PART TWO

DEVONPORT DOCKYARD IN THE TWENTIETH CENTURY

2.1 INTRODUCTION

The dockyard at Devonport was known as Plymouth Dock until 1843, when Queen Victoria and Prince Albert announced the change on their visit to Devonport Dockyard. Devonport 'Naval Base' is the total RN area which includes both operational and accommodation areas. It comprises 650 acres, including accommodation for the shore base HMS *Drake*. From south to north, facing west over the River Tamar and the Hamoaze, it consists of the original South Yard and Morice Ordnance Yard, and Keyham North Yard, which was developed from the 1860s and further extended at the beginning of the twentieth century.

Fig. 65. HMNB Devonport map. Royal Navy (2010). *Devonport Naval Base Handbook*. Plymouth: Plymouth HIVE/DE&S, p. 5.

The original yard then became known as South Yard and the new yard as North Yard, linked by a tunnel and railway beneath Morice Ordnance Yard from c.1857. At its south end, the tunnel passed through the North Smithery, requiring the removal of a blast furnace. In 1963, the MoD linked Morice Yard and South Yard by a flyover; Morice Yard and North Yard were linked in 1964. Use of the dockyard railway tunnel ended in 1966 and a bus service was introduced. (Flyovers to Make Dockyard One Unit, 1962) Babcock International owns one third of the Naval Base, but does not maintain the HMS *Drake* accommodation area. Princess Yachts acquired the freehold of its premises in Devonport South Yard in 2011, but Babcock International maintains the remaining buildings in that yard. Morice Yard is wholly owned by the MoD but Babcock International maintains the buildings, boundary walls and roads. The 'Dockyard' is the operational area owned by Babcock International since it took over from Devonport Management Ltd in 2007. This company had managed Devonport Royal Dockyard since 1987 as part of the MoD's reforms to introduce commercial management to its facilities. In 1997 Devonport Royal Dockyard was privatised, but the MoD retained a special share in Devonport Royal Dockyard Ltd (DRDL), which was transferred to Babcock International in 2007.

There are over 500 structures on the site. The characteristics of pre-twentieth century buildings are illustrated by the following images, but this report is concerned primarily with the significant late twentieth century structures. Grid references are included in the listing descriptions only, because the team was unable to obtain all the building details.[1]

Fig. 66. AA98/04662. Devonport Covered Slip No. 1 (1774–75) photograph by Eric de Mare showing the roof timbers added in the nineteenth century (1956). The only remaining intact eighteenth century slip within a royal dockyard (Coad, 1989, p. 197). Reproduced by permission of Historic England.

Fig. 67. BB96/03858. Devonport South Yard South Smithery (S126) photograph along north side of central building from northeast (29 Feb 1996). ©Crown copyright.HE.

Fig. 68. BB96/03859. Devonport South Yard South Smithery (S126) photograph detail of evidence of the line shaft on the north side of central building (29 Feb 1996). ©Crown copyright.HE.

[1] The only sources not publicly available were the plans supplied by Babcock International, derived from digital copies held by them.

Fig. 69. BB96/03867. Devonport South Yard South Smithery (S126) photograph of interior central building, view from southeast (29 Feb 1996). ©Crown copyright.HE.

Fig. 70. BB96/03891. Devonport South Yard South Smithery (S126) photograph of north elevation of centre building (29 Feb 1996). ©Crown copyright.HE.

Fig. 71. BB96/03865. Devonport South Yard South Smithery (S126) photograph of Cowans Sheldon driven capstan (1926) (29 Feb 1996). ©Crown copyright.HE.

2.2 FROM 1895 TO THE SECOND WORLD WAR

Fig. 72. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. c. Devonport Dock Dimensions. Reproduced by permission of Historic England.

Fig. 73. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. 100. Devonport North Yard (Keyham Extension) Dock No. 9, North midship section and outline of entrance. Reproduced by permission of Historic England.

Fig. 74. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. 102. Devonport North Yard (Keyham Extension) Dock No. 9, South midship section and outline of entrance. Reproduced by permission of Historic England.

Fig. 75. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. 104. Devonport North Yard (Keyham Extension) Dock No. 10, North midship section and outline of entrance. Reproduced by permission of Historic England.

Fig. 76. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. 106. Devonport North Yard (Keyham Extension) Dock No. 10, South midship section and outline of entrance. Reproduced by permission of Historic England.

Fig. 77. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. 117. Devonport North Yard (Keyham Extension) Prince of Wales Basin outline of entrance. Reproduced by permission of Historic England.

Two highly innovative nineteenth century designers, Colonel Godfrey Greene R.E. and Admiralty architect William Scamp, had provided Devonport with the remarkable Quadrangle factory building (1852–61, N173-7, N186-91, N203, Grade I, 1378566, SX 44902 55661), and, in collaboration with the engineering firm of Fox, Henderson, an iron-framed Smithery (1771, 1853–55, 1890, S126, II*, 1392692, SX 44935 54234). With the great northward extension of Keyham Yard, completed between 1895 and 1907, which doubled the dockyard's previous size, the yard was not provided with, and, indeed, did not require, any more pioneering structures for much of the twentieth century.

The 118 acre extension was required for the increased size of naval ships and to improve repair facilities in case of war. The work was carried out under the direction of Major Sir Henry Pilkington, Admiralty Civil-Engineer-in-Chief, with Charles Colson as Deputy Civil-Engineer-in-Chief responsible for the design. Sir Whately Eliot was the resident Superintending Engineer and G. H. Scott was Sir John Jackson's Agent and Engineer. Eliot and Scott wrote accounts of the construction for the Institution of Civil Engineers. The contract, awarded to Sir John Jackson, added three drydocks, two of which opened into a tidal basin, all three opening into a closed basin; a lock also opened into the closed basin. A retaining wall was built along the eastern boundary with the parade ground and barracks, which was twelve feet above the level of the extension. Underlying soil conditions consisted of mud overlaying rock to an average depth of forty feet. Much rock debris had also been deposited on the site from excavating the first Keyham docks. The underlying rock was called shillet, mostly soft and friable shale, but in places very hard. As the mud was too soft to support wagon roads and locomotives for excavation, experimental mud scoops and electric cableways were used. Building materials

included granite from Cornwall and Norway for the dock floors and altars and extension wall, local limestone, and concrete, containing shingle from Start Bay and the Needles. The limestone and granite were dressed at the quarries and shipped to the site. Concrete, totalling 1,300,000 cubic yards, was mixed on the Royal Naval Engineering College recreation ground. Small concrete blocks faced with granolithic concrete were used for facework in the upper walls of the docks and lock because there was insufficient limestone for facing, but the closed basin was faced with irregular coursed limestone. All the walls were founded on solid rock; in places concrete piles were sunk through more than fifty feet of mud. The entrance between the closed basin and the Hamoaze had both a sliding caisson and a ship caisson in case tides caused difficulties while warping in a ship. Sliding caissons were built at the entrances to all the docks, the lock and the closed basin, and ship caissons in Dock Nos 5 and 6 and the entrance to the closed basin. Excavated rock was deposited on the mud in Weston Mill Lake north of the barracks, to create a drill ground; mud was dumped at sea four miles south of Plymouth breakwater. (Eliot, 1908, pp. 2-8, 10-12, 18, 21; Scott, 1908, pp. 30, 33-7, 39, 40, 43)

HRH the Prince of Wales formally opened the Keyham Extension on 20 February 1907, sailing into Basin No. 5, thereafter also known as the Prince of Wales Basin. Within two years the non-tidal basin was dredged to a depth of 37 feet and Dock No. 8 was lengthened further. (*A Brief History of Devonport Naval Base*, p. 24) In 1909 the northern arm of the Keyham Extension was selected as the site for a mechanised Coaling Depôt and four electrically powered coal transporters began to be installed in 1910 (where the present *Defiance* building stands). This remained the principal coaling site until coal was replaced as the principal fuel for warships.

In 1903 a map records the change of name from Keyham Steam Yard to North Yard.

Fig. 78. Change of name from Keyham Steam Yard to North Yard. AdL, Vz 14/44 (1900–1923). H.M. Dockyard Devonport North and South Yards Keyham Steam Yard and Naval Barracks, Compiled by E. J. Powell from Mr. Townshend's Survey of North and South Yards and the Ordnance Survey. Director of Works Office 1903. Defence Estates Plans. Scale 1":16'. Courtesy MoD Admiralty Library Naval Historical Branch, Portsmouth.

In 1908 the SCE asked for 'instructions as to what is to become of the Pigeon Loft, as since disposal of Pigeons… the Loft has been unoccupied'. The pigeon loft was 'completed in 1897 at cost of £329. & is in good condition. The C. in C suggests that grounds enclosing it could be added to Admiralty House without expense to the Crown'. Several human houses could have built at that time for that money! In 1908 the British Admiralty replaced carrier-pigeons with wireless sets, but reverted to using them during the First World War (Smith, 2014, p. 71).

In 1920 a Cold Store which had been erected in North Yard as a First World War Measure by the Ministry of Food, marked with a red M, was offered to the Admiralty 'without charge for General Store Purposes subject to being available again in case of emergency.' The offer was accepted. (ALNHBP, AdL, Vz 14/43, 1908-23. Devonport Dockyard Defence Estates Plans)

Fig. 79. Cold Store site marked M on the wharf near North Lock, 1920. Devonport North Yard. AdL, Vz 14/43 (1908-23). Devonport Dockyard Defence Estates Plans. Scale 1:2500. Courtesy MoD Admiralty Library Naval Historical Branch, Portsmouth.

By 1924 that perennial problem, the size of dockyard facilities relative to ship size, prompted the widening of the entrance to Basin No. 5. An ICE article by G. S. Jacob, Civil Engineer-in-Charge, reflected on pre-First World War policies and First World War experience. He cited Admiral Earl Jellicoe's observation in 1919 that German battleships had thicker armour running along the full length of their vessels which gave them greater protection against underwater attack, enabling more of their ships to survive such damage. The Germans had also built 'proper dock accommodation first and designed the ships subsequently', whereas Britain had enlarged the *Dreadnoughts* without having docks to hold them. Jellicoe had reflected: 'Docks make no appeal to the imagination of the public and cost a great deal of money. The result was that August 1914 found us with a superiority in ships, but woefully lacking in dock accommodation.' (Jacob, 1930, pp. 83-6)

Owing to the greater size of post-war capital ships and the additional bulges added to pre-war vessels, none could now enter Basin No. 5 through the entrance or the lock, so they had to be repaired while berthed alongside the outer river wall, leading to 'a considerable increase in cost and loss of time; furthermore 'it was not possible for these ships to be served by the 160-ton cantilever crane provided on the east wall of the basin.' It was decided therefore to widen the direct entrance from 95 to 125 feet and the caisson chamber by 30 feet. It was resolved to carry out the entrance work using dockyard labour and to construct the new caisson by contract. Jacob reported that while the original sill and entrance walls had been faced with granite blocks, 'it was decided in view of the reliable nature of modern cement concrete to omit this facing from the new work and only to use granite for the sliding-ways and stops for the caissons.' The entrance work started on 1 May 1926 and was completed by the end of November 1926, with granite dressings completed on 12 December. A new electrically powered caisson was fitted in 1927. The total cost was estimated at £230,000 but was actually £131,000, due to 'the economical method of carrying out the work', a fall in prices, especially steel for the caisson, and the absence of any accidents, which saved a budgeted £25,000. Most of the labour force, averaging about 85 and reaching a maximum of 120, had been recruited from the local Labour Exchange, with senior hands transferred from within Devonport. (Jacob, 1930, pp. 89, 91-2, 94-5) The dockyard thus sought to boost local work during a period of high unemployment. In the ensuing discussion Sir Leopold Savile, Admiralty Civil Engineer-in-Chief during the project, emphasised that the lower cost was due to using existing caissons as dams. Mr N. G. Gedye noted Savile's 'tendency towards economy in the construction of naval dock works which had first been shown, he believed, in the Rosyth works by the substitution of concrete for granite in suitable positions'. (Savile *et al.*, 1930, pp. 114, 121)

Extra docking facilities were provided in 1925 with the addition of a 680 foot floating dock moored in Weston Mill Lake. (*A Brief History of Devonport Naval Base*, p. 24) In 1939 Dock No. 10 was also widened. An ICE article highlighted points raised in Part 1 about contractors and design. Contractors were Messrs Nuttall. Writing in 1947, Donald Hamish Little AMICE, commented that despite the difficulties of working around ship movements during the rush of rearmament, 'the Contractors became almost another department in the Dockyard and entered into its "give and take" life, to the mutual benefit of everyone.' Demonstrating ingenuity, dangerous flying granite fragments released by blasting the original wall were caught by torpedo nets. Little noted that the 'excellence of the existing work, which had been done forty or fifty years ago, when the dock was built' had aided the process of installing new groove sills at the entrances. Relative to Otter's comment (Part 1, 1.2.2) about old fashioned altars, Little explained that cutting away the altars of both walls and adding new concrete to the backs would have entailed much more work. The new straight walls at Singapore naval base 'decided the general profile of the new walls for the reconstructed docks at Devonport and Gibraltar.' He reflected that the 'docks look strange with an old fashioned wall on one side and a modern wall on the other side, but they were efficient, and the cost was considerably lower than that of new docks.' Ship caissons were used because widening the entrances did not leave room for sliding caissons. (Bertlin *et al.*, 1947, pp. 24, 32, 35-36, 39)

2.3 THE SECOND WORLD WAR AND ITS CONSEQUENCES

Fig. 80. HM Dockyard Devonport: aerial photographs. TNA, WORK 69/19 (1951). Reproduced with the permission of The National Archives.

This is one of a series of aerial photographs taken in 1951, many of which show the bomb damage to the parts of Devonport adjacent to the yard. These will be referred to later.

The yard had adequate docking and refuelling facilities, but the development of warships necessitated the provision of additional storage. The pre-*Dreadnought* battleships had four twelve-inch guns as their principal armament, but the first *Dreadnoughts* mounted no less than ten, and subsequent larger designs increased the calibre to 13.5, and then to 15 inches. As a consequence accommodation was required for the greatly increased numbers of heavy guns, and in 1911 a machine shop was converted to

a heavy gun store. As the drawing shows, an unremarkable building remained an unremarkable building, and the construction of practical sheds devoid of any architectural touches was to remain the norm for decades.

Fig. 81. Devonport Dockyard, machinery shop, 1911. Conversion of machine shop to heavy gun store. PWDRO, 663/320. © Plymouth City Council (Arts and Heritage).

As will be seen, the mindset this engendered in those responsible for the built environment of the dockyard was to remain deeply ingrained.

The proven lethality of submarine attack during the First World War resulted in the application of anti-torpedo bulges to capital ships, which necessitated the widening of docks to accommodate them. Consequently, after the war, the Prince of Wales's Basin entrance was widened and in 1939 the widening of Dock No. 10 was completed. All capital ships with the exception of HMS *Hood* could then be accommodated.

After the devastating bombing of Plymouth during the Second World War, the Superintending Naval Store Officer wrote to the Admiral Superintendent in November 1941 with suggestions for the reconstruction of the yard. The most pertinent suggestions for the purposes of this study were those for roads, siting of buildings, and type of new constructions. Roads were:

> perhaps the most generally unsatisfactory feature…generally narrow, ill paved, badly lit, full of blind corners and often, judging from the constant attention they seem to require, only of semi-permanent construction. Administrative and non-productive buildings should occupy sites away from water frontage and railway lines. Ample open space should be left around those buildings which handle large quantities of bulky materials…When the time comes to settle the types of buildings to be erected full consideration should be given to the monolith type of concrete building in which the upper floors are reached by inclined planes instead of by stairs or lifts…with the use of small petrol driven trucks running from floor to floor, it is possible to do much more work there than could be done in any building of equal size served by stairs, lifts and/or hoists and with no local foci of congestion.

It is remarkable that these last comments needed to be made twenty years after Matteo Trucco's Fiat factory, and shows how the development of the yard had proceeded in a wholly unsystematic manner (apart from the docking facilities and cranage). The charitable explanation would be that everything on the building side of the dockyard was done as cheaply as possible with no consideration of long-term efficiencies.

In June 1942, representatives of the City of Plymouth, accompanied by Professor Abercrombie, visited the Admiral Superintendent to determine whether the Admiralty would wish to acquire any areas adjacent to the dockyard (which had in many cases been occupied by substandard accommodation and were severely bombed) for post-war expansion. This was necessary information for Abercrombie to be able to prepare his plan for the reconstruction of Plymouth. Some preliminary information was provided, with the proviso that it was impossible to state definite post-war requirements.

The following month, the Director of Dockyards was present at a second conference where it was decided that 'taking a long view, a good case could be made for taking in a substantial additional area. The existing position offered a unique opportunity (not – it is hoped – likely to recur) of having more space for development on rational lines than has hitherto been available. Development of the Yard and its economical working has, in the past, been severely restricted by the close proximity of the Town.' A plan indicated the options available. (Fig. **82**)

Abercrombie's 1943 Plan for Plymouth accepted the Admiralty's arguments for reserving a very large area for post-war expansion. 'it is manifestly in Plymouth's interest to encourage anything that will make her chief industry more secure.' However, 'He would be a bold person who would be dogmatic on such a subject with world events and conditions changing as they have done during the past few

years. There is, therefore some justification for the request to have included in this Report a possible alternative layout for the reconstruction of the Devonport business area, as circumstances might render abortive the Admiralty scheme.' All that need be said here is that this alternative scheme would have ruthlessly destroyed old Devonport.

Abercrombie's concern was a grand vision for the total recasting of Plymouth city centre on Beaux-Arts lines (though realised without Beaux-Arts buildings) and he made no mention of John Foulston's buildings which had celebrated the rebranding of Plymouth Dock as Devonport. Of the three towns which made up the City of Plymouth: Devonport, Stonehouse and Plymouth, Plymouth was to be redeveloped at the expense of the others.

So the Admiralty's proposals were effectively rubber-stamped by Abercrombie, and the bomb-damaged areas by the dockyard were tidied up but no attempt was made to reconstruct them pending their swallowing up by the dockyard, as some aerial photographs taken in 1951 show (Figs 83 and 84).

Fig. 82. Proposed Devonport Dockyard boundary enlargement (1942). TNA, ADM 1/17810 (1942–44). Naval Stations: Post war reconstruction and development of Devonport and Plymouth: proposals and plans. Reproduced with the permission of The National Archives.

Fig. 83. HM Dockyard Devonport: aerial photographs. TNA, WORK 69/19 (1951). Reproduced with the permission of The National Archives.

Fig. 84. HM Dockyard Devonport: aerial photographs. TNA, WORK 69/19 (1951). Reproduced with the permission of The National Archives.

It has to be added that the Admiralty have now released the appropriated land and Devonport is now being redeveloped, with the surviving buildings of Foulston's day now accessible to the public again. It also means that the buildings constructed by the Admiralty in that area have now been demolished and so do not need to be considered in this survey.

In April 1943, the Civil Engineer-in-Chief proposed two ambitious schemes, one for the construction of a very large new graving dock at the former Gun Wharf site in South Yard, and the other for the redevelopment of Weston Mill Lake as a new basin, so anticipating future events. (Figs 85, 86 and 87)

Fig. 85. Naval Stations: Post war reconstruction and development of Devonport and Plymouth: proposals and plans (1943). TNA, ADM 1/17810 (1942–44). Reproduced with the permission of The National Archives.

Fig. 86. Naval Stations: Post war reconstruction and development of Devonport and Plymouth: proposals and plans (1943). TNA, ADM 1/17810 (1942–44). Reproduced with the permission of The National Archives.

Fig. 87. Naval Stations: Post war reconstruction and development of Devonport and Plymouth: proposals and plans (1943). TNA, ADM 1/17810 (1942–44). Reproduced with the permission of The National Archives.

Nothing came of these proposals, but they show that the Admiralty was deeply committed to the future of the yard. A very large number of files are preserved in the Plymouth and West Devon Record Office recording minutely the surrender of the new territories to the yard through the 1950s, but these relate rather to the melancholy history of the collapse of Devonport as a proudly independent town than to the dockyard.

At the end of 1953 plans were drawn up showing the dockyard in its current state, and identifying the different buildings. (Figs 88, 89 and 90)

Fig. 88. HM Dockyard Devonport: plans for development and modernisation. TNA, ADM 1/26498 (1953). Reproduced with the permission of The National Archives.

Fig. 89. HM Dockyard Devonport: plans for development and modernisation. TNA, ADM 1/26498 (1953). Reproduced with the permission of The National Archives.

Fig. 90. HM Dockyard Devonport: plans for development and modernisation. TNA, ADM 1/26498 (1953). Reproduced with the permission of The National Archives.

The next year a development schedule was drawn up to cover the period up to 1961. This indicated that the principal developments in the newly appropriated areas were to be in Fore Street, Goschen Street, Albert Road, Queen Street, Tamar Street, William Street, Moon Street, and James Street. None of these buildings, or those to be constructed in the existing yard, was of any innovative type.

2.4 A NEW ERA BEGINS

The two major developments at Devonport in the second half of the twentieth century were facilities for the nuclear refitting of submarines and frigate maintenance, but they took a long time to come to fruition. The first British nuclear submarine, HMS *Dreadnought*, was launched in 1960. The future nuclear fleet would need to be provided with refitting facilities, and seven sites were considered. At first it appeared as if Devonport was not going to be among them; there was no sign of this in 1963. Joan Vickers, MP for Plymouth Devonport, asked in December 1963 for 'a detailed programme of the work to be done in the Royal Dockyard, Devonport, for the year 1964–65.' The Civil Lord of the Admiralty, John Hay, replied

> The programme includes completing the modernisation of "H.M.S. Eagle", and provides for at least one other aircraft carrier to be in hand throughout the year. It also provides for the refit of a cruiser and a destroyer, as well as the usual refits of frigates, submarines and smaller craft. The construction of a frigate will continue.

Joan Vickers further asked 'how many men, women and apprentices will be employed in the Royal Naval Dockyard, Devonport, during the year 1964–65 as non-industrial and industrial workers, respectively.' John Hay, replied

> The numbers expected to be employed in 1964–65, in the Professional Departments of the Royal Naval Dockyard, Devonport, are:

	Industrial	Non-Industrial
Men	10,730	1,252
Women	100	
Apprentices	1,670	
	12,500	1,252

> It is not possible to specify the proportions as between men and women in the non-industrial figure, since a number of posts can be filled either way. (House of Commons Debates, 16 December 1963)

In July 1963 Miss Vickers asked about a plan for 'a prefabricated shop that is for making frigate parts.' She asserted that:

> Throughout last winter the frigate parts had to be prefabricated in the open; and hon. Members will remember the very bad weather conditions last winter. The men had to work in the snow and a good deal of illness resulted. This meant the men working in extremely difficult conditions. The sort of construction that has been under consideration for one or two years shows how work can be handicapped by lack of essential equipment. We ought to have up-to-date working conditions for our dockyard men. (Hansard Debates They work for you, 1 July 1963)

At a meeting of the Nuclear Powered Warships Safety Committee on 1 October 1964 chaired by Sir Solly Zuckerman, Chief Scientific Adviser to the government, it was decided that 'the Committee could not recommend Devonport as an acceptable site for a refitting yard for nuclear submarines.' In a paper of July 1965, the Director General of Dockyards and Maintenance assessed the risks. Any berth selected could only be a few hundred yards from the Dockyard wall, and as the prevailing winds were from the west or south-west, any accident leading to a release of airborne hazard 'would be carried straight over the fairly densely populated areas of Devonport or Keyham.' Two locations at Devonport had been proposed by the Dockyard Department. If enclosed berths were not necessary, 8 and 9 docks in North Yard appeared to be the most suitable. If enclosed berths were needed, then 2 and 3 docks in South Yard were to be used.

Fig. 91. Refitting of nuclear submarines: use of Portsmouth or Devonport Dockyards, with maps. 1965. TNA, ADM 329/7 (1964–65). Reproduced with the permission of The National Archives.

The relative hazards of the various dockyards and shipbuilding yards were assessed as follows:

Rosyth	1.0
Chatham	1.5
Belfast	15
Portsmouth	22
Devonport	27
Barrow	32
Birkenhead	32

These figures were arrived at by considering the effect of the maximum credible accident in relation to the density of population in the immediate neighbourhood of the yard. But, significantly, it was added that 'These calculations are so imprecise that there seems plenty of scope for a reassessment which would admit Devonport and Portsmouth to the list of acceptable yards and, of course, there is no need to stress how damaging to future developments the present recommendation is. [The Director's] thoughts so far…indicate that, safety considerations apart, the best advantage will almost certainly lie in starting in 1967 to adapt Portsmouth for nuclear refitting.' No paper has been located in TNA to indicate the reason for the decision to switch from Portsmouth to Devonport. Quite possibly this is to be found in AB62/514 (correspondence with the Atomic Energy Authority 1966–75) which, although catalogued among Devonport documentation, has been retained by the Department.

In 1969 there was parliamentary confusion about Devonport's rôles. Miss Vickers asked about 'Devonport Dockyard becoming the "lead" yard for the Leander class frigates. When does the hon. Gentleman think this will begin, and does he think that we may be able to have another ship built there? It is very soul-destroying only to do repairs.' She also questioned the White Paper's 'needs in the 1970s. The 1970s are very close; does this refer to 1971 or 1979? Can the hon. Gentleman tell us where in the dockyard it is proposed to have the facilities for these nuclear refits?' Sir Frederick Burden (Gillingham) asserted that 'We are now to have two [dockyards], at Chatham and Devonport. After a period, Chatham will be used solely for repairs and refits of nuclear submarines, though in the meantime, it will continue to maintain our conventional submarines—'. Gerald Reynolds (Islington North) confirmed that 'Chatham will be the main yard for the repair of nuclear Fleet submarines', Sir Frederick Burden adding 'that, in the mid-1970s, Devonport will also be a nuclear yard.' Dr David Owen, Labour MP for Plymouth Sutton and Under-Secretary of State for Defence, summed up:

> Between them, Chatham and Rosyth should meet our nuclear requirements up to 1973–74, when additional nuclear docking facilities will be needed and then further refit facilities. It has been announced in the White Paper that Devon-port will be our third nuclear dockyard. (Hansard Debates They work for you, 20 March 1969)

The first nuclear refits took place at Rosyth and Chatham, in line with the original recommendations, but when the final draft of the schemes for Dockyard Development was drawn up in April 1971, in addition to such general recommendations for all yards to rationalise and modernise workshops and the need to carry out systematic layouts of all new and existing workshops to make layouts more effective, Devonport was singled out for the provision of a Special Refit Complex for fleet submarines. The division of North Lock to provide two new medium-sized docks (11 and 12) was to be completed by the end of the year.

