



Plymouth
Britain's Ocean City

South Yard Area 5

Waterfront Development Strategy

March 2016



BECKETT RANKINE
Marine Consulting Engineers

CONTROLLED DOCUMENT STATUS

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Name

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Glossary of Terms
Glossary
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EXECUTIVE SUMMARY

The three historic dry docks at Plymouth South Yard present a significant opportunity for the development of a new commercial area focused on marine industries. There are very few similar facilities anywhere else in the UK and apart from others that remain in MOD ownership, there is a shortage of dry docks in the region.

A high level assessment has been made of the proposed facilities together with an overview of the potential organisations that could usefully benefit from them, and it is clear that there is significant interest even before any marketing has been undertaken.

The three docks are undoubtedly the main focus and must form the driver of this development, with support from optimum utilisation of the adjacent quayside land, jetties and retained buildings. These need to be suitably allocated to provide maximum added value and maximum utilisation.

Due to the fact that each dock was constructed at a different time, they each have distinct attributes. Therefore they should initially be considered individually when determining their optimum mode of development, and then wider consideration given to how the three elements best fit together as an overall strategy.

Indicative cost estimates have been prepared for refurbishment. Inevitably these are approximate at this stage and need to be refined following further investigations that will also help to reduce risk and uncertainty. With the cost of marine refurbishment being higher than shore based equivalent, all steps will need to be taken to provide a framework that will make this opportunity attractive to potential bidders, while at the same time achieving the objective of maximising growth and employment within a marine cluster in Plymouth.

The development and operation of South Yard Area 5 is likely to be most efficient if it is taken on by a single private sector development partner following a tender process. The management of interfaces, including MoD, QHM, security, PCC, utilities and all users could be complex and is best dealt with by a company with demonstrably suitable experience. An overarching contract can be agreed with provision for PCC requirements, for example, the allocation of Dock 4 as a "Marine Business Technology Centre" with a clear and precise specification.

Three different strategies have been presented which extend and slightly modify the masterplan for Area 5. Following the bidding process, the strategies should be refined and moulded to the best suited potential user(s). Input from these users will then be important to ensure the optimum scheme is developed that meets PCC's objectives and provides a long term sustainable and profitable workplace for the users.

With its stepped sides, **Dock 2** is the best suited for use as a dry dock, with the most likely suitable use being ship repair and /or building. Further improvement of the facility could be achieved by reinstating the caisson gate and refurbishment of the pump house. The dock could be covered and will also need some form of craneage.

Dock 3 has vertical sides and is therefore most suitable for the berthing of vessels, for example fish landing, support boats or vessels under repair. However, if the caisson gate is reinstated, this dock could also be used as a dry dock.

Dock 4 is the shallowest of the three docks and is therefore the best suited for use as a wet basin for small craft. This would involve the installation of a new gate system so that water is retained within the dock, rather than being held outside, as is it was originally designed for.

The retained listed **Buildings** could be used as offices or small workshops to support the quayside activities. Their utilisation should be maximised to minimise the need for new buildings.

As requirements will be quite varied depending on the final use, considerable care will be required in assessing uses for the limited amount of available **Land**, as well as optimising the location and size of any new structures. The open space at the head of Dock 2 is of particular value, and could be used for support to Dock 2 or Dock 3 either as an open space or building depending on the activities it will support.

Maximum use should be made of the **Quayside** space between the docks, with equitable allocation made to adjacent docks so that all dock operations are fully facilitated. The likelihood is that only one new building from the masterplan would be constructed (building 5.2) as the others take up possible storage space on the quay. However, specifically industry focused structures may be required such as a cold store and covered dock areas.

Due to the limited amount of land, all **Jetties** should be retained although they will all require repair and refurbishment to provide sufficiently robust structures with an adequate life expectancy. Jetties can be used for berthing vessels that work to support activities within the docks such as laying by, loading / unloading or repair and maintenance.



INTRODUCTION



Source: Google Earth



Source: Google Earth



Source: Google Earth

Plymouth City Council (PCC) commissioned Beckett Rankine (BR) to provide advice and strategy on potential uses for the dockside of Plymouth's South Yard (Area 5) that is to be regenerated.

PCC's regeneration of South Yard has already commenced in other areas around the site. The aim is to create a flagship marine industries production campus as it is recognised, by both the government and the European Commission, that the marine sector could see significant growth in the next coming decade. Area 5 will be the hub of the site for the marine industries allowing access to the large historic docks and jetties.

The site is located on the eastern bank of the River Tamar directly south of the Devonport/Torpoint Ferry. The area in discussion is part of the Devonport Dockyard and includes three docks, three jetties and approaches and several dock buildings including a disused pumphouse and former smithery. The land will be transferred from the Ministry of Defence (MoD) to the Council.

MoD currently occupy the site, and only partially use the area for storage of marine items such as Yokohama fenders and pontoons. As well as their major operations further to the north, MoD will remain active beyond the southern boundary of this site. There will be shared use of the most southern quay on the approach to Jetty 2. MoD will retain control of Jetty 2. MoD will also maintain a right of way through the site with security gates to their facilities at each end of the spine road.

This document presents a high level feasibility study to determine potential strategies for suitable marine industries that could be housed in the dock area. To gather information a site inspection was undertaken and information was sourced from previous studies, investigations and archive drawings. Furthermore, many phone contacts and meeting have been held both with operators of the docks, licensing authorities and marine contractors as well as interested potential users. The resulting accumulated information has fed into this document and provided the basis for potential development concepts for each dock area and the overall strategies.

The Area 5 site encompasses three historic and listed dry docks, associated quayside and listed buildings. Focus is on Dock 2, Dock 3 and Dock 4 as the principal assets with the surrounding jetties, quayside, buildings and areas to provide supporting infrastructure.

In developing concepts and strategies, consideration has been given to making the best use of the existing structures while taking into account their condition and likely requirements of the licensing authorities, matched against the perceived needs of the market for potentially interested marine industries.



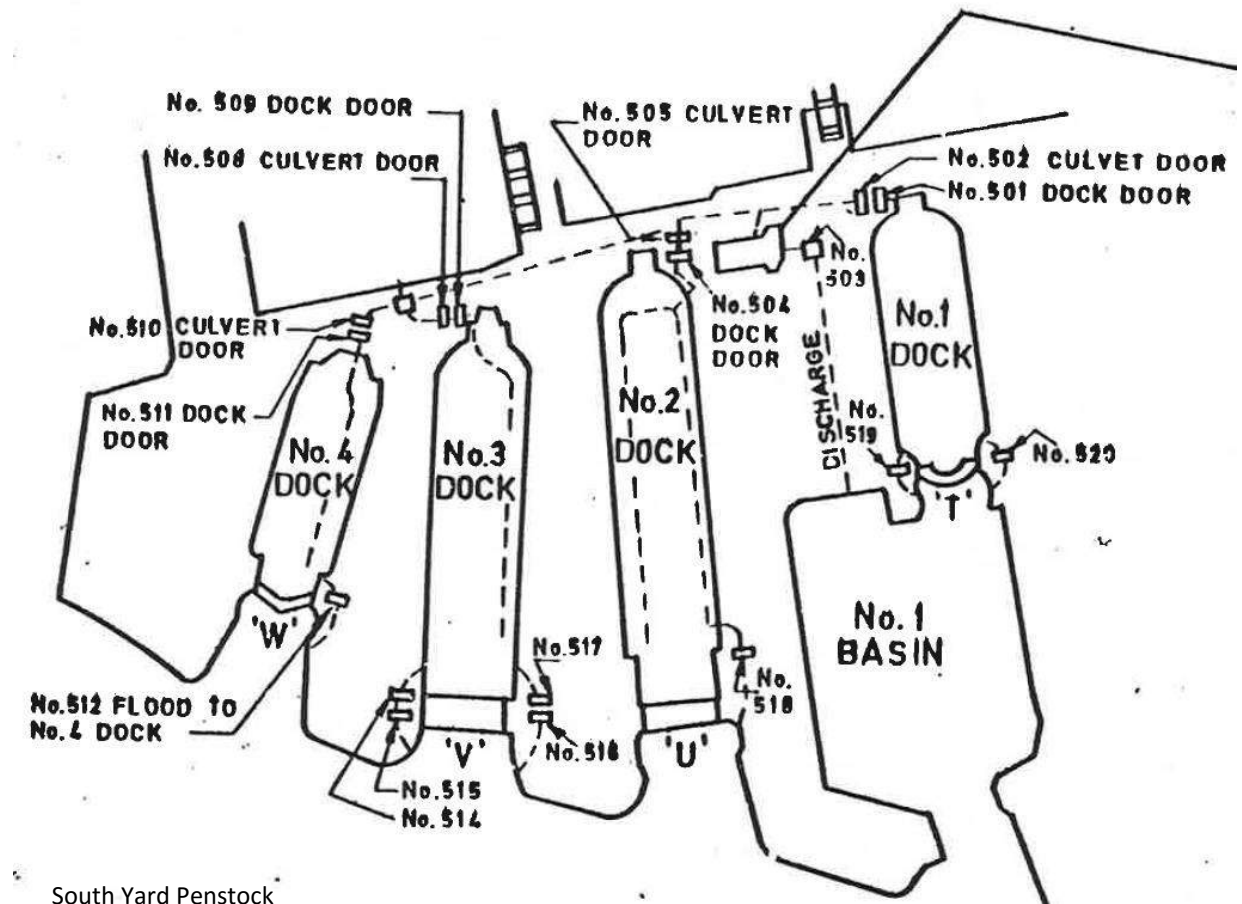
History of South Yard - Marine Structures

General

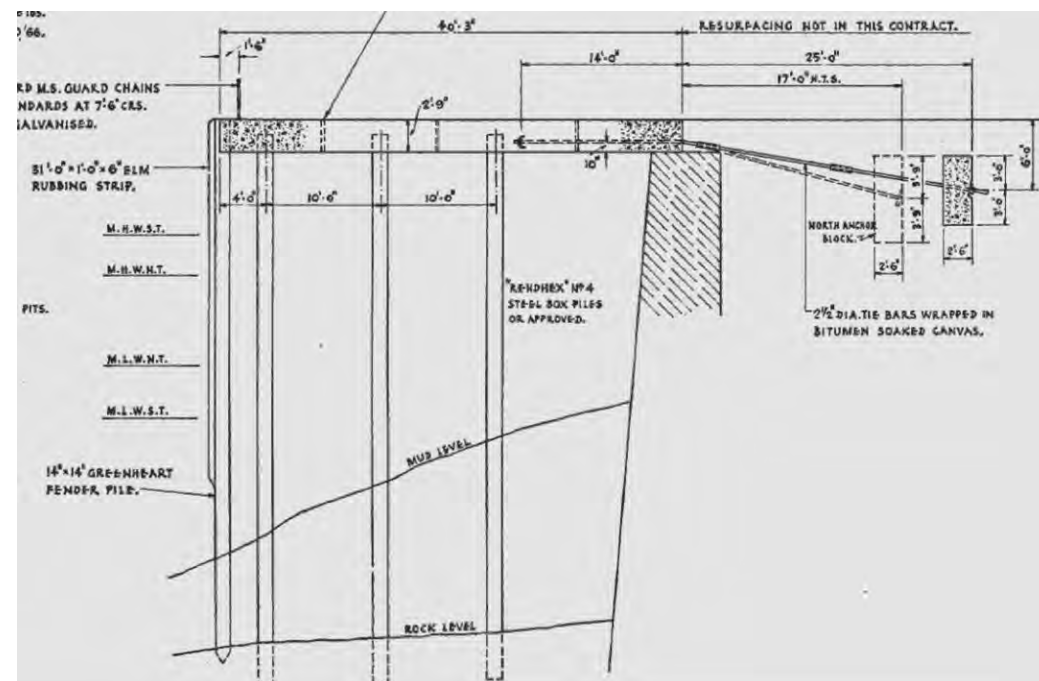
The operation of Plymouth South Yard commenced in 1698 with the completion of Dock 1 and its Basin. As part of a massive extension of the Dockyard during the mid 18th century further, land to the south and north of Dock 1 was assimilated. There have been a number of dry docks in the locations presently occupied by Docks 2, 3 and 4, which are the subject of this study. Dock 4 is largely the same as it was developed between 1760 and 1790. Dock 2 was constructed during the 1850s and Dock 3 replaced a dock of the same vintage as Dock 4 during the 1880s. In 1850, a new pump house for dewatering the four docks was constructed. The culverts ducting water from the sump at the seaward end of each dock ran back alongside or in some cases under the floor of the dock to discharge via a penstock chamber at the head of the dock and then into the discharge culvert running between the docks to the pump shaft in the pump house. The pumped water was discharged from the pump house through a discharge main to an outfall in Basin 1. The penstocks are hand operated.

Docks 2, 3 and 4 have been remodelled and adjusted over their working lives to accommodate the increase in size and technology within the new types of Royal Naval vessels.

The jetties 3, 4 and 5 between the docks were added during the 1860s in the form of timber decks supported on a grillage of cross braced cast iron piles and were extended during the 1880s. In the early 1960s, these structures were replaced by reinforced concrete deck slabs supported by steel Rendhex No.4 piles and restrained with tie rods.



South Yard Penstock
Source: Drawing provided by PCC



Elevation of Jetty 3
Source: Archive drawing by Plymouth Ministry of Public Building & Works (1966)



Aerial Image of Plymouth South Yard
Source: Ministry of Defence



History of South Yard - Marine Structures

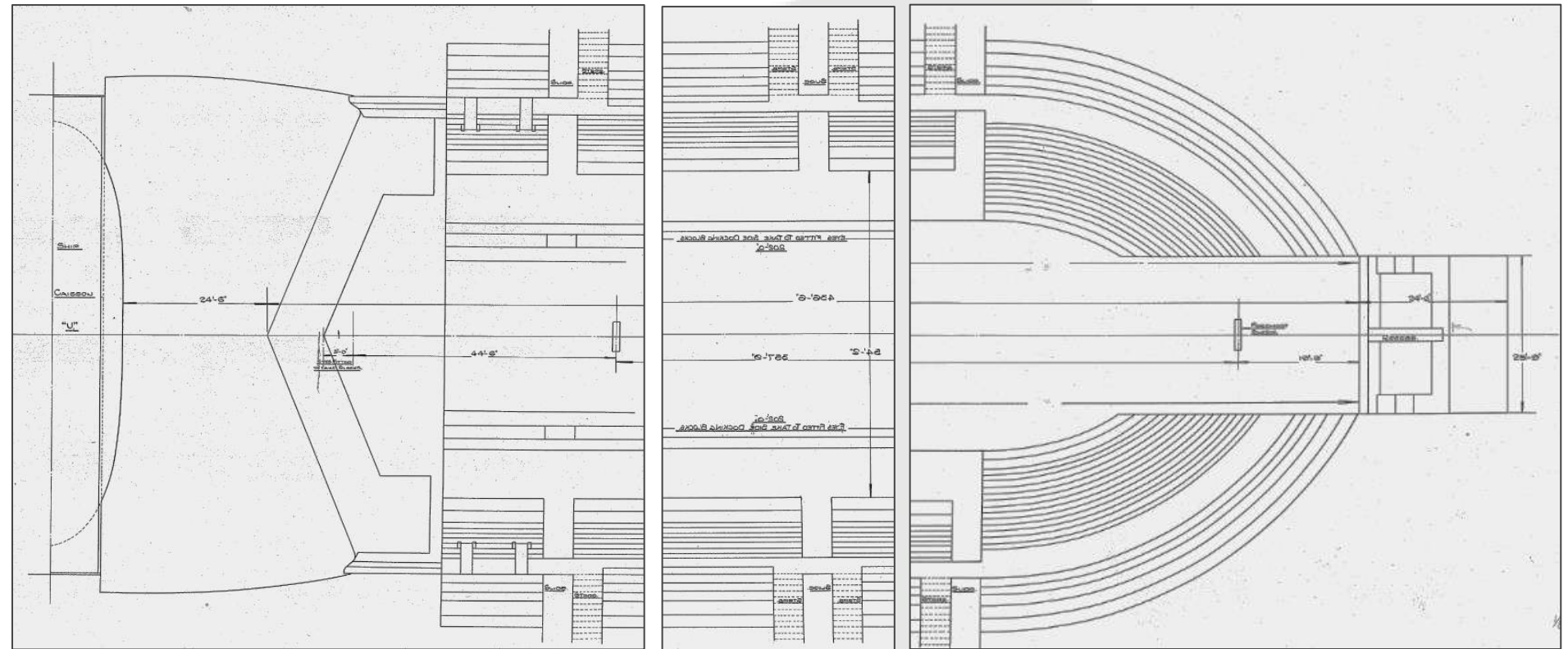
Dock 2

The dock was constructed in the 1850-60s and extended in the 1890s (From archive drawings provided the dock is 145.28m long by 29.56m wide at +7.67mCD cope edge level in the middle of the dock). The entrance sill is at a level of -4.47mCD and the top of the keel blocks at the entrance are 0.98m above this level and the floor and top of the 1.52m high keel blocks slope upwards by 0.61m over a distance of 129.77m. The depth of water from MHSW to the keel blocks is 8.5m in the middle of the dock. No contemporary drawings have been provided.

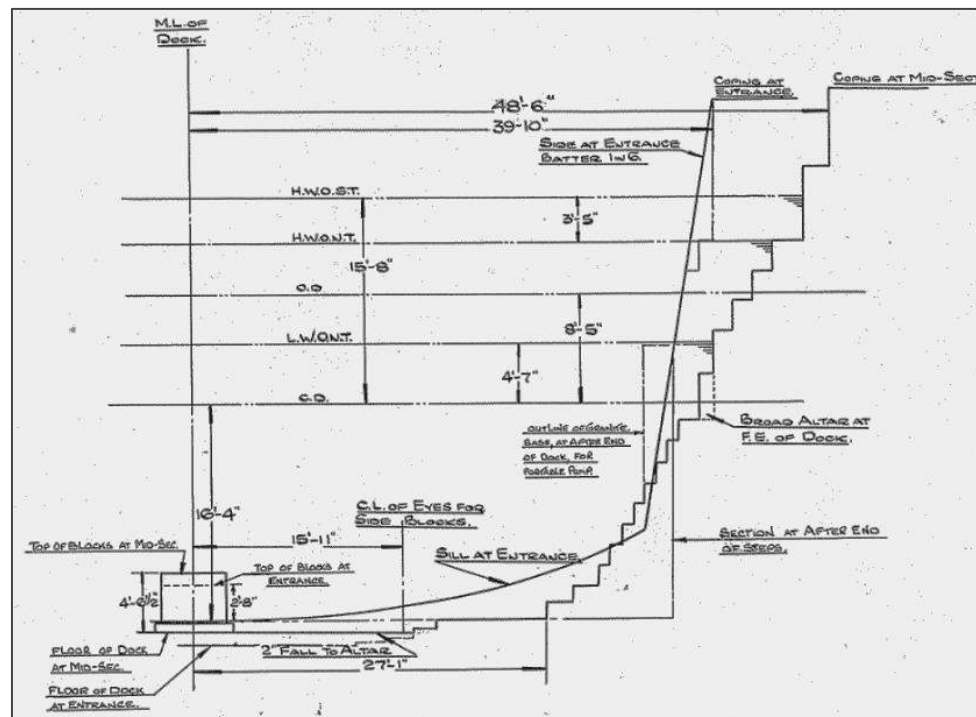
It is a Grade II* listed structure.

The drawings provided date from 1942 when new gantry crane rails were added to the dock edge for 5t cranes on the north side and 10t on the south. They indicate that originally the dock had a pair of mitre gates across the entrance, but at some stage a new sill was constructed at the seaward end to accommodate a ship caisson (as for Dock 3). These 1942 works reduced the width at the top of the dock to just over 24.3m.

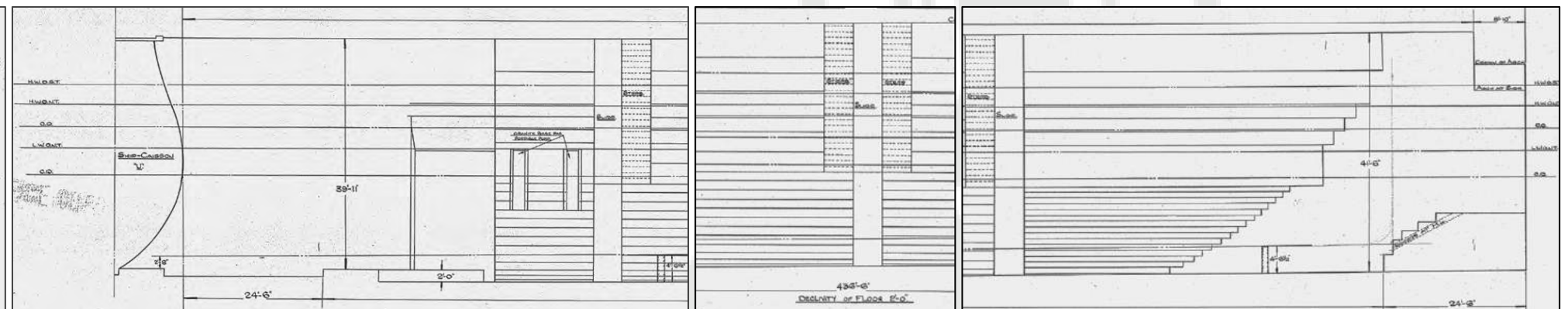
In 1983, a sonar pit sump was added to the dock.



Plan Sections of Dock 2 (showing entrance/middle and head of the Dock)
Source: Archive drawings provided by PCC



Section through Dock 2
Source: Archive drawings provided by PCC



Side elevation of Dock 2
Source: Archive drawings provided by PCC



History of South Yard - Marine Structures

Dock 3

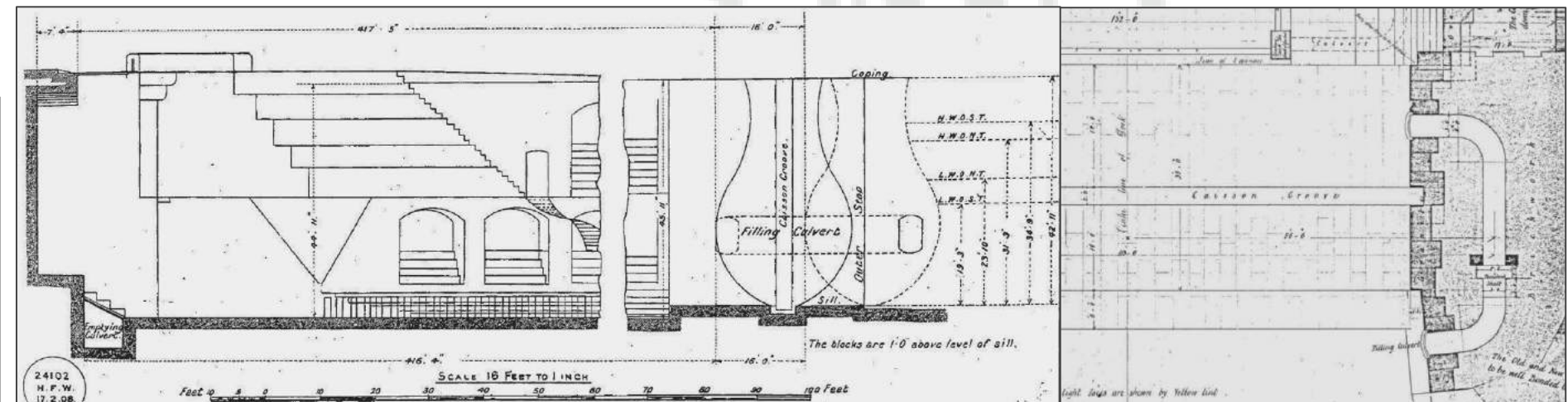
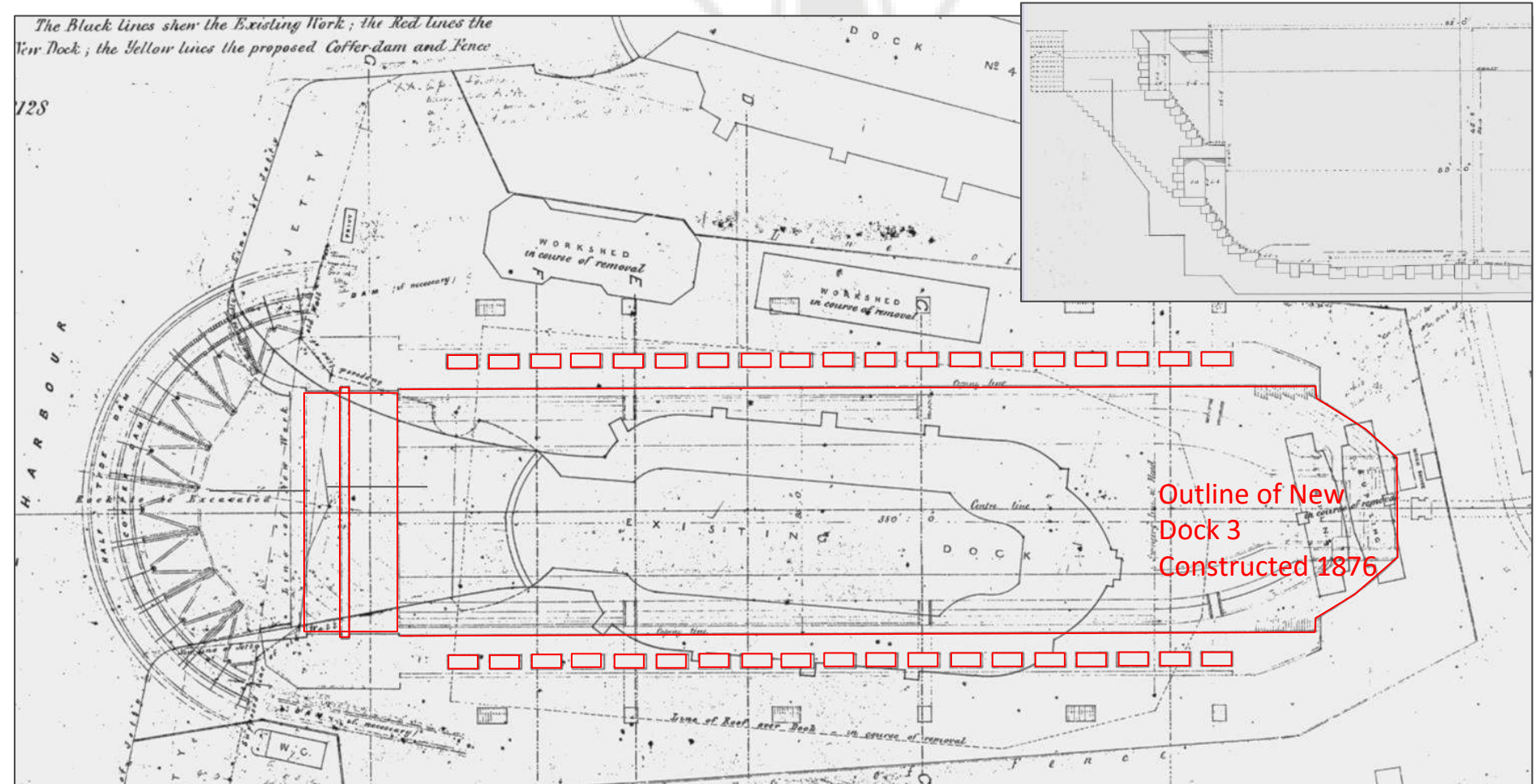
Dock 3 was built in the 1880s to replace an earlier dock of the same vintage as Dock 4. At cope level (+7.62mCD) this dock is about 127.23m long with the caisson in the inner groove position and 132.10m with caisson in the outer position. The sill level is -5.36mCD. The top of the 1.47m high keel blocks project 0.56m above the sill at the entrance. The top of the keel blocks and the floor slope up 0.305m from the entrance over a distance of 122.45m. The depth of water in the middle of the dock from MHWS is approx 10.59m. The drawings, detailing the new dock, date from 1877. It has been modified over the years, such as new portal gantry crane rails in 1943 to accommodate a 15t crane on the north side and 10t crane on the south side. In 1983, sump pits for sonar equipment was installed. It is a Grade II* listed structure.

