20	BW87
RAF/106G/UK/376	3027	3029	ST843695	ST859700	13-Jun-45	10500	20	BW87
RAF/106G/UK/376	4026	4028	ST841678	ST856680	13-Jun-45	10500	20	BW87
RAF/58/1433	56	59	ST841687	ST857692	11-May-54	8000	6	BW99
RAF/82/862	10	11	ST849688	ST849697	25-Feb-54	7000	6	BW99
RAF/82/862	15	15	ST838698	ST838698	25-Feb-54	4000	6	BW99
RAF/225A/UK842/1	9826	9826	ST850693	ST850693	06-Jul-40	12000	5	BW55
RAF/225A/UK842/1	9828	9828	ST855695	ST855695	06-Jul-40	12000	5	BW55
OS/70355	1	3	ST855698	ST844697	20-Sep-70	7500	12	BW99
OS/70355	4	4	ST838697	ST838697	20-Sep-70	7500	12	BW99
OS/71126	68	71	ST842700	ST842681	02-May-71	7300	12	BW99

OS/71081	11	12	ST853702	ST858702	14-Apr-71	6000	12	BW99
OS/66061	54	57	ST843694	ST861694	16-May-66	7500	12	BW99
OS/66061	81	84	ST839693	ST857693	16-May-66	7500	12	BW99
FSL/71215	215060	21506	ST849697	ST849686	08-Sep-71	12000	6	BW99
OS/88005	82	84	ST853688	ST840688	04-Mar-88	8000	12	BW99
RAF/543/3859	564	566	ST842696	ST858697	13-Jun-67	10600	36	BW99

Oblique Photos

NGR INDEX	ACCESSION	FRAME	ORIGINAL NO.	FORMAT	DATE FLOWN	6 FIG NGR
Number	Number		Number			
ST8368/1	WAP 11700	38	AA 732 2	Black& white	13-Jun-73	ST836680
ST8368/2	WAP 11700	39	AA 731 6	Black& white	13-Jun-73	ST836680
ST8368/3	WAP 11705	40	AF 868 1	Black& white	18-Oct-73	ST836680
ST8368/4	CAP 8120	1	LX	Black& white	26-Jun-53	ST835684
ST8368/5	CAP 8120	2	LX	Black& white	26-Jun-53	ST835684
ST8368/6	CAP 8120	3	LX	Black& white	26-Jun-53	ST835684
ST8368/7	CAP 8120	4	LX	Black& white	26-Jun-53	ST835684
ST8368/8	CAP 8120	5	LX	Black& white	26-Jun-53	ST835684
ST8469/1	NMR 15288	69		Black& white	15-Jun-95	ST847692
ST8469/2	NMR 15288	70		Black& white	15-Jun-95	ST849691
ST8469/3	NMR 15288	72		Black& white	15-Jun-95	ST849694
ST8469/4	NMR 15288	73		Black& white	15-Jun-95	ST847691
ST8469/5	NMR 15281	12		Colour slide	15-Jun-95	ST847690
ST8469/6	NMR 15281	13		Colour slide	15-Jun-95	ST846690
ST8469/7	NMR 15281	14		Colour slide	15-Jun-95	ST848692
ST8568/1	NMR 15288	59		Black& white	15-Jun-95	ST852682

ST8568/2	NMR 15288	60		Black& white	15-Jun-95	ST851683
ST8568/3	NMR 15288	61		Black& white	15-Jun-95	ST850681
ST8568/4	NMR 15288	62		Black& white	15-Jun-95	ST852682
ST8568/5	NMR 15288	63		Black& white	15-Jun-95	ST852682
ST8568/6	NMR 15288	64		Black& white	15-Jun-95	ST855687
ST8568/7	NMR 15288	65		Black& white	15-Jun-95	ST855688
ST8568/8	NMR 15288	66		Black& white	15-Jun-95	ST855686
ST8568/9	NMR 15288	67		Black& white	15-Jun-95	ST855687
ST8568/10	NMR 15281	7		Colour slide	15-Jun-95	ST851682
ST8568/11	NMR 15281	9		Colour slide	15-Jun-95	ST851682
ST8568/12	NMR 15281	10		Colour slide	15-Jun-95	ST855687
ST8568/13	NMR 15281	11		Colour slide	15-Jun-95	ST854686
ST8569/1	NMR 15288	68		Black& white	15-Jun-95	ST851691
ST8569/2	NMR 15288	71		Black& white	15-Jun-95	ST851693
ST8569/3	NMR 15595	7		Black& white	02-Oct-96	ST854695

APPENDIX IV: KEY PHOTOGRAPHIC SOURCES

Appendix V: Bibliography and Sources

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28 Days Later	http://www.28dayslater.co.uk/forums/index.php

Media

MVP Video Services	Deep, Dark & Dusty: The Story of Bathstone its Quarries and Quarrymen (date unknown)
MVP Video Services	Lifting the Lid of Box Hill: Central Ammunition Depot, Tunnel Quarry, Corsham (date unknown)
Pathe Film	Depicting the construction of the MAP Factory