> The primary function of the new docks will be programmed dockings and Dockyard Assisted Maintenance Periods of Fleet submarines.…The northerly of the two docks will be sufficiently large to accommodate a Polaris submarine if required in emergency. The frigate refitting complex…is now at the detail design stage and comprises three docks, Nos 5, 6 and 7, suitably enlarged and modernised associated with refit berths in Basin Nos 2 and 3. To enhance the supporting facilities particularly in the wet and windy climatic conditions at Devonport, the three docks are being covered with support stores and cranage within the covers.

Figs 92 and 93 show a model of the complex produced the next year.

The most significant stage in the upgrading of Devonport was then flagged up.

> Ultimately, Devonport is planned to be able to deal with a two-stream, or even a three-stream, flow of nuclear submarine refits and refuellings by the late 70's. A complete complex is now at the sketch design stage for two new graving docks and a wet refit berth sited in the NW of No 5 basin. The associated buildings are designed to take account of the proximity of the Fleet/ Submarine maintenance base also planned for the North side of No 5 basin.

The buildings to service the North Lock were due to be completed at the end of 1975. On May 16 of that year it was the subject of a short article in *Building Design*. Architects were Scott, Brownrigg and Turner, and the contractors Balfour Beatty. PSA architects were reported as 'wildly enthusiastic about this long, low structure' which 'has the slimness and grace of the modern warships it will service, an effect complemented by the lead-faced cladding of the upper level.'

Fig. 92. Photograph albums. Frigate complex: evidence of progress (1972). TNA, CM 20/91 (Jan 1971–Dec 1972). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 93. Photograph albums. Frigate complex: evidence of progress (1972). TNA, CM 20/91 (Jan 1971–Dec 1972). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

The 'long, low structure' was actually two buildings, N093 and N125, the latter being in two sections.

Fig. 94. *Babcock Site Atlas* (2011). Reproduced with the permission of the MoD.

N093 is the Plant House, the drawing of the plan from SB & T's office being dated April 1972 and the elevations September 1972 (Figs 95 and 96).

Fig. 95. Building N093. Babcock Drawing no. AB3/12B (1972). Reproduced with the permission of the MoD.

Fig. 96. Building N093. Babcock Drawing no. AB3/16B (1972). Reproduced with the permission of the MoD.

Building N125 is in two sections. The northern part held the nuclear facilities, shown here in two plans.

Fig. 97. Building N125 ground floor. Babcock Drawing no. AB2/11 (1972). Reproduced with the permission of the MoD.

Fig. 98. Building N125 first floor. Babcock Drawing no. AB2/12 (1972). Reproduced with the permission of the MoD.

Fig. 99. Sections through Building N125. Babcock Drawing No. AB1/80 (1972). Reproduced with the permission of the MoD.

Fig. 100. Building N125, plan of part of main block which ties in with part of the above sections. Babcock Drawing no. AB1/109. Reproduced with the permission of the MoD.

Fig. 101. Building N125, main block elevations. Babcock Drawing no. AB1/83 (1972). Reproduced with the permission of the MoD.

Fig. 102. Building N125, main block elevations. Babcock Drawing no. AB1/84A (1972). Reproduced with the permission of the MoD.

Fig. 103. Building N125, main block cladding. Babcock Drawing no. 2916/1A (1972). Reproduced with the permission of the MoD.

These buildings were intended for intermediate refitting of nuclear submarines, and it is clear from the plans that there was no provision for refuelling or any heavy work. In parallel with the redevelopment of the North Lock was the construction of the Frigate Complex whose completion was expected to be in December 1976. This building, N217, was an in-house design by the Directorate of Defence Works, the structural engineers being Sir Alexander Gibb and Partners (whom we shall meet again). The elevations, like the first drawings for the North Lock buildings, are dated April 1972. Each elevation is split up into several sheets, of which only sections are reproduced here. These buildings are the modern equivalent of the great mid-nineteenth century slip roofs and worthy successors in architectural terms. The shed can accommodate three ships at once in the 435 foot long covered drydocks, reducing refit time. The doors are 40m high to contain the ships' radar and communication antennae and each open in four vertical leaves. Flap gates were used instead of caissons to close the docks. They were intended to hold frigates into the twenty-first century, but the Type 22 Batch 3 vessels would be too long (Gibb, pp. 21-2; *Evening Herald*, 11 April 1987, p. 10) In 1989, Pevsner and Cherry considered it 'impressive both in its chillingly colossal scale and in its well-managed detail. The dominant feature is the row of six tall concrete piers on the seaward side which house the mechanism for the vertical sliding doors.' (p. 653)

Fig. 104. Building N217, part of east elevation, Frigate Complex, April 1972. Babcock Drawing no. ABG/16E. Reproduced with the permission of the MoD.

Fig. 105. Building N217, part of west elevation, Frigate Complex, April 1972. Babcock Drawing no. ABG/17C. Reproduced with the permission of the MoD.

Fig. 106. Building N217, part of section, Frigate Complex, April 1972. Babcock Drawing no. ABG/20F. Reproduced with the permission of the MoD.

The construction process, from June 1973 to June 1976, was recorded in a series of photographs. About 30 are available and a small selection is reproduced below.

Fig. 107. Photograph albums. Frigate Complex book no. 2 (1973). TNA, CM 20/69 (1972–73). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 108. Photograph albums. Frigate Complex book no. 3 (1973). TNA, CM 20/70 (1973–74). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 109. Photograph albums. Frigate Complex book no. 4 (1974). TNA, CM 20/71 (1973–74). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 110. Photograph albums. Frigate Complex book no. 6 (1975). TNA, CM 20/73 (1974–75). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 111. Photograph albums. Frigate Complex book no 7 (1975). TNA, CM 20/74 (1975). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 112. Photograph albums. Frigate Complex book no. 9 (October 1975). TNA, CM 20/76 (1975–76). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 113. Photograph albums. Frigate Complex book no. 9 (June 1976). TNA, CM 20/76 (1975–76). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

A contemporary Navy Days account in 1976 described: 'on June 2, water gushed into No.2 basin through the new balancing culvert to a depth of three feet. Six days later the basin and three docks were fully flooded.' It continued: 'Thousands of tons of hand faced granite were removed to provide the three new covered docks, longer and deeper than the originals and with vertical walls replacing the traditional stepped sides.' (Frigate docks flooded, 1976)

The roof covers when built were expected to last thirty years; in 2013 they were expected to last another twenty years, nearly twice the original life expectation. They are clad internally with Galvasbestos (1970s) which is being monitored by a specialist asbestos contractor. Recent capital expenditure projects have included replacement of the three massive doors and re-cladding, and new offices to house the warship support team. (Sutherland heads for the sheds, January 2014 p. 17) When the new doors were inserted in 2013, more birds entered and disturbed asbestos debris, probably from the original installation, which was a cause for concern, but the debris was cleared.

Of these two projects, the North Lock intermediate refit facility was originally estimated at £1.1 million, and came out at £3.85 million. The Frigate Complex, originally estimated at £5 million, ended up at £17 million. These figures paled by comparison with the combined figures for the Submarine Refit Complex and the Fleet Maintenance Base, which both occupied the North Arm of Keyham. The original sum for the maintenance base was £1.2 million, which rose to £7.5 m, and the refitting complex went from £13.5m to £42 m. (*Building*, February 4, 1977)

2.5 THE MODERN MOVEMENT ARRIVES AT DEVONPORT

In 1971, design and development of the Fleet Maintenance Base and the Submarine Refit Complex was awarded to the architectural partnership of Howell, Killick, Partridge and Amis (afterwards referred to as HKPA), with Sir Alexander Gibb and Partners as the structural engineers. The partners all had impeccable Modernist pedigrees, having worked for the LCC's Architects' Department on Alton West Estate, Roehampton. They developed a characteristic vocabulary in their buildings for the University Centre at Cambridge and St Antony's College, Oxford, and used significant elements of this at Devonport, so that in the (probably) unlikely event of any alumni working in the buildings they would instantly have felt at home. Their efforts were to bring a naval dockyard into rare prominence in the architectural press. The partner in charge of the project was Stanley Amis, in collaboration with Steven Osgood.

Taking the Fleet Maintenance Base (FMB) first…

Fig. 114. Babcock (2011). *Site Atlas*. Reproduced with the permission of the MoD.

A plan published in the *RIBA Journal* (April 1979, pp. 160-3) after the completion of the project shows the buildings as they were then, with their functions. They have since been added to and altered, as the above plan shows.

N009 SRC entrance control

N005 FMB utilities

N007 FMB stores, FMB naval offices and NAAFI

N019 FMB electronics maintenance room, FMB periscope workshop and tower and FMB workshop

N017 FMB water plant house

N018 FMB utilities

N020 FMB electrical plant house

At the Tamar estuary entrance to Basin No. 5, a locked basin, is a retractable caisson

N008 SRC central management offices

N016 SRC Submarine support facility

N022 SRC project control offices and workshops

Taking the buildings of the Fleet Maintenance Base from the top of the Babcock plan, N003 is not part of the new development. It is a redbrick building seen at top left here, and was originally a machine shop of 1932 to serve the floating dock moored nearby, then a support workshop for conventional submarine refits. When conventional submarines were phased out, it was used by riggers as a workshop. The machine shop took this form in 1956. This is typical of a dockyard building devoid of any architectural interest which was to be completely eclipsed by the new development. It is now extended by N002 and is a very sizeable building for waterfront naval stores**.** N002B & N002C are extra portakabins. N005 is a Lifting Equipment Store and boiler house.

Fig. 115. Photograph albums. Fleet Maintenance Base Devonport: Foundations book no. 1 (1974). TNA, CM 20/77 (1973–74). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

N009 is the entrance control complex. This is atypical of the rest of the buildings, being asymmetrical, with a two-storey block holding the messroom, amenity centre, lavatories, recorder's office, transformers and switchgear, and a single storey reception area covered by a space-frame. (Fig. 116)

Fig. 116. Submarine Refit Complex. Babcock Drawing no. AD8/7. Reproduced with the permission of the MoD.

By its very nature, this was the last building of the complex to be built, this particular plan dating from March 1977. The complex was officially opened by HRH Prince Charles on 23 May 1980. (*A Brief History of Devonport Naval Base*, p. 26)

Fig. 117. Photograph albums. Nuclear Submarine Refit Complex book no. 7 (July 1979). TNA, CM 20/67 (1978–79). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

The remainder of the buildings along the north side of the wharf all have similar external characteristics. All were steel-framed buildings but there any similarity to what had become in the twentieth century the traditional dockyard workshop/store as exemplified in Figure 2 ended. N005 is taken first.

Fig. 118. Building N005, Submarine Refit Complex. Babcock Drawing no. AD3/24A. (n.d.) Reproduced with the permission of the MoD.

This building housed the boiler house, demineralised water plant house and shore/ship electrical gear. The next two buildings, N259 and N260, as the numbering indicates, were not part of the original Maintenance Base but part of a further building campaign of the 1990s. N260 is an accommodation building for ships undergoing refits, by Yorkon Ltd, a firm specialising in modular steel-framed buildings. Far from a cutting-edge design, though no doubt gratifyingly inexpensive, elevations of a plan of 1994 are shown below.

Fig. 119. Building N260, Submarine Refit Complex. Babcock Drawing no. M1979/08 (1994). Reproduced with the permission of the MoD.

Fig. 120. Building N007 Submarine Refit Complex. Babcock Drawing no. AB2/1B (n.d). Reproduced with the permission of the MoD.

The N007 complex completes the northern edge of the wharf, and comprises, from east to west, ships stores, naval control offices, and the NAAFI.

Fig. 121. Building N007 Submarine Refit Complex. Babcock Drawing no. AB2/3A (n.d.). Reproduced with the permission of the MoD.

Fig. 122. Building N007 Submarine Refit Complex. Babcock Drawing no. AB2/5B (n.d.). Reproduced with the permission of the MoD.

Fig. 121 shows the elevation of the whole range of buildings, in two sections. Fig. 122 shows a section through the Stores end of the NAAFI building and Fig. 123 the second floor plan of the NAAFI building.

Fig. 123. Second floor plan of the NAAFI building, N007, Submarine Refit Complex. Babcock Drawing no. AB2/14D (n.d). Reproduced with the permission of the MoD.

The NAAFI building is supported by pilotis. (Fig. 123) When completed, the complex formed a striking visual unity. (Figs 123 and 124) This is a remarkable example of a Modernist interior transposed from a Cambridge University building by the same architects into a completely different context. As such it is probably unique and clearly deserving of attention. The inside and electrics are satisfactory - it has probably been redecorated inside a couple of times, driven by inspection/as needed – but essentially is unchanged from its original design. The windows have had to be replaced because of salt corrosion of steel fittings, as the western elevation faces the harbour/weather side. The concrete on west elevation also suffers from algae. As it is the first building that personnel from incoming ships see, thus creating a first impression of the Naval Base, Estates try to keep it clean. (Welch, pers. comm., 2013)

Fig. 124. NAAFI building (July 1977). TNA, CM 20/80 (1976).[2] PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

Fig. 125. NAAFI building (March 1979). TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

To the left of the above picture is N019, the FMB workshop complex, HMS *Defiance*. As Fig. 125 shows, this is part of the unified design. However, it has suffered roof damage due to gutter leaks and seagull activity: making nests and breaking seashells. The steel behind the cladding has rusted and the cladding is loosening. All its steel windows have been replaced with uPVC. It has always had the same use: offices/workshop. (Welch, 2013)

Fig. 126. NAAFI building (July 1977). TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

The projecting element at the left of the workshop building is the Mast and Periscope Shop. Still to be constructed when this photograph was taken was the Periscope Tower (Figs 127 and 128).

Fig. 127. N019, Periscope Tower. Babcock Drawing no. AD1/44B (n.d.). Reproduced with the permission of the MoD.

Fig. 128. Mast and Periscope Shop (September 1979). TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

The other buildings in the FMB area are more concerned with nuclear systems, and this a therefore

[2] TNA, CM 20/80 date range appears to extend beyond 1976.

an appropriate place to break off the survey of the buildings with an account of the place the Devonport buildings have in HKPA's *œuvre*. Unity is given to all their buildings at Devonport through uniform concrete cladding. The rapid ageing and discolouration of concrete surfaces was accepted and even celebrated in works of a slightly later period, such as Lasdun's National Theatre, but during the late 1950s many designers sought various means of countering the effects of weather. These have most recently been summarised in Adrian Forty's *Concrete and Culture* (2012) where Partridge is quoted as being concerned 'to aim defensively at ensuring that the effects are negligible and insufficiently damaging to the general design.' The HKPA design was intended to weather attractively, and fits into the story of Brutalist architecture.

Precast panels made from Cornish granite aggregate to a high quality were used to this end in the Wolfson Building at St Anne's College, Oxford (1960–79), shown in *Architectural Review* (August 1964) and St Antony's College, Oxford (1966–71), as seen in Cantacuzino (1981). The HKPA partner involved in the design of the precast panels at Devonport was Steve Osgood, and he contributed an article 'Precast concrete walling for a naval base' to *Concrete* (August 1978). The FMB buildings were steel-framed, while the Nuclear Submarine Complex was to be concrete framed. Different fixings were therefore designed for the two constructional types.

So far the similarities of finish between HKPA's college buildings and the Devonport complex can be seen. The NAAFI building also gave the opportunity to display a similar internal spatial ploy. The finished building, surely the magic moment where a NAAFI met the Modern Movement head on, derived its grand dining room from the dining hall of the University Centre, Cambridge (1963–67). In neither building is the distinctive feature very evident from the outside when seen from pedestrian level. Fig. 129 shows a building which, compared with the dockyard buildings of the preceding part of the twentieth century, might have descended from another planet. Fig. 130 reveals the dining room roof, which presents many more opportunities to be seen from above at Devonport than does its antecedent at Cambridge. The sectional drawings in Cantacuzino's monograph display the almost clone-like characteristics (1981, pp. 73, 108). Perhaps it need hardly be said that no Admiralty document seen has commented on this fact, or, indeed, on the quality of the architecture at all. Pevsner and Cherry observed that it was 'distinguished by a large canted glazed wall overlooking the water.' (1989, p. 653)

Fig. 129. NAAFI building (September 1979). TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

Fig. 130. NAAFI building, September 1979. Detail from Fig. 125. TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

Before considering the nuclear submarine complex it is appropriate to consider a further project which the PSA appointed HKPA to carry out on March 16 1972. This was for a feasibility study of

> Planning the spaces between and around the buildings…relative to Landscaping, Hardscaping, Street Furnishings, etc., in order to provide the best possible functional and aesthetic environment for this area…the intent of the study was not to be a civic design operation as such, but an investigation into spatial organisation leading to an integrated set of recommendations for fixtures and finishes. Thus the Dockyard operation is looked at, and solutions put forward from a rather different point of view to that normally associated with Dockyard planning. This view rests on the premise that a disciplined image and visual organisation will influence practical working discipline.

New buzz words were introduced to the yard. 'We believe the Dockyard can and should develop a strong corporate identity akin to the developing PSA identity in order to rationalise guidelines for future design issues.' Haphazard and uncoordinated use of wharfsides and spaces between buildings 'must be considered a thing of the past.' To ensure all of this, it was recommended that an environmental

officer responsible to the Port Admiral should be appointed. HKPA had no difficulty in illustrating examples of bad practice in their Report.

Figs 131 and 132. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

Dockyard buildings made four principal demands upon the space outside them, as indicated in the following diagram.

Fig. 133. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

Because of the historically formed layout of the yard, 'the spatial attributes which would be given priority on a contemporary industrial estate are unattainable.' This leads to the support space around buildings conflicting with the road system, causing traffic hold-ups and the temporary shut-down of the whole system on occasion to allow safe arrival and departure of personnel. It was noted that the circulation space must be kept empty at all times; however, the presence of often empty space made its appropriation for parking and storage a habitual practice, producing the chaos shown in Fig. 131. In the 1970s a workforce of 13,000 wished to bring in their cars.

The development of the North Arm from scratch has allowed support spaces to be clearly distinguished from roadways through their very materials, changes of materials only happening where there was 'a functional change in the use of the surface'. The function of different areas and objects should be reflected in their design, but a new set of skills needed to be brought into play, as this entailed 'a particular skill generally found only in people with a high level of visual training and expertise.' The sub-text of this would have been displeasing to constructors and planners who had spent their working lives accustomed to chaos and acceptance of disorder. The choice of colour for standardised elements and objects should also promote clarity and associate 'linked and related elements'. Fortunately, a tradition of colour coding was already in existence in the navy (Figs 134 and 135).

Fig. 134. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

It will come as no surprise to anybody with a slight knowledge of the acceptance of the Modern Movement in Britain that here we have a direct reference to the Nautical Style, the subject of a seminal article in the January 1938 issue of *Architectural Review*. The author, John Piper, had just made the transition from abstraction to the highly stylised renderings of British landscape and architecture that were to make him one of the major artists this country produced during the twentieth century. To see his name invoked in a report on dockyard planning must have struck some readers as a strange and perhaps unwanted innovation. The use of varying textures to indicate different spatial uses was a key feature of another concept advocated by *Architectural Review* after the war, that of Townscape. HKPA probably thought that enough unfamiliar material had already been inserted in their report, so made no mention of this.

Their recommendations were graphically illustrated. Fig. 135 shows the varying materials and textures that were to be used to differentiate the different functional spaces in the North Arm. A similar initiative was urged at Portsmouth in 1974 (TNA, 1974, CM 1/157).

Fig. 135. Site plan in the feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works naval base development. Reproduced with the permission of The National Archives.

Note the FMB Stores building labelled 'Supermarket'. That must have grated as well. The proposals were further illustrated by two more diagrams.

Fig. 136. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

Fig. 137. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

Finally, consideration was given to the provision of shelters for the workers employed in refitting and maintenance. These had to be simple to move and be capable of being combined to form a modular unit. These structures did, of course, exist, but did not fit in with HKPA's vision, being all too readily part of the old clutter.

Fig. 138. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

Fig. 139. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

To replace this motley collection HKPA proposed a new standardised design, which incidentally would fit in alongside their permanent structures, while being capable of easy transport and able to form multiple combinations.

Fig. 140. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

Finally, the construction of a number of brick planters 'growing up out of the paving and located at the crest end of the Fleet Maintenance Base buildings' was recommended.

In 1976 the PSA Joint Planning Team followed up the HKPA report with one of their own, which generally took on board the architects' recommendations, though tactfully omitting all references to architectural literature and theory. This was not enough, however, to appease an unknown but clearly very senior dockyard official, who pinned to the front page of the copy of the report retained at TNA a note stating 'Another glossy "magazine" produced at enormous expense.' The subtext of this does not need to be spelt out. The examples given of new buildings at Devonport which were 'good examples of material and colour co-ordination whilst maintaining freedom of architectural expression' were the unremarkable Central Office Blocks 1 and 2 in North Yard, the Apprentice Training Centre at Goschen Yard, and, perhaps surprisingly, given their wish to play safe, the DoE Daily Issue Store in South Yard, an uncompromisingly Brutalist building now demolished with the return of the area to Devonport.

Fig. 141. External Planning Guide by Joint PSA and MoD Planning Team: a study of spaces around and between buildings. TNA, CM 20/55 (1976). PSA: Devonport: Publication and Research Studies. Reproduced with the permission of The National Archives.

Fig. 142. External Planning Guide by Joint PSA and MOD Planning Team: a study of spaces around and between buildings. TNA, CM 20/55 (1976). PSA: Devonport: Publication and Research Studies. Reproduced with the permission of The National Archives.

Unsurprisingly, HKPA's specially designed mobile shelters were not mentioned: instead standard Portakabins were illustrated. Indeed, none of HKPA's designs were illustrated.

While work started on the FMB another project got under way. This was not a completely new facility in a new location, but rather an implementation of one of the recommendations of the 1971 Dockyards Development Plan, for the consolidation and rationalisation of workshop facilities. Long

term development was outlined in 1978 until 1998, including a programme of works for Weston Mill Lake, extensions to the FMB and SRC, improvements to Wharf No. 8 and Basin No. 3, Quadrangle Refurbishment, Goschen Yard and the 'Historical Enclave' in South Yard (TNA, CM 20/47, 1978).

At Devonport the location of the Weapons/Radio Afloat and Combined Weapons Equipment workshops were satisfactory, but those of the Weapons/Radio and Electrical Factories were not. In almost all cases the buildings had not been designed for these activities. The buildings were distributed unsystematically all over the yard, as the figures below show.

Fig. 143. Production and support activities for combined weapons equipment workshops: and associated administrative and ancillary facilities; phase 2. TNA, CM 20/54 (1974). PSA: Devonport: Publication and Research Studies. Reproduced with the permission of The National Archives.

It was recommended that all these activities were to be concentrated on the area of the Combined Weapons Equipment Workshop in South Yard.

Fig. 144. Production and support activities for combined weapons equipment workshops: and associated administrative and ancillary facilities; phase 2. TNA, CM 20/54 (1974). PSA: Devonport: Publication and Research Studies. Reproduced with the permission of The National Archives.

This complex of buildings, S056 and S057, was to accommodate the Combined Weapons Equipment Workshop, the Magnetic Minesweep Shop, the Weapons/Radio Factory, the Nuclear Calibration Annexe, the Wind Tunnel, the Electrical Factory, and various associated facilities. A volumetric projection as to the appearance of the complex in 1984 was drawn up.

Fig. 145. Production and support activities for combined weapons equipment workshops: and associated administrative and ancillary facilities; phase 2. TNA, CM 20/54 (1974). PSA: Devonport: Publication and Research Studies. Reproduced with the permission of The National Archives.

Fig. 146. Buildings S056 and S057. Babcock Drawing No. 2300/ZG/01 (n.d.). Reproduced with the permission of the MoD.

It was clearly thought that HKPA had enough on their hands without this additional work, and the design was apparently done in-house, the drawings emanating from the Exeter based South West Division of the Mott, Hay & Anderson Group of Consulting Engineers. These show that the depiction above was not realised. They also date from the re-cladding of the buildings in 1988, when DML had the management of the yard (having taken over in April 1987), and so the authorship of the design given here cannot be positive. They also show a reversion to traditional dockyard styling and construction.

Fig. 147. East elevation of Building S057. Babcock Drawing no. 2300/ZG/05 (c.1988). Reproduced with the permission of the MoD.

Fig. 148. West elevation of Building S056. Babcock Drawing no. 2300/ZG/09 (c.1988). Reproduced with the permission of the MoD.

Another project which began at this time was the beginning of the execution of the wartime plan to reclaim Weston Mill Lake, which began in 1972.

Fig. 149. January 1977 top, June 1977 below. Weston Mill Lake: land reclamation evidence of progress; book no 2. TNA, CM 20/83 (Jan 1974–Dec 1979). PSA: Devonport: Works Projects. Photograph albums. Reproduced with the permission of The National Archives.

From 1986–89 a new jetty and facilities were installed in Weston Mill Lake to berth six Type 22 frigates, by casting and sinking twenty-nine concrete caissons. Mouchel was appointed in 1983 by PSA to make recommendations for the site and was appointed lead and civil engineering consultants for the project, with PSA as project manager. Pearce and Lohn, Mouchel directors, likened the caissons

to the Second World War Mulberry Harbour units. A two-storey amenity building was constructed at the centre of the jetty, constructed on its own raft foundation on the reclaimed land. Costain's engineer described construction problems and solutions. The caissons were cast on reclaimed land on the north-western shore of Weston Mill Lake by slip-fill and floated to the site, moored to the bed and keyed together. The major problems were establishing coordination of construction vessels with naval vessels, achieved through radio communication with Harbour control; and obtaining security clearance for transient workers, obtained through cooperation with the authorities. (MacIntyre, 1992, pp. 227-8, 234; Pearce & Lohn, 1992, pp. 235, 241, 242, 244) The redevelopment of this as a working basin is still proceeding; for example, following the phasing out of the Type 22s it has become the principal base for the navy's Amphibious Flotilla.