The 1890 work replaced the mitre gates of the original Dock with a ship caisson that could seal the dock by being moored at the seaward side of the sill for short term re-fits or located during the falling tide into a recess within the dock sill. The north and south side walls consist of two tiers of granite archways and there is a curved head wall at the east end of the Dock. There are 20 arches in each tier along each wall. The arches are about 4m high x 3.6m wide and supported by 1.2m wide pillars.

The Dock was finally used to exhibit HMS Courageous but in 2006 the caisson was scrapped following the expiration of its operating licence.



Courageous in 3 Dock, Devonport



Plans and elevations of Dock 3
Source: Archive drawings provided by PCC.

Photograph of HMS Courageous
Source: Royal Navy Engineers Benevolent Society Members Buletin Special Supplementary Edition HMS Courageous
(<http://www.rnebs.co.uk/Files/Courageous%20Special.pdf>)



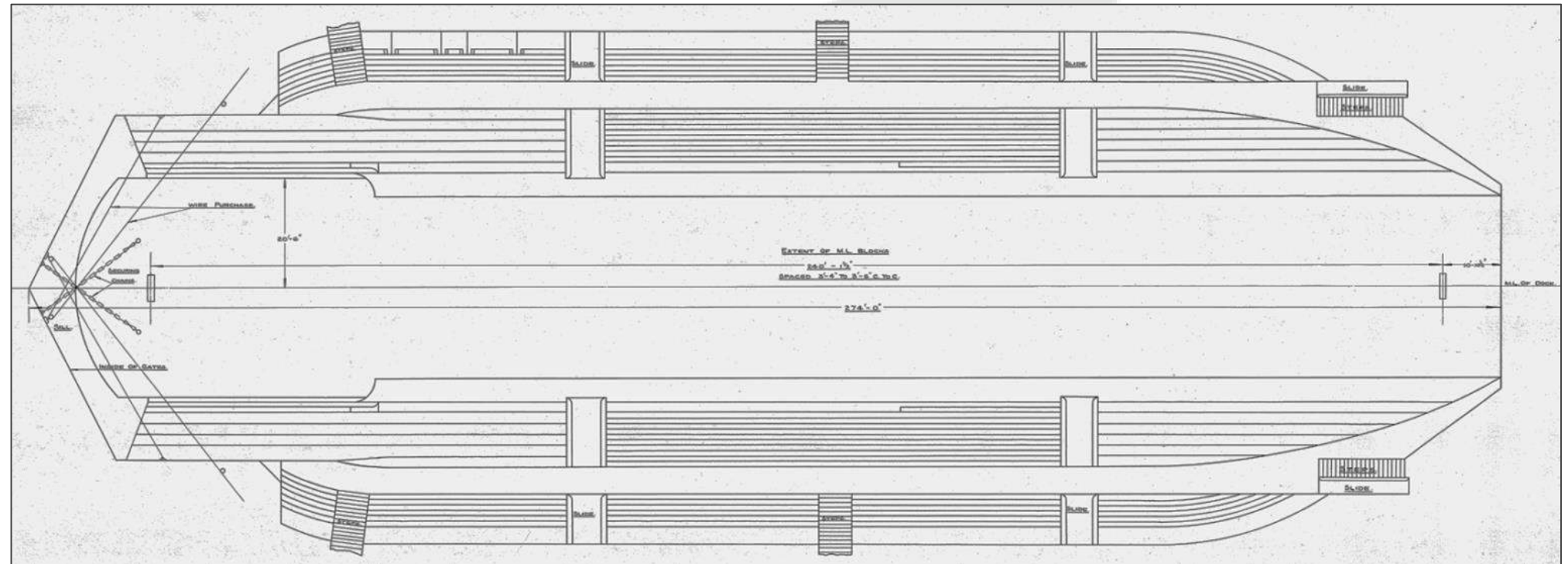
History of South Yard - Marine Structures

Dock 4

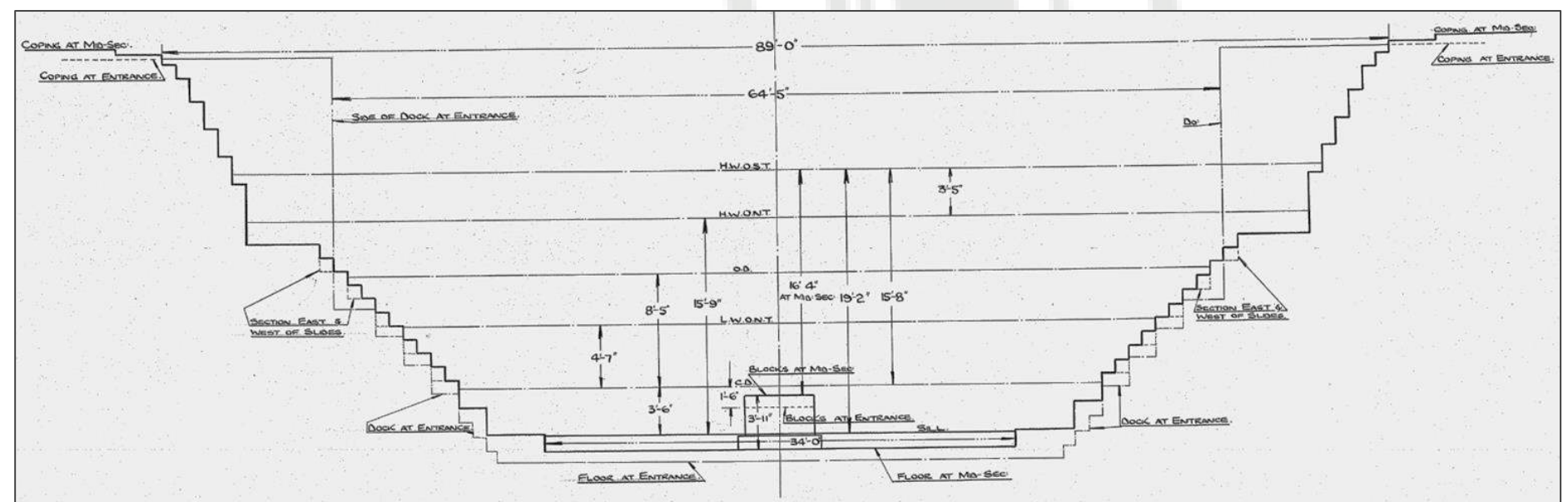
The dock was constructed in 1785 with cast iron mitre lock gates and is of similar size and construction to Dock 1. It was extensively rebuilt and extended in the late 19th and early 20th centuries. At the cope (level +7.92mCD) the dock is 83.52m long by 27.13m wide at the middle of the dock. The sill level is -0.51mCD and the 1.22m keel blocks extend 0.71m above the sill at the entrance. The top of the keel blocks and the floor rise 0.51m in 81m along the length of the dock. The width of the dock at the entrance is 20m and the width narrows in depth to 13m at the base. The dock is now a Grade II* listed structure.

The earliest drawings provided date from 1908 when the dock was modified to accommodate the Tribal Class of Coastal Destroyer. New steel mitre gates were installed, which were restrained by chains. The gates were removed several years ago, and the Dock is not in use.

Information provided by Babcock Marine identified that a 12/3 ton portal crane base was provided on the south side of the dock.



Plan view of Dock 4
Source: Archive drawings provided by PCC.



Section through Dock 4
Source: Archive drawings provided by PCC.

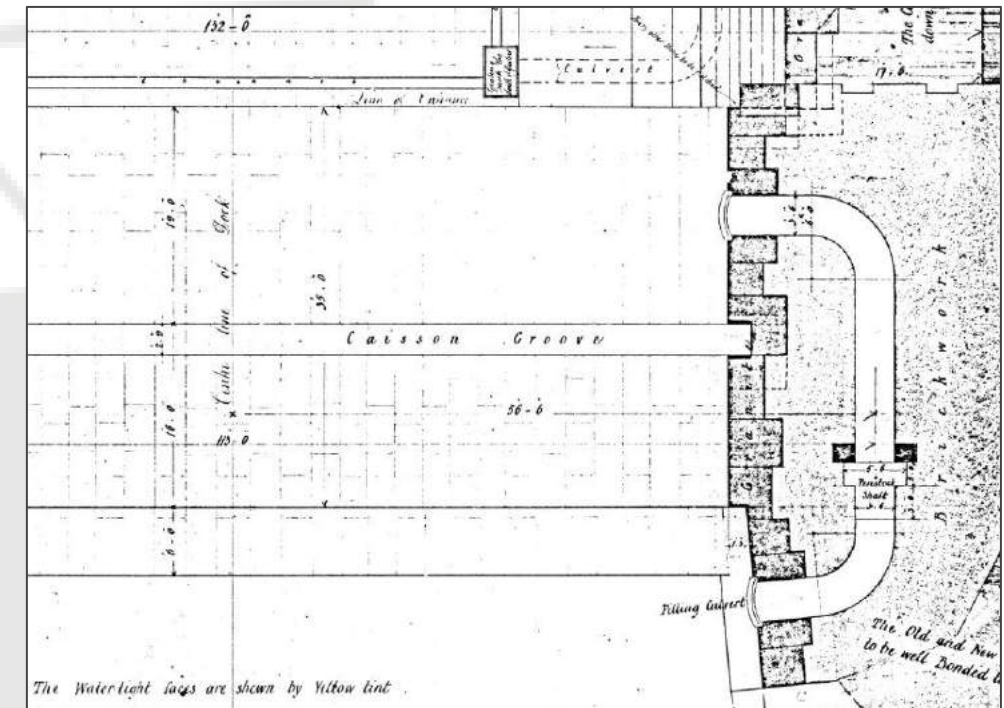


Operation of the Dry Docks

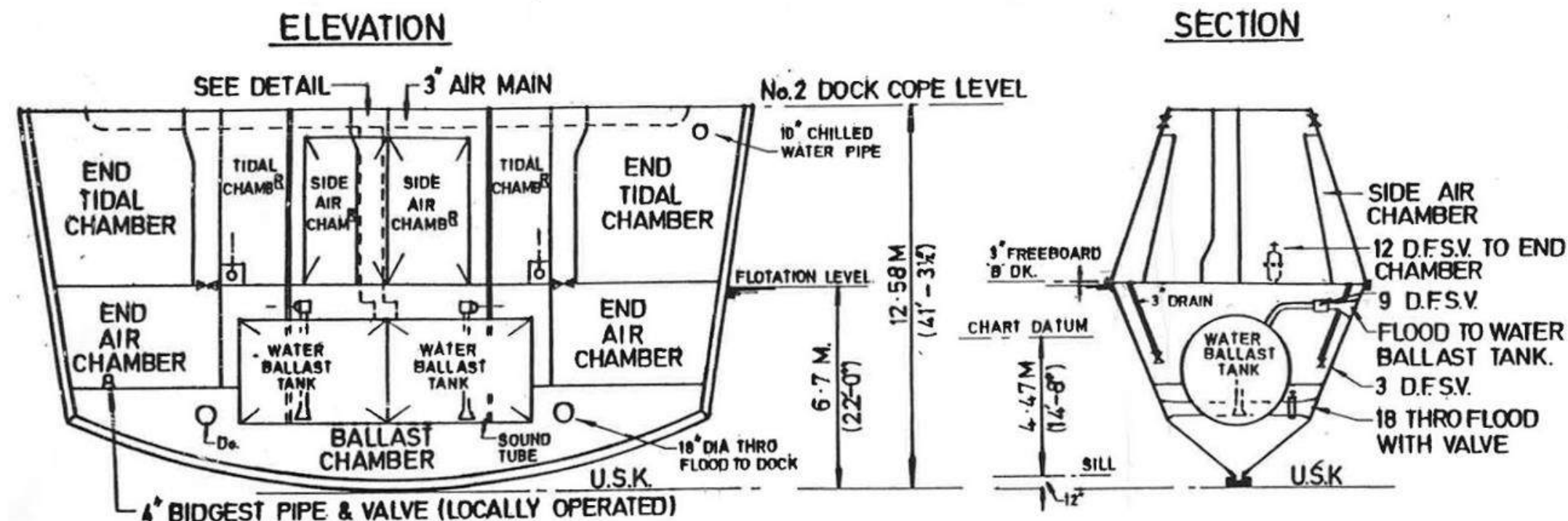
Dock 2

Dock 2 entrance has recesses for buoyant mitre gates and ship caisson. Caisson operation sequence would be:

- The dry dock is set up with the keel blocks and props for the next vessel(s) to enter the dry dock.
- The discharge drain is sealed to prevent silt entering the discharge culvert prior to the dock being flooded. Hand operated valves and penstock respectively operate two throughflood pipes in the caisson and a single flood culvert in the side wall and flooding takes about 2 hours. (NB penstock on this dock cannot be used to retain water in dock).
- On the rising tide, the ballast water is emptied from the ship caisson by opening internal valves. With a tug in attendance, the caisson floats off its sill with a water level of about +3.34mCD and is moored alongside a jetty.
- The vessel is brought into the dock first, as the tide permits, before High Water and the caisson is then manoeuvred back into position as the tide begins to fall.
- Ballast water is then placed back into the ballast tanks within the caisson, sufficient to keep the caisson in place as the tide falls.
- At low water, the penstocks on the flooding culverts are closed. The seal is removed from the discharge drain and, as the tide begins to rise, the hand operated penstock at the head of the dock is opened and one of the two electric pumps in the pumphouse empties the remaining water from the dock.



Filling Culvert around Caisson
Source: Archive drawings provided by PCC



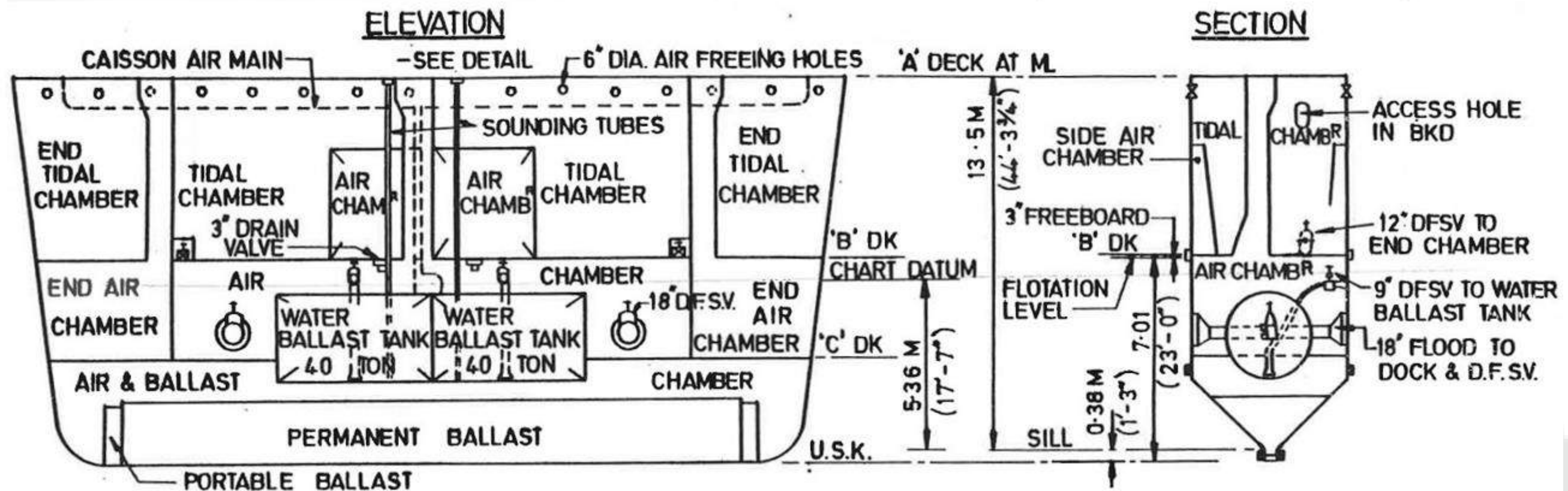
Ballast Arrangement in Caisson
Source: Archive Drawings PCC



Operation of the Dry Docks

Dock 3

This dock can only accommodate a caisson gate, but the keel of the caisson is level rather than the curved section of Dock 2. The caisson operation was otherwise the same as for Dock 2. The caisson could have been set in the inner groove on the sill or at the outer position. The caisson, when ballast water had been removed, would have floated with a water level of about +3.48mCD.



Ballast arrangement in original caisson for Dock 3
Source: Archive drawings provided by PCC



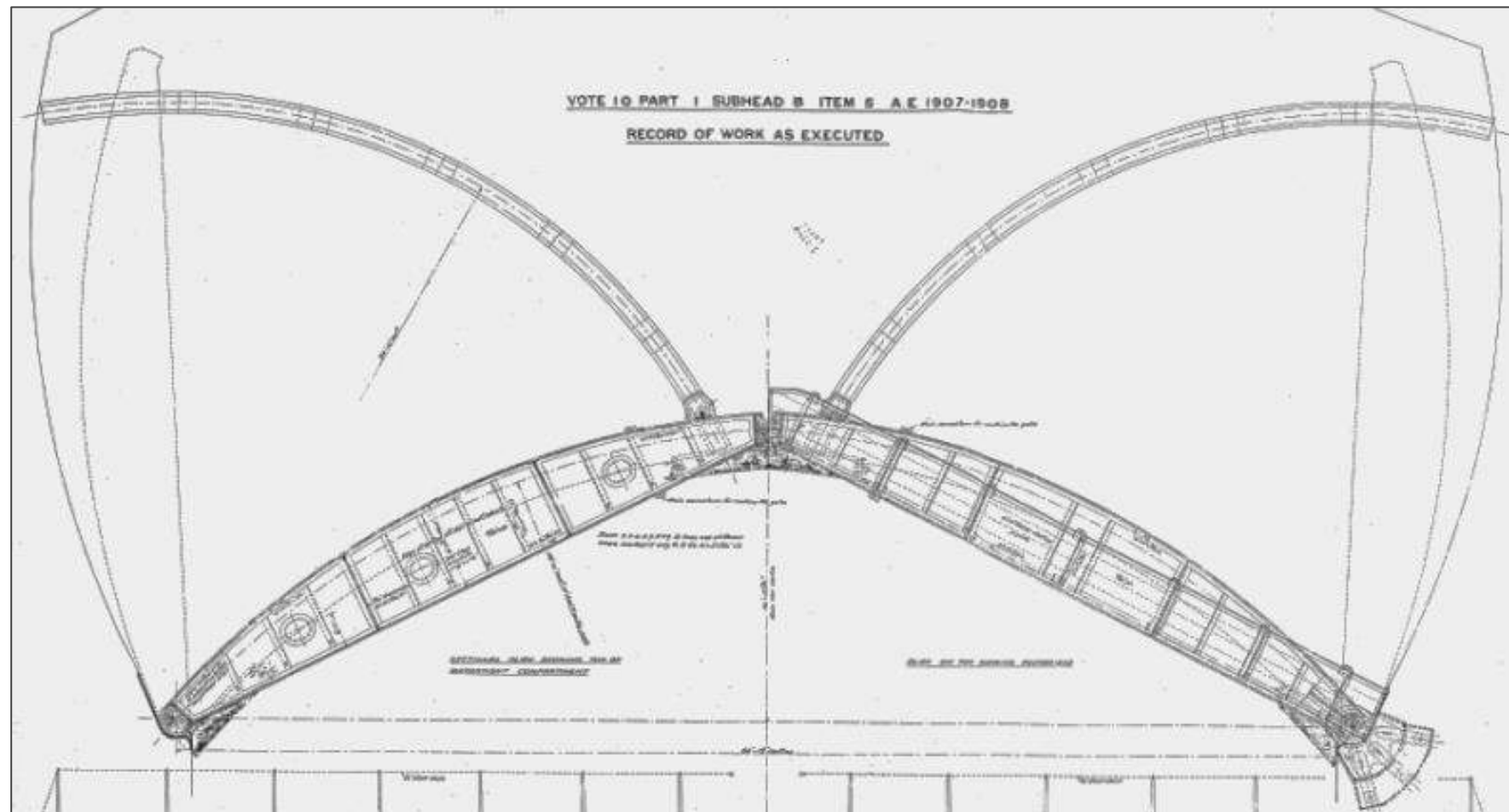
Operation of the Dry Docks

Dock 4

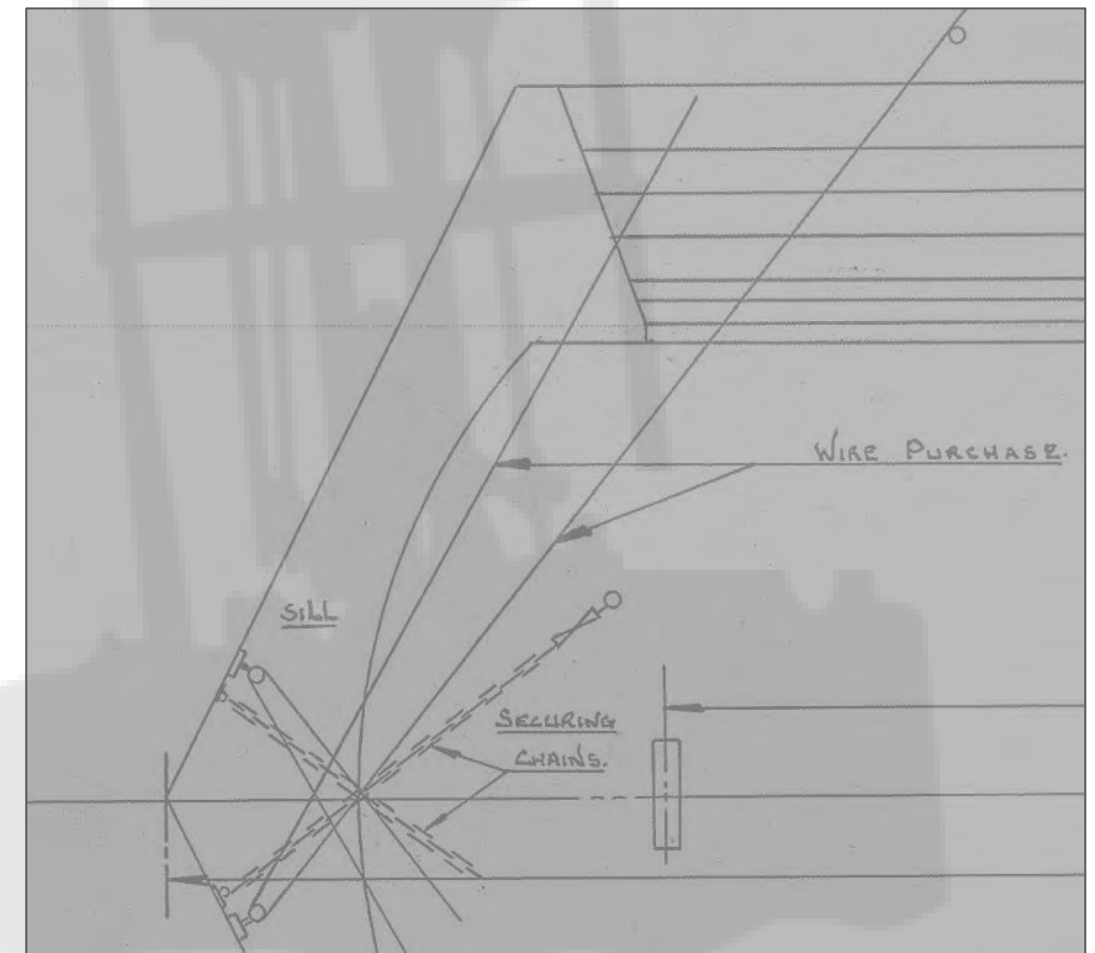
The semi buoyant mitre gates could have been operated at a water level as low as +2.69mCD, with the weight supported on rollers.