2.6 THE SUBMARINE REFIT COMPLEX

Stage 1 of the construction began in 1973, and involved the preparation of the site prior to Stage 2, which began in 1975. Stage 1, a civil engineering project undertaken by Costains, began by the construction of a cofferdam to enclose the site.

Fig. 150. Cofferdam completed. TNA, CM 20/61 (1973–74). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 1. Submarine Refit Complex December 1974. Reproduced with the permission of The National Archives.

The water was pumped out, the silt cleared from the floor of the basin, and the wall strengthened. Stage 2, like the FMB, was the responsibility of Sir Alexander Gibb and Partners and HKPA. Foundations for the complex were begun in 1975.

Fig. 151. Submarine Refit Complex (May 1975). TNA, CM 20/62 (1975). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 2. Reproduced with the permission of The National Archives.

Unlike the buildings of the FMB, this portion of the SRC, the main support buildings, was founded on the bedrock of the original basin, and was of massive reinforced concrete construction.

Fig. 152. Submarine Refit Complex (January 1976). TNA, CM 20/63 (1976). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 3. Reproduced with the permission of The National Archives.

The most publicly visible part of the complex was the 80 ton crane required to lift the nuclear core and its container out of the submarine berthed in one of the dry docks which flanked the main support buildings. Unlike preceding dockside cranes, this was to be an integral part of the structure of the building, and its massive base became evident early in the construction process. The whole of Dock No. 9 and its surrounding infrastructure buildings were designed to conform to a Design Based Event (DBE): a 1:10,000 year earthquake possibility. This included anything which would affect nuclear safety: cranes, rails/tramway and concrete structures. The large cantilever crane (1977) was not permitted under the DBE assessment and was removed in September 2008 (*Plymouth Herald*, September 27, 2008), the complex process described by Malcolm Smith:

> As part of the MoD programme, a refuelling crane with a lifting capacity of 80 metric tons has had to be removed and recycled. The crane was one of the largest in Western Europe, had been a feature of the local Plymouth skyline for over 30 years and reached the end of its design life. It had to be dismantled to make way for a new low-level facility that would, owing to its lower height, improve future safety and include a reactor access house and rail system. The hammerhead cantilever-design crane had been constructed in the 1970s to carry out lifts when nuclear submarines were being refitted and refuelled. It was located in the centre of the Submarine Refit Complex at Devonport, spanning the central office structures between two

docks (Docks 14 and 15). (March 2009, p. 27; also see *The Naval Engineering Review*, Winter 2009, pp. 3-12.)

The Central Management Office was removed at the same time in 2008 because of safety procedures. A new de-fuelling cover is to be built to make lower level de-fuelling safer.

Fig. 153. Submarine Refit Complex (September 1976). TNA, CM 20/64 (1976–77). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 4. Reproduced with the permission of The National Archives.

By January 1977 the characteristic HKPA cladding was evident.

Fig. 154. Submarine Refit Complex, view from the west (January 1977). TNA, CM 20/64 (1976–77). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 4. Reproduced with the permission of The National Archives.

The main support buildings were in two principal blocks, N016 and N022, as seen in Fig. 114, Babcock (2011). *Site Atlas*. Both are seen under construction above, flanking the 80 ton crane.

Fig. 155. Building N016, Submarine Refit Complex, west elevation. Babcock Drawing no. AW4/3M (n.d.). Reproduced with the permission of the MoD.

Fig. 156. Building N022, Submarine Refit Complex, west elevation. Babcock Drawing no. AW4/3M (n.d.). Reproduced with the permission of the MoD.

Fig. 157. Building N016, Submarine Refit Complex plan, reference 7137/N/9030 (n.d.). Babcock Drawing no. illegible. Reproduced with the permission of the MoD.

The plan (floor not identified on this copy) of N016 shows that this was the building which contained the stainless steel pond in which the extracted cores were deposited by the crane. This core pond is seen in Fig. 158.

Fig. 158. Submarine Refit Complex (September 1978). TNA, CM 20/67 (Jan 1978–Dec 1979). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 7. Reproduced with the permission of The National Archives.

Fig. 159. Building N022 Submarine Refit Complex plan. Babcock Drawing no. AB5/1A (n.d.). Reproduced with the permission of the MoD.

This figure shows that N022 was a mechanical workshop, while N016 dealt with the nuclear refuelling. To the north of the main support buildings was N008, the Central Management Offices (CMO). This was a nine-storey building visually linked with the other buildings by the precast HKPA granite aggregate cladding panels. Probably for the same reasons that required the railway lines serving the nuclear refuelling facility to be capable of withstanding a high degree of seismic shock, it has been replaced by a much lower building, N008G Amenity Office, a single storey Portakabin-type building which is weathering very well.

Fig. 160. Building N008, Submarine Refit Complex, north elevation. Babcock Drawing no. AW3/1J (n.d.). Reproduced with the permission of the MoD.

Fig. 161. Submarine Refit Complex (April 1978). TNA, CM 20/65 (Jan 1977–Dec 1978). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no 5. Reproduced with the permission of The National Archives.

As seen above, this building was connected into the circulation system by means of a raised overpass. Turning to the remainder of the nuclear support buildings on the North Arm, N017 was the Demineralised Water Plant House.

Fig. 162. Submarine Refit Complex Building N017. Babcock Drawing no. AB4B/28B (n.d.). Reproduced with the permission of the MoD.

Next to it, N020 was the Nuclear Utilities Electrical Power House, building in three sections.

Fig. 163. Submarine Refit Complex Building N020. Northern section and part of central building, Babcock Drawing no. AB4B/20 (n.d.). Reproduced with the permission of the MoD.

Fig. 164. Submarine Refit Complex Building N020. Part of central building and southern section, Babcock Drawing no. AB4B/11 (n.d.). Reproduced with the permission of the MoD.

Fig. 165. Submarine Refit Complex Building N020. Section through high level plant room. Babcock Drawing no. AB4B/16. Reproduced with the permission of the MoD.

This range of buildings forms another handsomely unified group. The southernmost building in the group, with N017 and N020, is N021, the Caisson Control Centre, illustrated in Submarine Refit Complex (*RIBA Journal*, April 1979). This appears to be an in-house PSA design.

Fig. 166. Submarine Refit Complex Building N021. Babcock Drawing no. AB1/1 (n.d.). Reproduced with the permission of the MoD.

Behind this row of buildings was N018, the nuclear effluent treatment plant house. This was a building of sections, as seen when under construction.

Fig. 167. Submarine Refit Complex, N018 (November 1975). TNA, CM 20/78 (1975). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: Foundations book no. 2. Reproduced with the permission of The National Archives.

The building was used to store intermediate level nuclear waste (ILW) in the form of ion exchange resin beads which were used in the purification and decontamination processes. For a thorough account of this see Wolff, *Ion Exchange Resins for use in Nuclear Power Plants* (2012). A sufficient quantity of this decayed within a few years to be reclassified as low level waste which was sent by rail to Drigg in Cumbria. ILW was stored in two types of container, Resin Catch Tanks (RCTs) and Magnox flasks. The RCTs were dumped at sea until 1983. The western side (on the right) dealt with storage of the nuclear containers, the eastern side with the administrative and office side of things and maintenance of the equipment, as seen in a plan prepared in 1992 when major alterations were about to be made. The project, D154, was described in the local press as extending and upgrading the 'facilities for storing intermediate-level radioactive waste material, making DML independent of any national intermediate-level waste storage site. DML now have the capacity to store on site all the intermediate-level nuclear waste generated at Devonport until the level of radioactivity drops to the point where the waste is reclassified as low-level waste. It is then disposed of using the low-level waste route.' (Plymouth Reference Library press-cuttings)

These modifications were carried out by Sir Alexander Gibb and Partners, and left the building, externally, virtually as HKPA left it.

The new internal arrangements of Building N018 were shown in a photograph reproduced in an important article, The D154 project: Redevelopment of the Submarine Support Facilities at Devonport Royal Dockyard, written by Malcolm Smith (Aug 2002) in *Ingenia*, to which extensive reference will be made later on.

N018 was supplemented by N018A, for drum storage of processed chemical effluent. This was another characteristic HKPA building in appearance, though in fact a sympathetic design by the Plymouth based Form Design Group.

Fig. 168. Submarine Refit Complex Building N018A. Babcock Drawing no. SWP/A/106/80 (n.d.). Reproduced with the permission of the MoD.

To the south of this was N020A, the Direct Current Powerhouse, containing three sets of transformers, regulators and rectifiers on the ground floor, with two switch rooms on the upper floor. This was also by the Form Design Group.

Fig. 169. Submarine Refit Complex Building N020A. Babcock Drawing No. SWP/A/281/80 (n.d.). Reproduced with the permission of the MoD.

No drawings for N021A, the Transformer Building, have been located. To complete the survey of the original development of the FMB and the Submarine Refit Complex the buildings on the eastern side of Dock No. 14 should be mentioned. These are N008A, N008B and N008C. Drawings for these, dating from March 1977, show four buildings, for Degaussing, Flammable Stores, Bottle Stores, and NUPM Stores (function of the last is unknown).

Fig. 170. Submarine Refit Complex. Babcock Drawing no. AB7/14C (n.d.). Reproduced with the permission of the MoD.

Fig. 171. Submarine Refit Complex. Babcock Drawing no. AB7/14C (n.d.). Reproduced with the permission of the MoD.

It is not known which three of these are now present, or which is which. By September 1979, the buildings were essentially completed, the docks operational, and the cofferdam which enclosed the submarine complex within the basin was being removed. (Fig. 172) This shows the 80 ton crane completed. A gantry crane had been considered, but was rejected in favour of a cantilever crane. This was built by Stothert and Pitt of Bath, celebrated as crane designers but now defunct as a manufacturer. HKPA were involved in the design: 'We insisted' the HKPA architect-on-site, Leonard Goodchild, was quoted as saying. They wished to change the structure from a conventional open lattice to a box-type structure, but the wind resistance made this impossible. The result was a compromise, but a memorable one.

Fig. 172. Submarine Refit Complex with 80 ton crane, 1979. TNA, CM 20/68 (1979). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 8. Reproduced with the permission of The National Archives.

By April 1979, the whole area was sufficiently complete for the *RIBA Journal* to publish a laudatory article, singling out the

> Submarine Refit base…by far the most impressive part of the site. The scale is Piranesian. He would certainly have enjoyed the crane.…Probably the greatest aesthetic problem in dockyard design is to achieve cohesion and unity in an assemblage of differently sized and used buildings, to offset the inevitable visual clutter of stores equipment, cranes, etc. In recent years this has rarely been attempted, still more rarely obtained, and the result is that in most of our ports the chance for visual excitement is lost in tawdriness and mess. Like Brunel and Hartley, HKPA, in association with the engineers, have deliberately developed a vocabulary of structural and cladding forms to bring consistency to the various structures, sufficiently flexible to let individual buildings do their own thing, yet creating a controlled backdrop to the busy dockyard activity.…The result is an appropriately ship-shape and handsome set of buildings where heavy engineering, high technology, ships and architecture meet at the water's edge.

This glowing review from the mouthpiece of the architectural establishment was reinforced the next year by the Civil Engineering fraternity, when the complex won the Building category for the Concrete Society's annual awards. The judges echoed the RIBA correspondent's words: 'In this great complex, a considerable range of concrete construction techniques has been used but the whole blends into a unity. Dominated by a crane of massive proportions, the final building draws the eye with its shape and finish. A powerful building for a powerful purpose!' Pevsner and Cherry in 1989 praised the integration of the cranes with the buildings. In particular: 'The varied heights and shapes are neatly unified by rectangular cream-coloured precast concrete cladding panels.' (p. 653)

Fig. 173. Submarine Refit Complex, 1980. TNA, CM 20/68. (1979). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 8. Reproduced with the permission of The National Archives.

Before leaving the redevelopment of the North Arm, N259 must be mentioned. This building was Part 1 of Stage 2 of the FMB extension.

Fig. 174. Building N259. Babcock Drawing no. 85007/AD1/8 (n.d.). Reproduced with the permission of the MoD.

Fig. 175. Building N259. Babcock Drawing no. 85007/AD1/1 (n.d.). Reproduced with the permission of the MoD.

These plans, from 1987, were the work of the Plymouth based architects Stride Treglown. Workshops and storage were on the ground floor, with offices, including the Property Management office, above. Another major development around Basin No. 5 was in the offing for the 1990s.

2.7 A GREEN POLICY IS FORMULATED FOR DEVONPORT

In December 1978, a forward planning policy document for the yard was produced. Its authors were clearly impressed by the consistency of style represented by the HKPA designs, which contrasted with previous twentieth century buildings. 'The introduction of red bricks…was an example of a material which did not relate to the total concept; and from that time an increasing variety of new materials of different textures and colours have been used to the detriment of the general dockyard scene.' Modern materials could work well alongside traditional ones, and this was most satisfactorily achieved by use of a warm mid-grey in a variety of textures.

This tacit approval of the HKPA design strategy was followed by a proposal which was very advanced for its date. The future sources of energy for the base were considered. It was foreseen that this would in a foreseeable time affect future developments. Self-sufficiency in oil was likely to last until the mid-1990's, and oil might have to be restricted to space heating. Natural gas reserves were estimated to last 20 to 25 years, depending on the accuracy of estimates and the possibility of new discoveries. Not foreseeing the events of the 1980s, an annual output of 165 million tonnes was estimated by 2000. There was currently a surplus of generating capacity for electricity, which was expected to last another eight years. To a certain extent, oil or coal could be used for some power stations. Major decisions still had to be made over future nuclear generating stations.

Renewables, it was generally thought, would not be able to contribute more than 2% to 5% of the national requirements. But, if the Quadrangle (1852–61, N173-177, N186-191, N203) were to be re-roofed with a space-frame the better to handle and update Scamp's vision of a fully flexible workspace, then solar energy panels might be sufficiently advanced to be incorporated in the roof structure. Sections were drawn up to illustrate this.

Fig. 176. Quadrangle, longitudinal section. TNA, CM 20/57 (1978). PSA: Devonport: Publication and Research Studies. Master Development Plan: future development; vol. 2. Reproduced with the permission of The National Archives.

Fig. 177. Quadrangle, cross-section. TNA, CM 20/57 (1978). PSA: Devonport: Publication and Research Studies. Master Development Plan: future development; vol. 2. Reproduced with the permission of The National Archives.

The space-frame was never inserted, and the building remains essentially as Greene and Scamp left it. Now, with the building listed, the installation of appropriate solar panels on the Quadrangle would not necessarily be precluded. Approval could be given for ones that did not harm the historic fabric or appearance. However, this proposal is well worth noting as being well ahead of its time, and shows that the yard authorities were prepared to think well ahead for environmentally friendly solutions.

2.8 MODERNISATION AND ENHANCEMENT OF NUCLEAR SUBMARINE SUPPORT FACILITIES

In 1992, Devonport Management Limited - DML (who had taken over operations in the Yard since 1987) prepared a planning application document with the above title. Both DML and the MoD put forward alternative schemes for this. The layout as existing in 1992 was first illustrated, then the DML scheme, and then the MoD scheme. Neither of these schemes was adopted in full. Both schemes were based around the redevelopment of the Western Promontory and the drastic re-handling of Dock Nos 9 and 10 for the use of nuclear submarines.

The Dock No. 10 project was described in the local press: 'Leviathan: A 7,500 tonne earthquake-proof concrete wall replaces the steel gate on No. 10 Dock' (Plymouth Reference Library cutting).[3] This, completed in late 1997, was because DML:

> needs to retain the ability to dock attack submarines while redeveloping submarine docks (Nos 14 and 15 in the Submarine Refit Complex) and so No. 10 dock was brought up to the latest nuclear standards for use as an interim non-refuelling dock while the submarine refit complex docks are out of commission…the conversion has been designed to render the dock earthquake-proof up to seismic shocks of 0.25g. The dock structure of granite and mass concrete sits on bedrock but to enhance stability during seismic shock, the west wall was physically tied into the bedrock by 70-metre deep rock anchors set at one-metre intervals. The old welded steel dock gate was discarded and replaced by a multi-cellular 7,500 tonne reinforced concrete leviathan.

This wall seals on a flat sliding surface rather than being wedged in a slot, so relative movement between the dock gate and dock structure under seismic shock does not result in crushing of the gate. New concrete 'arrestor' cradles were built in the dock bottom round the dock blocks on which the submarine rests. These ensure that in the event of a catastrophic failure leading to a massive inrush of water, the submarine will be safely held in place.'

Improvements in storing and handling nuclear waste were a key part of the project, though these left little external evidence in the buildings, and have been dealt with previously in the refurbishing of building N018. The decision taken in 1993 that Devonport would become the single refitting base for nuclear submarines meant that the new and larger *Vanguard* class (12m in diameter and 150 m long) would have to be accommodated, and Dock No. 9 would need to be enlarged for this purpose. The different size of the vessels was graphically shown in the article referred to below.

This was the D154 project, the contract for which was agreed in March 1997. In August 2002 Malcolm Smith, the former Technical Director of the project, published a well-illustrated article, 'The D154 Project', in *Ingenia*, the journal of the Royal College of Engineering. This article was thought so important that it was reprinted in February 2003 in *Engineering Technology*, and in the May/June 2004 issue of *The Nuclear Engineer*. As the authoritative study, this has been drawn upon here. DML published a set of plans showing the proposed phasing of construction.

Key to both proposals was the decision to change the technique of loading and unloading nuclear fuel into the submarines. The 80 ton crane would eventually become redundant with nuclear fuel rods being lifted from the docked submarine into a Reactor Access House (RAH) which spanned the dock on beams, and the nuclear flasks would not be lifted at all. They would be moved horizontally by the RAH and then transferred to a Low Level Refuelling Facility (LLRF) where they would be loaded for transport by rail out of the dockyard.

The DML proposals were set out in a series of phased diagrams going up to 2003. The whole new redevelopment of the nuclear submarine facilities was illustrated in a well produced booklet issued

[3] Plymouth Reference Library holds files of local press cuttings, notably of the *Evening Herald* (11 April 1987), a Devonport Dockyard picture special, (September 19, 1998) and a special issue (February 2000), showing the reconstructed submarine facilities and the HKPA administration block demolished and replaced by a lower building with a larger footprint.

by DML in March 2002. This described the principal new facilities as 'the Vanguard Class refitting and refuelling facility at 9 Dock; two Swiftsure and Trafalgar Class refitting and refuelling facilities at Docks 14 and 15; upgraded berths and wharves; power range testing facilities for all submarines' and various buildings and plant to support these. The exact sequencing of all this work is not known, nor are the numbers – and hence the drawings and location – of many of these buildings. Consequently only the Low Level Refuelling Facility (LLRF) and the buildings around Dock Nos 9 and 10 are dealt with here.

The MoD proposals for the siting of the LLRF were the ones which were acted on. The building was numbered N006, and the first plans located are dated March 1997. It was described in the local press as follows. 'To service all the new nuclear docks, a new low-level refuelling facility is being built in the corner of Basin No. 5. To meet the earthquake requirements, a 25,000 tonne foundation block was cast directly on to the bedrock under the basin, and this was then anchored to the bedrock using tensioned steel rods. An image was shown in a press cutting held in Plymouth Reference Library: 'Taking shape: the new low level refuelling building under construction. It stands on a concrete pad anchored by steel cables to the bedrock.'

A more detailed scientific explanation was given in 'Installing rock anchorages in a nuclear-licensed dock site' (Chapman *et al.*, 2006). Rock anchorages had been installed in submarine refit complex in the 1970s to stabilise existing basin walls during the construction of the dividing wall which created Docks 11 and 12, and in constructing the promontory between Docks 14 and 15. More rock anchorages were fitted during the D154 Project. (Chapman *et al.*, 2006, pp. 63-4, 73) The building houses the storage pits used for new and used fuel elements, together with a low-level fuel-handling crane.

Smith (2002, pp. 29, 31, 33) illustrated the interior of the LLRF building during its construction and one of the Reactor Access Houses with a cradle straddling Dock No. 9. Docks 14 and 15 were upgraded with a Butterley Crane (2002) and equipped with low level fuel handling facilities. This was illustrated in the *Evening Herald* of September 19, 1998, which shows the refuelling crane removed and the multi-storey management offices replaced by a lower building to reduce the risk of collapse during an earthquake.

Turning to the new buildings to serve the rebuilt Dock Nos 9 and 10, neither of the original layouts made by DML and the MoD was exactly followed. The final solution was shown in *Ingenia* (2002, p. 32)

Fig. 178. Babcock (2011). *Site Atlas*. Reproduced with the permission of the MoD.

By 1997, Dock No. 10, as proposed by DML, had been brought up to standard for use as a non-fuelling maintenance dock while Dock Nos 14 and 15 were being upgraded. The dock, as stated earlier, was made earthquake-proof and the steel dock gate replaced by a 7,500 ton reinforced concrete gate. N094, a production building, was erected on its eastern side, seen on the general plan. (Fig. 179)

Fig. 179. D154 Phase 3 Location Plan sheet no. 15 (n.d.). No Babcock drawing number. Reproduced with the permission of the MoD.

The buildings are clearly visible in a 2010 Google aerial photograph (Fig. 180), in an illustration from the 2002 DML booklet and in NAO (National Audit Office) (6 December 2002). *Ministry of Defence: The Construction of Nuclear Submarine Facilities at Devonport*.

Fig. 180. Google aerial photograph of Devonport Dockyard. Retrieved from Google Earth in 2013.

At the head of Dock No. 9, reconstructed to refit and refuel *Vanguard* class submarines, is N099, the PWR2 (Pressurised Water Reactor) Training Rig. The *Vanguard* class is powered by a new pressurised water reactor, PWR2, which had double the service life of previous models. Also at the head of Dock No. 9 is N102, the PCD/ARC building. This houses the Primary Circuit Decontamination/Alternative Core Removal Cooling plant. This cools the reactor and, in the words of the DML brochure, 'provides a means by which decontamination and boronation chemicals can be injected into the submarine's primary circuit. Boronation chemicals are used to absorb neutrons and suppress nuclear fission.'

Building N102, a complex building, according to the *Ingenia* article, 'contains 92 rooms with equipment and plant connected by over 20 km of pipework and 150 km of electrical cable.' This work had been anticipated by the construction of a new Pipe Shop, for which no dated plan has been located. Clearly, facilities must have also been built to house and maintain such a quantity of cable. Pipe Shop N110 was converted, when *Vanguard* came in 2002, to a Layapart Store for *Vanguard* items as they were removed. It is now HQ Store and Office for *Vanguard* class operations, supporting the nuclear fleet. It also stores items from surface ships in refit. No real changes have occurred to the external structure, but some offices have been installed internally for *Vanguard* class operations. A concrete wall, now gone, used to divide ferrous from non-ferrous pipes. Cranes run lengthwise within the building. Dark coloured pneumatic compressed air tubes which carried communications and drawings between offices still remain. The hot air blower heating system no longer functions. In the 1970s other metals were added because copper became too expensive and there was a shortage for tubing, so alloys were used which corroded. These cannot be repaired so it is defunct. Infrared heaters now operate.

At the north end on the eastern side of Dock No. 9 is N117, the Electrical Plant House. The principal building serving Dock No. 9 is the Reactor and Refuelling Production Building (RRPB).

Babcock Marine took over running the yard in 2007. But before that they had added a further chapter to the story of the Submarine Refit Complex. They had designed a moveable lightweight roof to cover Dock No. 14 while refitting operations took place. It can be removed as each refit is completed. Submarine refits used to take 2.5 years; they now take 1.5 years.

By the time Babcock's Principal Engineer published an article on the structure in 2008 (Baird, *Design and construction of an environmental enclosure for a refitting dock*) it had been used for two refits during the previous five years. The roof is shown in the illustration of the refit of *Triumph*. Although not a permanent structure by definition, it is conceivable that it may last as long as such an apparently permanent a fixture as the 80 ton crane, which was demolished in September 2008 after having performed its final refuelling on that very submarine in April of that year.

The Management slab block N008, as mentioned earlier, has also now been replaced, though it still figured on the 2011 *Babcock Site Atlas*. The replacement is shown in an illustration published in the Plymouth *Evening Herald* of September 19, 1998 and a plan in the *Ingenia* article.

As part of the D154 project Docks 14 and 15 were strengthened, the floors raised and the entrances sealed with multi-cellular caissons. The rail system for transferring nuclear containers was extended and seismically qualified. Since the 1990s further rock anchorages have been installed to address corrosion and stress corrosion cracking affecting the 1970s anchorages, to meet more stringent nuclear safety case requirements for all the nuclear docks and facilities. After installation of bar anchorages in May 1999 in the LLRF, housing new and used nuclear fuel, water was found to be leaking through the heads of several of the anchorages in August 1999. It was penetrating the boreholes in which the anchorages were fitted, either from the underlying rock or from Basin No. 5, through the mass concrete slab. This was resolved by filling the sealing cap voids with pressurised grease. (Chapman *et al.*, 2006, pp. 63-4, 73).

2.9 MODERNISATION AND CHANGING ROLES OF EARLIER BUILDINGS

A museum has existed at Devonport in some form since the early nineteenth century, one artefact being the flag under which Nelson fell at the Battle of Trafalgar. Ten items, including a model of the Dockyard Gates, 'were carried in the Procession of Dockyard Employees in honour of the Coronation' of William IV and Queen Adelaide in 1831. The artefacts were kept in a shed known as the Adelaide Gallery, but it was destroyed in the Dockyard Fire of 1840. In 1911 the Rigging House in South Yard housed a painting of the Channel Fleet approaching Plymouth Sound 'Painted on wood by J. Pengelly, labourer, 1862', seventy figureheads, twelve ship models, twenty-four boats or parts of ships, four carvings, and twenty-three 'Relics', including a piece of the keel of the *Royal George*, recovered from the wreck in 1840. (Admiralty, April 1911, pp. 33-9; Dicker, 1970) Shown on an 1888 map lying south of Dock No. 1, the

area was bombed during the Second World War; the Glass Fibre Shop is now on this site.