The dock could be left tidal until HW to suit the bow first entry of the vessel. However, to avoid a reverse head condition on the gate it was essential that prior to the tide falling the pump out of the dock must commence. The seal had to be removed from the discharge culvert grating prior to closure of the gates so that the discharge culvert could be flooded in advance of the dock being sealed. When the gates were sealed and secured by cables at the top, the discharge pumps were then started and the dock emptied.

When the water had drained the gates were further secured using chains to anchor points on the dock floor.



Plan drawing of Mitre gates provided for Dock 4
Source: Archive drawings provided by PCC



Securing chain details for Mitre gate
Source: Archive drawings provided by PCC





BR INSPECTION

BR undertook a visual inspection of the docks on 9th September 2015. The inspection coincided with a spring tide maximising the area above water that was inspected visually for defects, and to assess any sediment build up within the dock basins. The inspection involved a walkover and boat survey.

The purpose of this visit was to enhance BR's understanding of all aspects of the site and to explore areas for potential business suitability. A review of any defect/damaged areas of the dock that may affect the performance of the structures was also undertaken.

This document refers to information collected during the inspection and also reflects what has been previously noted in the "Condition Survey of Docks and Jetties" produced by URS in August 2014.



Quayside Area between Dock 1 and Dock 2



Crane rails run along the entire northern side of the dock approximately 0.5m from the quay edge. From Google Earth, it is apparent that these were operable in 2009.

The rails showed signs of deterioration with rusting and weeds present. The surrounding concrete appeared in a good condition.

Stepped access areas to Dock 2 are provided in the quay.

The guard rails around the access areas had rust staining, and the base plates were heavily corroded.

This is the downstream end of Area 5. The Quay area is commonly referred to as the approach to Jetty 2. The current proposal identifies that this area is to be shared with the MoD, with fencing to demark the boundary.

General Condition - No significant deterioration was noted. Some rutting in the tarmac was recorded. Quayside handrailing was present but requires replacing to meet safety regulations.



The Main Dock Pump House (SO87) and the Pneumatic Store (SO89) are located on the eastern side of the dock. Both are Grade II listed.

Twin pumps are located inside the pump house that serve all four docks through individual valves and culverts. It is understood that the pumping equipment was used to drain the water out of the docks only. Filling of the docks was done via tidal filling pumps located either side of the caisson. The pumping equipment requires upgrading if it is to be put back into use. It is understood that the water drains into Dock 1 which is to remain in control of the MoD. An agreement with the MoD will be required to establish the rate and amount of discharge acceptable. The internal areas of the substation building (SO85) were not accessed during the survey. From the survey, it was suspected that a number of items in the pneumatic store contain asbestos. An Asbestos Survey carried out in 2010 by Shield Environmental Services Ltd identified items that have asbestos present but note that they are safe insitu.

A number of VR (Victoria Regina) historic bollards were seen, and although some rust staining was visible, the bollards appeared to be in sound condition.



It appeared feasible that the non-Listed Shower Block and Latrines (Building SO84) could be demolished as proposed.

It is intended that a fence will be erected to define the boundary, with MoD having exclusive access to the bollards on Jetty 2, which is not part of this study.

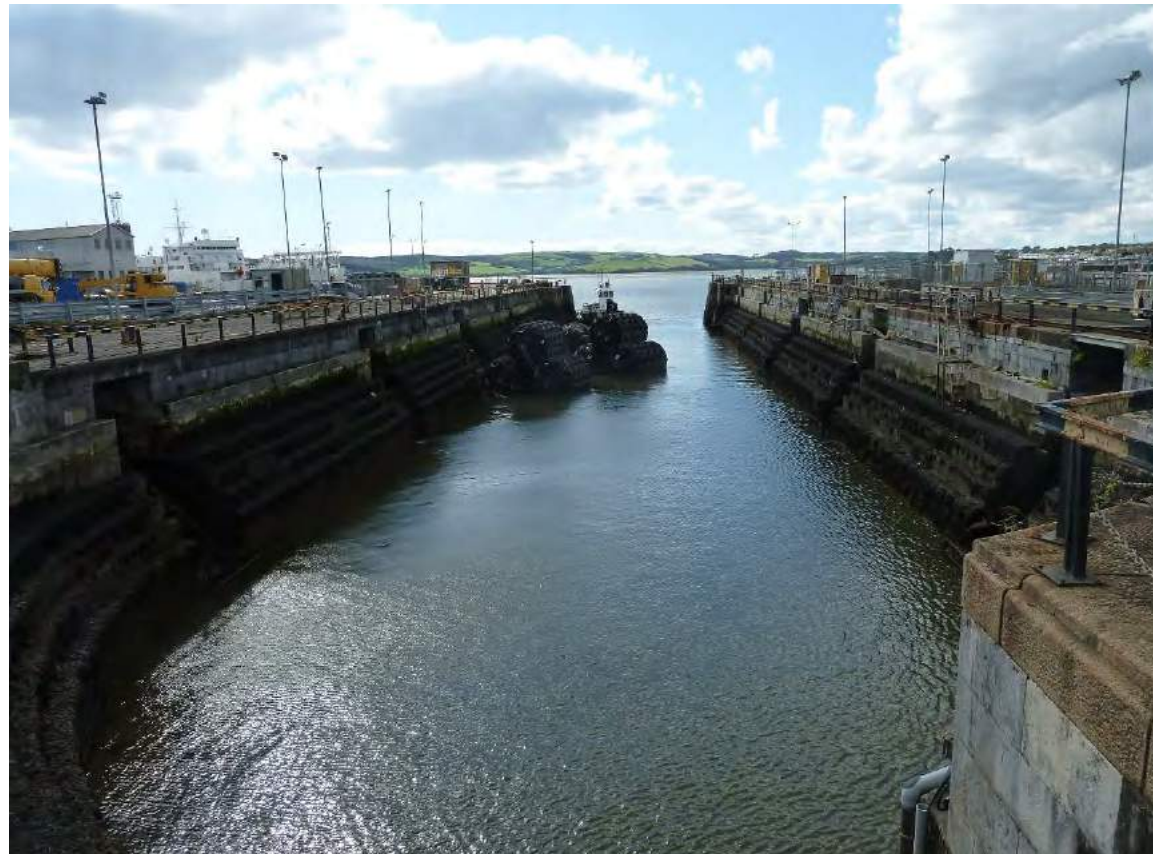


Dock 2



Dock 2 is the largest of the docks. The structure is a traditional dock outline with stepped access on either side. A number of disused services run the length of the dock.

A caisson was originally positioned in the recessed areas on the entrance walls. It is understood to have been previously taken out and scrapped.



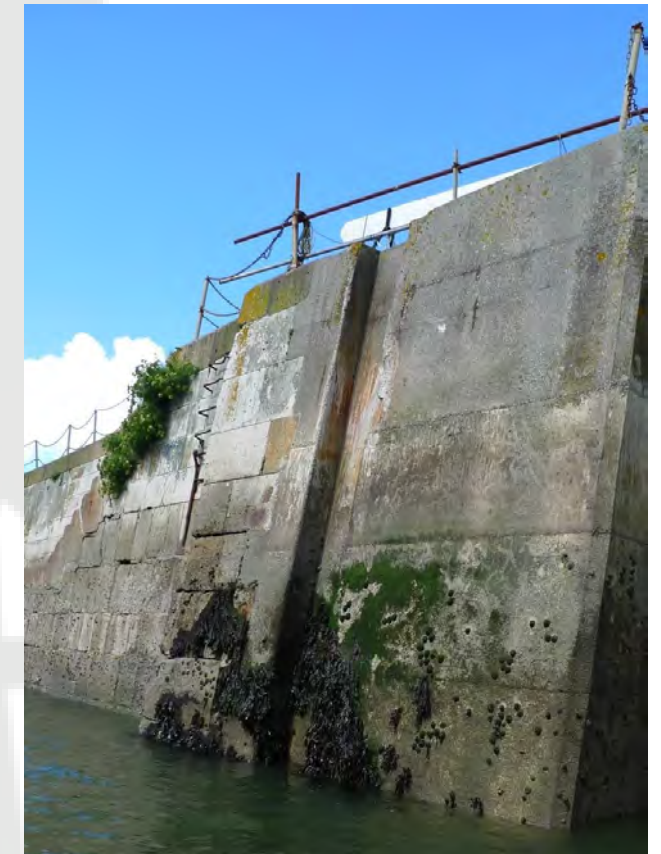
Overall the Ashlar blockwork appeared in a reasonable condition with some localised damage noted at the north wall dock entrance.

The jointing in the blockwork has been eroded over time, however no water seepage was observed.



From the archive drawings the dock measures approximately 30m wide by 145m long and is 8.5m deep at MHWS to keel blocks.

There was a note from an inspection in 2002 that there was evidence of efflorescence on the blockwork and that seawater was seen entering through the blockwork near the entrance. From further enquiries about the previous operations of the dock and water tightness of the structure, it is likely that this is a relatively small and contained problem that can be solved with local repair works.



The recesses in the dock walls appeared in good condition, with only marine growth observed.

The dock ladder has heavily corroded and is not suitable for use.

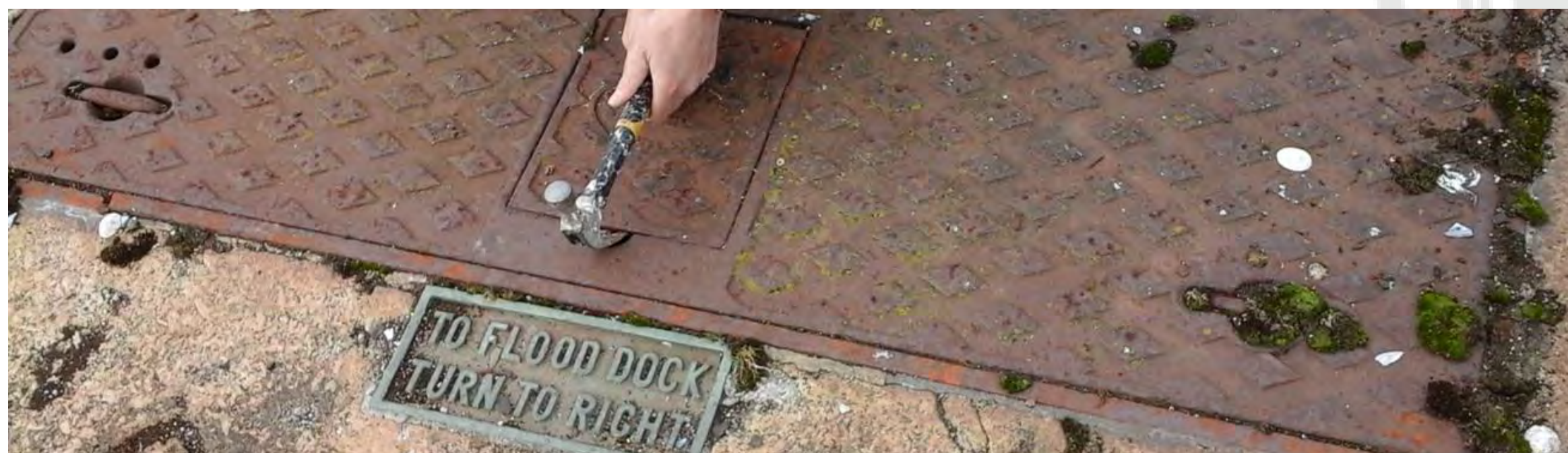


Quayside Area between Dock 2 and Dock 3



This Quayside does not have existing buildings. Crane rails are present serving both sides of the quay, with some parts of the rails having been removed.

A flood valve is located on the western end of the quay just before No. 3 Jetty, this would have been used to flood the dock when required.

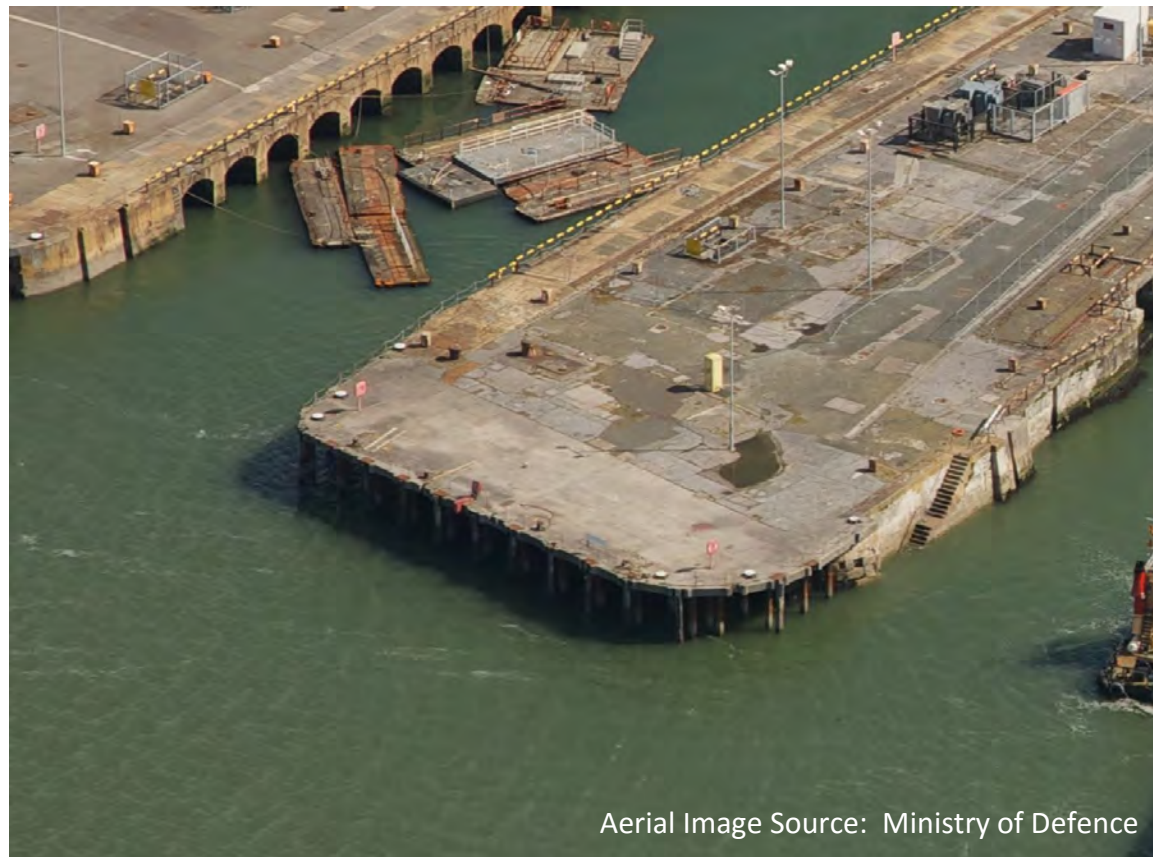


From previous MoDs inspections of the jetty, it was noted by Unicorn in 2000 that an area of approximately 3m2 of tarmac “had sunk 200-300mm” on the jetty.

It is recommended in the report that this area should be re-tarmacked. The URS ‘Condition Survey of Docks and Jetties’ (2014) identified that a later inspection (2002) revealed that this repair had not been carried and requested that further investigation should be sought before remedial works are carried out.



Jetty 3



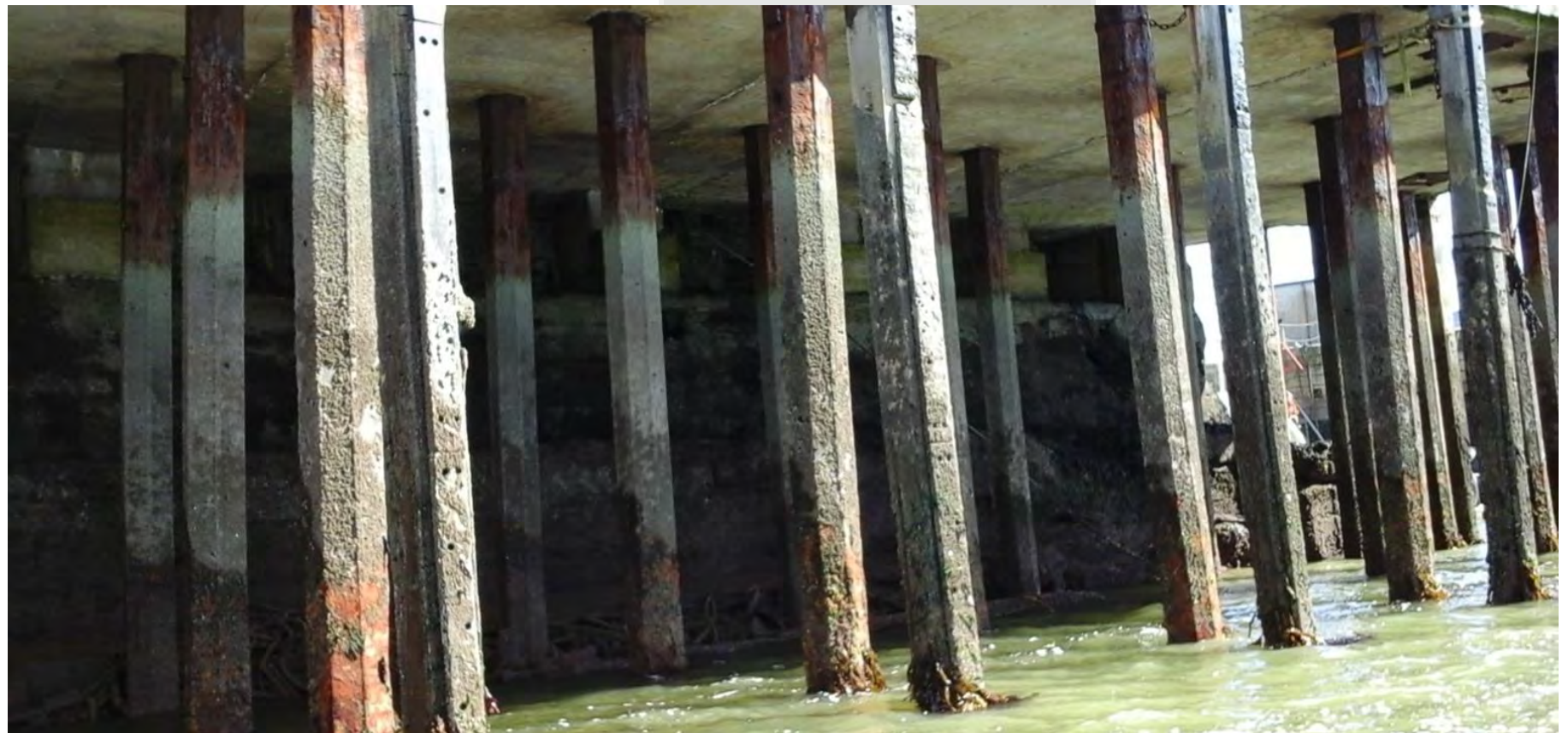
Aerial Image Source: Ministry of Defence

Recessed wooden timbers with a UHMW-PE facing forms part of the fendering protection to the jetty. Square fenders connect the tops of the piles to the deck of the jetty.

The timber fenders appear in a good condition, and previous reports have suggested that these were replaced in 1995. Some of the UHMW-PE facings are missing.

Jetty 3 is formed of a 600mm suspended reinforced concrete slab, extending the quay to the west, supported by Rendhex piles. The rear wall of the jetty is of ashlar block construction with an additional concrete front, potentially introduced as strengthening works to the quay.

Timber fenders with a UHMW-PE facing are connected into the concrete slab via square fenders. The rear wall has been strengthened with a concrete abutment.



The Rendhex piles are in a poor condition, and at the low water mark the corrosion has extended to complete section loss of the pile. The previous URS 'Condition Survey of Docks and Jetties' (2014) report had identified that 21 piles had a thickness less than 10mm (original thickness 15-16mm).

Significant replace/repair works would be required to restore this jetty back to use.

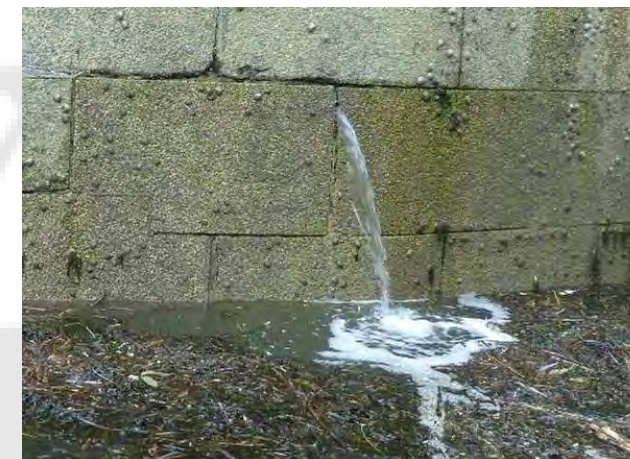


Dock 3



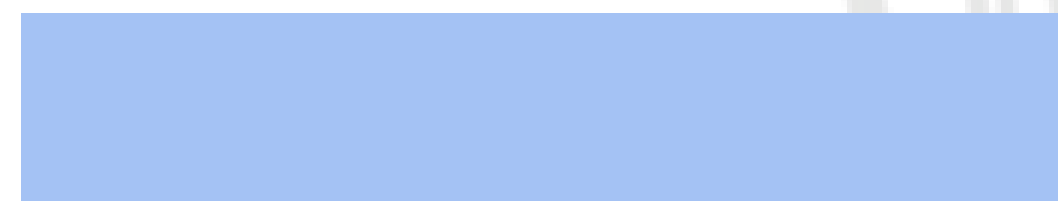
Dock 3 is the most architecturally advanced of these structures. The dock has a unique access configuration whereby stairways lead to granite arches that allow for vertical sides to the dock.

The old caisson gate slotted into a formed sloped recess to allow the dock to be dewatered.



The above water elements of the dock appeared to be in a good condition. There are minor cracks in the blockwork and some water seepage was also recorded.

Water pouring from joints or cracks in the blockwork walls often results from 'tidal lag' where the free water level in the dock or sea has fallen more quickly than the water level within the structure. Any voids in the structure fill with water when the tide is high and act as a reservoir with water pouring out through any gaps. Minor repairs such as pointing and grouting can be used to reduce or eliminate this problem.



Archived drawings note that there are also sonar pits at the base of the dock. Google Earth shows the large submarine HMS Courageous dry docked here about 10 years ago. It is understood that she was removed in 2007 because the caisson gate had exceeded its design life and was then scrapped.



Aerial Image of Dock 3

Source: Google Earth



Quayside Area between Dock 3 and Dock 4



The entrance to the quayside area is gated and is currently used as a car parking area. The quay appears to have been resurfaced and the VR bollards have been repainted to restore them back to their original condition.



A sign attached to the quay boundary fence identifies permissible loads on the quay. Following discussions with Babcock Marine, it is unknown when this assessment was done but it has been highlighted that it was not recent and, therefore, does not account for any deterioration noted.

There is a medium sized workshop located near Jetty 4.



Jetty 4



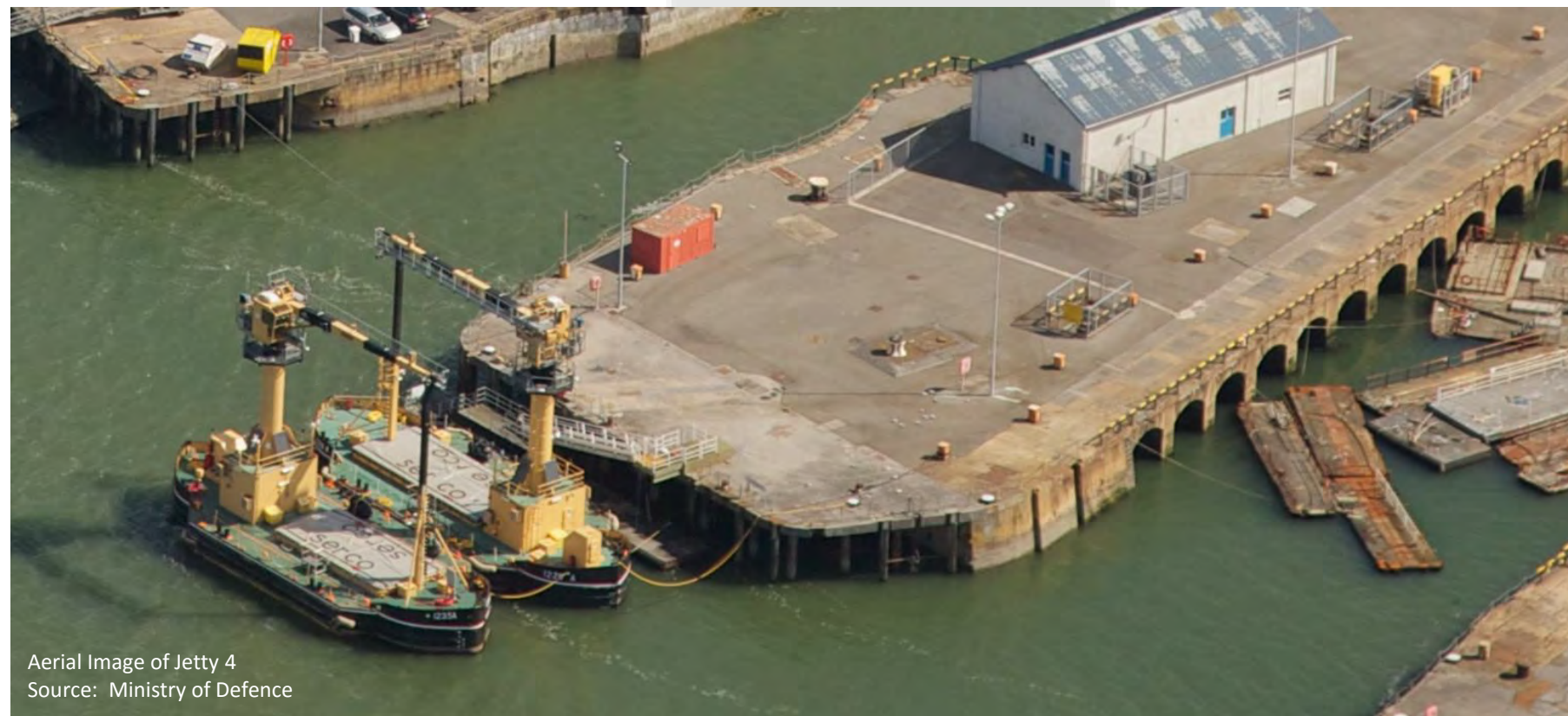
Similar to Jetty 3, this jetty is formed from a 600mm suspended reinforced concrete slab supported by Rendhex piles.

Timber fenders with a UHMW-PE facing are positioned within recesses in the concrete slab.



The original blockwork wall has suffered considerable deterioration, and the rear wall has been reinforced with a concrete buttress. Previous reports identified that there were no signs of significant deterioration or undermining of the concrete buttress.

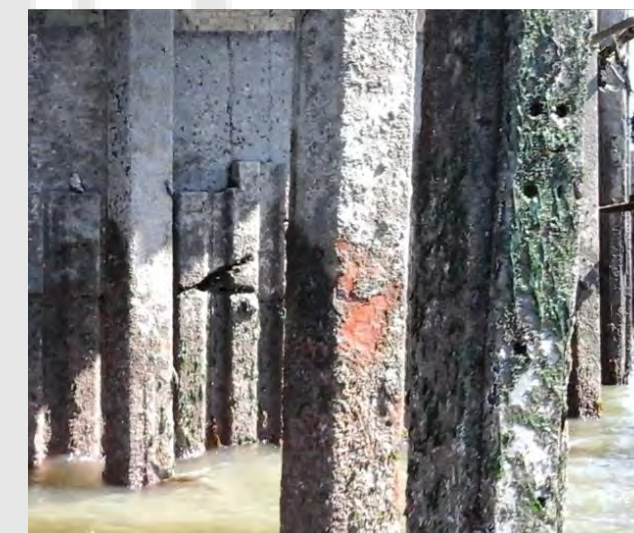
The tops of the Rendhex piles have suffered from some corrosion and blistering. It has been suggested in previous records that zinc anodes may have been placed below the water line, but these were not visible during BR's inspection. The bright orange colouring of the piles at low water suggests that Microbiologically Influenced Corrosion (MIC) may be evident.



Aerial Image of Jetty 4
Source: Ministry of Defence

From the previous URS report 'Condition Survey of Docks and Jetties' (2014), it was noted that a fixed brow and floating pontoon structure was present. During the BR survey, the brow and pontoon were no longer in place, but the fixed cantilevered steel bankseat remains. The bankseat is anchored through the concrete deck.

The load capacity of the jetty was highlighted on a yellow sign. However, following discussions with Babcock Marine it is unknown when this assessment was done but it has been highlighted that it was not recent and did not account for the deterioration noted in the steel piles. It is envisaged that the load capacity will be reduced due to the deterioration of the jetty.

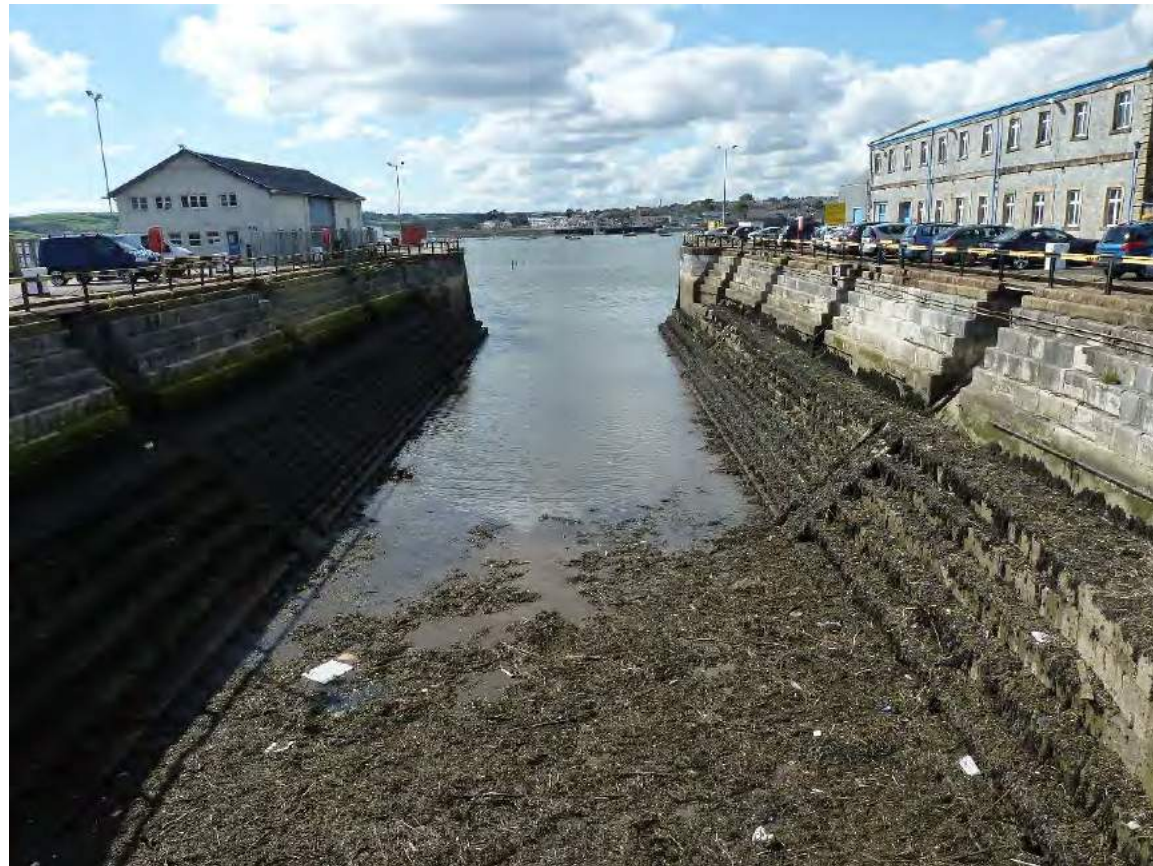


Dock 4



Dock 4 is the smallest basin of the three docks approximately measuring 30m wide by 85m long with depths of only 4.65m to the keel blocks at MHWS. The dock outline is similar to Dock 2 with stepped access from both sides.

The dock is relatively shallow and during low spring tides the silt is exposed at the head of the dock. Heavy marine growth was observed below the high water mark.



The URS 'Condition Survey of Docks and Jetties' (2014) notes that record drawings indicate that a masonry sill with a timber facing is provided at the entrance.

From record drawings, it is also known that the dock previously had a set of iron gates rather than a floating caisson as used for the other docks. These gates were removed in the 1990s, and the dock was left as a tidal dock.

The blockwork appeared in generally good condition with only minor damage recorded. Some settlement was noted on the south wall of the dock and repairs were evident. There was apparent water seepage through the blockwork in some areas.

Two filling culverts are located on the south side of the dock.



Quayside Area North of Dock 4



Building SO15 is located on this quay and provides substantial office space with ancillary storage and Yard.

The quay is also used as a parking area and appears to have recently been resurfaced.



Aerial Image of Quayside Area
Source: Ministry of Defence

The VR bollards have been refurbished and painted.

The lower half of the northern boundary wall of the site appeared in good condition. The upper section, although notably damaged, seemed in a stable condition.



To the northern boundary of the site there is a public slipway on the foreshore. It is not envisaged that this could be incorporated within the Area 5 facilities because there is no direct access to it. Also landside access for this slipway is restricted anyway because of the low level MoD bridge.



Jetty 5

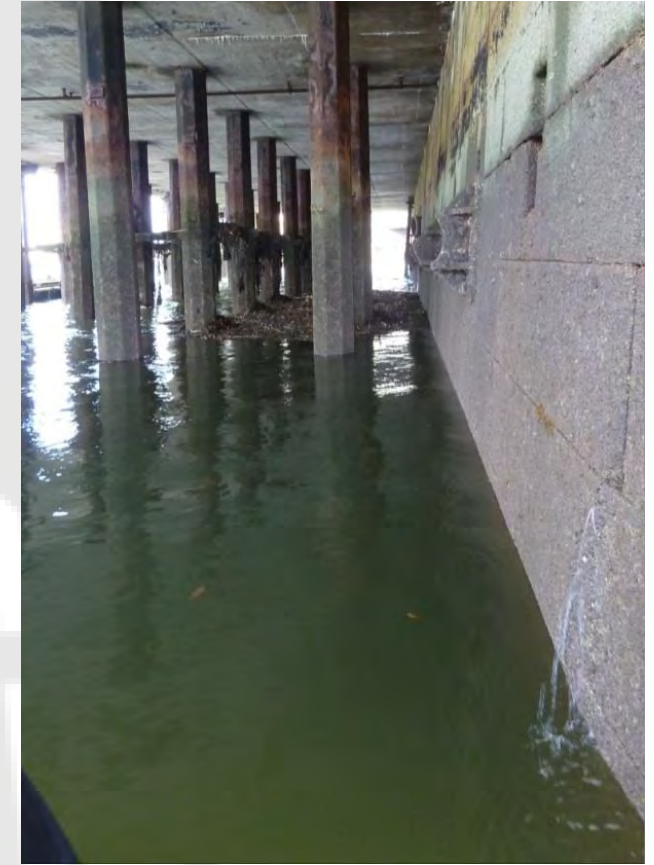


Jetty 5 was constructed with a 840mm concrete suspended deck supported by Rendhex piles. The jetty approximately measures 12m wide by 54m long.

Timber fenders with a UHMW-PE facing are positioned within recesses in the concrete slab. Signage on the approach identify the outdated loading restrictions on the jetty, which requires a new assessment to take into account the condition of the piles.



Aerial Image of Jetty 5
Source: Ministry of Defence



Corrosion was noted on the top of the piles. However, this appears to be less significant than the other jetties.

In the URS 'Condition Survey of Docks and Jetties' (2014) it was noted that the piles were painted in 1994 and that some paint remained on the piles in 2014.

During BR's survey no paint was evident, this may be due in part to the marine growth around the piles.

The timber fenders appeared to be in a good condition. The ladder on the jetty is not suitable for use and would require replacement.

It was observed that water was seeping through the blockwork wall. However, unlike the other jetties, no additional reinforced facing was identified, the blockwork appeared in a good condition.

Evidence of a previous jetty structure was seen in the form of cut down box sections.



BR Inspection Summary



Jetty/ Dock No.

General Condition

Notes

Obstructions for redevelopment

Features

Dock 2

Good condition – repointing required, some blockwork damage particularly at the entrance.

An inspection survey carried out by Unicorn on behalf of the MoD in 2002 noted water entering dock through blockwork (when the dock was dewatered).

Dock is stepped to allow access at lower levels however this limits its width at lower tides. Water entering through dock wall should be investigated further if required to be a dry dock.

Largest of the three docks

Jetty 3

Poor condition – severe corrosion of steel piles at a lower level. Undercutting of the concrete buttresses base.

Corrosion appears to be due to MIC. Remedial works have been undertaken to the Quay wall.

Requires either demolition or strengthening work. Possible MIC present.

Dock 3

Good Condition – Water seepage through some joints of blockwork. Significant calcite deposits noted.

Water seepage should be investigated further if required to be a dry dock.

Vertical sides – width is maintained and vessels can berth close to the quay edge.

Jetty 4

Fair Condition – Some local corrosion of steel piles, missing fenders.

Remedial works have been undertaken to the Quay wall.

Dock 4

Good condition – Local damage to blockwork.

Smallest of all docks, half of dock dries out at low tide.

Good quay space to the north of the dock.

Jetty 5

Good condition – local corrosion to the top of steel piles, some damage to blockwork with water seepage.

Largest jetty.



STUDIES

This section provides BR's interpretation of the previous surveys and studies, carried out by others in the past, provided by PCC. Where necessary BR has used the data in these studies to produce graphical representation to identify clearly the findings of the reports.

In addition to the review of the studies, contact has been made with contractors and field experts or stakeholders to increase our understanding of the impact of the findings.

The review commences with the study of the sediment within each dock. If the docks are to be re-used as a marine facility, all sediment within the dock will need to be cleared using a process known as dredging. The cost of this activity relates to the volume and also depends on the possible contamination of the material.

The flood risk of the area is discussed with the use of the EA flood map. It will be a requirement of the planning process to assess the site's flood risk and show how this affects the proposal.

The studies include a heritage assessment that highlights the historic importance of the area with a number of buildings and structures being designated as a Grade II*.

Finally, this section reviews the works required as a result of the damage/defects noted from both BR's survey and other previous surveys. Further studies are also recommended to increase our knowledge of the structures capacity and inform us further on the feasibility of the proposed concepts.



Aerial Image Source: Ministry of Defence

Aerial Image Source: Ministry of Defence



Siltation Overview

Bathymetry

Dock 4 contains the greatest depth of silt. This may be due to the earlier removal of the dock gates to this basin.

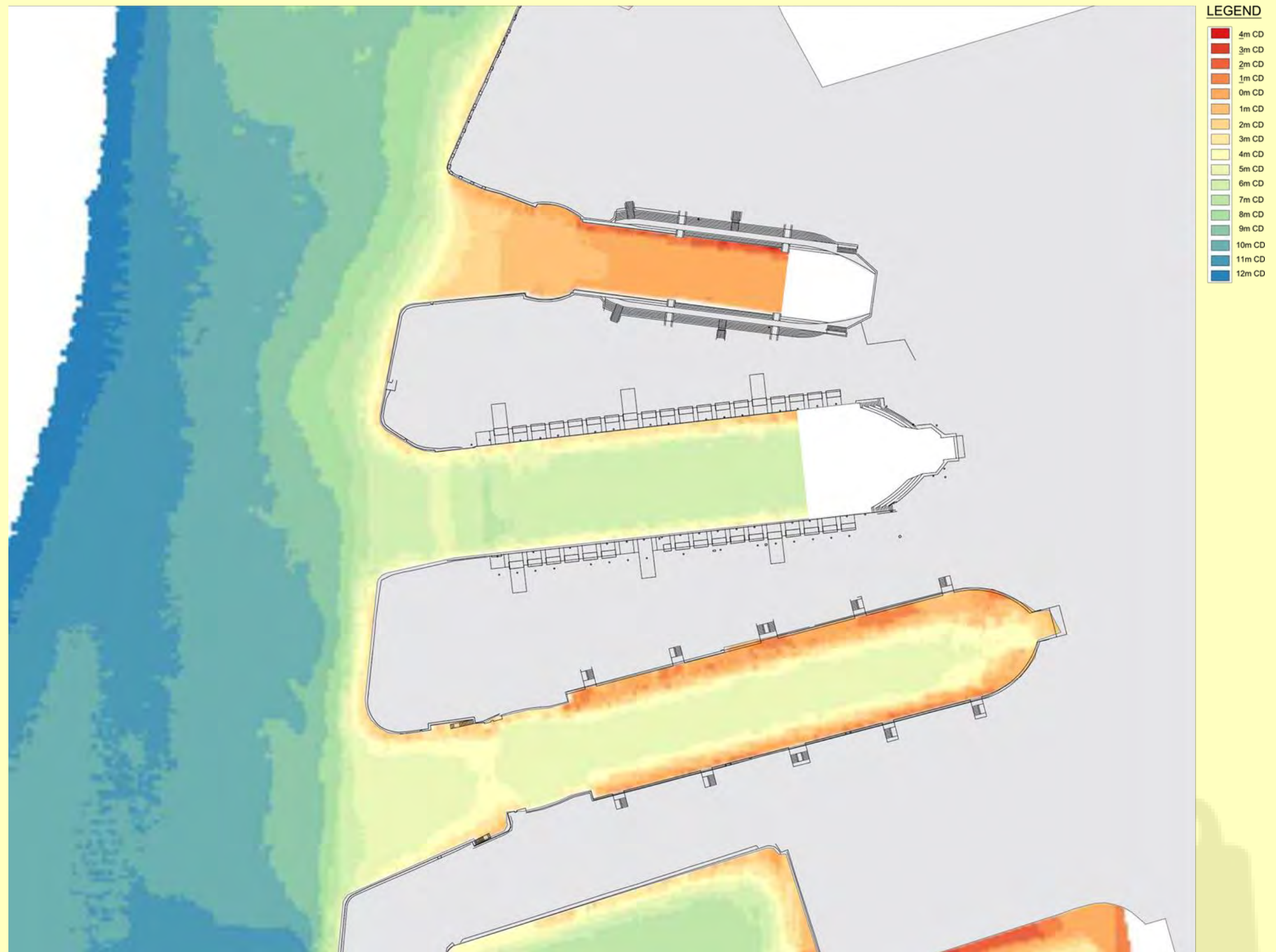
There is, however, more silt volume in the other docks due to their size.

Estimated silt quantities:

- Dock 2 - 3,400 m³
- Dock 3 - 4,400 m³
- Dock 4 - 2,700 m³

Source: AECOM Dock Sediment Sampling and Analysis Report.

The siltation image (right) has been created from bathymetry data provided by Shoreline Surveys Ltd in 2014. The contour colours reflect the level of silt compared with the level of Chart Datum (CD). The scale towards red represents higher levels recorded and blue lower.



BR's siltation imagery based on bathymetrical survey conducted by Shoreline Surveys LTD

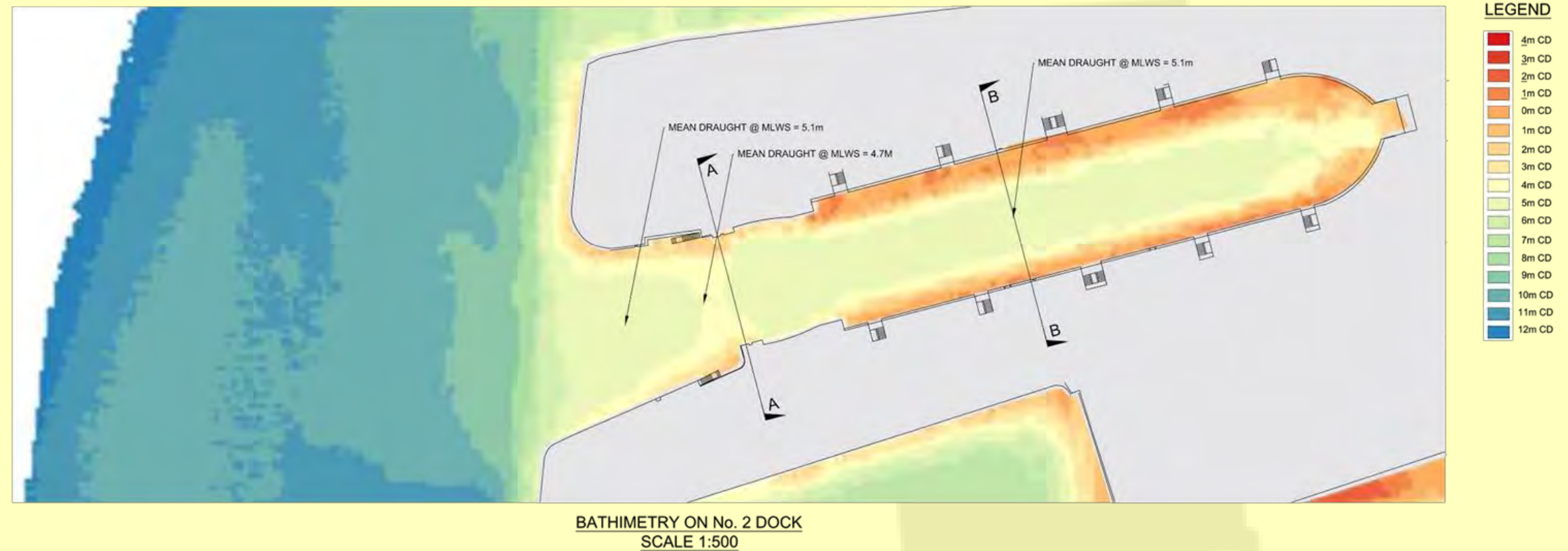


Dock 2 Siltation

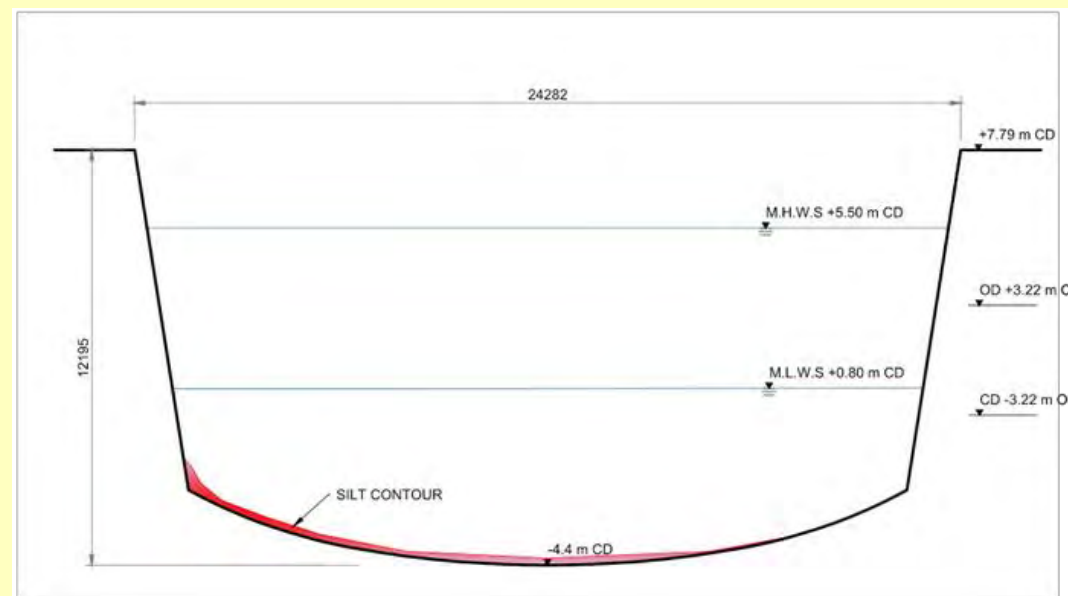
It is understood that the caisson for Dock 2 was removed in 2007 leaving it tidal for the last 8 years. While the dock is open to the sea, it is subject to continual deposition of silts that are brought in by the tide.

The image (top right) identifies that higher levels are shown along the sides of the dock that are attributed to both the stepped sides and the accretion of silt on the steps.