From 1941, Stanley Greenwood of the Naval Stores Department at Devonport gathered artefacts and was influential in persuading Admiral 'Dick' Wildish, the last Admiral Superintendent of the Dockyard in the 1960s, Norman Chaff, his Civil Secretary, and Dockyard Welfare Officer Councillor Fred Stott, to set up a new museum. Chaff appealed for items in the local press. (Devonport Dockyard Museums) On Monday April 28 1969, Basil Greenhill, Director of the National Maritime Museum at Greenwich, opened Plymouth Dockyard Museum in the old Fire Station in South Yard. It moved in the 1970s to the former St Lo church near Fore Street Gate and to its current location within the former Pay Office (c.1780, S32, Grade II*, 1388408, SX 44972 54625) in South Yard in the late 1970s (New Museum Tells Dockyard Story, 1969). Its collection of figureheads are now somewhat confined within the former Fire Station. David Pulvertaft's authoritative study describes Devonport's naval figureheads which remain or have been lost or scattered (Pulvertaft, February 2009, pp. 81-5).

Plymouth Naval Base Museum was managed from 1993 until 2007 by Commander Charles Crichton OBE and cared for by volunteer Friends. Its collection and submarine HMS *Courageous* in Basin No. 3 are now open to the public through the Devonport Naval Heritage Centre, which brings visitors into Devonport Naval Base via pre-booked coach tours. The collection is distributed currently within the Fire Station/Stables (1851, SO32, II, 1378506, SX 44941 54598), the Pay Office (SO32), a post-war building housing the model ship collection, Gilroy House and the Mould Loft/ Scrieve Board (S122), but it is likely that it will be moved in the next few years. In 2014 Plymouth City Council bid for HLF funds to refurbish and extend the City Library and Museum and Art Gallery on North Hill (Rossiter, 2014). The grant of £12.8m will create a history centre, expected to open in 2019, within listed buildings on North Hill. These will house five heritage collections in one building: 'Plymouth City Museum and Art Gallery; Plymouth and West Devon Record Office; South West Film and Television Archive; South West Image Bank and the Local Studies and Reference Collection from the Central Library.' (HLF, 27.5.2014) This will remove the collection from its original location, and among such competition only a fraction will be displayed.

Near Fore Street Gate is Gilroy House (former Porter's Lodge), which contains four police cells and a Lighthouse exhibition. Badly damaged in the Second World War and repaired, the remaining original building is possibly of a similar age to Portsmouth Porter's Lodge (c.1708). The orbs from the original Fore Street Gate pillars are in the front garden. Fore Street Gate Police Station (1854, N223, II, 1378576, SX 45126 55496) was a Dockyard Police Museum in 2008 which has now closed. Outside was a revolvable wooden sentry box (to avoid the wind) relocated from Clarence Steps at Royal William Yard. Also in 2008 some decorative cast iron urinals from outside Ferry Road Gate, broken into large pieces, were stacked near the White Yarn House (1796, S135, Grade II*, 13785030).

The Master Ropemaker's Office, later the first Dockyard School (c.1816, c.1868, S103, Grade II, 1378518, SX 45102 54452), has been renovated, as has the Joiners' Shop/Hemp Store (1766, S95, Grade II, 1378520, SX 45082 54395). After a £300,000 conversion it opened in April 2005 as a business making rigging, ladders, fenders and shackles for RN tugs, employing ex-dockyard workers and maintaining dockyard skills.

The first manifestation of change to South Yard was Princess Yachts' acquisition in 2011 of the East Ropery (1763–71, S132, I, 1388400, SX 45188 54215) and Tarred Yarn Houses (White Yarn House, 1763, S135, II*, 1378503, SX 45185 54296; Tarred Yard Store, 1769, S138, II*, 1378504, SX 45217 54200; Tarring and Wheel House S136 and Tarred Yarn House S137, 1763, II*, 1378505, SX 45205 54238) an exclusive entrance through Mutton Cove Gate and land to erect ship halls. The physical and visual impact of the ship halls and a steel security fence has reduced the cohesion of the historic buildings as an integrated group. Vistas are now very different from the 1922 view of South Yard looking towards the Tamar illustrated in *A Brief History of Devonport Naval Base* (pp. 6-7). The Relay Warehouse Building (1903, S173), among others, was demolished to prepare for Princess Yachts acquisition of part of South Yard (Architects Design Group, 2010, Design and Access Statement). The following images record some of the changes.

Fig. 181. DP130113. Devonport South Yard: photograph of Building S173 recorded before demolition. General view looking northeast across the dockyard towards S172 and S173 (8 Feb 2011). King's Hill Gazebo (1822, S186) and the newly roofed Covered Slip No. 1 are on the right. S173 was constructed as a Plumbers' Shop as part of the project dating from 1900 to supply the building of *Dreadnoughts* on nearby Slip No. 3 (English Heritage, Aug 2010, Listing Advice Report Building S173). Princess Yachts vessels are seen on the left. ©Historic England.

Fig. 182. DP130116. Devonport South Yard: photograph of Building S173 recorded before demolition. View of S173 looking towards the west end doorway on the west elevation (8 Feb 2011). King's Hill Gazebo (1822, S186) can just be seen behind it to the right, with new fencing to secure Princess Yachts' land. Shallow Dock is in the bottom right hand corner. ©Historic England.

Fig. 183. DP13021. Devonport South Yard: photograph (8 Feb 2011) of Building S173 recorded before demolition. Stone dated 1903 on the west elevation. ©Historic England.

Fig. 184. DP13023. Devonport South Yard: photograph of Building S173 recorded before demolition. Cast iron lamp bracket on the southwest corner of S173 (8 Feb 2011). ©Historic England.

Fig. 185. DP13028. Devonport South Yard: photograph of Building S173 recorded before demolition. Interior with Cowans Sheldon overhead gantry dated 1941 (8 Feb 2011). ©Historic England.

Nearby Slip No. 3 was also altered in 2011 when it was taken over by Princess Yachts (Architects Design Group, 2010, Design and Access Statement). The Gazebo (1822, S186, Grade II*, 1388430, SX 45164 54042) is now isolated among Princess Yachts buildings. Slip No. 4 is being refurbished to take Landing Craft. The Scrieve Board (1814–21, S122, SM 1002575/Grade II*, 1388417, SX 44859 54124) is now used for museum items stored previously in the Ropery. The North Smithery (1808, S23, Grade II*, 1388402, SX 44862 54618), also known as The Old Smithery, needs an estimated £3-6m to make the building safe. It is considered now to be beyond a level where this would be practicable. The roof is detached. South Saw Mills (SO128, SO148-150, Grade II*, 1388413, SX 44986 54180) are considered salvageable, but SO128 and SO149 are in a very poor condition. The Boathouse Complex north of the Camber Channel is used by Babcock for timber work. The Gunstore (S119), a machine shop converted to a heavy gun store in 1911, was a monument to the *Dreadnought* era. It was on Jetty No. 1, but has now gone.

In North Yard the Keyham Extension Gate was removed in 2013 because it was collapsing, as its ramp was beyond repair. The river wharves of Basin Nos 2 and 3 give a magnificent view of the Quadrangle frontage and the caissons can be seen in Basin No. 5. Samuel Bentham spelled the word 'cassoon', which is still the common dockyard pronunciation in both dockyards. New ship caissons have been installed by Ravenstein: J/08 in 2009 and Q/10 in 2012 (Ravenstein, 2009; 2012). The windows of the Dock Pumping Station (1905, N114-N115, Grade II, 1378571) have been replaced like-for-like.

Fig. 186. Section of a map showing the Quadrangle workshops in 1903. AdL, Vz 14/44 (1900–1923). H.M. Dockyard Devonport North and South Yards Keyham Steam Yard and Naval Barracks, Compiled by E. J. Powell from Mr. Townshend's Survey of North and South Yards and the Ordnance Survey. Director of Works Office 1903. Defence Estates Plans. Scale 1":16'. Courtesy MoD Admiralty Library, Naval Historical Branch, Portsmouth.

The initial flexible design of the Quadrangle (1852–61, N173-7, N186-91, N203, Grade I, 1378566, SX 44874 55635) has allowed extensive modernisations to be carried out within its original shell and under its original roof. 'The Quadrangle, now part of the Factories Group, is still used for what it was originally intended. The design intent of the internal courtyard still applies to its covered areas.' (Welch, 2013) In the late twentieth century the building was always a support workshop. Windows are original or like-for-like. Brickwork has been re-pointed where necessary and the external face has been recently cleaned. The original entrance opens onto the Basin No. 3. Just inside are the original stairs. Two archways aligned with the Quadrangle's northern elevation to the west and east gave access to the railway line. The old travelling cranes have been replaced. In 1993 brick/concrete/block (earlier divisions had used corrugated iron) partitions were inserted to divide the space further

and some internal brick structures were inserted. Iron girders are all original, neo-classical design. There is plentiful evidence of crossing tramlines and original flagstones, and wall fixtures for hanging services.

The building is divided into five bays, each with separate functions, all manufacturing items for ships in refit. It is the centre of Devonport refit activities, handling all functions except wooden support. More facilities will be moving into the Factory to be fully centralised. In the 1970s it had 110 workers; in 1913, 52. More women are gaining apprenticeships and becoming employed, causing changes to facilities and attitudes.

In the Foundry (now the Cleaning Bay) were furnaces with granite pits, and tram rails. One bay has the original bricks and iron beams. The Foundry's original Diocletian (Palladian) windows on the western and eastern elevations ventilated fumes and heat. The Pipe Shop opened in the Factory in 1976 and closed in 2000. The Bottle Shop is an original Quadrangle building which cleaned air bottles for submarines (Evans, 2004, *Building the Steam Navy*). The Boiler Makers' and Shipwrights' area is defined by corrugated iron that is at least sixty years old. Tramlines (filled in) remain. In the Water Pressure Test Bay is a 15 cwt Power Hammer (Alldays & Onions Birmingham & London, c.1991), originally from the North Yard Smithery. An old press for shaping edges is still used today and for training apprentices. In Sheer Alley is an air-driven guillotine still used to cut steel plates. Most current cranes are four to ten years old, but one red crane, used to move big plates, dates from 1948. A Sedgwick Plate Bending Machine was still in use until 2013, then de-commissioned. There is a new pipe-bending machine for 6 inch diameter pipe, but an old pipe-bending machine for 8 inch diameter pipe is still in use.

Within HMS *Drake*, Devonport Naval Barracks, the Chapel of St Nicholas (1905–7, Grade II, 1386364, SX 44852 56796) still holds services. Devonport's newest building here is for Haslar Company, a rehabilitation centre for disabled personnel. It is a light yellow brick building, in contrast to the local limestone of the rest of the blocks.

The future of South Yard is certain; its disposal by the MoD is under way. *Plymouth and the South West Peninsula City Deal* announced plans in 2014 to 'Unlock 32,400 square metres of new marine workspace as part of a potential phased release of the South Yard site at Devonport Naval Base that could, in the long term, unlock 85,000 square metres of new marine workspace.' Incorporating the Ministry of Defence, Plymouth City Council and other local authorities, the Homes and Communities Agency and the Heart of the South West Local Enterprise Partnership, it will develop a "whole-site" strategy for South Yard, including small amount of housing. (pp. 4, 5) An identically named booklet identifies South Yard as the 'flagship' campus to 'facilitate the international relocation and development of supply chain companies and enable the growth of local marine sector companies.' (pp. 2, 8)

Fig. 187. Devonport's concrete Frigate Complex June (1973–76, N217) and the limestone North Yard Offices (N215, 1903, 1910), visible over the dockyard wall. A. Coats 2013.

At Devonport the sea is evident from most of the naval base, as the facilities have extended north along the estuary rather than inland. Early twentieth century buildings are mostly Edwardian baroque in limestone, while post-Second World War buildings, reflecting their technological functions, steel framed and concrete clad. More recent additions have been Portakabins, which in an era of rapidly changing fleet requirements are flexible to serve immediate requirements. There are large car parks at the gates and within the naval base, but 350-400 workers still cycle into the yard.

Devonport's future was regarded as being in some doubt at the time of the 2010 Strategic Defence and Security Review, and occasional concerns about its long-term prospects have surfaced since then, so it is not entirely inconceivable that the yard will ultimately face closure. However, it remains an essential facility for the Royal Navy. It will undertake the refits of the new *Astute* class submarines, and almost certainly also those of the *Trident* successor boats.

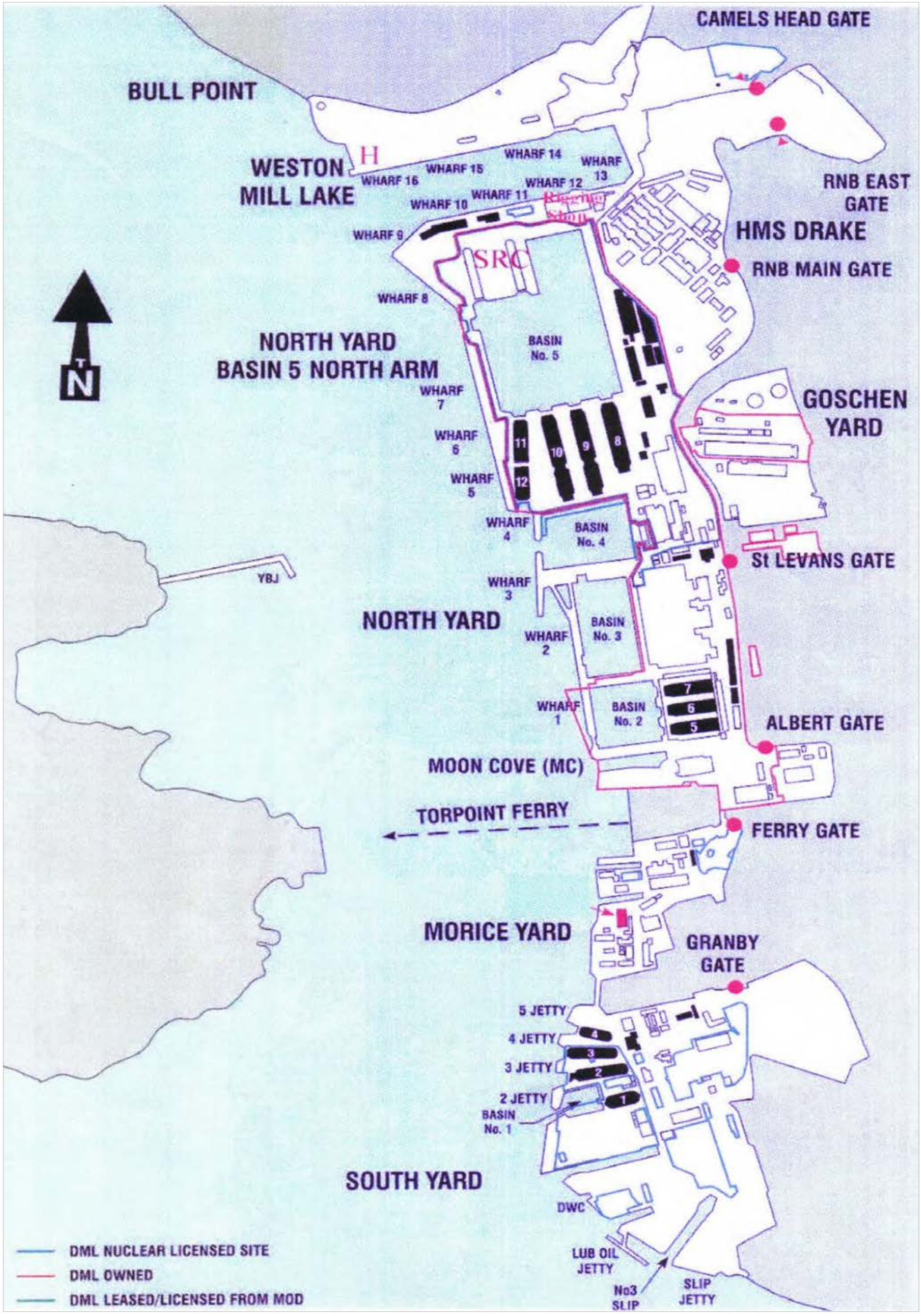


Fig. 65. HMNB Devonport map. Royal Navy (2010). *Devonport Naval Base Handbook*. Plymouth: Plymouth HIVE/DE&S, p. 5.

Left: Fig. 67. BB96/03858. Devonport South Yard South Smithery (S126) photograph along north side of central building from northeast (29 Feb 1996). ©Crown copyright.HE.

Above: Fig. 66. AA98/04662. Devonport Covered Slip No. 1 (1774–75) photograph by Eric de Mare showing the roof timbers added in the nineteenth century (1956). The only remaining intact eighteenth century slip within a royal dockyard (Coad, 1989, p. 197). Reproduced by permission of Historic England.

Left: Fig. 68. BB96/03859. Devonport South Yard South Smithery (S126) photograph detail of evidence of the line shaft on the north side of central building (29 Feb 1996). ©Crown copyright.HE.

Fig. 69. BB96/03867. Devonport South Yard South Smithery (S126) photograph of interior central building, view from southeast (29 Feb 1996). ©Crown copyright.HE.

Fig. 70. BB96/03891. Devonport South Yard South Smithery (S126) photograph of north elevation of centre building (29 Feb 1996). ©Crown copyright.HE.

Fig. 71. BB96/03865. Devonport South Yard South Smithery (S126) photograph of Cowans Sheldon driven capstan (1926) (29 Feb 1996). ©Crown copyright.HE.

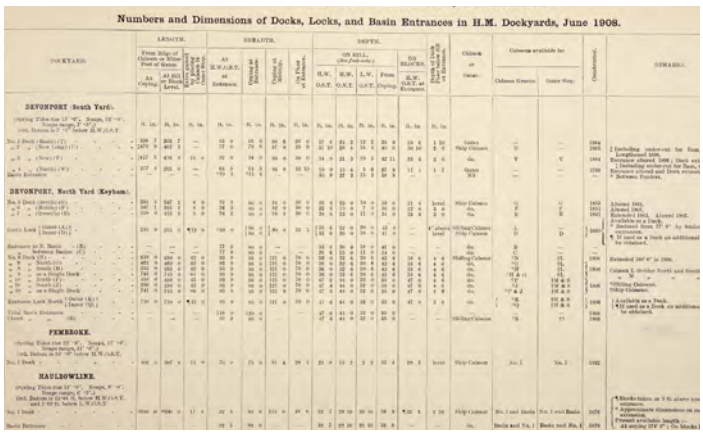

Numbers and Dimensions of Docks, Locks, and Basin Entrances in H.M. Dockyards, June 1908.

Fig. 72. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. c. Devonport Dock Dimensions. Reproduced by permission of Historic England.

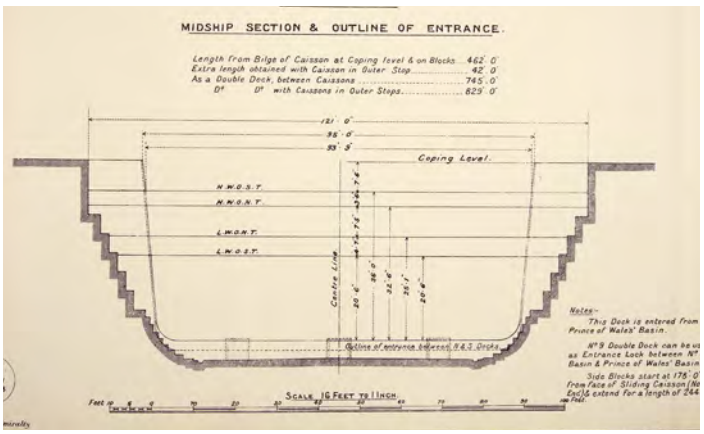


Fig. 73. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. 100. Devonport North Yard (Keyham Extension) Dock No. 9, North midship section and outline of entrance. Reproduced by permission of Historic England.

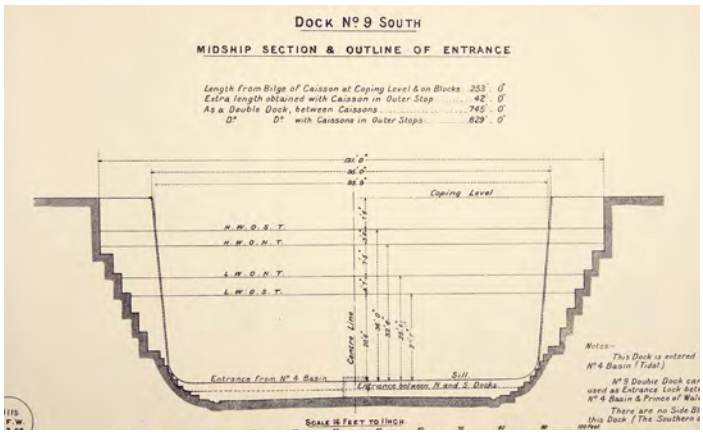


Fig. 74. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. 102. Devonport North Yard (Keyham Extension) Dock No. 9, South midship section and outline of entrance. Reproduced by permission of Historic England.

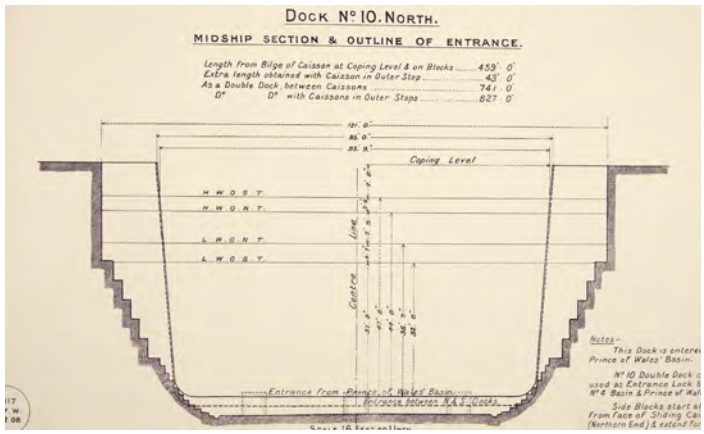


Fig. 75. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. 104. Devonport North Yard (Keyham Extension) Dock No. 10, North midship section and outline of entrance. Reproduced by permission of Historic England.

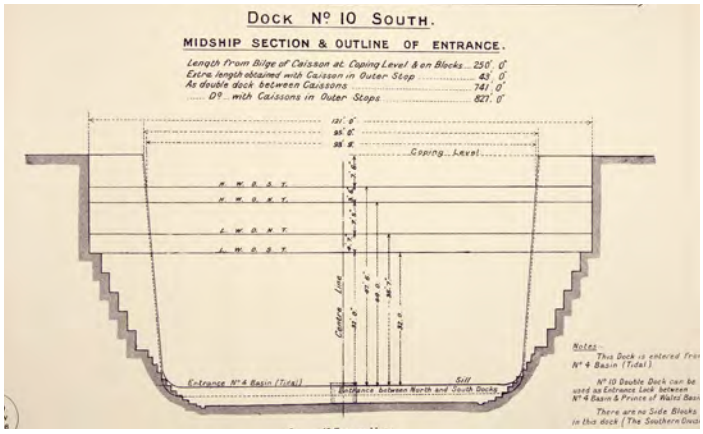


Fig. 76. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. 106. Devonport North Yard (Keyham Extension) Dock No. 10, South midship section and outline of entrance. Reproduced by permission of Historic England.

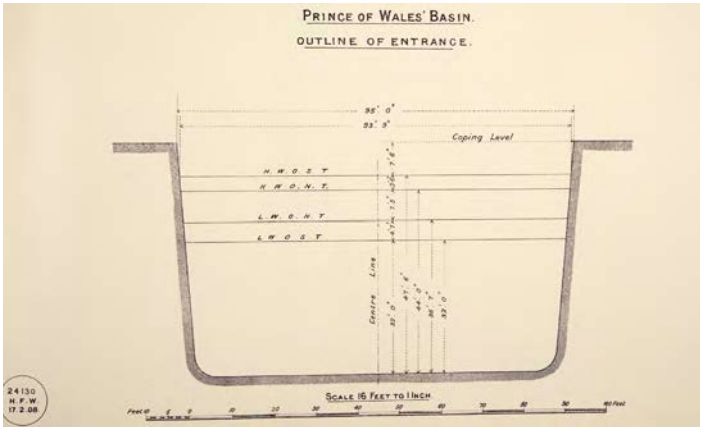


Fig. 77. ADM01 (June 1908). Numbers and Dimensions of Locks, Docks and Basin Entrances in HM Dockyards. Admiralty Book, p. 117. Devonport North Yard (Keyham Extension) Prince of Wales Basin outline of entrance. Reproduced by permission of Historic England.

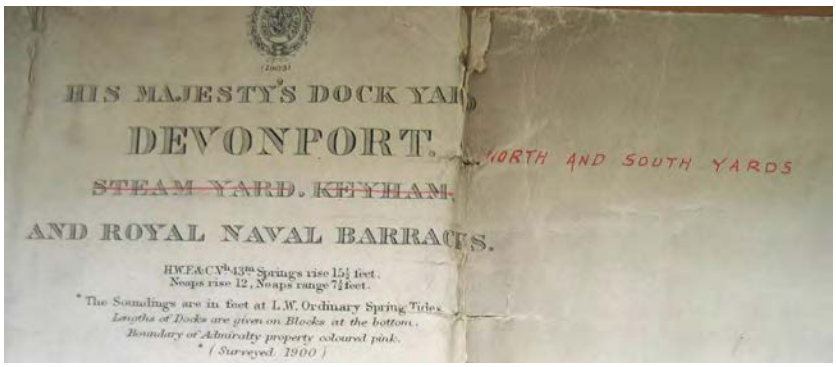


Fig. 78. Change of name from Keyham Steam Yard to North Yard. AdL, Vz 14/44 (1900–1923). H.M. Dockyard Devonport North and South Yards Keyham Steam Yard and Naval Barracks, Compiled by E. J. Powell from Mr. Townshend's Survey of North and South Yards and the Ordnance Survey. Director of Works Office 1903. Defence Estates Plans, Scale 1":16'. Courtesy MoD Admiralty Library, Naval Historical Branch, Portsmouth.