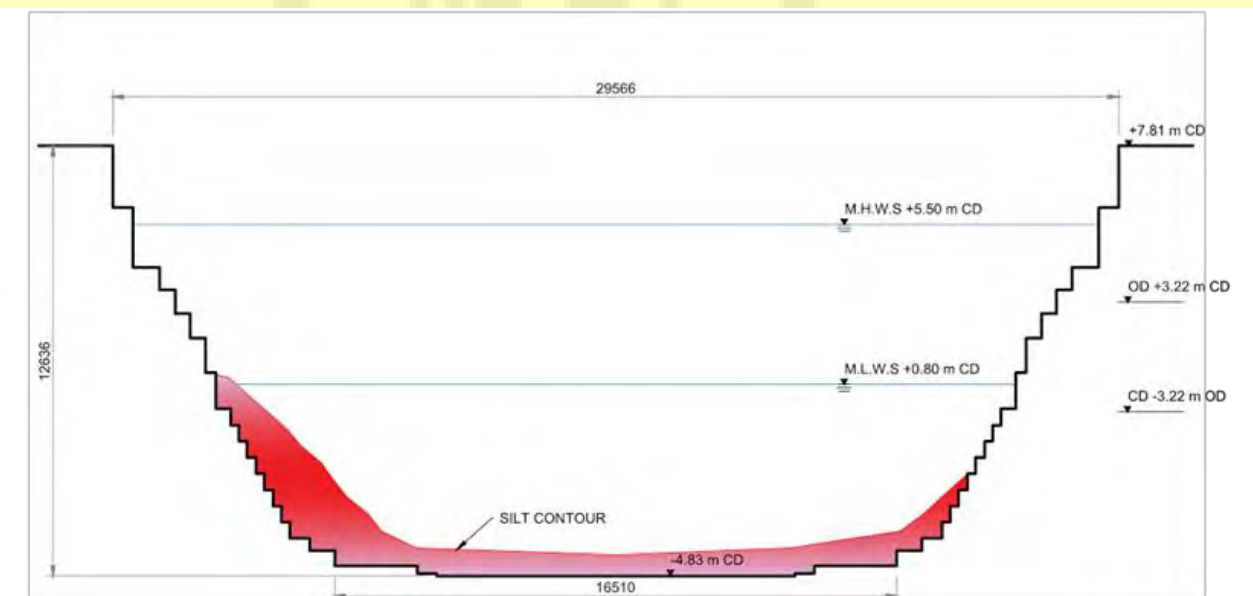
Sections A-A and B-B identify the amount of silt in comparison to the outline of the dock. This shows that there is greater sediment buildup in the middle of the dock compared to the entrance. Approximately 800mm has accreted over the 8 years suggesting an accretion rate of 100mm per year.



BR's siltation imagery based on bathymetrical survey conducted by Shoreline Surveys LTD in 2014



BR's sections developed from archive drawings

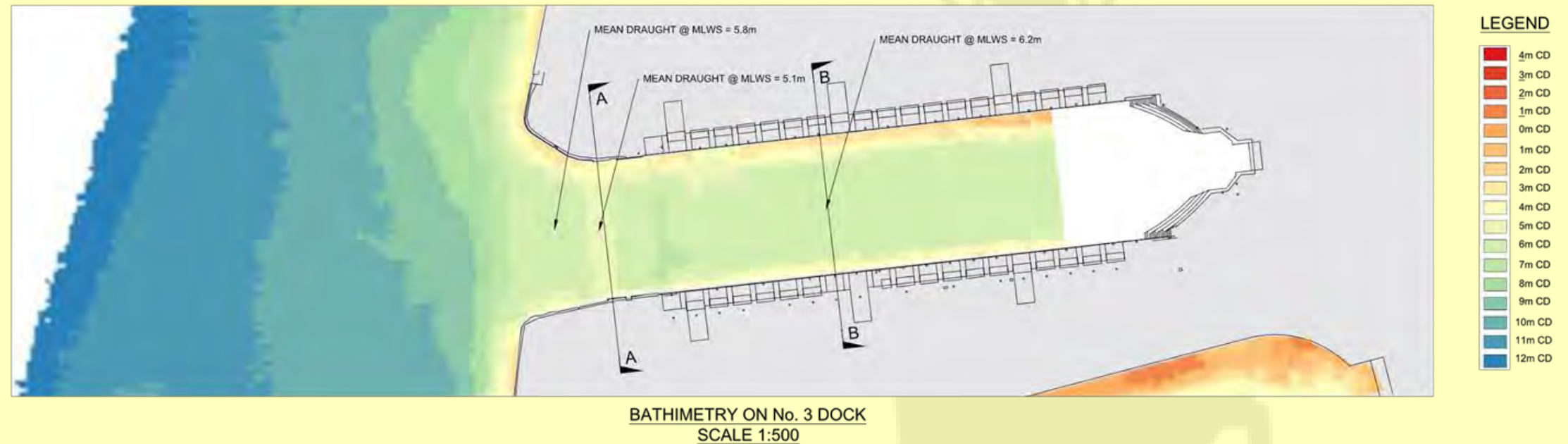


Dock 3 Siltation

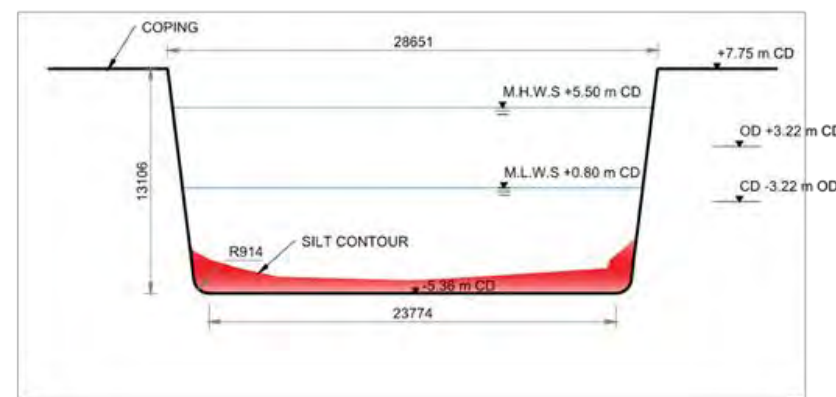
It is understood that the caisson for Dock 3 was removed around the same time as Dock 2 (in 2007) leaving it tidal for the last 8 years. While the dock is open to the sea, it is subject to continual deposition of silts that are brought in by the tide.

The image (top right) does not show the variation in depths as clearly as Dock 2 due to Dock 3 not having stepped sides. However, the image identifies that the sides of the dock are at a higher level. It also suggests that there appears to be slightly higher levels on the north side of the basin compared to the south.

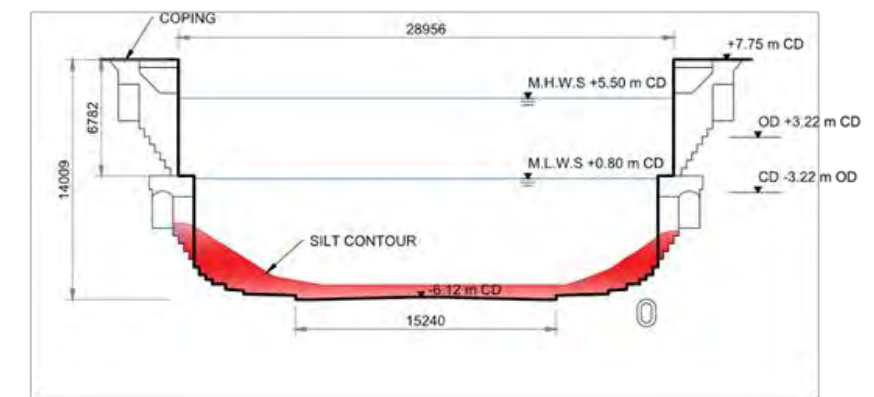
Sections A-A and B-B identify the amount of silt in comparison to the outline of the dock. These show that depth of silt is approximately 720mm suggesting a 90mm accretion rate per year.



BR's siltation imagery based on bathymetrical survey conducted by Shoreline Surveys LTD in 2014



SECTION A-A: ENTRANCE SECTION THROUGH No. 3 DOCK
SCALE 1:200



SECTION B-B: MID SECTION THROUGH No. 3 DOCK
SCALE 1:200

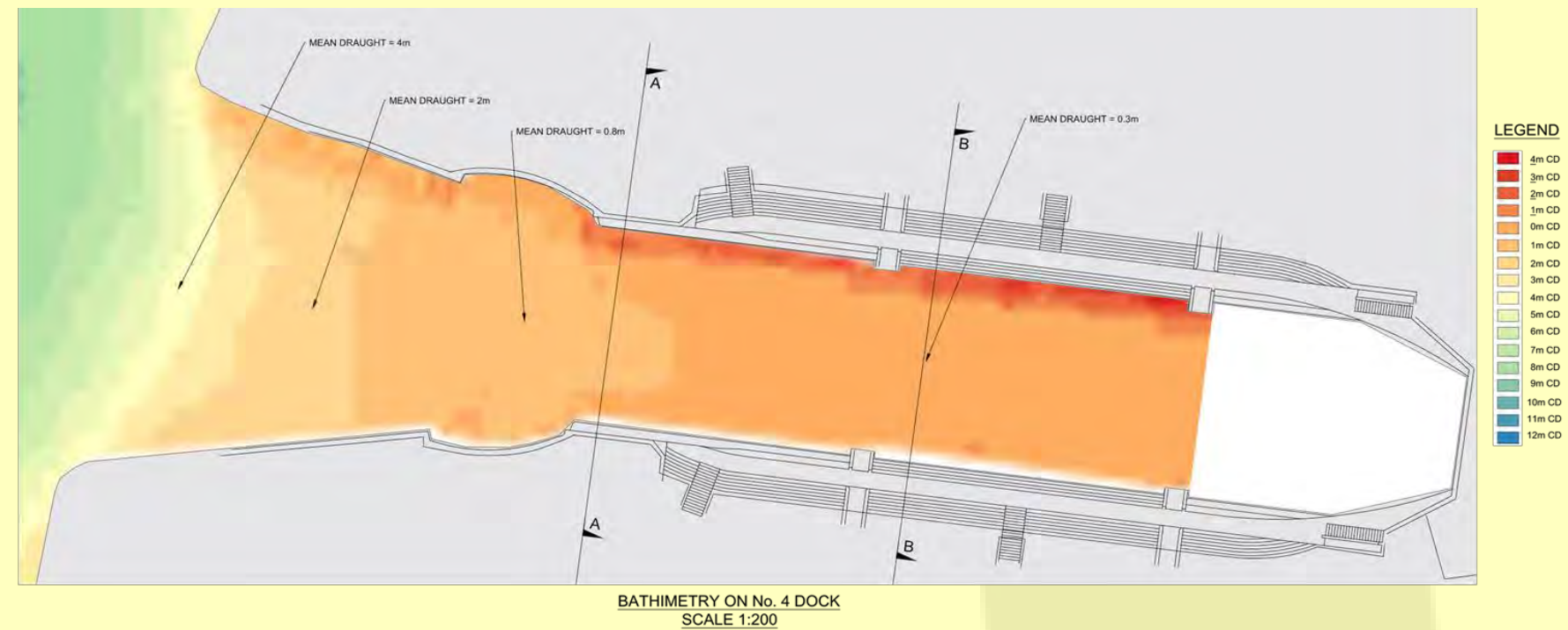
BR's sections developed from archive drawings



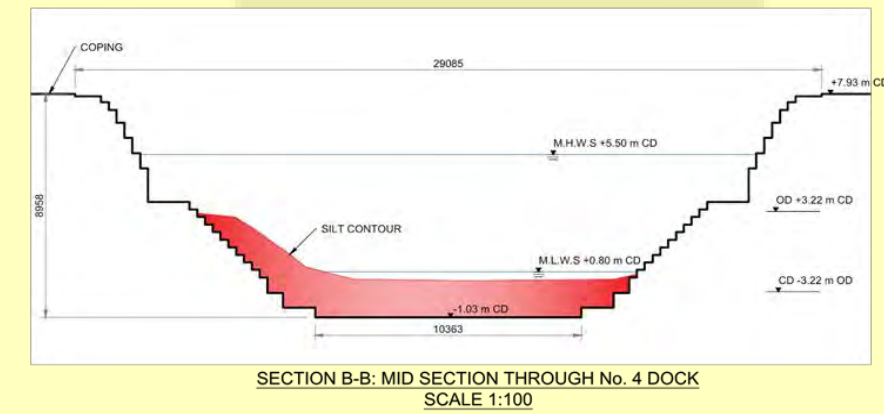
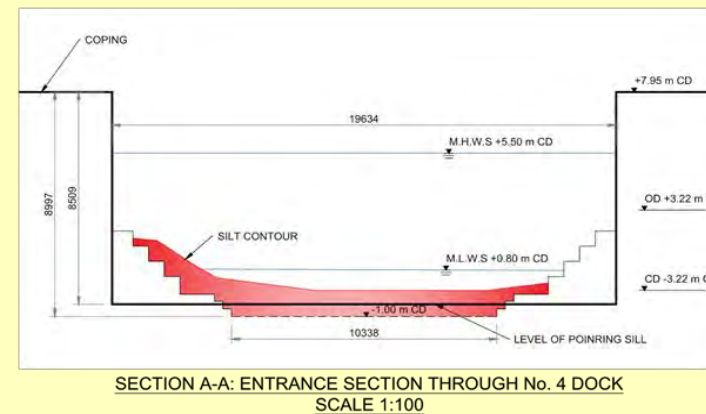
Dock 4 Siltation

It is understood that the mitre gates for Dock 4 were removed around mid 1990s leaving it tidal for the last 20 years. While the dock is open to the sea, it is subject to continual deposition of silts that are brought in by the tide.

Sections A-A and B-B identify the amount of silt in comparison to the outline of the dock. These show that depth of silt is approximately 1500mm suggesting a 75mm accretion rate per year. The results also show that silt appears to have accumulated on one side of the dock; however a photograph provided this year shows that the level of silt appears to be evenly spread. This may highlight some possible inaccuracies with the bathymetric data.



BR's siltation imagery based on bathymetrical survey conducted by Shoreline Surveys LTD in 2014



BR's sections developed from archive drawings

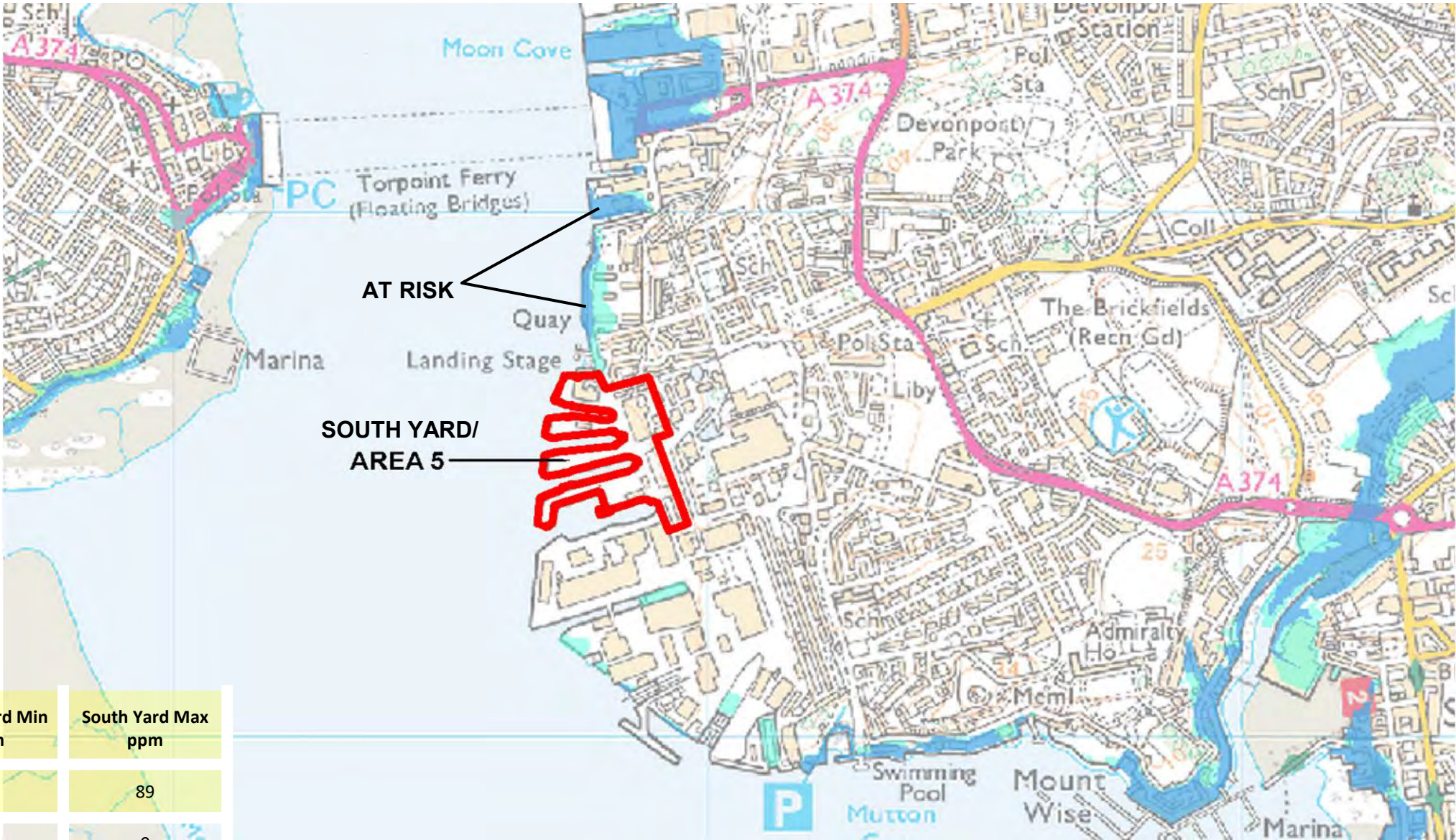


-- Level of silt suggested in the bathymetry survey

Photo of Dock 4 during low spring tide showing silt level
Source: PCC



Flood Risk and Contaminants



Environment Agency Flood Map for Planning (from Rivers and the Sea) NOT TO SCALE
Source: <http://maps.environment-agency.gov.uk/>

Flood Risk Assessment URS (2014): It is considered that flood risk does not represent a constraint to the granting of planning permission for the planning application.”

From the EA map (above) the South Yard area is outside of the flood risk zone which represent flood risk from a 1:200 and 1:1000 year event. Therefore, the development area is at very low risk of flooding.

South Yard contaminant levels (left) are taken from AECOM Dock Sediment Sampling and Analysis Report.

Contaminant Action Levels are between 1 and 2. CEFAS recommend further testing is carried out to determine suitability to dispose at sea. Although there is exceedance in some values, the Aecom report identifies that some results may be overly conservative, therefore displaying higher values than in reality. In addition, they suggest that the elevated levels may coincide with levels found in through natural sources rather than contamination. It is therefore thought that disposal at sea could be validated but would have to be reviewed on a case by case basis by the MMO. From the removal of silt in Docks 11 and 12 there was a small percentage of silt that was contaminant. As a result this was required to be disposed of at landfill which is considerable more expensive than disposing of at sea.

Action Levels taken from: <https://www.pla.co.uk/Environment/Cefas-Guideline-Action-Levels-for-the-Disposal-of-Dredged-Material>

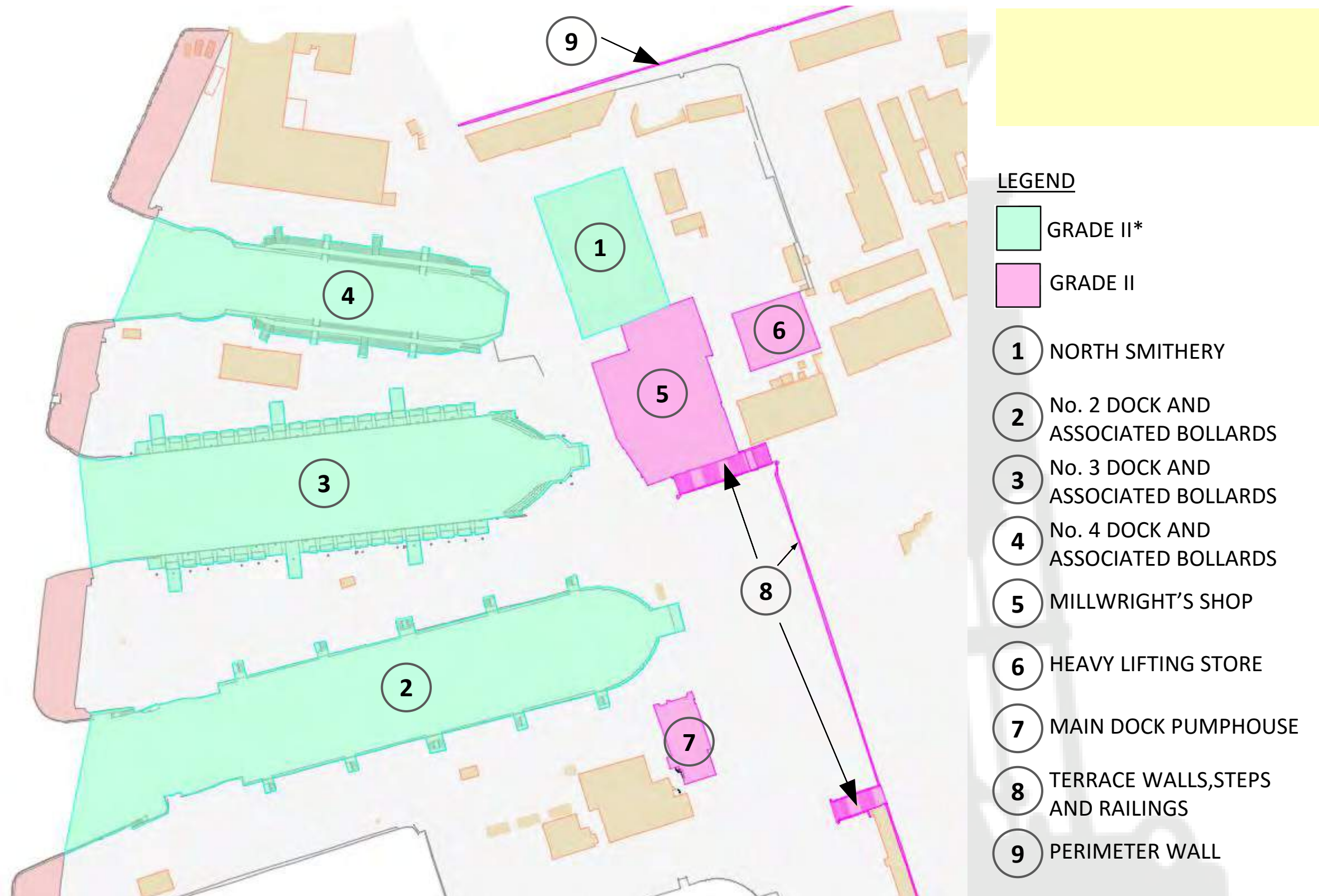
Contaminant/ Compound	Action Level 1 ppm	Action Level 2 ppm	South Yard Min ppm	South Yard Max ppm
Arsenic	20	100	23	89
Mercury	0.3	3	0	0
Cadmium	0.4	5	N/A	N/A
Chromium	40	400	10	47
Copper	40	400	45	220
Nickel	20	200	11	50
Lead	50	500	62	170
Zinc	130	800	110	320
Orgotins; TBT DBT MBT	0.1	1		
PCB's, sum of ICES 7	0.01	none		
PCB's, sum of 25 congeners	0.02	0.2		
*DDT	0.001			
*Dieldrin	0.005			



South Yard Listed Buildings

Due to the historical significance of the South Yard docks, the Government's Department for Culture, Media and Sport (DCMS) has allocated it a Grade II* listing. This designation is given to only 5.5% of all listed buildings and signifies that they are "particularly important buildings of more than special interest".

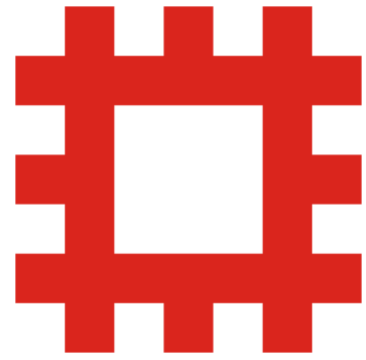
Other South Yard assets have been nominated to be Grade II listed (which represents 92% of all listings) as they are stated to be "of special interest" (Historicengland.org.uk).



Due to this listing the council is obliged to write to Historic England about their proposals and will require listed building consent prior to any works being undertaken. It is recommended that a pre-application is submitted to Historic England before further developments are made. The pre-application is free unless it involves significant input from Historic England (15 hours or more) which then a charge of £35/hr is applicable. Following our initial discussions with Historic England, it was evident that the high designation listing is due to the age and present condition of the docks rather than their architectural significance. However, Historic England were positive on the prospects for regeneration of the marine use of the docks. They have indicated that they would seek that any alteration or addition would need to show that it will provide a long term sustainable solution for the docks. Discussion with Historic England in regards to upgrading the listing from Grade II* to Grade I identified that this is a very unlikely occurrence. However, if a structure were to be upgraded the application to undertake works to the would not be considered differently to a Grade II* listing.



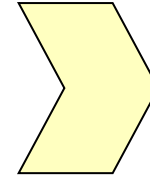
South Yard Listed Buildings



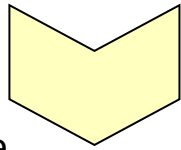
Several buildings and structures on the site are Listed.

North Smithery

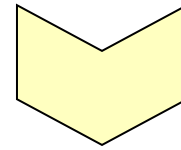
Grade II* Listed
Significance: Exceptional



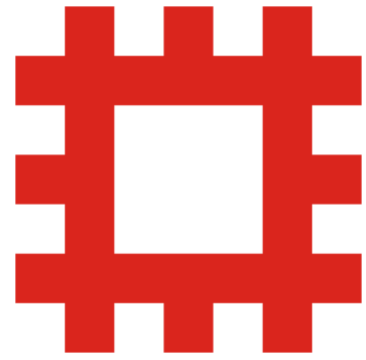
Millwright's Shop
Grade II Listed
Significance: Considerable



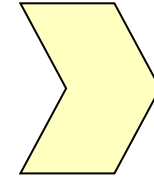
Terrace Wall and Steps
Grade II Listed.
Significance: Considerable



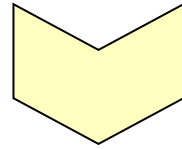
South Yard Listed Buildings



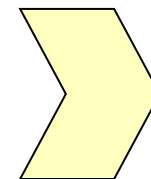
Heavy Lifting Store
Grade II Listed
Significance: Considerable



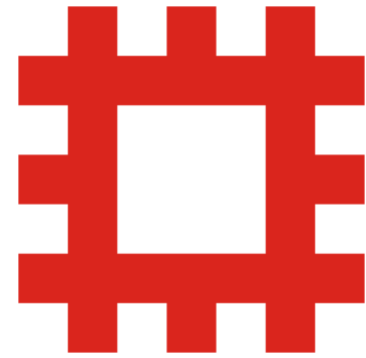
Perimeter Wall Enclosing North Corner of South Yard
Grade II Listed
Significance: Considerable



Main Dock Pump House
Grade II Listed
Significance: Considerable



South Yard Listed Buildings



Dock 2, Dock 3 and Dock 4 and associated bollards

Grade II* Listed

Significance: Exceptional

A number of VR (Victoria Regina) historic bollards were present and although some rust staining was present they appear to be in sound condition.



Source: URS "Heritage Baseline Assessment" Report (2014)



Further Studies Required

Additional visual and intrusive investigations could be undertaken to allow for a further assessment of the docks, jetties and quayside areas. Appropriate surveys would help to reduce development risk and increase the accuracy of cost estimates.



Priority items are highlighted in **RED**
All costs are initial estimates and are to be used as guidance only.

Docks

Further discussions with Cefas should be undertaken to establish if further sampling and testing are required to dispose of dredged material to sea. Cost of further tests £5,000.

A dive survey should be undertaken to determine the underwater condition of the docks. Cost £30,000 to £40,000 (based on a 4 day 5 man dive team).

Review of the feasibility of tidal gate/sill in docks - Site measurement and visual survey from a boat and additional item for divers to inspect. Cost £5,000.

For the construction of possible new gates, a detailed measurement survey will be required of the docks' entrances. This could be undertaken using 3D digital techniques such as Lidar and side scan sonars. Cost of the 3D analysis £20,000-£30,000 (for all docks).

Although the docks have been in use in recent times if dredging, to accommodate deep draughted vessel, around the jetty heads a UXO survey may be required. Cost £10,000.

Services

Review condition of culverts, flooding main and penstocks via ROV. Cost £10,000-£15,000 (cost for all docks).

Testing of electrical and pump equipment within the pumping station. Together with the survey of the culverts this will determine the feasibility of refurbishing the pumping station. Cost £5,000. Testing of electrical services in and around the dock area. Cost £2,000.*

Jetties

Jetty 3 is in a very poor condition, a decision is required whether to demolish or re-build the entire structure. As quayside and berthing space is a valuable commodity to any working dock area, it is anticipated that this will be re-built. To establish design parameters, boreholes should be undertaken. Cost £20,000 - £50,000 assuming 3 boreholes driven through concrete deck, rather than using marine plant.

Jetty 4 & 5 require further investigation to establish their current and potential future capacity. A study into the future jetty loadings should be undertaken which can be provided following the chosen marine industry utilisation and loadings. The capacity check for the piles can be based on the thickness readings recorded by URS in their maritime inspection Report in Appendix C. To aid with the calculations a reinforcement cover meter should be used to establish the reinforcement in the jetty suspended slab and compare this with the drawings available. Concrete cores should also be undertaken to evaluate the deterioration of the concrete and assess whether remedial works are required. Cover meter and core works and testing cost £10,000 (based on 10 cores and scanning area of 100m2).

Quayside Areas

Establish the capacity of the quayside areas. Further concrete cores should be undertaken to allow for assessment of concrete deterioration and depth of concrete slab. Use of non dynamic testing to determine any voids in the subbase material either by use of Ground Penetration Radar (GPR) or Surface Wave Ground Stiffness (SWGS) technics. Cores and non dynamic testing cost £50,000 -£60,000 (based on 20 cores and 10,000m2 deck area)

* It is understood that an existing study is underway for the overall assessment of the existing and proposed services and therefore has been excluded from this list.





POTENTIAL USERS

This section discusses the various potential users who might be interested in being part of this regeneration scheme for Area 5.

Potential users could include the following industries:

- Ship repair/Shipbuilding
- Research and Technology
- Testing
- Training
- Fishing
- Cargo
- Windfarm (maintenance)
- Marine contractors

BR recognises that Area 5 does have some restrictions on its attractiveness to large industries, this is due to a number of reasons:

- Restricted Site Access
- Limited Available dock and quayside space
- Competition from other port facilities
- MoD restrictions

There is an opportunity for other small enterprises to support the potential users highlighted above, who could utilise the office space provided in the numerous buildings around the site.

A number of companies were contacted to understand how they might use the dock and whether the areas could accommodate each of the company's operations. This information has been interpreted and added to our own experience of the requirements for various potential marine industries.

The focus has been to ensure that any of these business sectors would have a marine interest, and their operations would involve the working use of the docks whether this would be as a dry, wet or open dock.

From BR's initial enquiries four main industry sectors were seen viable, these were shipbuilding & repair, services & marine contractors, research & technology and fishing support.



Shipbuilding & Repairs



Historically, South Yard's dry docks were used initially for shipbuilding but were principally for ship repair. Suitable for the construction of naval vessels, they are narrow compared with modern dry docks for large ships.

There is still considerable demand today for shipbuilding and repair facilities, it seems that South Yard still has a role to play in providing these, albeit with modern facilities that would be significantly different from the original. Many locally based vessels are taken a long way for repairs and refitting, for example to shipyards in mainland Europe.



Proposals for use of a new, regenerated South Yard range from taking just quayside/warehouse facilities to using an entire basin to build boats for the fishing industry. Local and non-local companies have displayed an interest. Industry specific propositions range from traditional boat building, mini-sub manufacturing and yacht building and repair services, to the manufacturing and fitting of new on ship parts and technologies.

This translates as a need for long term, secure, waterside facilities for berthing both larger and medium sized vessels with the provision of uninterrupted, significant lengths of quayside access (up to 160m) to deep water, with adaptable cranage. An important requirement is waterfront access that is available all year round and modern warehouse / open space in the near vicinity with appropriate welfare facilities.



Some form of dry docking facility would be crucial to the success of these activities. This could be achieved by the reinstallation of the dock gates or the provision of a lift out arrangement for smaller vessels. The concept of having a floating dry dock system for refitting similar to that already in use elsewhere was proposed by one company as a modern, more flexible system for the refitting and refurbishment of boats. However, the dimensions of the docks are not particularly well suited for this.

Summary - the provision of modern, adaptable, well serviced, deep water quayside facilities and dry dock(s) are needed to secure the interest of prospective shipbuilding and repair companies. Any or all of the docks at South Yard could be utilised for ship building and repair activities in some form or another.



Service & Contractors



Marine servicing and contracting has been established in Devonport for many years, and South Yard has the potential to allow for the consolidation of this industry in the area to provide future economic growth and job opportunities.

Specialist marine service and work boat suppliers were amongst those expressing interest, with most looking for space to expand operations or start new branches to get closer to larger companies that would use their services. Also, the facilities offered would be better than their own.



Direct access to the sea was a fundamental requirement and relatively deep berths with workshop access and possibly office space were considered important. Vessels ranged from landing craft, barges, tugs and survey vessels from 30m to a maximum of 100m and berthing for these small to medium sized working craft with shallow keels were the general requirements, some with unusually wide beams.

Covered workspace/workshop areas close the waterside with office and welfare facilities were considered important, with a particular concern that small marine enterprise business didn't clog up quay space as unlimited access to the quayside was a high priority as was the use of a dry dock facility. The use of cranes to lift heavy equipment out of work craft was mentioned and mobile crawler cranes suggested.

Summary – Good, active quayside workspaces with unlimited access to the water and good support facilities with the potential for expansion are needed to attract marine services and contractors to South Yard.

The vertically faced Dock 3 would be the most suitable area for these activities rather than the stepped side docks that would need adapting to enable safe berthing.



Technology, Research, Development & Training



There is a considerable potential in this sector, particularly from small and medium sized companies, as shown in a number of proposals that required space for expansion due to new product development/testing requirements with the need for easy access to open water. There is resonance with Plymouth University's Smart Sound approach in this sector, and there is a discernible interest from blue economy companies.



Proposals ranged from marine occupational and rescue training to scientific instrument manufacturing and drone marine vessel testing. Easy access to open water was cited as the most important criterion, but only limited quayside length was needed (from enough to board a vessel to 30m) as proposed vessel usage was limited to small motor boats, catamarans, barges and small water craft.

There was an identifiable need for project specific access as well as all year round, with small workshop and office facilities as well as warehouse storage the most sought after facilities. Several companies were interested in sharing facilities if their practical needs deemed it appropriate.

Summary – the development of technologies and research area within Area 5 of South Yard has significant support and interest from within the industry. The provision of modern, flexible, small and medium sized units with good access to open water for testing is required along with good quayside access.

These activities would be well suited to the area around Dock 4, with a focus on the use of maintained water in the dock and tidal access to the open sea, enabled by the construction of a new gate. Jetty 5 could be used by vessels requiring all tide berthing and access, and building SO15 and surrounding open areas, particularly to the north of Dock 4 could be used for offices, workshops and support activities.



Cargo Handling



Cargo handling in Plymouth includes Millbay Docks as well as Cattedown and Victoria Wharves. For example, ABP operate the 46 acre Millbay Docks facility, which includes:

- RoRo berthing for vessels up to 12,000DWT with a capacity of up to 180 tonne vehicles across the linkspan ramp.
- Alongside berthing for General Cargo vessels up to 5,000DWT and 12,000DWT at anchor.
- Storage 5,000sq.m covered & 34,000sq.m open (vehicles/goods).

Annually handles up to 2mt freight, 200,000 cars and 600,000 passengers.



As an ex Ministry of Defence location, South Yard was not conceived for commercial cargo handling activities and the stepped docks would not be well suited for this activity. A small amount of cargo handling could be accommodated in the vertically sided Dock 3 and on the jetties, although the limited available land space would be a disadvantage.

Consideration would also have to be given to improving road access if significant amounts of cargo were to be brought in or out of the port. In any case, the development of the South Yard as another cargo handling site in Plymouth harbour would not necessarily enhance the current commercial cargo handling industry in the area.

South Yard is a historic site and the 3 docks in Area 5 are all listed as are many of the structures and buildings. This would make adaptation of the site for safe installation and use of modern cargo handling equipment somewhat of a challenge and perhaps even impossible.

There seems to be limited interest in South Yard from the cargo handling industry, therefore a conclusion can be drawn that developing the area with additional cargo handling facilities would not necessarily enhance Plymouth City Council's vision to provide the area with new and modern maritime credentials to create skilled, sustainable employment. It is, however, expected that some amounts of cargo will be handled on an occasional basis as a small part of other activities.



Fishing Support



Plymouth is one of the top three ports in England for landing fish and yet it does not have enough modern, dedicated berthing facilities. Currently, fishing vessels discharge their catches at various jetties that are often used for other forms of cargo handling.

This can make planning difficult, particularly for larger fishing vessels that might spend up to 9 days at sea and then remain in port for up to 5 days. Smaller trawlers fish and land their catch on a daily basis.



Because facilities for fishing vessels in Plymouth are restricted, the provision of additional new berths and associated facilities would provide an opportunity for expansion of the fleet. Other nearby berths could also be used for small cargo or reefer vessels to import/export fish between the other UK and possibly overseas ports. The presence of ship repair yards in the near vicinity would be an added attraction.

Specific requirements cited included all tide access to alongside berths for large fishing vessels, approximately 55m length, 12m beam and up to 7m draught as well as all tide access to alongside berths for smaller fishing vessels, approximately 23m length, 8m beam and 6m draught. Also, berth provision for 1,300 DWT reefer vessels, approximately 63m length, 13m beam and 8m draught would be required as well as workspace buildings including a cold store of say 1,000m².



Upcoming legislation relating to vessel flagging and catch landing has the potential to increase fish landings in the UK. It has been suggested that one of the docks in South Yard could form the basis of a 'Pelagic Hub' for freezer trawlers, with clean boxes of frozen fish landed for onward export. But this might require some external road improvements regarding HGV access and egress through what is essentially a residential area.

Summary – Large scale provision of modern, dedicated berthing facilities for the fishing industry potentially has a role in the development of South Yard. There is pent up demand for such facilities, and addressing these could support and secure the industry's economic and employment status in the Plymouth area. These activities would be best suited to the vertically faced Dock 3 and the jetties, rather than the stepped sided docks that would require adaptation to enable safe berthing.

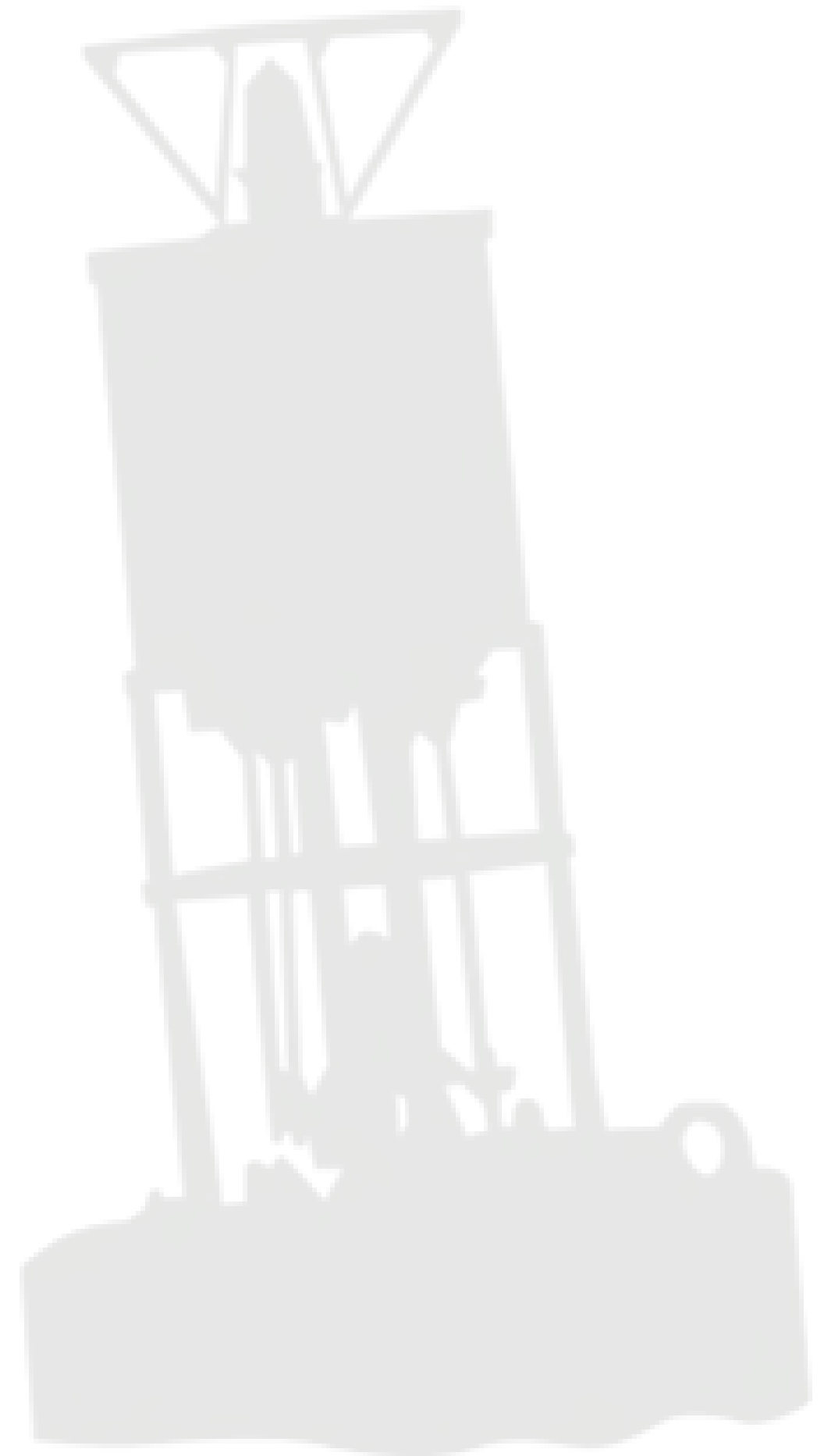


MARINE REGULATIONS

Marine proposals require a number of additional consents and licences due to their sensitivity to the environment. In addition to this further regulations will be placed on the proposal due to the presence of the MoD either side of the South Yard area.

This section discusses the main marine authorities at a high level to review the regulations applicable to the scheme.

It is recommended that further discussions are held with the each of the authorities including the MoD to validate the proposals to progress further with the designs.



Plymouth Order 1999 & 2005



MoD & QHM RELEVANT COMPULSORY REQUIREMENTS

Mandatory Requirement

Notification of arrivals and departures.

Forbidden navigation in the vicinity of MoD/QHM's areas.

Testing/discharging of firearms, weapons or explosives is not allowed in the limits of the Dockyard Port.

Navigation, anchorage and mooring restrictions in the vicinity of MoD/QHM's jetties, dolphins, vessels or any other property of MoD/QHM.

Swimming underwater and diving is not allowed within the Harbour or in the vicinity of MoD/QHM's walls, slipways, etc, in the vicinity of Her Majesty's Vessels or where anchorage is prohibited.

To give notice and Certificate of Fitness it is necessary in case of vessels which be carrying hazardous or dangerous cargo.

The master of every vessel towing another vessel within the Dockyard port, shall give prior notice to the Queen's Harbour Master not less than 60 minutes prior to commencement of the tow.

Vessels with mechanical, equipment or structural defects do not have allowed navigation within the Dockyard Port except with the permission of the QHM.

VHF radiotelephony equipment is necessary for vessels over 20m length and small boats engaged in any type of commercial activity.

Vessels over 20m length are subjected to movement control.

Speed restrictions in the water of Dockyard Port.

Temporary restrictions on movements within the Dockyard Port by QHM when necessary.

Mandatory Requirement Impact on Potential Users

Possible impact on flexibility, particular with fishing sector.

No significant impact.

Not anticipated to be an issue.

No significant impact, possible control procedures for vessels moored outside of docks.

No impact.

Possible requirement to have ad hoc inspections of vessels, possible hazardous substance with technology sector.

No significant impact.

Clarification required for ship repairs industry. Possible procedures required to ensure safe navigation into dock.

No significant impact.

Potential impact particularly in regards to flexibility for fishing fleets.

No significant impact.

No significant impact.



Warships in Harbour



Initial Scheme Design Approval between Plymouth County Council and MoD

A preliminary agreement has been made between PCC and the MoD in regards to the Warships in Harbour (WIH) regulations. The WIH regulations and procedures ensures that risks associated with warships carrying explosives within their stowage areas in the local vicinity are As Low As Reasonably Practicable (ALARP).

The agreement contains the details of the proposed buildings including the floorspace area and a number of potential jobs. Car park spaces are also identified in this initial agreement. The table below outline the agreed figures.

Area 5	Floorspace (sqm)	Potential Jobs
Existing Buildings	8,700	337
Proposed Buildings	6,920	214
Totals	15,620	551

Current agreement of floor space and potential jobs
Source: Approved Initial Development Scheme Assumptions document provided by PCC

If advances within the new proposal cause deviations from the initial agreement then approval may be required from the MoD. Such approvals should be sought if there are certain changes to agreed populations or building use. If the area is within the 168m Safeguarding Arc illustrated within the agreement (and shown opposite) then stricter regulations will be inhibited. This area includes a large proportion of dock 2 and the seaward end of dock 3.

Potential Operational Impact

The proposed scheme incorporates a number of additional buildings which should provide a sustainable future for Area 5. The number of employees listed in the agreement also appears to relate to the potential employment rate rather than the actual employment, which should offer some expansion. Both the floorspace and the potential jobs are for the docks being used in the marine commercial sense rather than residential or retail sector, whereby building areas and employment would be far greater than stated.

The WIH does to some extent restrict the growth to the dock area, however it is believed it should not impact the operational business perspective.



WIH area for South Yard
Source: Plan 10 - City Deal Approved Development and Populations Densities (WIH)

Key:

168m Safeguarding Arc

Statutory Authorities



Marine Management Organisation (MMO) - A marine license will be required from the MMO to undertake any construction, alteration or improvement works in or over the sea and/or on or under the sea bed.

It would be advised that a pre-consultation process is sought with the MMO for the planned works. This will include a screening study that will allow the project to review what studies are required. Studies may include an EIA, archeological, hydrodynamic, ecology study, etc. A marine licence is applied for through the MMO's online system and once a licence has been submitted a case office will be designated to the project. MMO target to turn around licences within 13 weeks, though there is no statutory timeframe and, therefore, depending on the workload of the MMO and the complexity of the project this may take significantly longer.

Fees - the MMO charge different fees dependent on the total cost of the project or the total volume of dredged material. If the project cost is greater than £1,000,000 the MMO will not define the cost incurred but instead state that the process will be based on a time charge basis. For dredging with disposal at sea applicable MMO charge £2,700 for between 5,000m³ and 19,000m³ of material.

Environment Agency (EA) - Works on, over, under or near a main river, flood or sea defence will require a Flood Defence Consent (FDC). This will involve an application submission that will detail the works involved including drawings, method statements, risk assessments and demonstrate the effects on the environment. A Water Framework Directive may also be required. The FDC application is considered for a period of 8 weeks (this is a statutory time frame for the EA to respond). The application cost is £50.

Queen's Harbour Master (QHM) - QHM is in statutory control of the Dockyard Port in Plymouth. Permission from QHM will need to be sought. It is advised that early discussions are held with QHM to further understand their requirements. For dredging activities, QHM requires a 'Baseline Document' to be created to highlight details of the dredging activity and examine sensitive areas in the local vicinity.

MMO's Fees for Dredging

Band	Amount of disposed material (cubic metres)	Fee
2a	0 to 499	£450 paid in full in advance
2b	500 to 1,999	£700 paid in full in advance
2c	2,000 to 4,999	£1,400 (maximum) invoiced in arrears
2d	5,000 to 19,999	£2,200 (maximum) invoiced in arrears
2e	20,000 to 99,999	£2,700 (maximum) invoiced in arrears
3	100,000 and over	Hourly rate: MMO staff £94, Cefas staff £86

MMO Fees

Source: <https://www.gov.uk/government/publications/marine-licensing-fees/marine-licensing-fees>





Potential MoD Restrictions*

Shipbuilding & Repairs

Potential Restrictions	Potential Impacts
Restrictions in navigation by i.Size of vessels to be repaired. ii.Necessity of towing vessels with defects.	A number of vessels may not be seaworthy and may need assistance. This may require an agreement between the MoD and the operators on the methodology to navigate vessels in and out of the docks.
Conflicts in the use of the water adjacent to Jetty 2 (i.e. navigating or mooring incompatibilities).	To ensure that Jetty 2 is not inhibited the operator should consider movements when changing vessels or when operating caisson.
Accidental leakage of hazardous or pollutant substances (i.e. oils, fuel, etc).	Due to the nature of ship repair, substance leakage is common. As there may be tight restrictions on waste a containment solution may be best adopted.
Restrictions by nationality of vessels to be repaired.	Restrictions on nationalities is unlikely to have a great impact on the operators as this is likely to be focused on the local market.
Restrictions of use in the quayside between Dock 1 and Dock 2. Daily activities could be considered as a potential hazard.	The operator will have to accept that all works are to be contained in their designated area.
MoD transit roadways and replace/repair services with notice (immediate in emergency).	Unlikely to be a common occurrence for MoD to take full control. But operators should be aware.

Services & Contractors

Potential Restrictions	Potential Impacts
1. Restrictions in navigation owing to the size of vessels.	1. Vessel size restriction may limit interest. The MoD's requirements on vessel size and control will need to be fully understood, as this could impact the growth of a company.
1. Restrictions by nationality of vessels.	1. Some marine plant is manufactured and purchased overseas, but as these will be new plant, it is not anticipated that it will cause concern to the MoD.