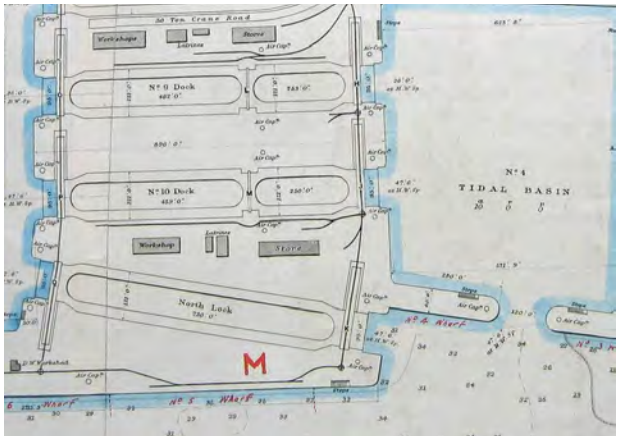


Fig. 79. Cold Store site marked M on the wharf near North Lock, 1920. Devonport North Yard. AdL, Vz 14/43 (1908-23). Devonport Dockyard Defence Estates Plans. Scale 1:2500. Courtesy MoD Admiralty Library Naval Historical Branch, Portsmouth.

Fig. 80. HM Dockyard Devonport: aerial photographs. TNA, WORK 69/19 (1951). Reproduced with the permission of The National Archives.

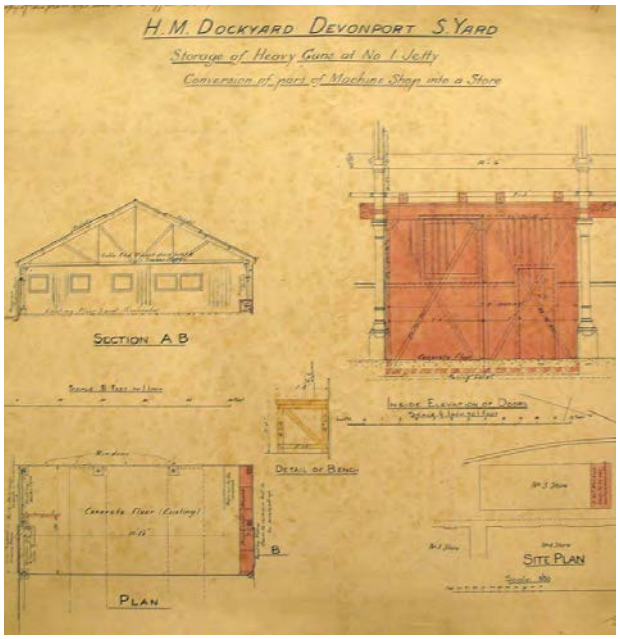
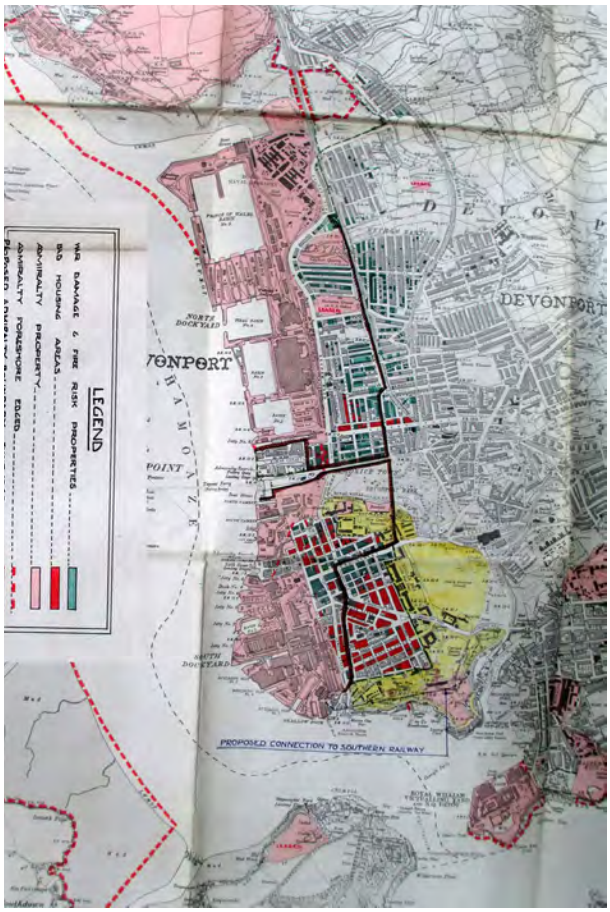


Fig. 81. Devonport Dockyard, machinery shop, 1911. Conversion of machine shop to heavy gun store. PWDRO, 663/320. © Plymouth City Council (Arts and Heritage).



Right: Fig. 82. Proposed Devonport Dockyard boundary enlargement (1942). TNA, ADM 1/17810 (1942–44). Naval Stations: Post war reconstruction and development of Devonport and Plymouth: proposals and plans. Reproduced with the permission of The National Archives.

Fig. 83. HM Dockyard Devonport: aerial photographs. TNA, WORK 69/19 (1951). Reproduced with the permission of The National Archives.

Fig. 84. HM Dockyard Devonport: aerial photographs. TNA, WORK 69/19 (1951). Reproduced with the permission of The National Archives.

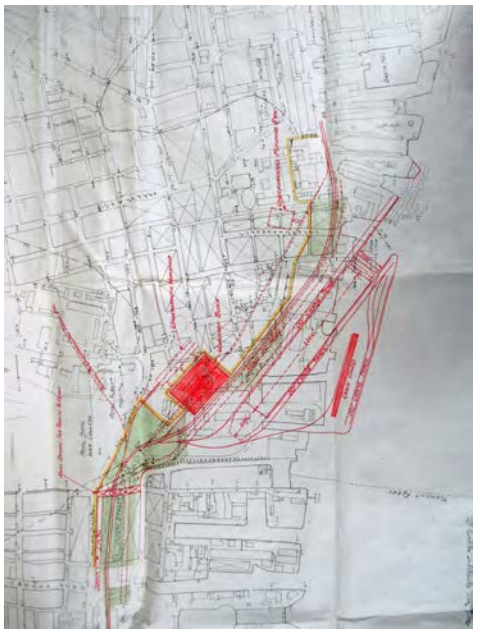


Fig. 85. Naval Stations: Post war reconstruction and development of Devonport and Plymouth: proposals and plans (1943). TNA, ADM 1/17810 (1942–44). Reproduced with the permission of The National Archives.

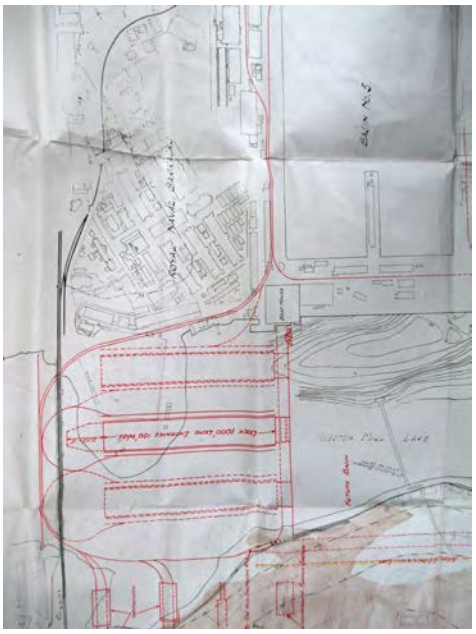


Fig. 86. Naval Stations: Post war reconstruction and development of Devonport and Plymouth: proposals and plans (1943). TNA, ADM 1/17810 (1942–44). Reproduced with the permission of The National Archives.

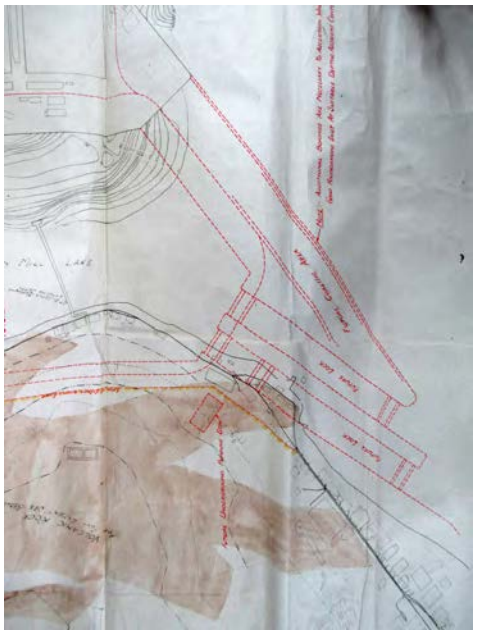


Fig. 87. Naval Stations: Post war reconstruction and development of Devonport and Plymouth: proposals and plans (1943). TNA, ADM 1/17810 (1942–44). Reproduced with the permission of The National Archives.

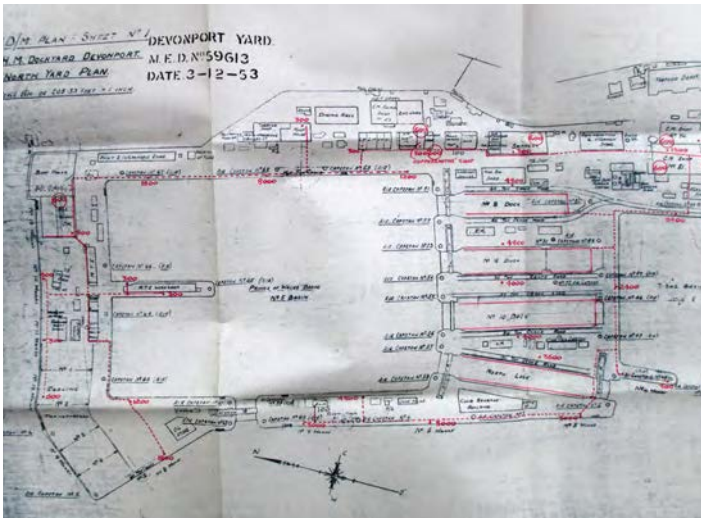


Fig. 88. HM Dockyard Devonport: plans for development and modernisation. TNA, ADM 1/26498 (1953). Reproduced with the permission of The National Archives.

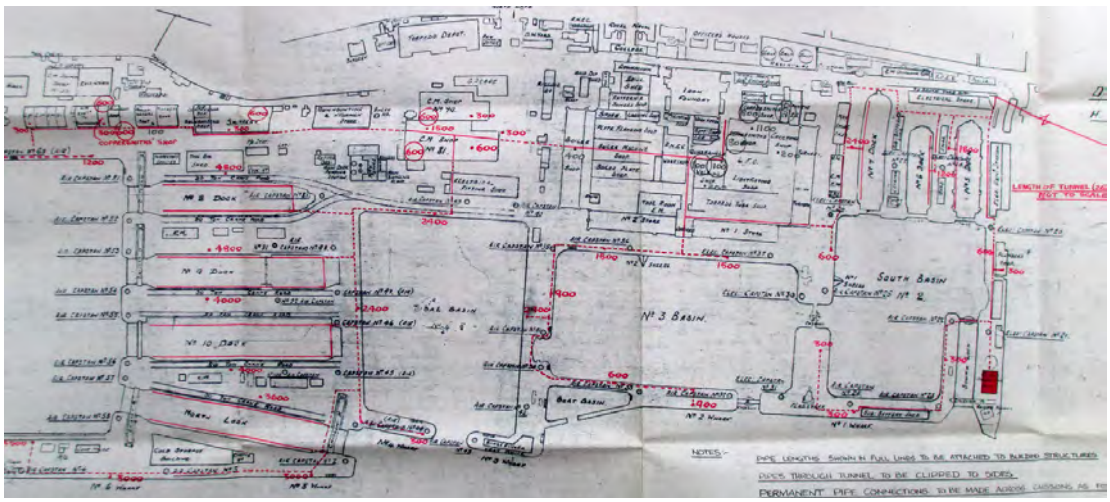


Fig. 89. HM Dockyard Devonport: plans for development and modernisation. TNA, ADM 1/26498 (1953). Reproduced with the permission of The National Archives.

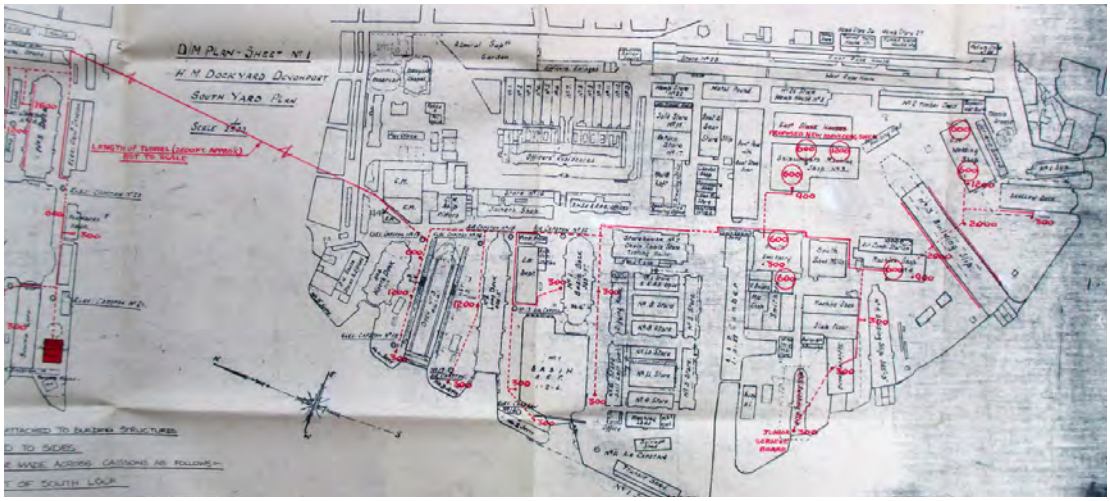
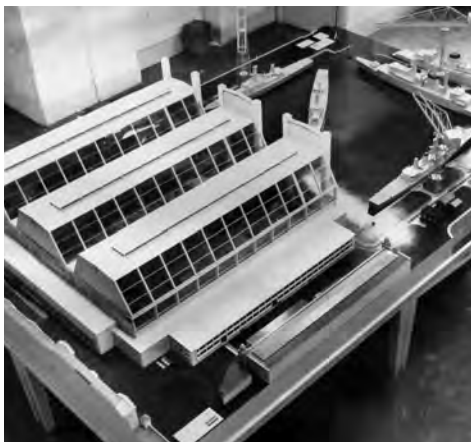


Fig. 90. HM Dockyard Devonport: plans for development and modernisation. TNA, ADM 1/26498 (1953). Reproduced with the permission of The National Archives.

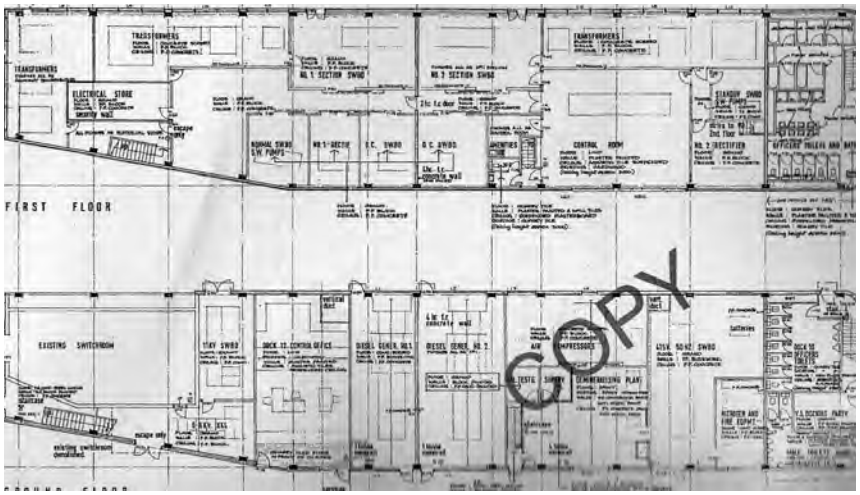
Fig. 91. Refitting of nuclear submarines: use of Portsmouth or Devonport Dockyards, with maps. 1965. TNA, ADM 329/7 (1964–65). Reproduced with the permission of The National Archives.



Right: Fig. 92. Photograph albums. Frigate complex: evidence of progress (1972). TNA, CM 20/91 (Jan 1971–Dec 1972). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Right: Fig. 93. Photograph albums. Frigate complex: evidence of progress (1972). TNA, CM 20/91 (Jan 1971–Dec 1972). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 94. *Babcock Site Atlas* (2011). Reproduced with the permission of the MoD.



Right: Fig. 95. Building N093. Babcock Drawing no. AB3/12B (1972). Reproduced with the permission of the MoD.

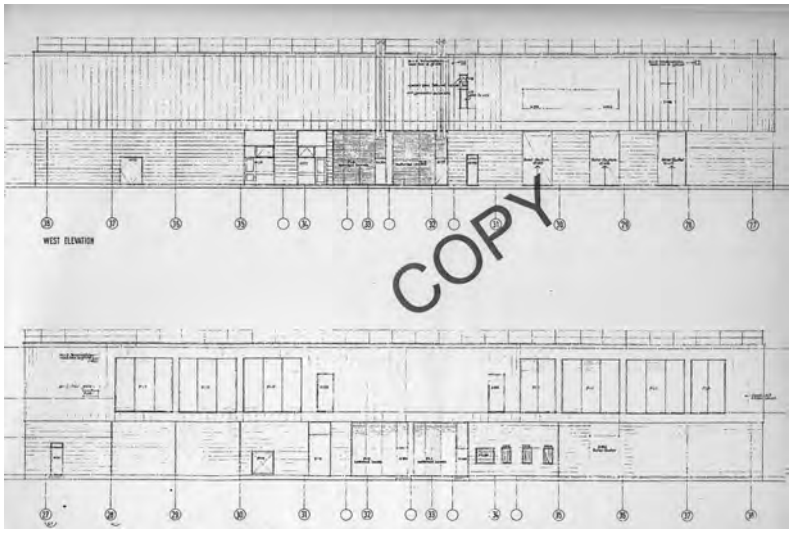


Fig. 96. Building N093. Babcock Drawing no. AB3/16B (1972). Reproduced with the permission of the MoD.

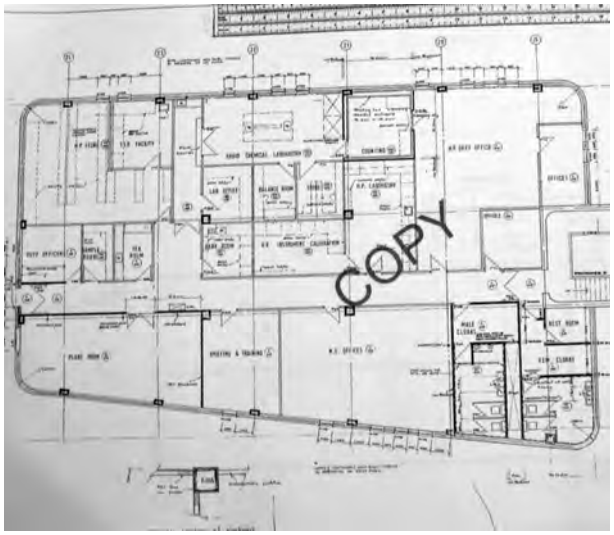


Fig. 97. Building N125 ground floor. Babcock Drawing no. AB2/11 (1972). Reproduced with the permission of the MoD.

Fig. 98. Building N125 first floor. Babcock Drawing no. AB2/12 (1972). Reproduced with the permission of the MoD.

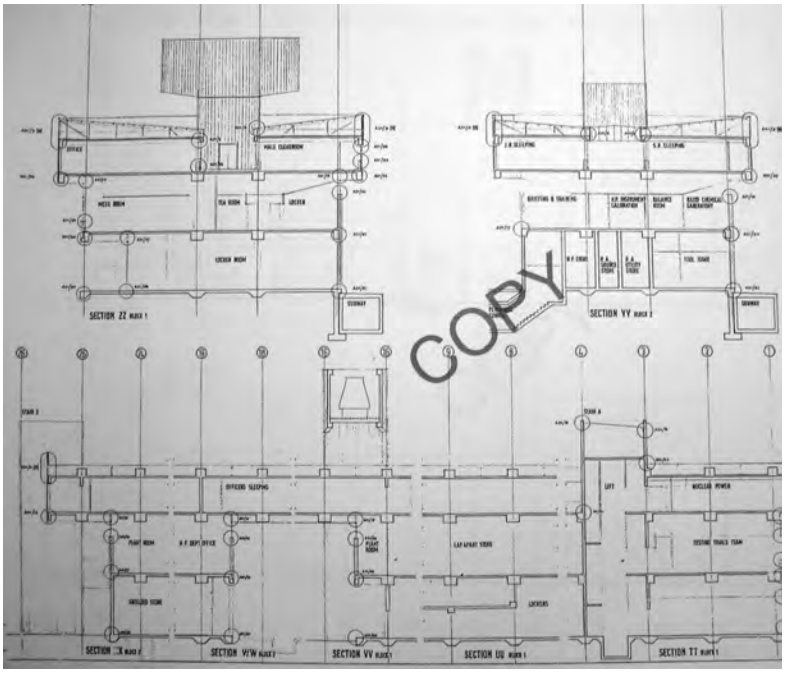


Fig. 99. Sections through Building N125. Babcock Drawing No. AB1/80 (1972). Reproduced with the permission of the MoD.

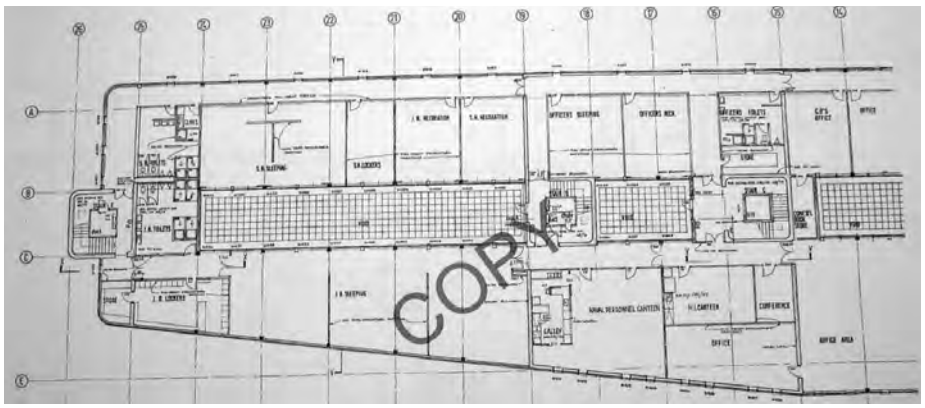
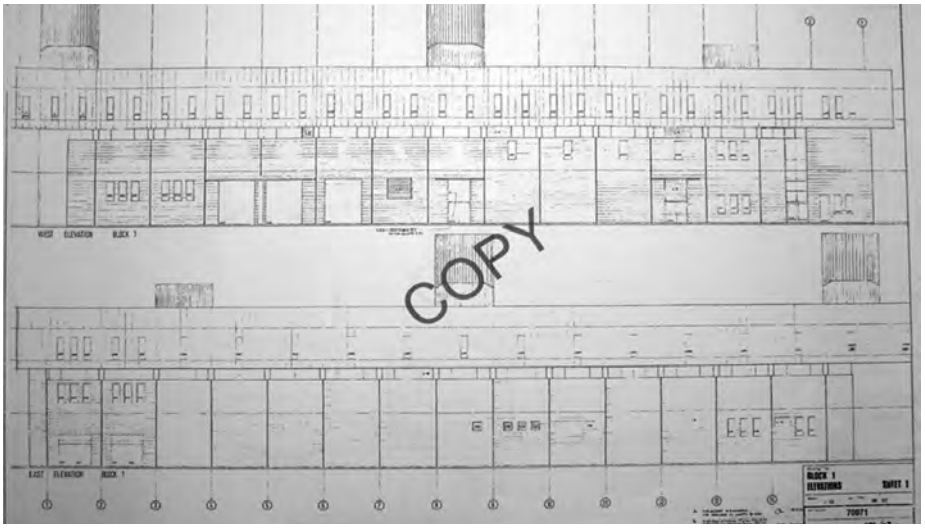


Fig. 100. Building N125, plan of part of main block which ties in with part of the above sections. Babcock Drawing no. AB1/109 (1972). Reproduced with the permission of the MoD.



Left: Fig. 101. Building N125, main block elevations. Babcock Drawing no. AB1/83 (1972). Reproduced with the permission of the MoD.