*For further information see Lease agreement between 'The Secretary of State for Defence and The Council of the City of Plymouth' 2015 for Premises at H M Naval Base Plymouth (Area 5)



Potential MoD Restrictions

Technology, Research, Development & Training

Potential Restrictions	Potential Impact
Potential restrictions on use in respect of <ul style="list-style-type: none">a. Explosives and specially hazardous, combustible, inflammable or dangerous articles, materials or liquids.b. Radio, radar or sonar transmission.c. External radio or TV aerials or ancillary supports or wiring.d. Interference with MoD telecommunication systems, radio reception or transmission, or computer systems.	Restrictions on technical devices could considerable impact this sector. The MoD's requirements should be fully understood. However, as the technology dock is the furthest away this may reduce the restrictions that may be imposed. It is unlikely that this sector would be involved in producing/testing arms, therefore this would have little impact. Due to a possible changing number of users and lack of experience there may be a potential of not following the correct procedures.
Cargo restrictions.	This sector may require the shipment of unusual items, the protocol that may be developed may slow down the general delivery items.
Restrictions on number of companies.	The opportunity in this sector could be to a continuing turnover of companies to use the dock. This may be restricted by the MoD.
Restrictions by nationality of vessels.	Testing items are likely to be made in the UK and to be of small scale.

Fishing Support

Potential Restrictions	Potential Impact
Dumping of rubbish.	Fishing business tend to have significant waste, the operator will have to ensure a waste control system is in place.
Restrictions in navigation owing to size of vessels.	The size of vessels are unlikely to concern the MoD.
Restrictions by nationality of vessels.	It is unlikely that there will be an overseas operator in this dock.
Potential restrictions on the use of radio, radar or sonar transmissions are not allowed under the Crown Period unless they are fully in accordance with the procedures set by the Landlord or commander.	It is likely to be a single operator and therefore will be able to familiarise themselves with the communication procedure outlined by the MoD.



CONCEPTS

This section focuses on evaluating each dock and discussing options to refurbish them to a working standard in various forms.

The concepts are driven by the requirements of potential generic operating companies and seeks to find the optimum solutions that will ensure an effective working area best suited for the types of work envisaged.

Each dock is evaluated regarding its physical form, most suited vessel types and their mode of use (wet dock, dry dock, etc.). This then is used to discuss the relevant development options for each dock.

The below table identifies the available water depths in each dock based on archive drawings made available by PCC.



Dock	Tide Level	Depth of water to highest Keel block	Depth of water to lowest keel block	Depth of water to base (at highest point of dock)	Depth of water to sill (entrance)
Dock 4	MHWS (+5.50mCD)	4.79m	5.30m	6.01m	6.01m
	MLWS (+0.80mCD)	0.09m	0.6m	1.31m	1.31m
Dock 3	MHWS (+5.50mCD)	10.00m	10.30m	11.77m	10.86m
	MLWS (+0.80mCD)	5.30m	5.60m	7.07m	6.16m
Dock 2	MHWS (+5.50mCD)	8.38m	8.99m	9.90m	9.97m
	MLWS (+0.80mCD)	3.68m	4.29m	5.20m	5.27m



Repair Works and Techniques

Damaged Blockwork: Damage was nominally noted around the entrance to the dock, none of which appeared of structural concern. Recommend to monitor deterioration.



Marine Growth: Removal of marine growth is an ongoing maintenance issue particularly in Dock 4. Cost to remove approx £5,000.

Water Seepage: To repair areas where water seepage is recorded through the mortar, a quick setting water proof product such as Vandex Plug could be applied. To reduce the amount of water through the blockwork a waterproof sealant can be brushed on to the exposed blockwork faces. Cost approx £5,000-£10,000.



Levelling Quayside areas: Quay surfaces have rutted in places and are generally uneven. Cost to remediate unevenness £400,000 - £500,000 (for quays on approach to Jetty 2 and 3)

Replacing Handrailing: Replace handrailing around jetties with new 1m high railings with mixture of chains and bar railings. Evaluate handrailing around docks. Cost £150/m total approx £20,000.

Rusty Bollards: Clean and repaint. Cost £500.

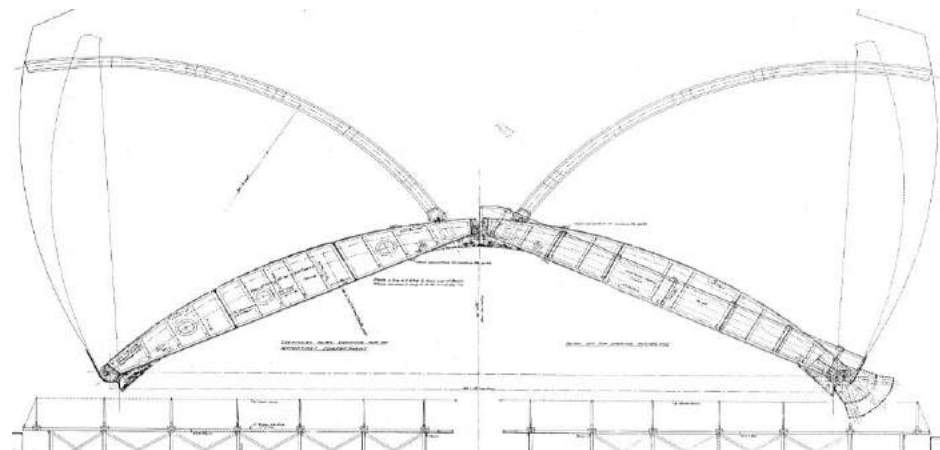
Damaged and Insufficient Marine Safety Equipment: Replace ladders, buoys and safety chains. Cost £10,000-£20,000.

Pumphouse, Penstocks and Culverts: Refurbish pump house and penstocks (plant and machinery only). Cost £500,000. (assuming culverts are not blocked with silt).

All costs are initial estimates and are to be used as guidance only. Further detailed cost estimates can be seen on the Cost Estimates on page 67.



Gate Concepts

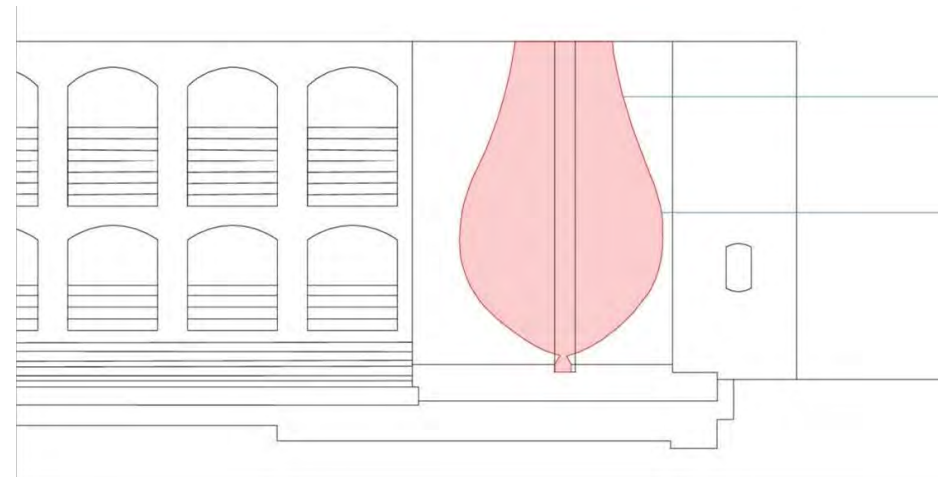


Dock 4 Mitre Gate
Source: Archive drawing provided by PCC

MITRE GATES



Source: <http://www.geograph.org.uk>



SHIP CAISSON GATES



Source: <https://historicengland.org.uk>

Caisson gates were previously adopted for Dock 2 and Dock 3. Caissons are also referred to as floating gates, they are predominantly of steel construction and are either rectangular or ship like shaped (as referred to in this instance). They provide a full closure gate for all states of the tide and can be used for either a wet or dry dock. The advantage over the other types of gates is that it does not restrict the width of the dock when a vessel enters. One disadvantage is that the operation is more time consuming and requires more resources. It can take considerably longer for vessel rotation. Estimated cost for a caisson in Dock 2 is £2.3 million.



Source: www.plymouthfisheries.co.uk

RADIAL SECTOR GATES



Source: <http://travellinginnodirection.blogspot.co.uk>

A pair of mitre gate was adopted for Dock 4 until it was scrapped in the 1990s. The gate is formed of two steel gate leaves that open and close in a controlled manner via hydraulic rams. The direction of the mitre depends on the side of the retained water. Dock 4 previously was a dry dock, and ,therefore, the point to the mitre was directed to the sea. However, it is thought that Dock 4 may be more effective now as a wet dock, so the direction of the gates would have to be reversed. The advantage of this type of gate is that the time of operation is relatively quick. However, a disadvantage is that it takes up some width and also if the gate direction has to be changed a number of alterations to the dock would be required, such as the positioning of the quoin blocks and pintles. Mitre gates cannot support a reverse head, i.e. they would be liable to open if the water level becomes higher on the inner side of the mitre. Estimated cost for new mitre gates in Dock 2 is £3 million.

Radial sector gates open and close by rotation that is controlled through a hydraulic mechanism. The gate does not rely on the force of water and, therefore, can withstand a reversal in water head, unlike a mitre gate. They are quick to operate and use considerably less energy than the mitre gates, but are expensive to construct and in this case will require a frame that will limit the width of the access channel into the dock.

Estimated cost for new radial sector gates in Dock 2 is £3-3.5 million (including frame).

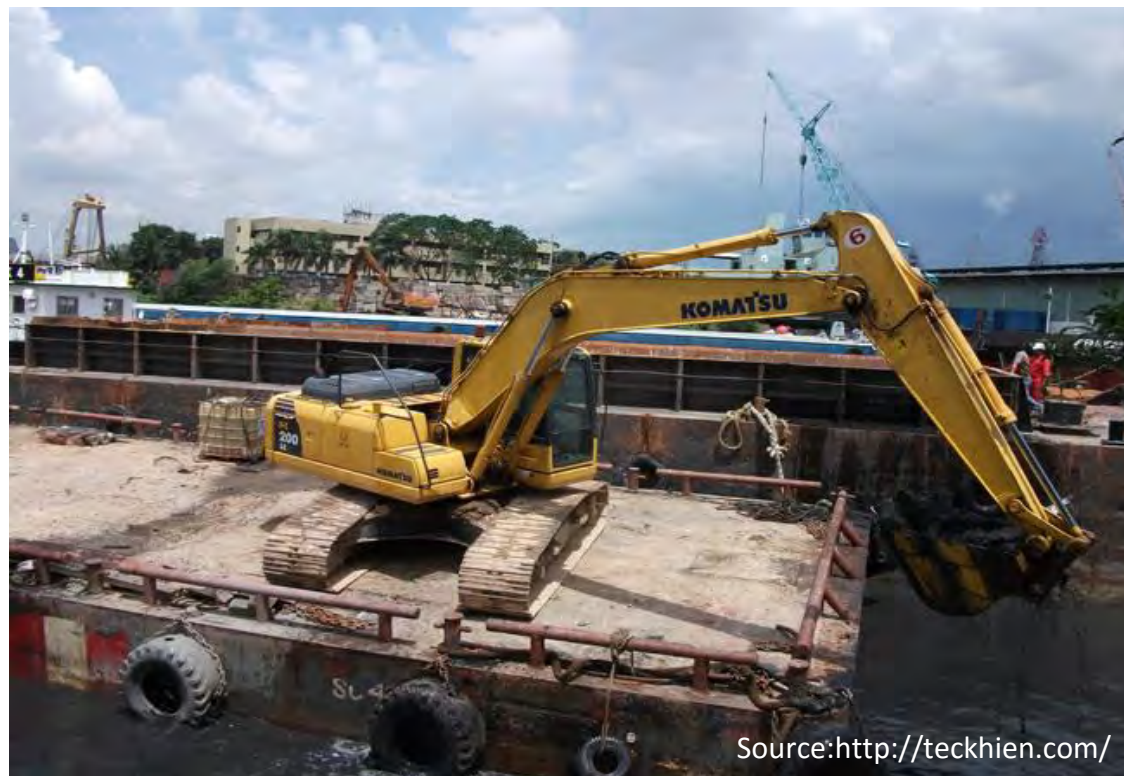
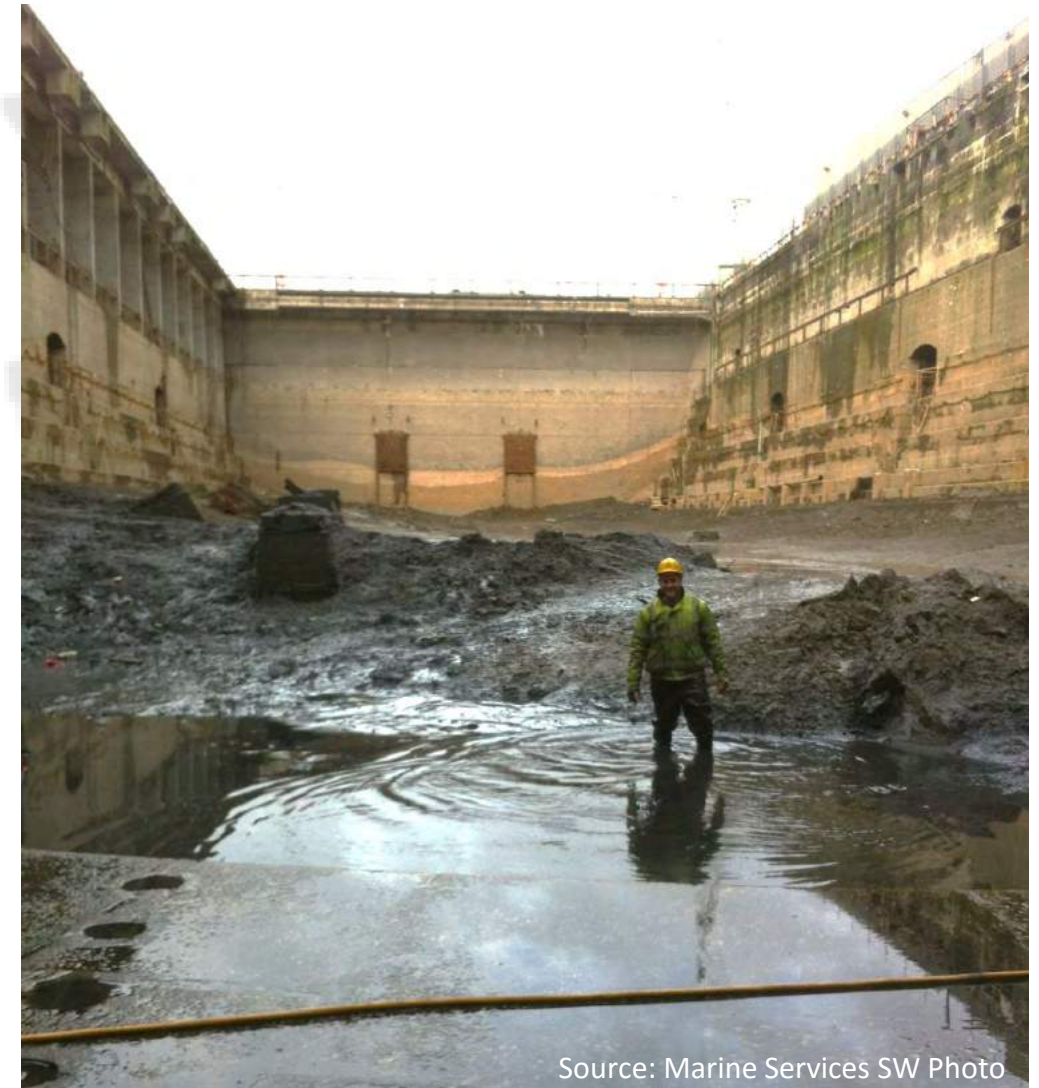


Dredging

Silt deposits within the docks will be required to be cleared through the process of dredging. There are a number of techniques to achieve this process and the chosen technique will be dependent on the quantity and contamination of the silt.

It has been advised from Marine Services (SW) Ltd (contractors who recently dredged north yard) that, due to environmental concerns, new regulations have been put in place to limit dredge arisings in and around the Plymouth area including the Rame Head. Alternative disposal sites are now required which include as far away as Falmouth and Portsmouth.

If the material is contaminated then a suitable disposal site must be sought, probably on-shore. It is understood that some contaminated material in the North Yard was transported to Swindon to be disposed of (see photo to the right).



The dredging methodology for these dockyards would have to ensure that there is minimal sediment disturbance into the water column. It is envisaged that the operation would involve a barge with a backhoe excavator (see photo to left) which would lift the silt over the dock to a hopper barge moored at the entrance to the dock. The hopper then would then be manoeuvred to a suitable disposal site via tug boats.

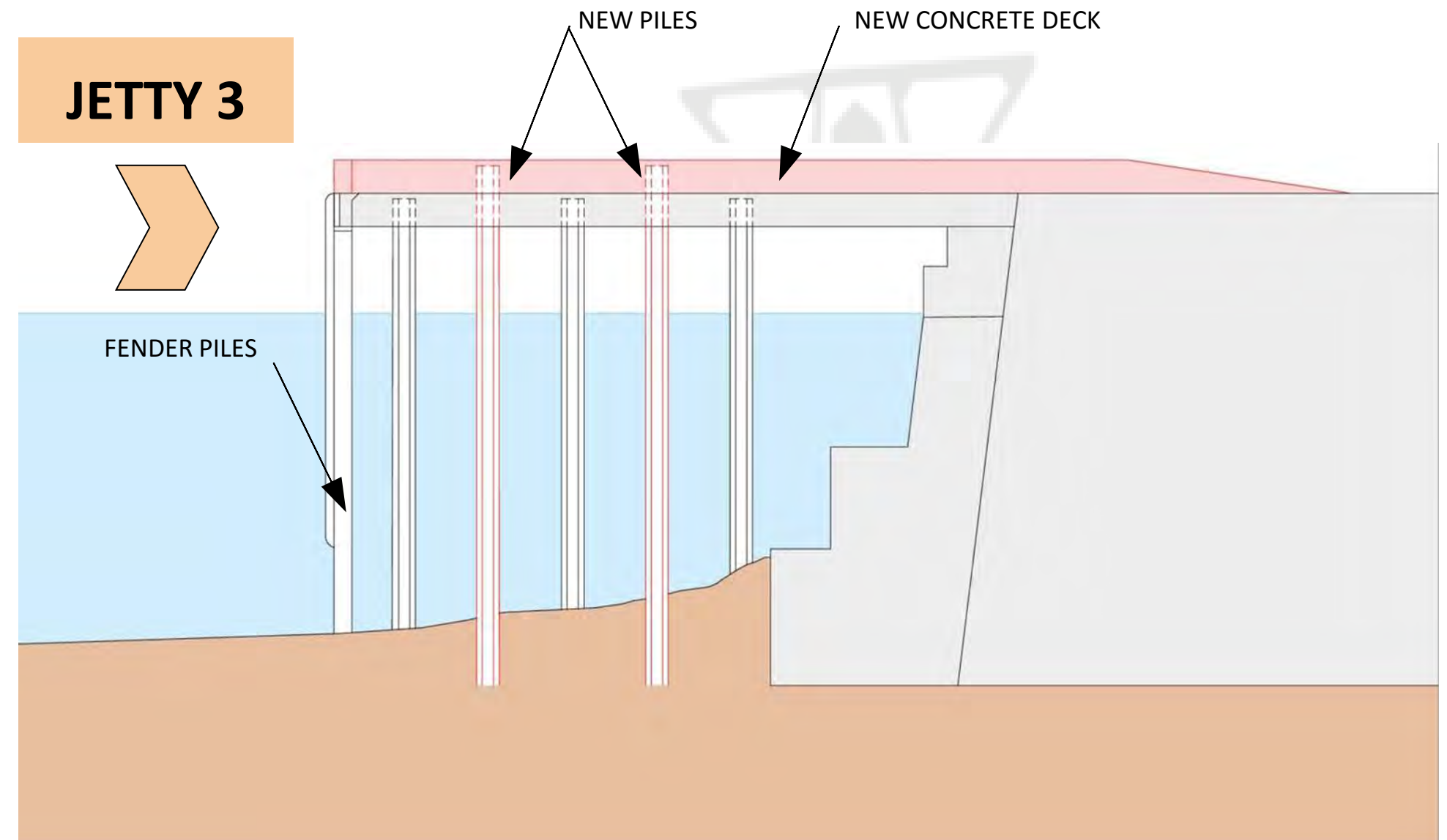
Cost Estimate for undertaking dredging works for all three docks would be approx £1 Million. (Dock 2 £330k, Dock 3 £390k and Dock 4 £280k assuming all work carried out on same mobilisation.



Concepts for Jetties

Owing to its poor condition, Jetty 3 it is unlikely to be suitable for future. For the redevelopment of Jetty 3, a solution may be in the form of a new concrete deck supported by new steel piles. The old fender piles will also need to be replaced. This procedure could be more cost and time effective in comparison with refurbishment or integrating new piles into the existing deck (due to the number of piles).

A high level cost estimate for such works would be in the order of £1.5 -£2 million.



JETTIES 4 & 5

Jetties 4 & 5 are in a fair condition, with some steel thickness loss in the piles and small areas of spalling in the concrete suspended slab. Depending on the required loading, it is likely that only minor works to the piles will be required.

To prevent from further corrosion piles could be repaired using techniques like steel plating and fibre wrapping/Denso Tape:

- Plating consists of welding additional plates/or collars in the deteriorated areas of the steel piles.
- Denso Tape and Fibre wrapping (with carbon sheets) wrap around the pile to protect them from further corrosion if the thickness is deemed acceptable for future use.

The approximate costs for carrying out such works would be £100k per jetty.



Source: <http://densona.com>



Concepts for Dock 2

Summary

Form of Existing Structure:

Shallow stepped sides. The overall width of the dock is approximately 29.5m at a level of +7.8mCD reducing to approximately 16.5m at a level of -4.5mCD in the centre. The caisson gate was removed about 8 years ago, resulting in some siltation.

Proposed Types of vessel:

When this functioned as a dry dock, it could accommodate vessels of up to 150m loa with a 20m beam. The shape of the landward end is restrictive to the available area and its development potential as a modern facility. The size of vessels accommodated in this dock could be limited to say 100m or less allowing the landward 40m or so to be covered with a suspended deck.

Mode of Use

Wet dock without Impounding (no gate):

This dock is not suitable for accommodation of vessels afloat on each side of the dock because of the stepped sides. Vessels of 15m beam and 4m draught can be accommodated in the central area at all states of the tide, but mooring posts would need to be provided along one side of the channel. This option is unlikely to have significant long term value but could be an option for temporary moorings during the development of the other docks.

Wet dock with Impounding - Fixed Sill:

The tidal range at mean spring tides is 4.7m with HW at +5.7mCD and mean neap tides it is 2.2m with HW at +4.4mCD. A fixed sill at +1.7mCD would permit up to 2.4m draught vessels to pass into the basin at mean neap tides and above. The impounded water depth would be 5.2m and give a usable basin width of approximately 22m.

Wet dock with Impounding - New Gate:

A full closure gate would be provided if larger draught vessels need to be accommodated afloat. The deepest draught vessel that might be considered with tidal recharge only would be about 7.5m. A radial sector gate is preferred as there may be water head reversal. The width of gate entrance can be limited to between 7.5m and 10m as appropriate for safe vessel transit. Regarding vessel operation, it is unlikely to be as cost effective as Dock 3 for cargo unloading as the moorings will not be close alongside.

Dry Dock with New Gate:

Install either a replica of the original caisson or, if more cost effective, a suitably reduced caisson of a size able to accommodate the beam and draught of the largest vessel to be accommodated. Reducing the size would require additional concreting works to the quay.

Mooring of vessels

If a wet dock option is selected, because of the stepped sides, the vessels will need to be fended off using the pontoon and/or guide frames to maintain an adequate alongside depth.