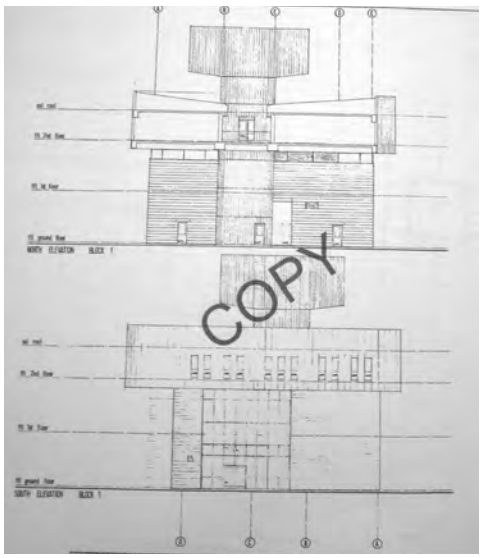
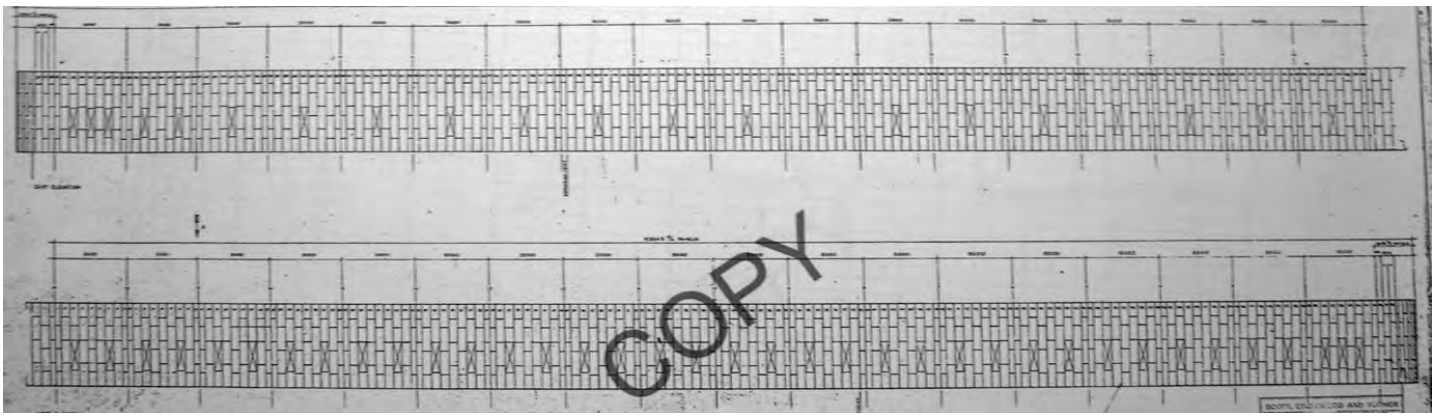


Fig. 102. Building N125, main block elevations. Babcock Drawing no. AB1/84A (1972). Reproduced with the permission of the MoD.



Above: Fig. 103. Building N125, main block cladding. Babcock Drawing no. 2916/1A (1972). Reproduced with the permission of the MoD.

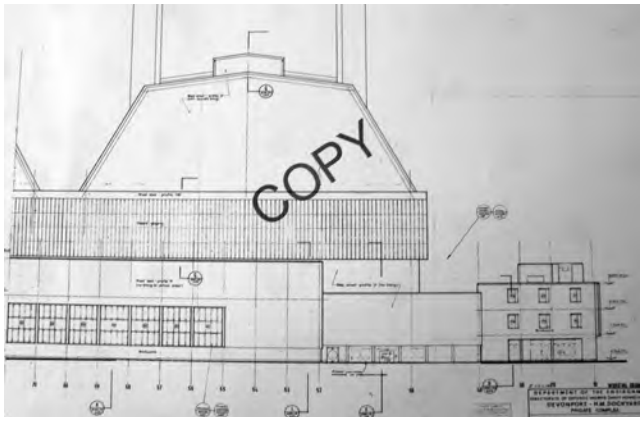


Fig. 104. Building N217, part of east elevation, Frigate Complex, April 1972. Babcock Drawing no. ABG/16E. Reproduced with the permission of the MoD.

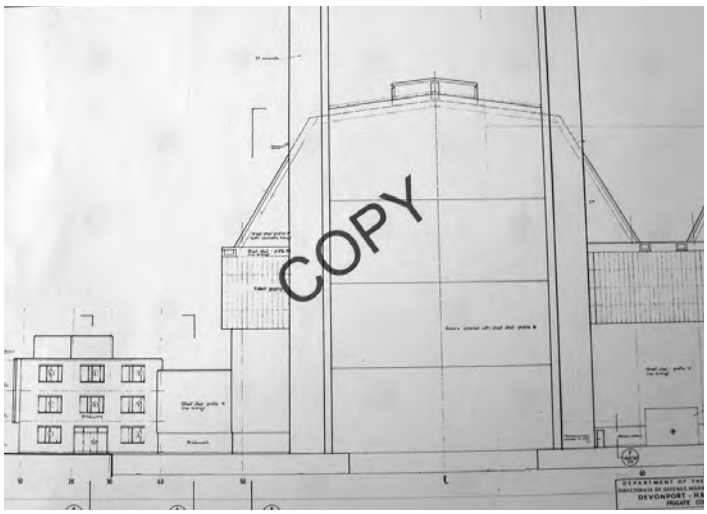


Fig. 105. Building N217, part of west elevation, Frigate Complex, April 1972. Babcock Drawing no. ABG/17C. Reproduced with the permission of the MoD.

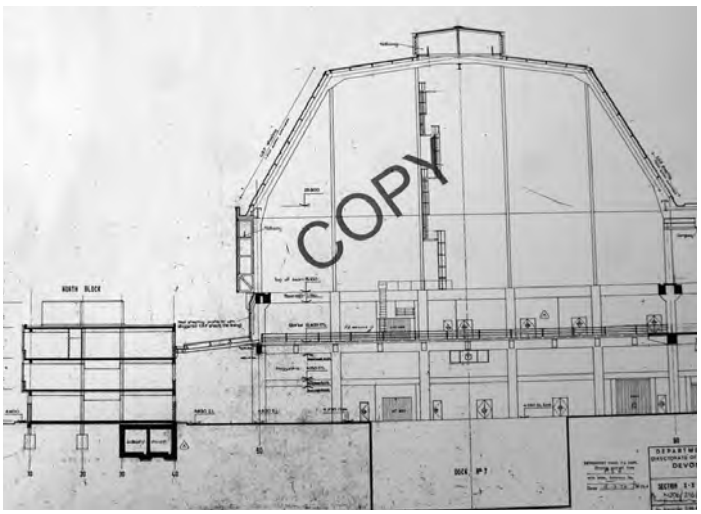


Fig. 106. Building N217, part of section, Frigate Complex, April 1972. Babcock Drawing no. ABG/20F. Reproduced with the permission of the MoD.

Fig. 107. Photograph albums. Frigate Complex book no. 2 (1973). TNA, CM 20/69 (1972–73). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 108. Photograph albums. Frigate Complex book no. 3 (1973). TNA, CM 20/70 (1973–74). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 109. Photograph albums. Frigate Complex book no. 4 (1974). TNA, CM 20/71 (1973–74). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 110. Photograph albums. Frigate Complex book no. 6 (1975). TNA, CM 20/73 (1974–75). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 111. Photograph albums. Frigate Complex book no 7 (1975). TNA, CM 20/74 (1975). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

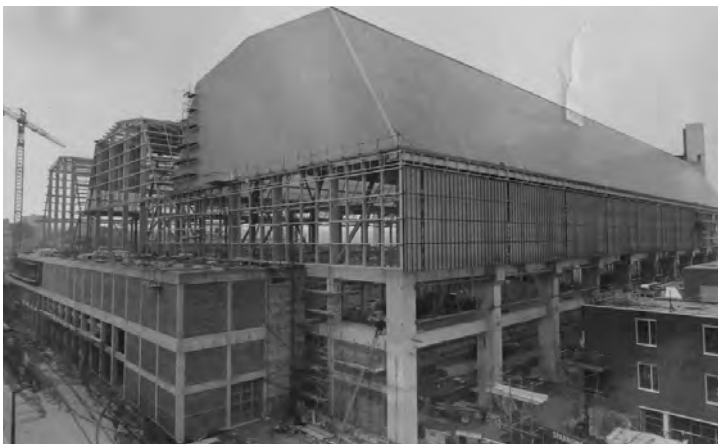


Fig. 112. Photograph albums. Frigate Complex book no. 9 (October 1975). TNA, CM 20/76 (1975–76). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

Fig. 113. Photograph albums. Frigate Complex book no. 9 (June 1976). TNA, CM 20/76 (1975–76). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

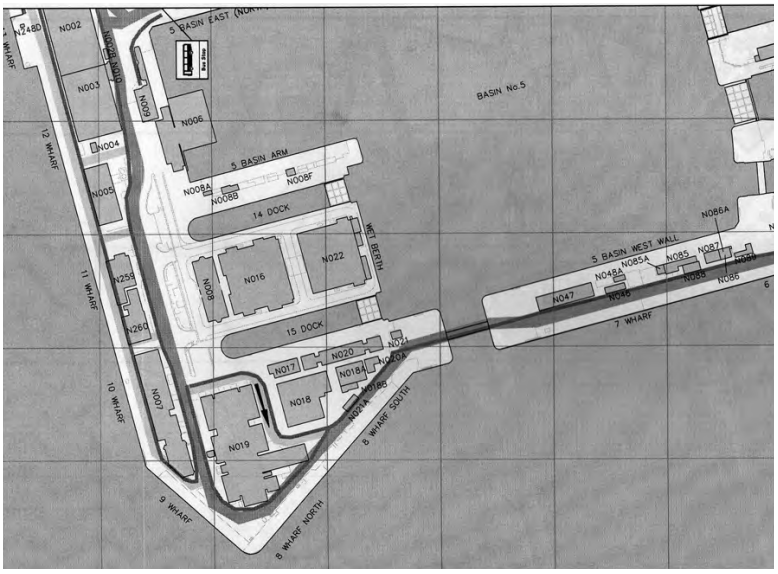


Fig. 114. Babcock (2011). *Site Atlas*. Reproduced with the permission of the MoD.

Fig. 115. Photograph albums. Fleet Maintenance Base Devonport: Foundations book no. 1 (1974). TNA, CM 20/77 (1973–74). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

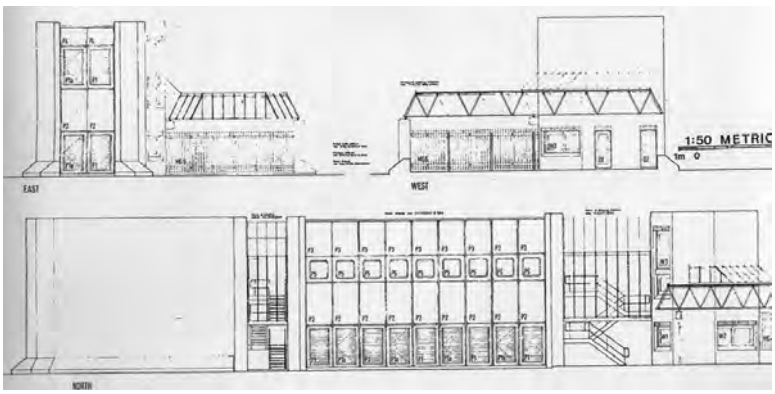


Fig. 116. Entrance control complex, Submarine Refit Complex. Babcock Drawing no. AD8/7 (1977). Reproduced with the permission of the MoD.

Fig. 117. Photograph albums. Nuclear Submarine Refit Complex book no. 7 (July 1979). TNA, CM 20/67 (1978–79). PSA: Devonport: Works Projects. Reproduced with the permission of The National Archives.

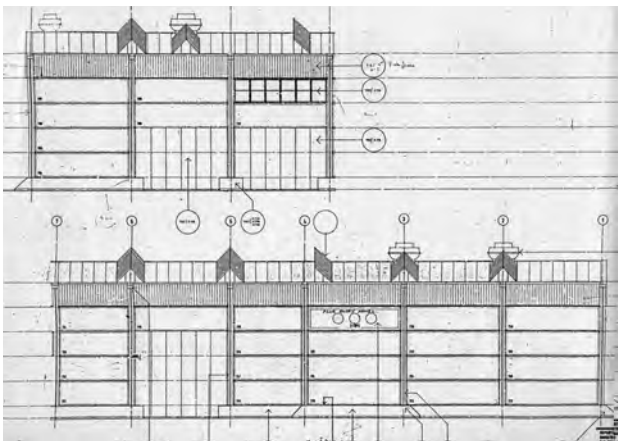


Fig. 118. Building N005, Submarine Refit Complex. Babcock Drawing no. AD3/24A (n.d.). Reproduced with the permission of the MoD.

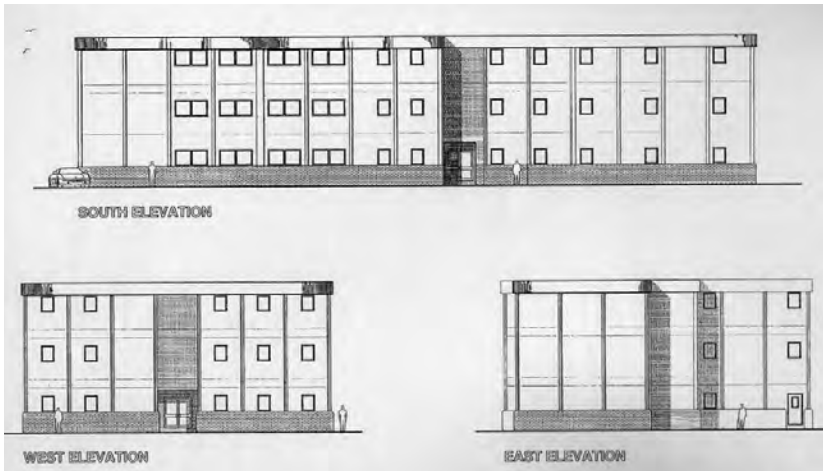


Fig. 119. Building N260, Submarine Refit Complex. Babcock Drawing no. M1979/08 (1994). Reproduced with the permission of the MoD.

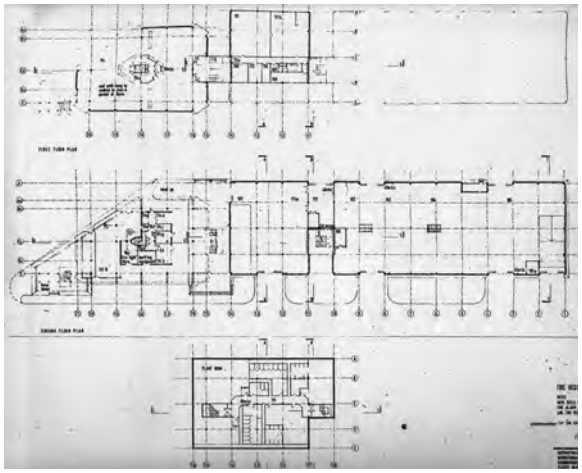


Fig. 120. Building N007 Submarine Refit Complex. Babcock Drawing no. AB2/1B (n.d.). Reproduced with the permission of the MoD.

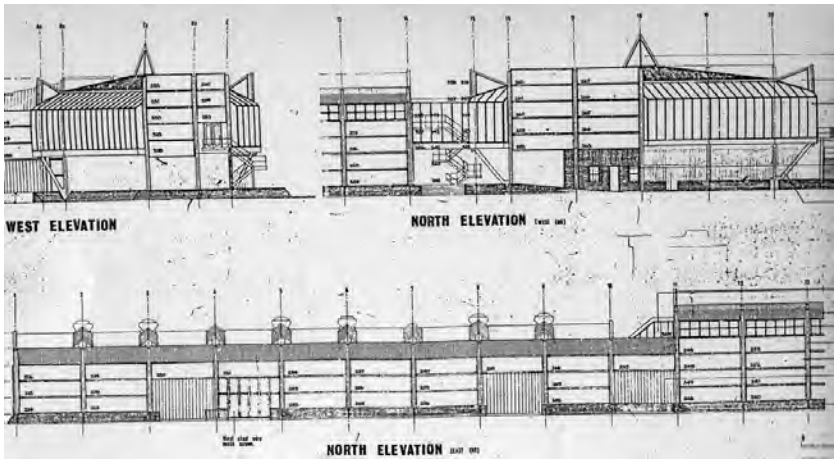


Fig. 121. N007 Submarine Refit Complex. Babcock Drawing no. AB2/3A (n.d.). Reproduced with the permission of the MoD.

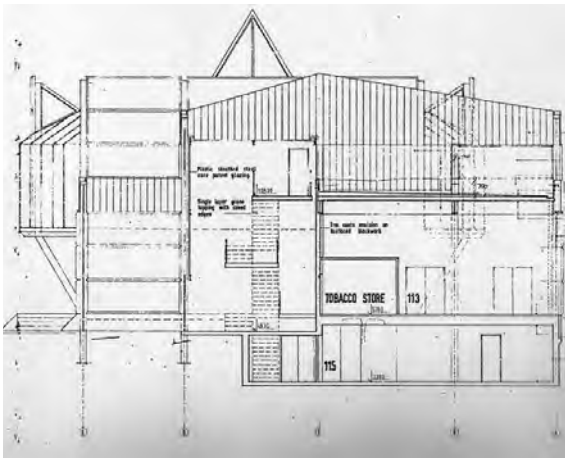


Fig. 122. N007 Submarine Refit Complex. Babcock Drawing no. AB2/5B (n.d.). Reproduced with the permission of the MoD.

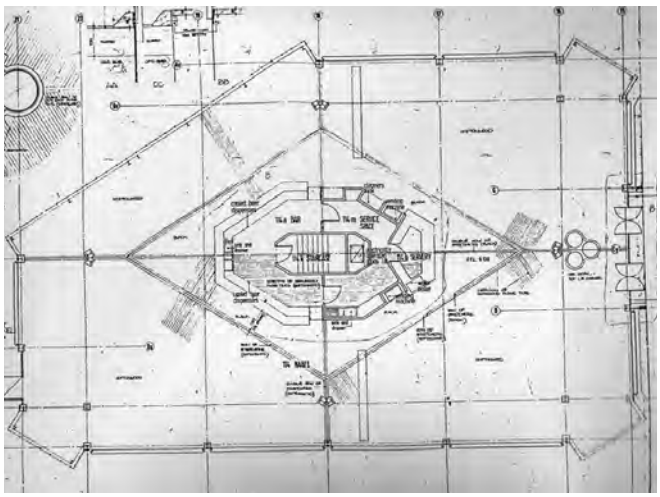


Fig. 123. Second floor plan of the NAAFI building, N007 Submarine Refit Complex. Babcock Drawing no. AB2/14D (n.d.). Reproduced with the permission of the MoD.

Fig. 124. NAAFI building (July 1977). TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

Fig. 125. NAAFI building (March 1979). TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

Fig. 126. NAAFI building (July 1977). TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

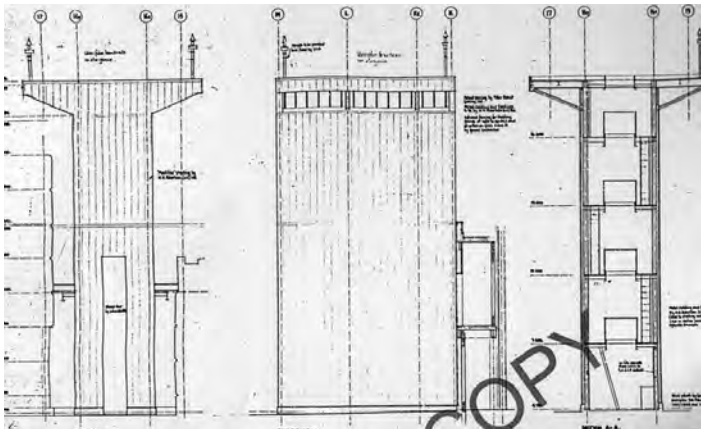


Fig. 127. N019, Periscope Tower. Babcock Drawing no. AD1/44B (n.d.). Reproduced with the permission of the MoD.

Fig. 128. Mast and Periscope Shop (September 1979). TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of the MoD.

Fig. 129. NAAFI building (September 1979). TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

Fig. 130. NAAFI building, September 1979. Detail from Fig. 125. TNA, CM 20/80 (1976). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: book no. 4. Reproduced with the permission of The National Archives.

Figs 131 and 132. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

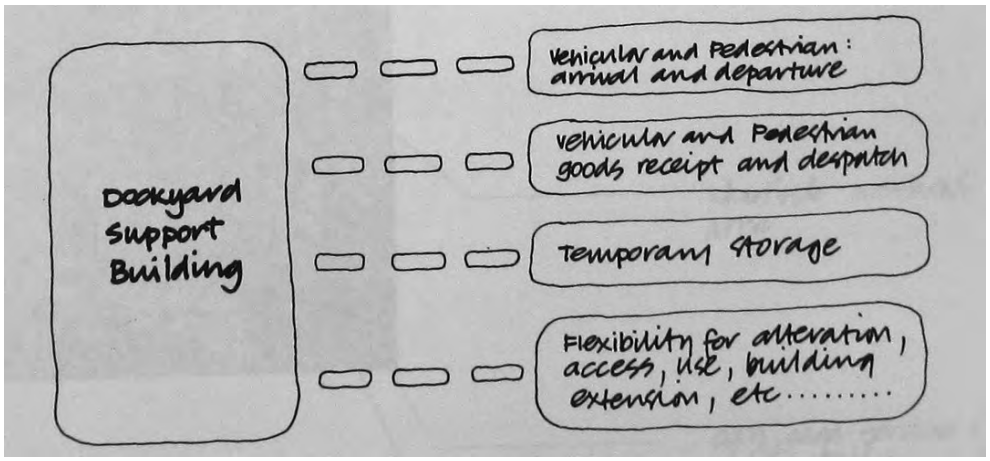


Fig. 133. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

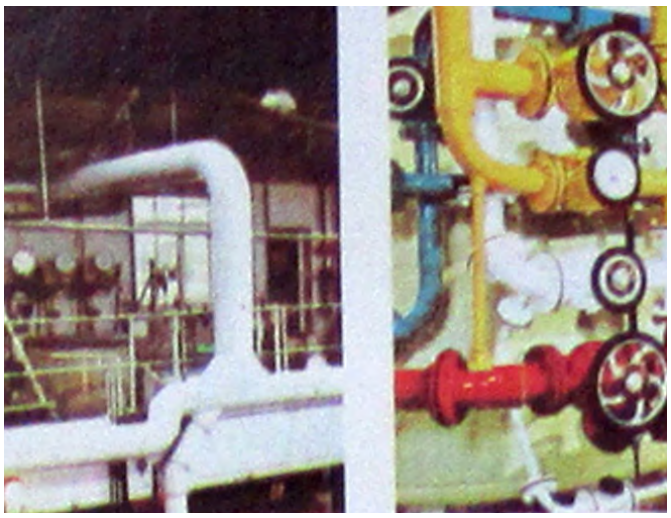


Fig. 134. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

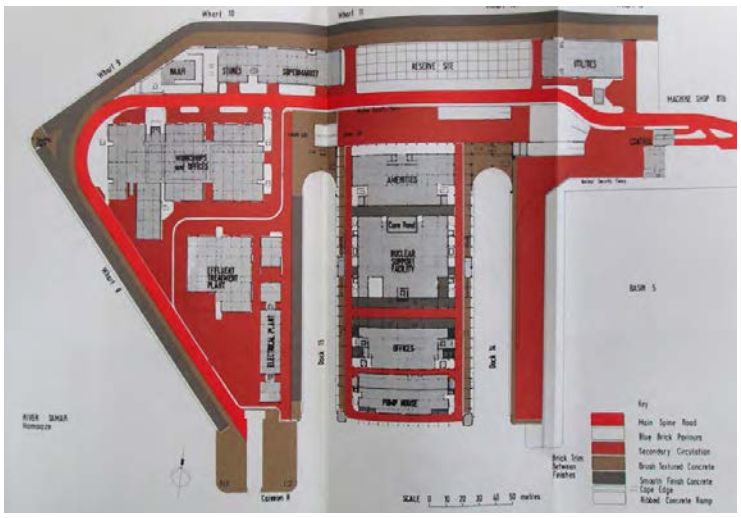


Fig. 135. Site plan in the feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works naval base development. Reproduced with the permission of The National Archives.

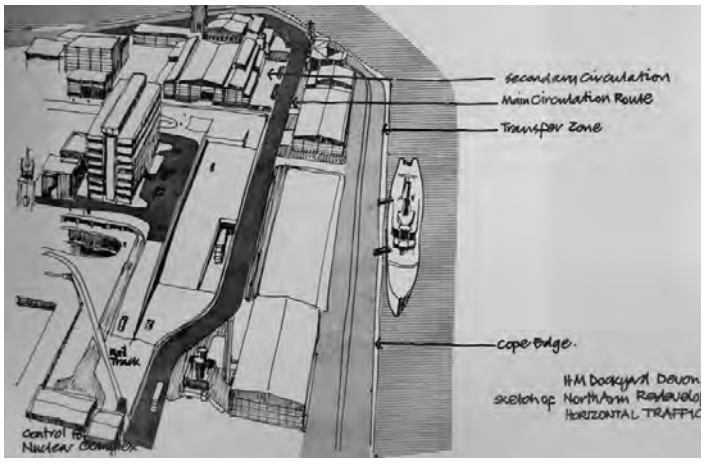


Fig. 136. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

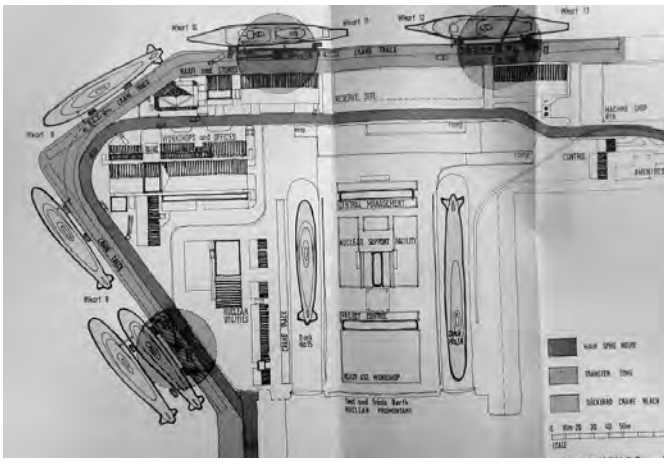


Fig. 137. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

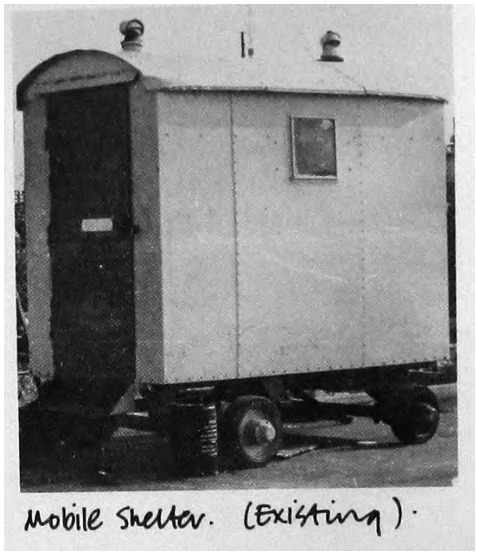


Fig. 138. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

Fig. 139. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

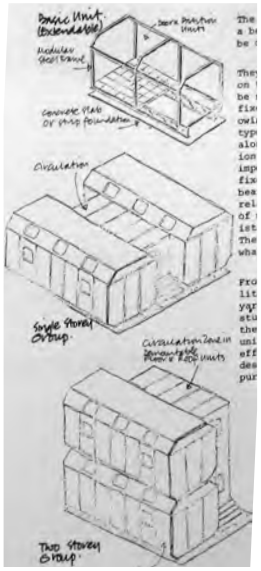


Fig. 140. Naval base development; feasibility study on proposed development of the North Arm of the dockyard. TNA, CM 20/48 (1974). PSA: Devonport: DoE Directorate of Defence Works. Reproduced with the permission of The National Archives.

Fig. 141. External Planning Guide by Joint PSA and MoD Planning Team: a study of spaces around and between buildings. TNA, CM 20/55 (1976). PSA: Devonport: Publication and Research Studies. Reproduced with the permission of The National Archives.

Fig. 142. External Planning Guide by Joint PSA and MOD Planning Team: a study of spaces around and between buildings. TNA, CM 20/55 (1976). PSA: Devonport: Publication and Research Studies. Reproduced with the permission of The National Archives.

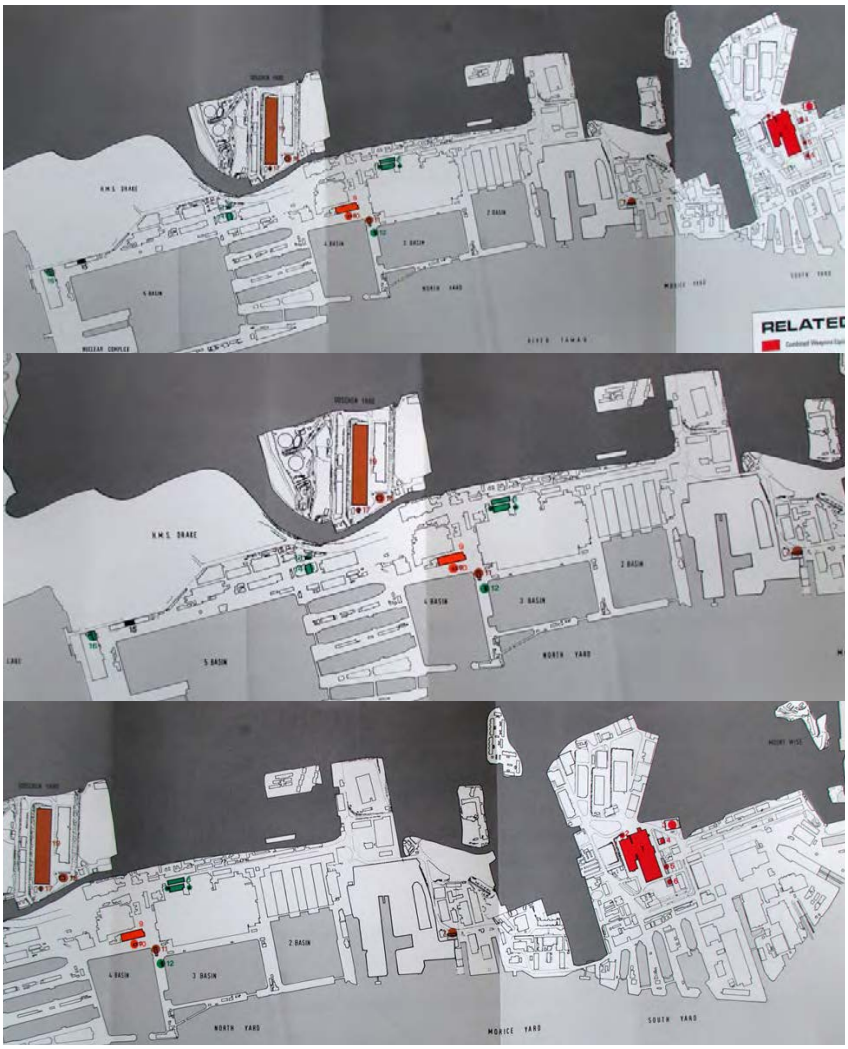


Fig. 143. Production and support activities for combined weapons equipment workshops: and associated administrative and ancillary facilities; phase 2. TNA, CM 20/54 (1974). PSA: Devonport: Publication and Research Studies. Reproduced with the permission of The National Archives.

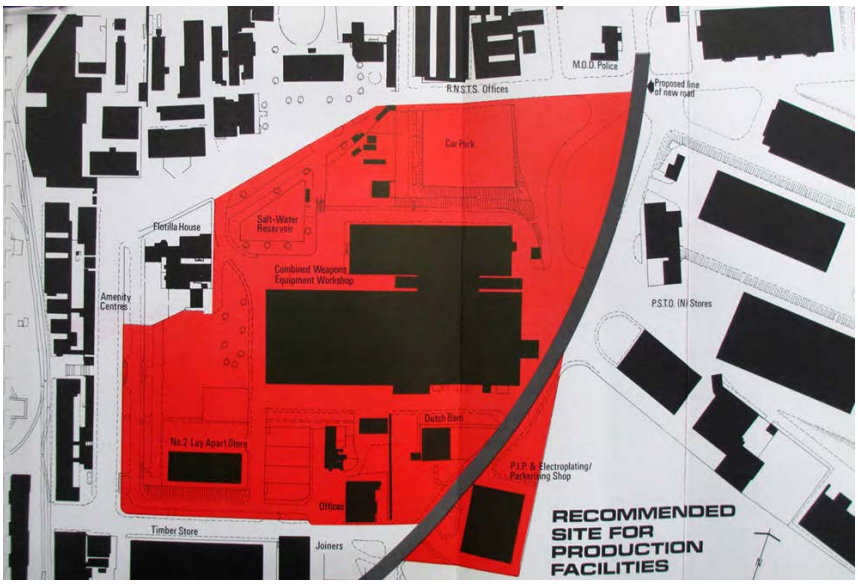


Fig. 144. Production and support activities for combined weapons equipment workshops: and associated administrative and ancillary facilities; phase 2. TNA, CM 20/54 (1974). PSA: Devonport: Publication and Research Studies. Reproduced with the permission of The National Archives.

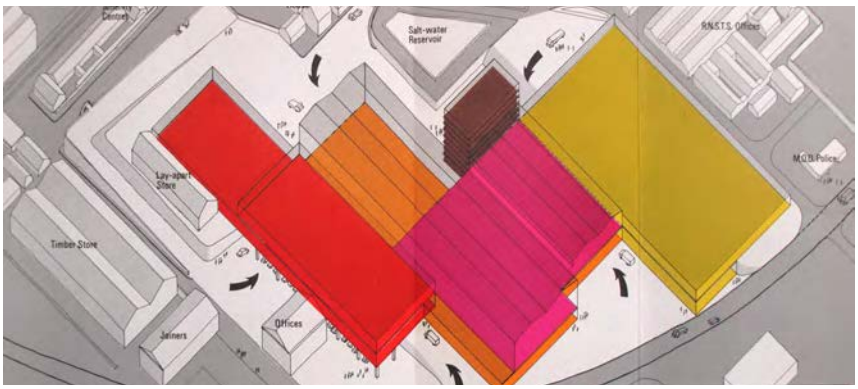


Fig. 145. Production and support activities for combined weapons equipment workshops: and associated administrative and ancillary facilities; phase 2. TNA, CM 20/54 (1974). PSA: Devonport: Publication and Research Studies. Reproduced with the permission of The National Archives.

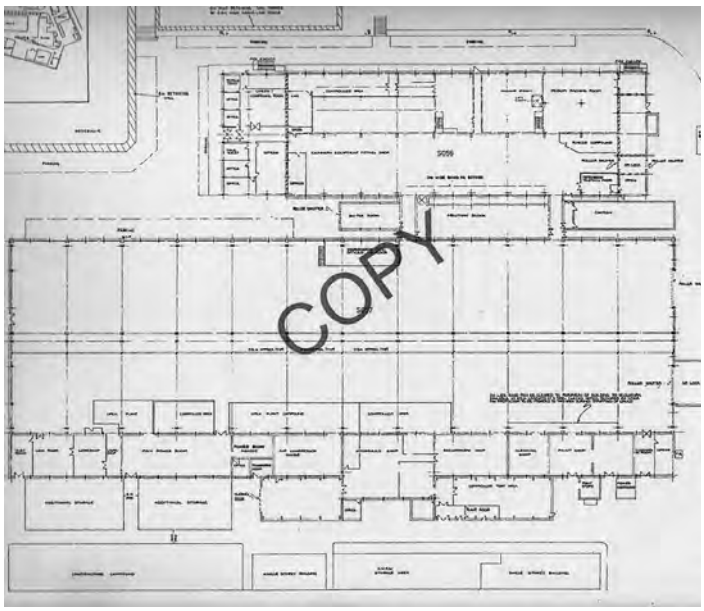


Fig. 146. Buildings S056 and S057. Babcock Drawing No. 2300/ZG/01 (n.d.). Reproduced with the permission of the MoD.

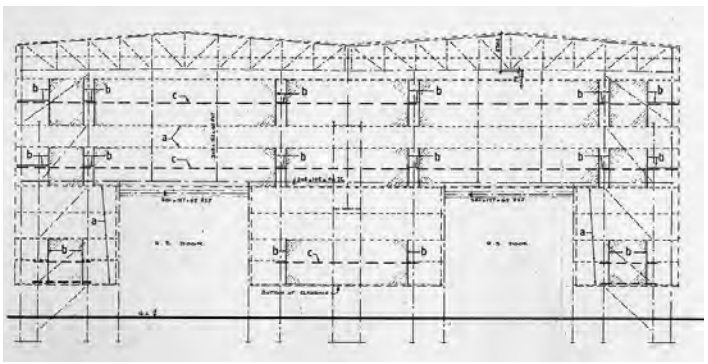
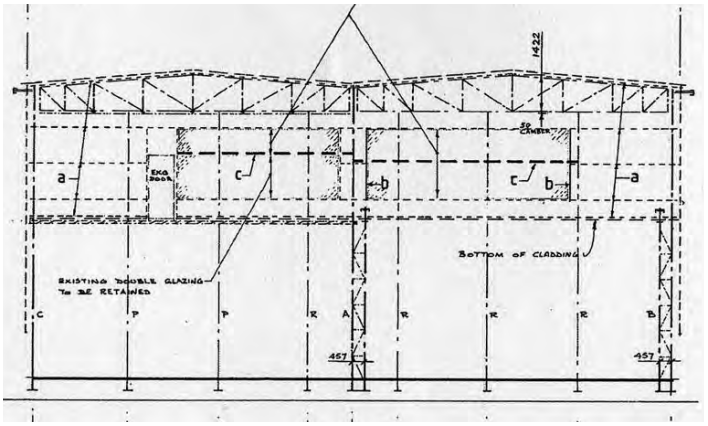


Fig. 147. East elevation of Building S057. Babcock Drawing no. 2300/ZG/05 (c.1988). Reproduced with the permission of the MoD.



Right: Fig. 148. West elevation of Building S056. Babcock Drawing no. 2300/ZG/09 (c.1988). Reproduced with the permission of the MoD.

Fig. 150. Cofferdam completed. TNA, CM 20/61 (1973–74). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 1. Submarine Refit Complex December 1974. Reproduced with the permission of The National Archives.

Above: Fig. 149. January 1977 top, June 1977 below. Weston Mill Lake: land reclamation evidence of progress; book no 2. TNA, CM 20/83 (Jan 1974–Dec 1979). PSA: Devonport: Works Projects. Photograph albums. Reproduced with the permission of The National Archives.

Fig. 151. Submarine Refit Complex (May 1975). TNA, CM 20/62 (1975). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 2. Reproduced with the permission of The National Archives.

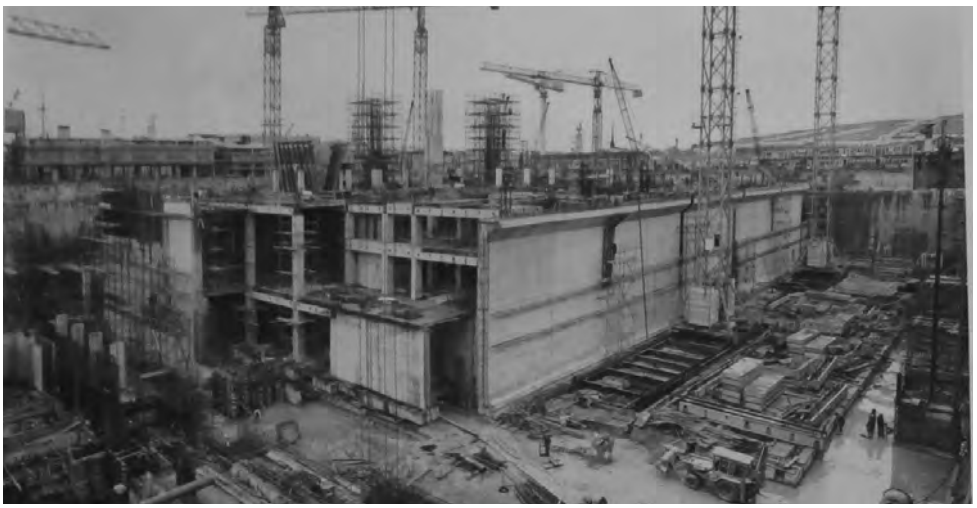


Fig. 152. Submarine Refit Complex (January 1976). TNA, CM 20/63 (1976). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 3. Reproduced with the permission of The National Archives.

Fig. 153. Submarine Refit Complex (September 1976). TNA, CM 20/64 (1976–77). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 4. Reproduced with the permission of The National Archives.

Fig. 154. Submarine Refit Complex, view from the west (January 1977). TNA, CM 20/64 (1976–77). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 4. Reproduced with the permission of The National Archives.

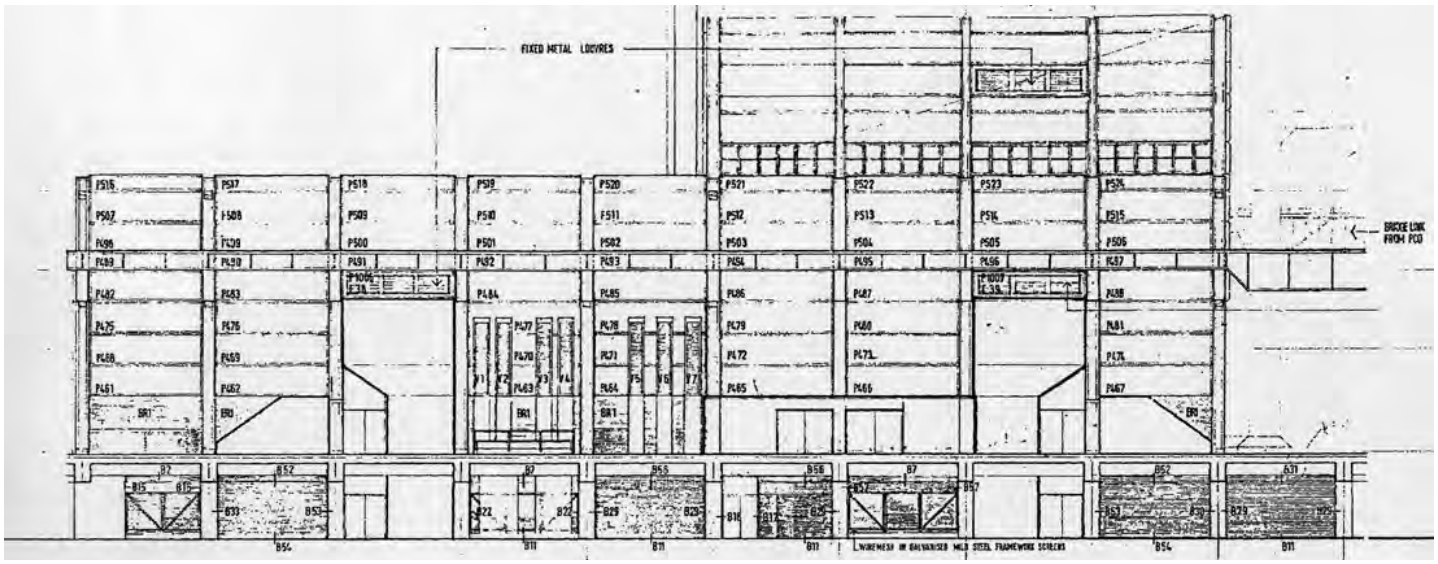


Fig. 155. Building N016, Submarine Refit Complex, west elevation. Babcock Drawing no. AW4/3M (n.d.). Reproduced with the permission of the MoD.

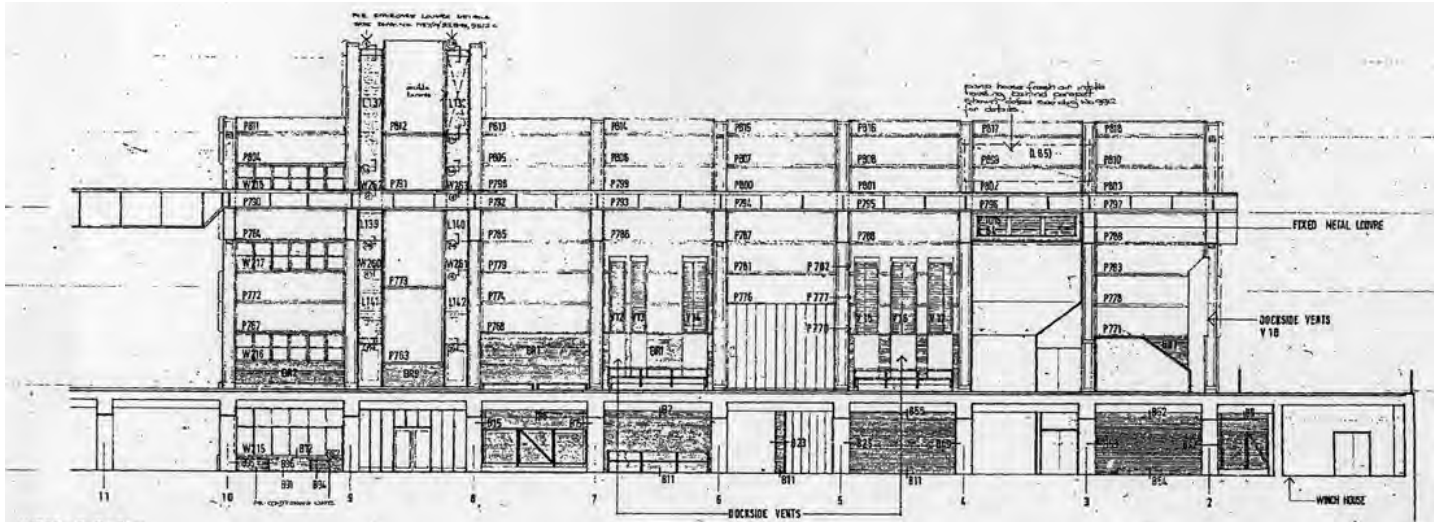


Fig. 156. Building N022, Submarine Refit Complex west elevation. Babcock Drawing no. AW4/3M (n.d.). Reproduced with the permission of the MoD.

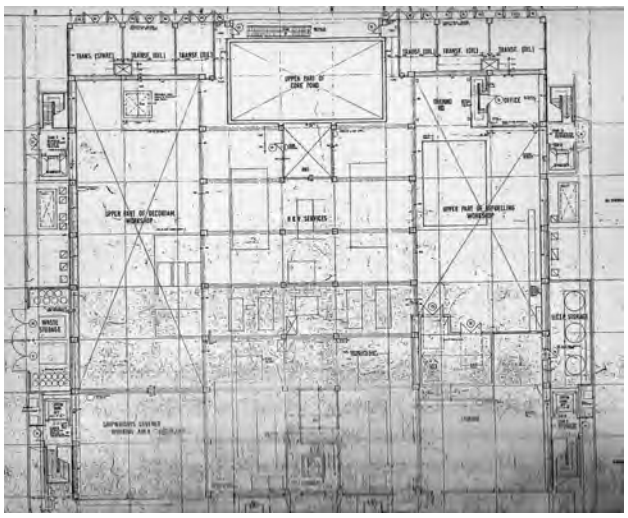


Fig. 157. Building N016, Submarine Refit Complex plan, reference 7137/N/9030 (n.d.). Babcock Drawing no. illegible. Reproduced with the permission of the MoD.

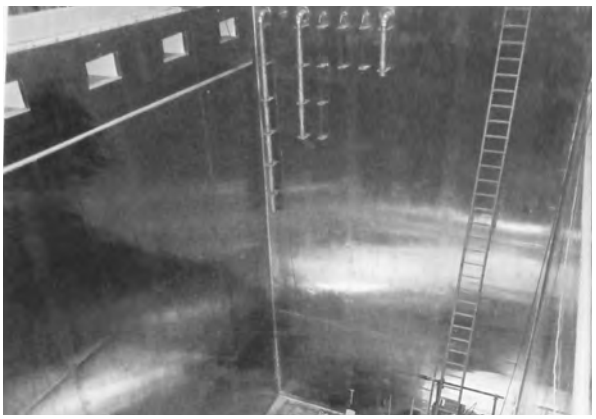


Fig. 158. Submarine Refit Complex (September 1978). TNA, CM 20/67 (Jan 1978–Dec 1979). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 7. Reproduced with the permission of The National Archives.

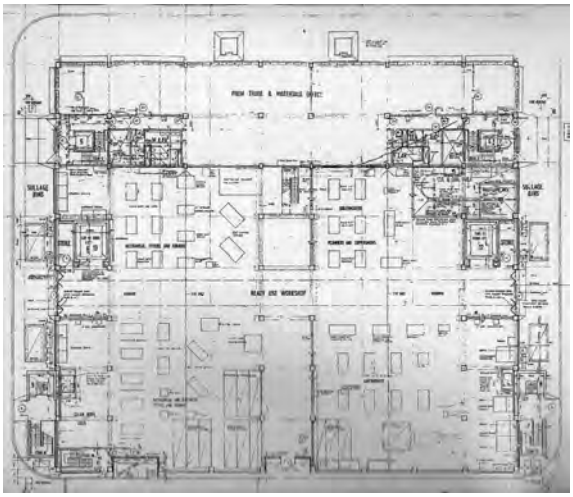


Fig. 159. Building N022 Submarine Refit Complex plan. Babcock Drawing no. AB5/1A (n.d.). Reproduced with the permission of the MoD.

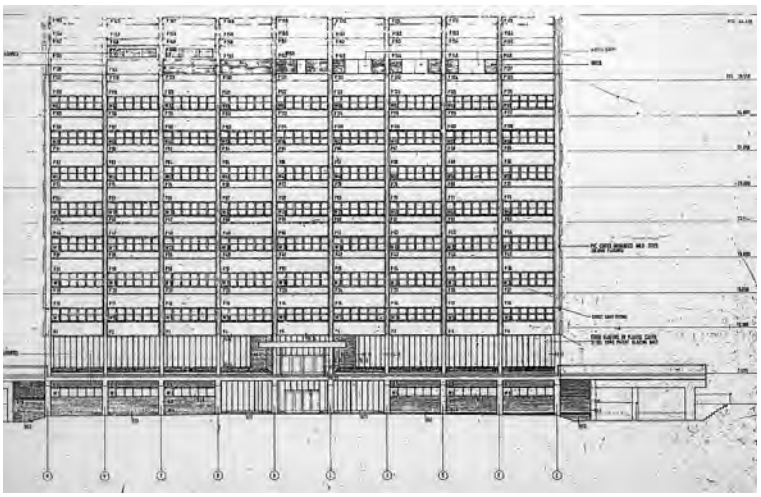


Fig. 160. Building N008, Submarine Refit Complex, north elevation. Babcock Drawing no. AW3/1J (n.d.). Reproduced with the permission of the MoD.

Fig. 161. Submarine Refit Complex (April 1978). TNA, CM 20/65 (Jan 1977–Dec 1978). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no 5. Reproduced with the permission of The National Archives.

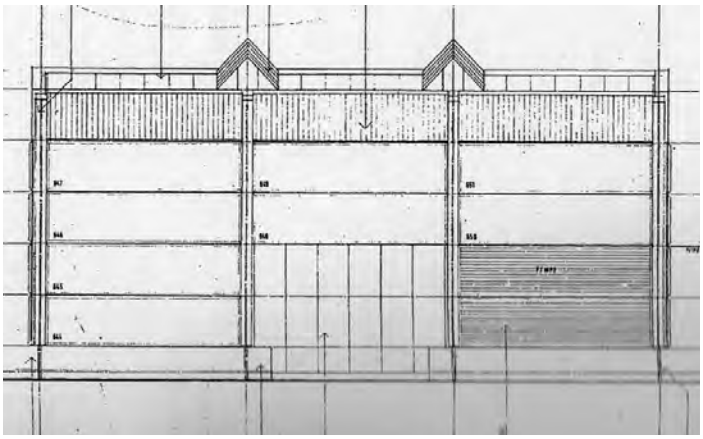


Fig. 162. Submarine Refit Complex Building N017. Babcock Drawing no. AB4B/28B (n.d.). Reproduced with the permission of the MoD.

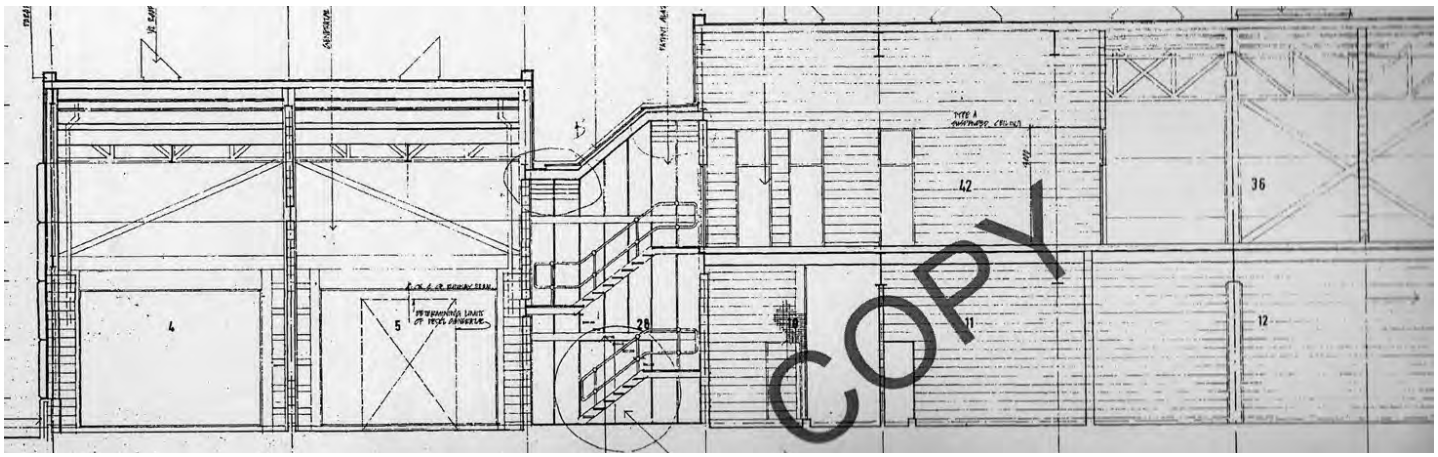


Fig. 163. Submarine Refit Complex Building N020. Northern section and part of central building, Babcock Drawing no. AB4B/20 (n.d.). Reproduced with the permission of the MoD.

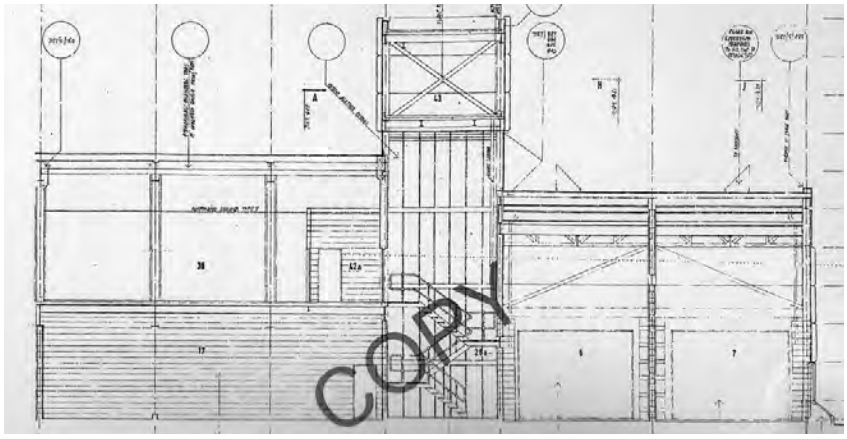
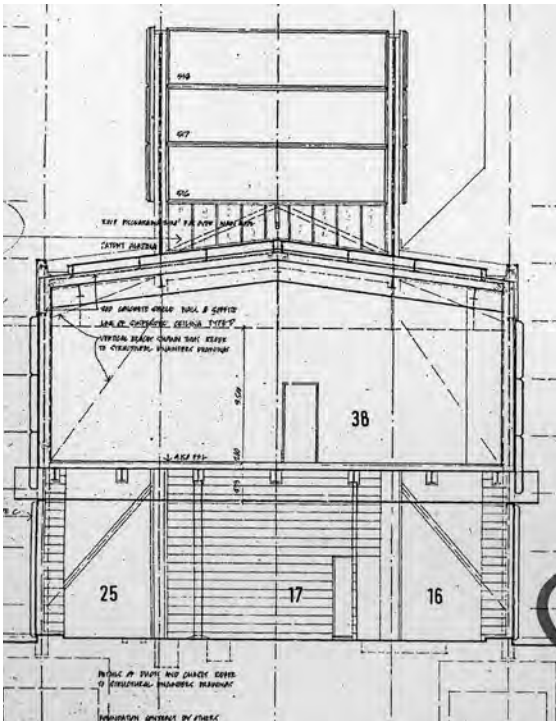


Fig. 164. Submarine Refit Complex Building N020. Part of central building and southern section, Babcock Drawing no. AB4B/11 (n.d.). Reproduced with the permission of the MoD.



Right: Fig. 165. Submarine Refit Complex Building N020. Section through high level plant room. Babcock Drawing no. AB4B/16. (n.d.). Reproduced with the permission of the MoD.

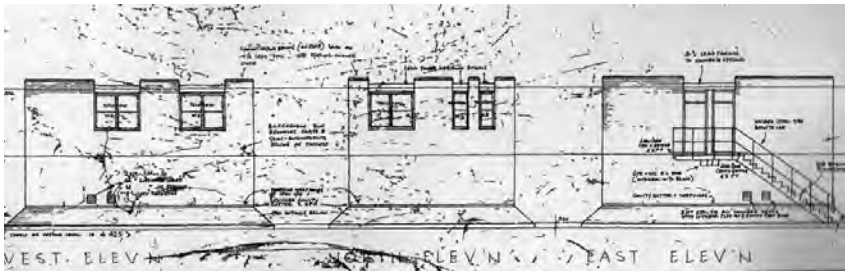


Fig. 166. Submarine Refit Complex Building N021. Babcock Drawing no. AB1/1 (n.d.). Reproduced with the permission of the MoD.

Right: Fig. 167. Submarine Refit Complex, N018 (November 1975). TNA, CM 20/78 (1975). PSA: Devonport: Works Projects. Photograph albums. Fleet Maintenance Base Devonport: Foundations book no. 2. Reproduced with the permission of The National Archives.

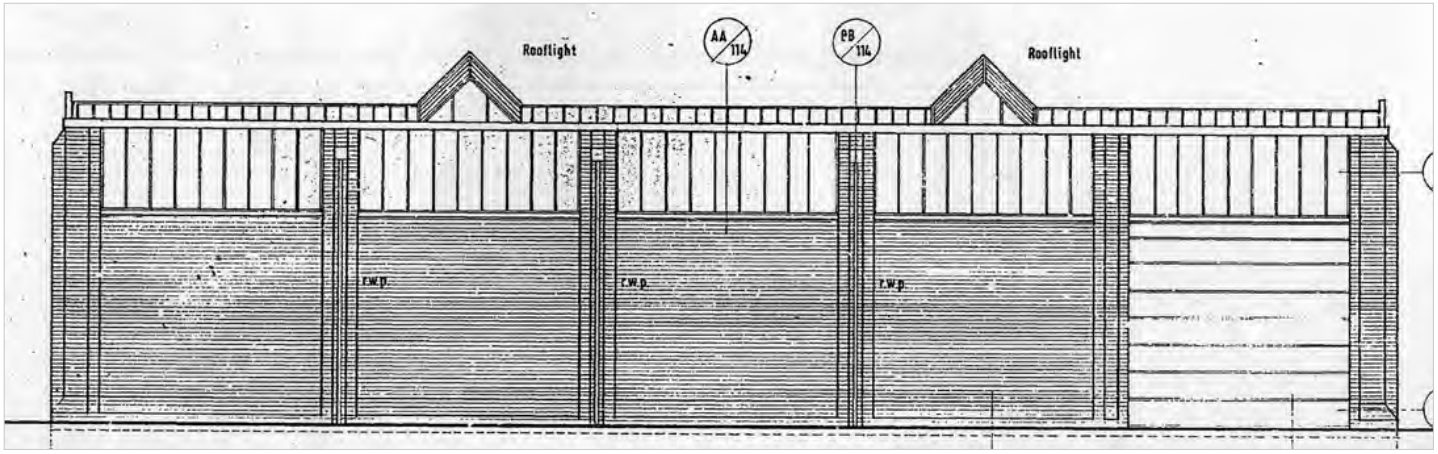


Fig. 168. Submarine Refit Complex Building N018A. Babcock Drawing no. SWP/A/106/80 (n.d.). Reproduced with the permission of the MoD.

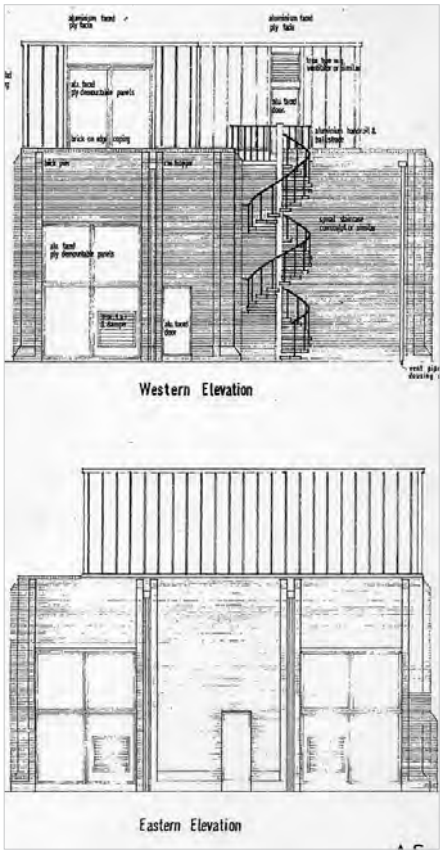


Fig. 169. Submarine Refit Complex Building N020A. Babcock Drawing No. SWP/A/281/80 (n.d.). Reproduced with the permission of the MoD.

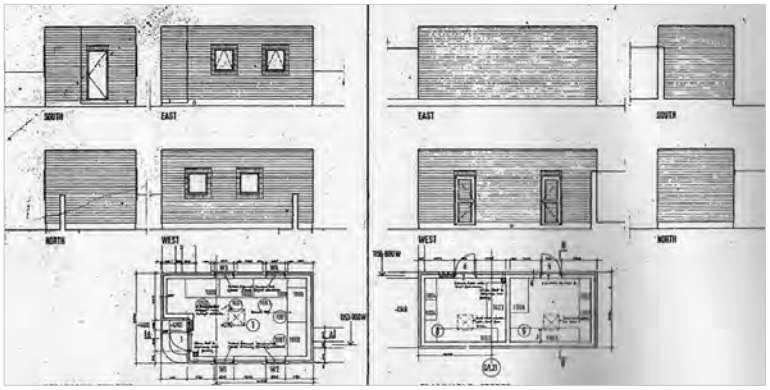


Fig. 170. Submarine Refit Complex. Babcock Drawing no. AB7/14C (n.d.). Reproduced with the permission of the MoD.

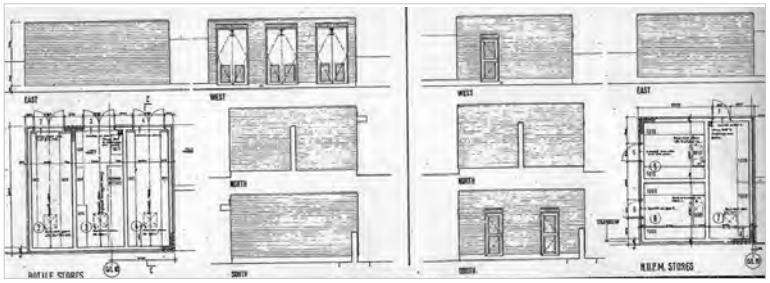


Fig. 171. Submarine Refit Complex. Babcock Drawing no. AB7/14C (n.d.). Reproduced with the permission of the MoD.

Above: Fig. 172. Submarine Refit Complex with 80 ton crane, 1979. TNA, CM 20/68 (1979). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 8. Reproduced with the permission of The National Archives.

Fig. 173. Submarine Refit Complex, 1980. TNA, CM 20/68. (1979). PSA: Devonport: Works Projects. Photograph albums. Nuclear Submarine Refit Complex book no. 8. Reproduced with the permission of The National Archives.

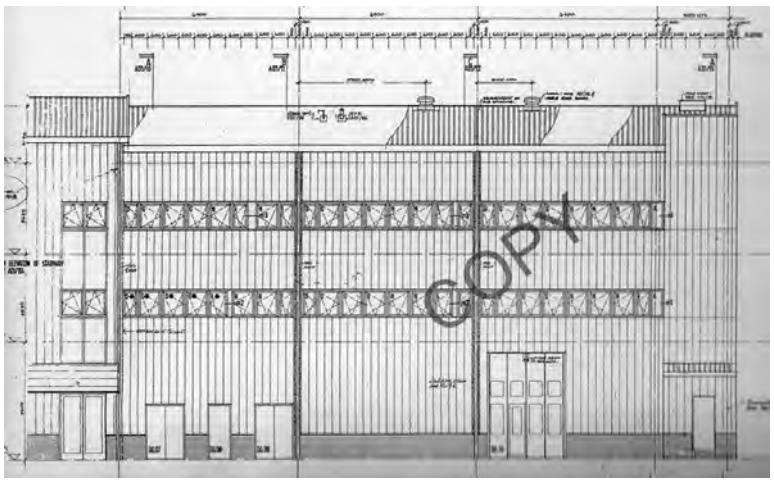


Fig. 174. Building N259. Babcock Drawing no. 85007/AD1/8 (n.d). Reproduced with the permission of the MoD.

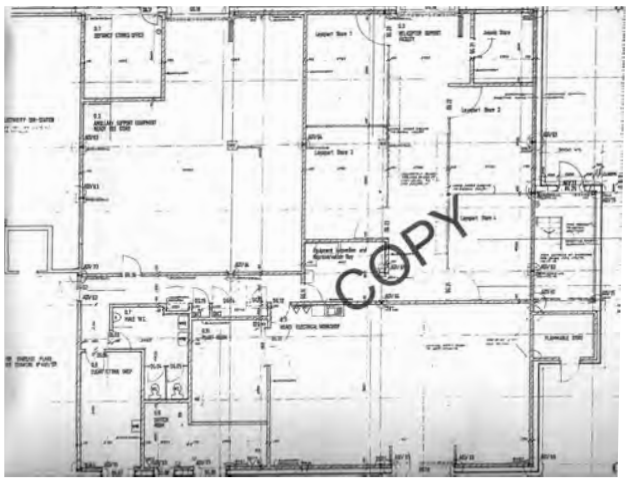


Fig. 175. Building N259. Babcock Drawing no. 85007/AD1/1 (n.d). Reproduced with the permission of the MoD.

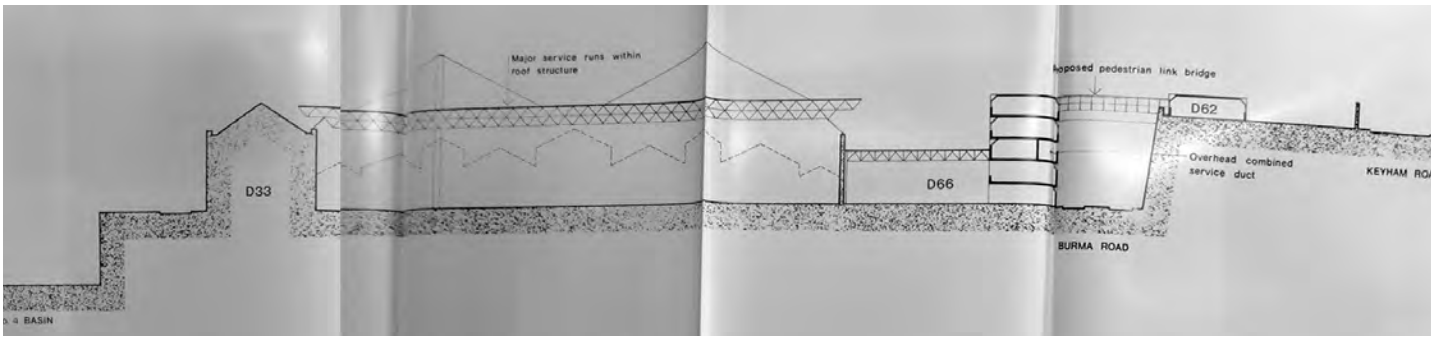


Fig. 176. Quadrangle, longitudinal section. TNA, CM 20/57 (1978). PSA: Devonport: Publication and Research Studies. Master Development Plan: future development; vol. 2. Reproduced with the permission of The National Archives.

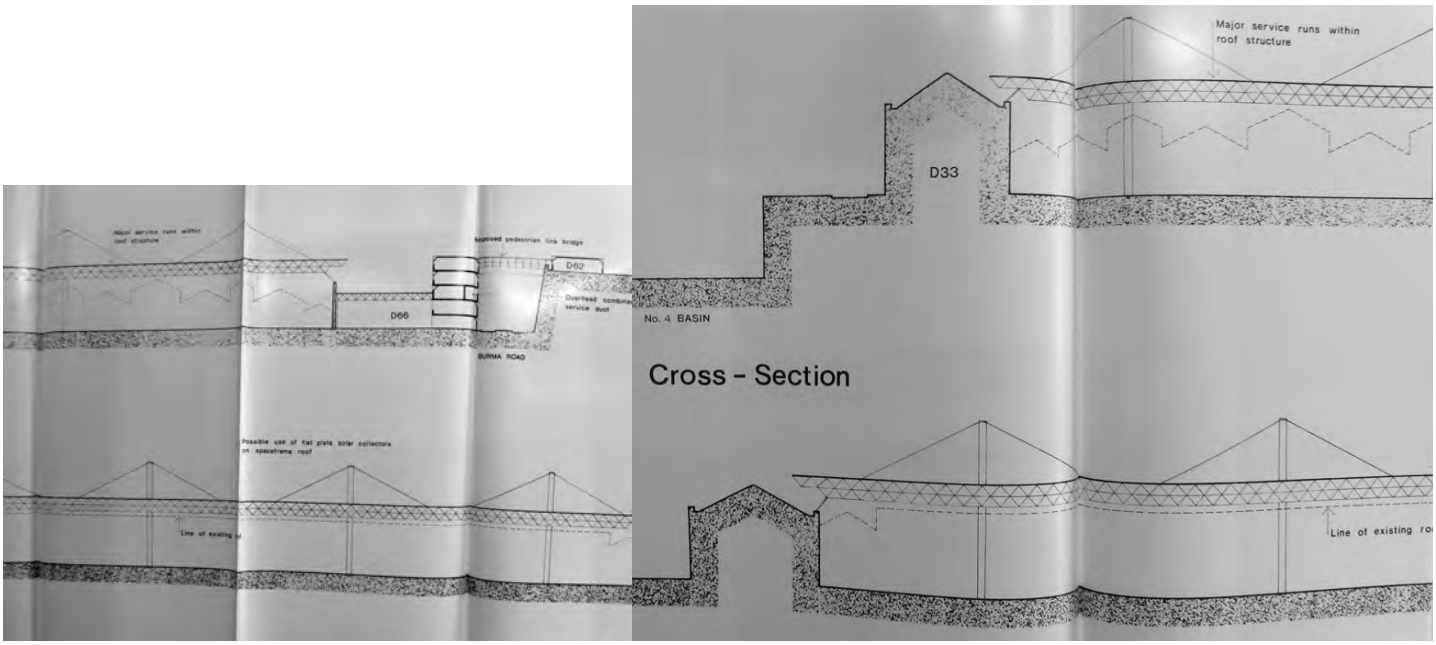


Fig. 177. Quadrangle, cross-section. TNA, CM 20/57 (1978). PSA: Devonport: Publication and Research Studies. Master Development Plan: future development; vol. 2. Reproduced with the permission of The National Archives.

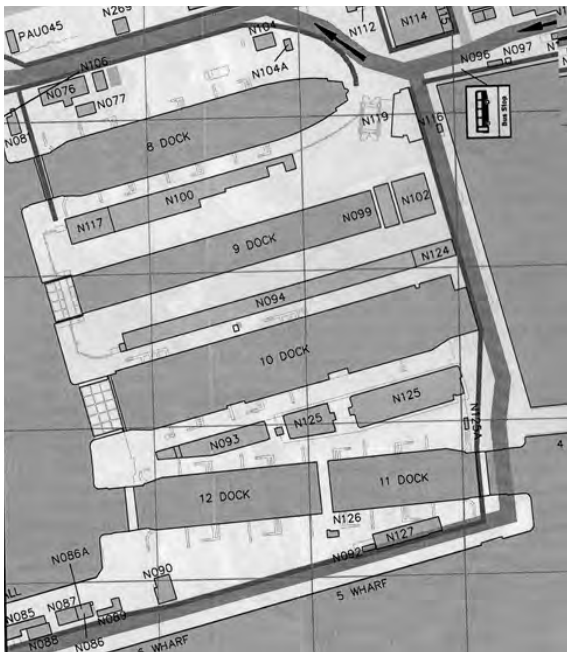


Fig. 178. Babcock (2011). *Site Atlas*. Reproduced with the permission of the MoD.

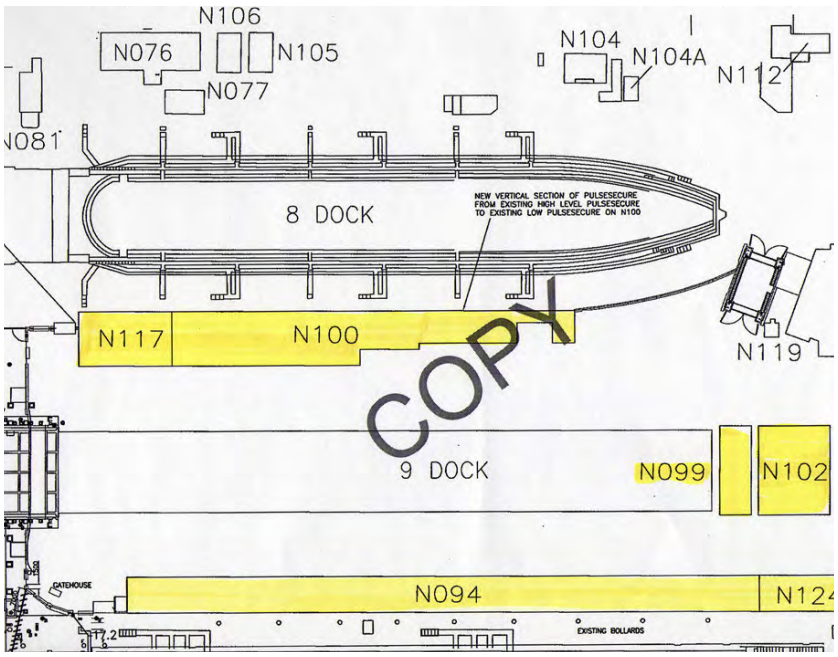


Fig. 179. D154. Phase 3 Location Plan sheet no. 15 (n.d.). No Babcock drawing number. Reproduced with the permission of the MoD.

Fig. 180. Google aerial photograph of Devonport Dockyard. Retrieved from Google Earth in 2013.

Fig. 181. DP130113. Devonport South Yard: photograph of Building S173 recorded before demolition. General view looking northeast across the dockyard towards S172 and S173 (8 Feb 2011). King's Hill Gazebo (1822, S186) and the newly roofed Covered Slip No. 1 are on the right. S173 was constructed as a Plumbers' Shop as part of the project dating from 1900 to supply the building of *Dreadnoughts* on nearby Slip No. 3 (English Heritage, Aug 2010, Listing Advice Report Building S173). Princess Yachts vessels are seen on the left. ©Historic England.

Fig. 182. DP130116. Devonport South Yard: photograph of Building S173 recorded before demolition. View of S173 looking towards the west end doorway on the west elevation (8 Feb 2011). King's Hill Gazebo (1822, S186) can just be seen behind it to the right, with new fencing to secure Princess Yachts' land. Shallow Dock is in the bottom right hand corner. ©Historic England.

Fig. 183. DP13021. Devonport South Yard: photograph (8 Feb 2011) of Building S173 recorded before demolition. Stone dated 1903 on the west elevation. ©Historic England.

Fig. 184. DP13023. Devonport South Yard: photograph of Building S173 recorded before demolition. Cast iron lamp bracket on the southwest corner of S173 (8 Feb 2011). ©Historic England.

Fig. 185. DP13028. Devonport South Yard: photograph of Building S173 recorded before demolition. Interior with Cowans Sheldon overhead gantry dated 1941 (8 Feb 2011). ©Historic England.

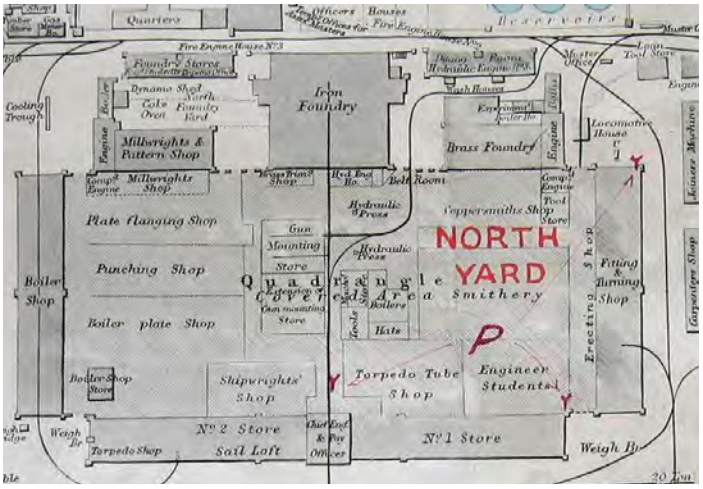


Fig. 186. Section of a map showing the Quadrangle workshops in 1903. AdL, Vz 14/44 (1900–1923). H.M. Dockyard Devonport North and South Yards Keyham Steam Yard and Naval Barracks, Compiled by E. J. Powell from Mr. Townshend's Survey of North and South Yards and the Ordnance Survey. Director of Works Office 1903. Defence Estates Plans. Scale 1":16'. Courtesy MoD Admiralty Library, Naval Historical Branch, Portsmouth.

Fig. 187. Devonport's concrete Frigate Complex June (1973–76, N217) and the limestone North Yard Offices (N215, 1903, 1910), visible over the dockyard wall. A. Coats 2013.