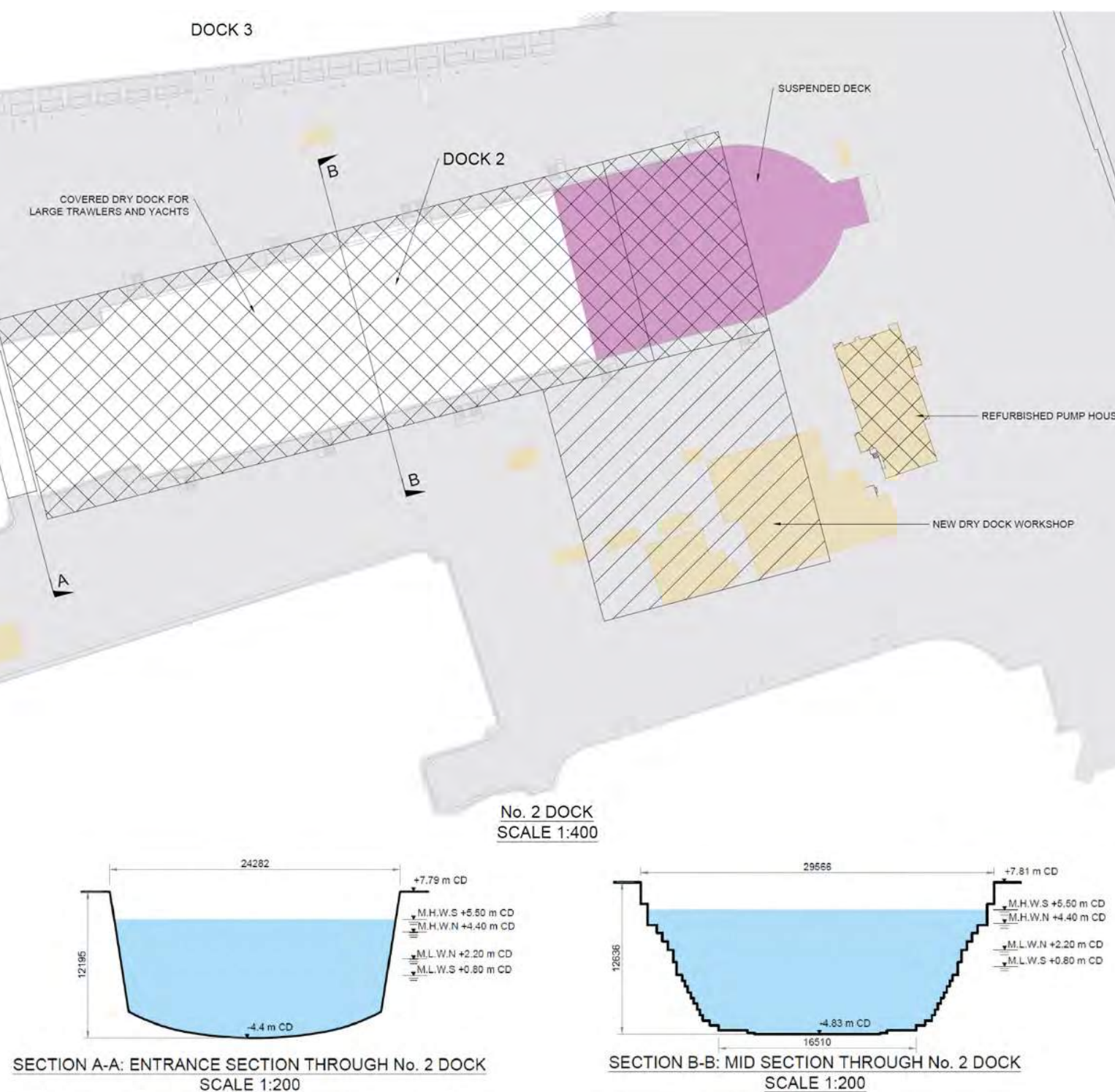
Dock 2 - Development Options

Option 1. Dredge and leave as tidal: Poor access to limited range of vessels and not likely to be commercially viable. Approx cost including all other necessary works (portal crane etc) £8million.

Option 2. Dredge and install fixed sill: To permit access for vessels with 2.4m draught and 5m beam that would leave during a period close to HW. Could be used as an afloat fitting out basin for small vessel refurbishment possibly combined with use of boat lift dock and/or trailer launch slipway at the landward end of the dock. A suspended deck would shorten the dock length and reduce landside constriction of the site. Approx cost £8-9million.

Option 3. Dredge and install full closure wet dock gate: Unlikely that this option will be as cost effective due to the cross section of this dock. Could be considered if there is a commercially viable need for deeper draught trawler or cargo vessel to be loaded/offloaded during a full tidal cycle and dock 3 is not available for this purpose. Approx cost £10-11million.

Option 4. Dredge and reinstate as dry dock: most likely use for this dock. Install new caisson (or possibly mitre gates), place suspended deck on landward end of dock, install new workshop facilities, refurbish pumps/penstocks, install suitable cranes and, if required, provide covered dock. Approx cost £10-11million.



Concepts for Dock 3

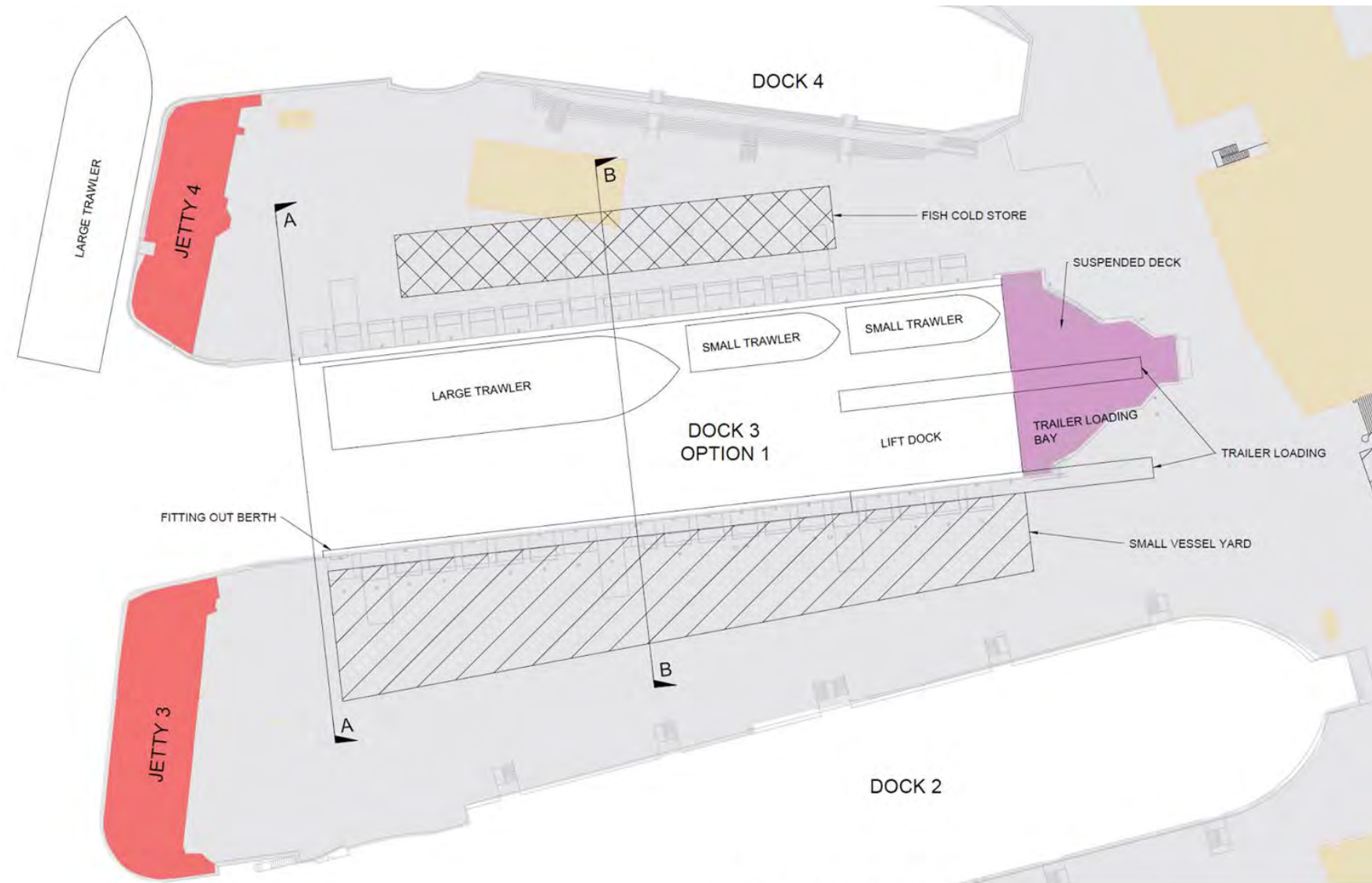
Summary

Form of Existing Structure:

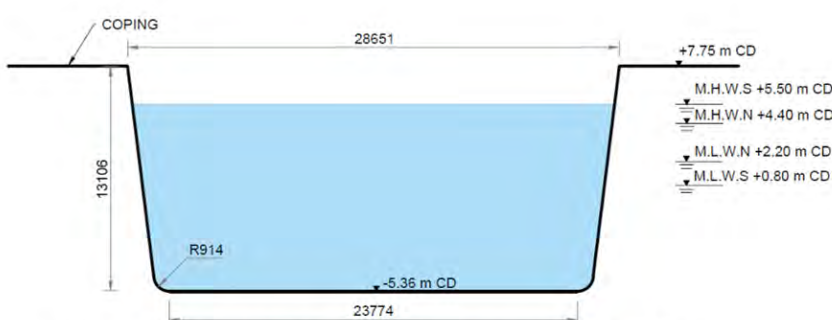
Almost vertical sides. The overall width of the dock is approximately 29m between the level of +7.66mCD down to +0.88mCD, then reduced to approximately 27m down to the level of -4mcd. It is then stepped down to approximately 15.24m at -5.35mCD in the centre. The original caisson gate has been removed leaving the dock permanently flooded for about 8 years, resulting in some siltation.

Proposed Types of vessel:

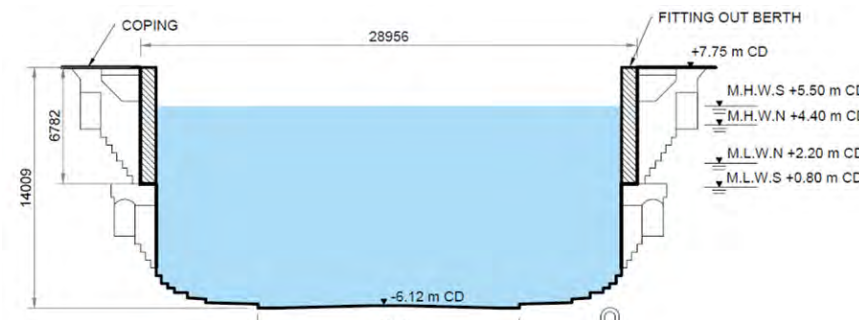
Well suited for alongside berthing in afloat condition.



BATHIMETRY ON No. 3 DOCK
SCALE 1:400



SECTION A-A: ENTRANCE SECTION THROUGH No. 3 DOCK
SCALE 1:200



SECTION B-B: MID SECTION THROUGH No. 3 DOCK
SCALE 1:200

Mode of Use

55

Wet Dock without Impounding (no gate):

Following silt removal, 4.5m maximum draught vessels could be accommodated as "always afloat" for all tides. Vessels with deeper draught could be accommodated for short periods during the higher tidal sector.

Wet Dock with Impounding - Fixed Sill:

Tidal range at mean spring tides is 4.7m with HW at +5.7mCD and at mean neap tides it is 2.2m with HW at +4.4mCD. A fixed sill is not a practical option.

Wet Dock with Impounding - New Gate:

A full closure gate would be required. The deepest draught vessel that might be considered with tidal recharge only (i.e., not using pumping) would be about 7.5m with a minimum impounded water level of +4.4mCD. A caisson gate can be used. However for offloading cargo or catches on each tide use of a radial sector gate would be preferred. The width of the radial sector gate entrance can be limited to 13.5m or as appropriate for safe transit of the largest vessel.

Dry Dock with New Gate:

If the dock is to be re-established as a dry-dock, a caisson gate can be used. Alternatively a radial sector gate could be used, however it is possible that two pairs of gates would be required if the dock is to provide both a wet and dry dock. It would be advisable that if a single pair of gates are installed that during the works, in the entrance, that this incorporates additional works to allow for the gates to be reversed in the future.

Mooring of Vessels

The upper 5m of the dock wall will require an outstand of 1m to provide a flush face for fendering. For berthing similar vessels on either side of the dock with a movement passage between would limit vessel beam to about 8m. However, vessels with beams of up to 12m can be accommodated on one side with smaller vessels on the other side provided the smaller vessels exit the dock before the larger vessel.

Dock 3 - Development Options

Option 1. Dredge and leave as tidal: To provide access to a limited range of vessels up to 4.5m draught. Small trawlers such as the Admiral Grenville (l=22.1m b=6.75m d=3.1m) and any of the Princess yachts can be accommodated. Offloading of larger trawlers could be accomplished over the high water period provided that they departed the berth before mid-tide. If this is not possible then larger trawlers might be offloaded at Jetty 4 or Jetty 3 depending upon which side of the dock has been designated as the trawler berth. The fish cold store will also need to be placed close, possibly even adjacent to the trawler berth. Smaller vessels for refitting can be serviced on the other side of the dock, possibly combined with a boat lift dock at the landward end of the dock. Approx Cost £3.5million.

Option 2. Dredge and install full closure caisson gate: This would be used for vessels of up to 100m length and 20m beam to dry dock (nb the stepping at the base of the dock might require special framing or keel blocks). Could also be used as a wet dock for afloat refurbishment, but due to the time to remove the caisson this would not be suitable for daily operation. The main workshop associated with this activity would be located along one side of the dry dock with refurbished cranes as required. There is a likelihood that the dock will need to be covered if high specification yachts or similar are to be fabricated in this facility. Approx cost £5million.

Option 3. Dredge and install full closure radial sector gate: To permit larger trawlers such as the Wiron 2 (l=52m b=12m d=6.2) to offload throughout tidal cycle. The dock would only be accessible during period close to HW, which may not suit the trawler operational requirements. The other operations within the dock will be as set out in option 1. Approx Cost £6million.

Option 4. Dredge and install a floating drydock: This would have maximum dimensions of 91m long and 22m beam. The available water depth would also restrict the size of vessels that could be repaired. Approx Cost £4.5million.



Concepts for Dock 4

Summary

Form of Existing Structure:

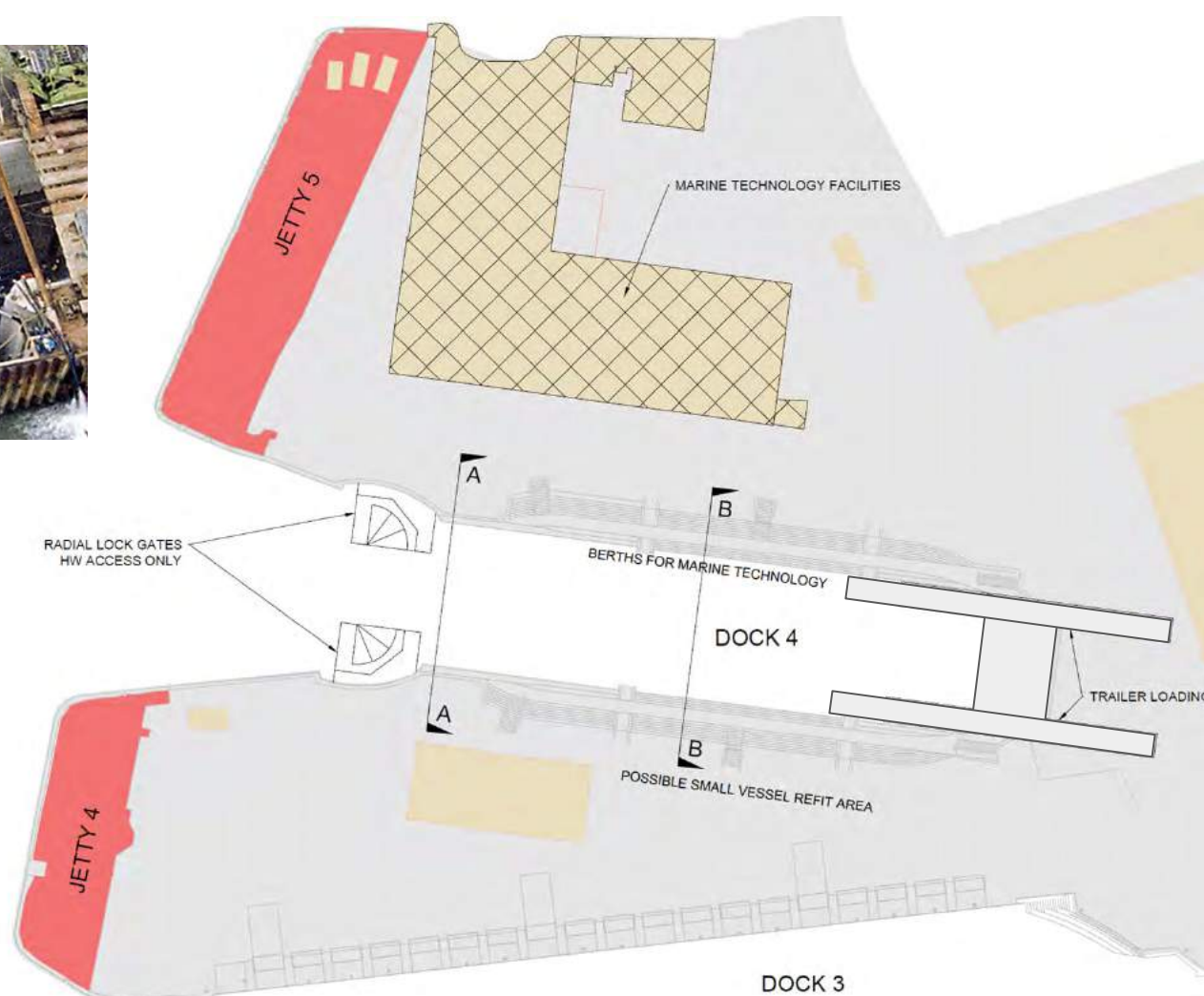
Shallow stepped sides. The overall width of the dock is approximately 29m at a level of +7.9mCD reducing to approximately 10.3m at a level of -1mCD in the centre. Concrete keel blocks along the centre of the dock will need to be removed to permit safe navigation. The original mitre gates have been removed leaving the dock permanently flooded for many years, resulting in considerable siltation.

Proposed Types of Vessel:

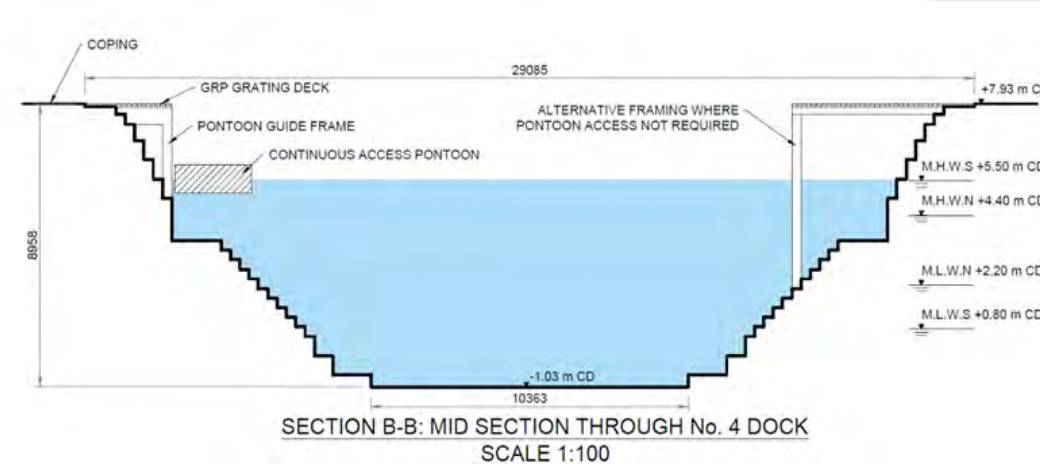
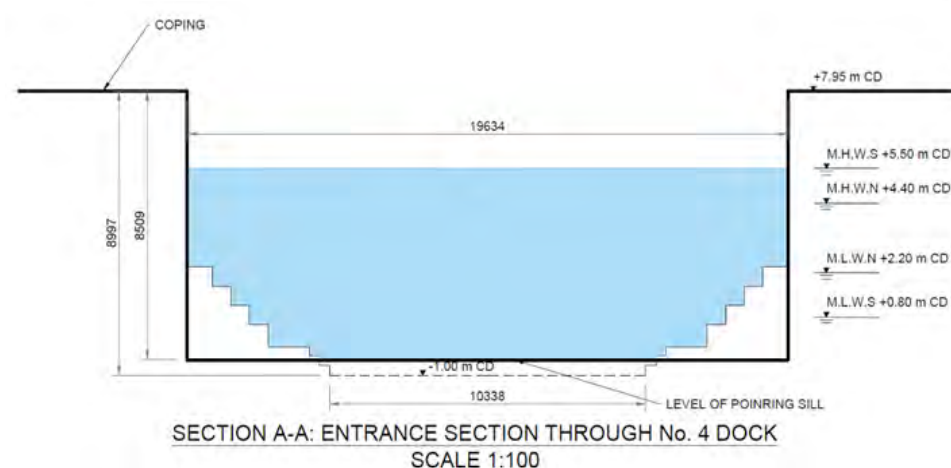
Well suited for the accommodation of shallow drafted small craft and barges as a wet dock.



Construction of Similar Gates



No. 4 DOCK
SCALE 1:400



Mode of Use

Wet Dock without Impounding (no gate):

Following silt removal, 1m maximum draught vessels could be accommodated as "always afloat" for all tides. Vessels with deeper draught could be accommodated for short periods during the tide, or alternatively remain in the dock if they can take the ground.

Wet Dock with Impounding - Fixed Sill:

The tidal range at mean spring tides is 4.7m with HW at +5.7mCD and at mean neap tides it is 2.2m with HW at +4.4mCD. A fixed sill could be constructed across the entrance at +1.7mCD. This would permit up to 2.4m draught vessels to pass into the basin at mean neap tides and above. The impounded water depth would be 2.7m.

Wet Dock with Impounding - New Gate:

A full closure gate could be provided if larger draught vessels need to be accommodated. The deepest draught vessel that might be considered with tidal recharge only would be about 4.5m. In terms of vessel operation, this is unlikely to be cost effective on its own. However this may be essential to protect craft, also the possibility for development trials of new marine concepts and craft might enhance the potential profitability and these would need retained water free from external disturbance by bow waves, etc. A radial sector gate is preferred as there may be some water head reversal. The width of the gate entrance can be limited to between 7.5m and 10m as appropriate for safe vessel transit.

A half tide flap up gate, closing when the tide is below 3.3mCD would permit access of vessels up to 3.75m draught when the tide is above mean sea level. Although this type of gate is much cheaper than radial sector gates, there have in the past been issues in preventing these gates from bouncing up as the propellers move over them causing damage to the vessel and provision of an adequate restraint system is therefore essential. Also, open to the effect of bow waves during high water.

Dry Dock with New Gate:

Reinstate to original use with new gate. Unlikely to be viable because of draught limit.

Mooring of vessels

Because of the stepped sides of the dock the vessels will need to be fendered off using a pontoon and/or guide frames to maintain an adequate alongside depth. To allow for passing of vessels within the dock, a maximum beam would be 5m for vessels with 2.4m draught. Larger vessels could be accommodated but without passing.

Boat Launching / Extraction

A boatlift could be installed at the head of the dock. This would require a pair of parallel concrete running beams flush with the road surface, extending over the dock and supported from the dock floor. A standard travelling boat hoist would be operated. This would block the road for occasional short periods. Alternatively a slipway could be constructed, but this would partially infill the dock and would not be as versatile. A mobile crane could be used which may require piled base construction.

Dock 4 - Development Options

Option 1. Dredge and leave as tidal: Poor access to a limited range of vessels. Could be used as a NAABSA berth for small construction supply barges limited to 10m beam to be offloaded by long reach mobile crane. Approx Cost £1million (including boat hoist).

Option 2. Dredge and install fixed sill: To permit access for vessels with 2.4m draught and 5m beam that would leave during a period close to HW. Could be used with as an afloat fitting out basin for small vessel refurbishment possibly combined with use of boat lift dock and/or trailer launch slipway at the landward end of the dock. Approx Cost £1.5million.

Option 3. Dredge and install full closure gate: Vessel sizes as option 2, but this could provide a mixed use basin including testing of prototype craft supported from the northern side and an afloat small vessel maintenance/fitting out facility on the south as for option 2. Office and workshop facilities would be in the nearby building. Lift dock, mobile crane lift out and/or slipway facilities would be available to all basin users. Approx Cost £3-4million.



STRATEGY

Following on from the concepts, this section assesses the overall use of Area 5 starting with a SWOT analysis that helps the development of three strategies. The strategies evaluate suitable marine activities in designated areas to illustrate and evaluate the feasibility as a whole.

A high level costing exercise has also been undertaken to review the financial implications that each strategy may incur.





SWOT ANALYSIS

Strengths

- Deep Water Docks
- Dry Dock Capability
- Quayside Access
- Mix of size / arrangement of Docks
- Established Marine Activity nearby
- Limited Similar facilities in the Region
- High Interest Level

Weaknesses

- Gates/Caissons Removed
- Limited Available Land Area
- Uncertainty around reinstating Dry Docks
- Jetty 3 in Poor Condition
- MoD Route through the Site
- Contaminated Sediment
- Road Access Restrictions Offsite

A SWOT analysis has been conducted to undertake a high level review of the area, with a view towards creating a framework for sustainable business ventures for the docks.

SWOT

Threats

- High Cost of Refurbishment
- Lack of Space for Expansion
- MoD Restrictions
- Avoiding Incompatible Users
- Competition with other Facilities
- Technology Changes
- Heritage structures compatibility with modern working

Opportunities

- Technology Advances
- Grants / Financial Support
- Support to Plymouth Sound Test Area
- Increase to Fishing Capacity
- Creating jobs in the Marine Industry
- Retraining Marine Based Workforce
- Ship Yard repair area



Strategy A

LEGEND

Technology R&D

- T1 SO15 - Refurbish for offices & workshops
- T2 Dock 4 - New radial gates & vessel moorings
- T3 Jetty 5 - Refurbish piles & vessel moorings

Fish Landing

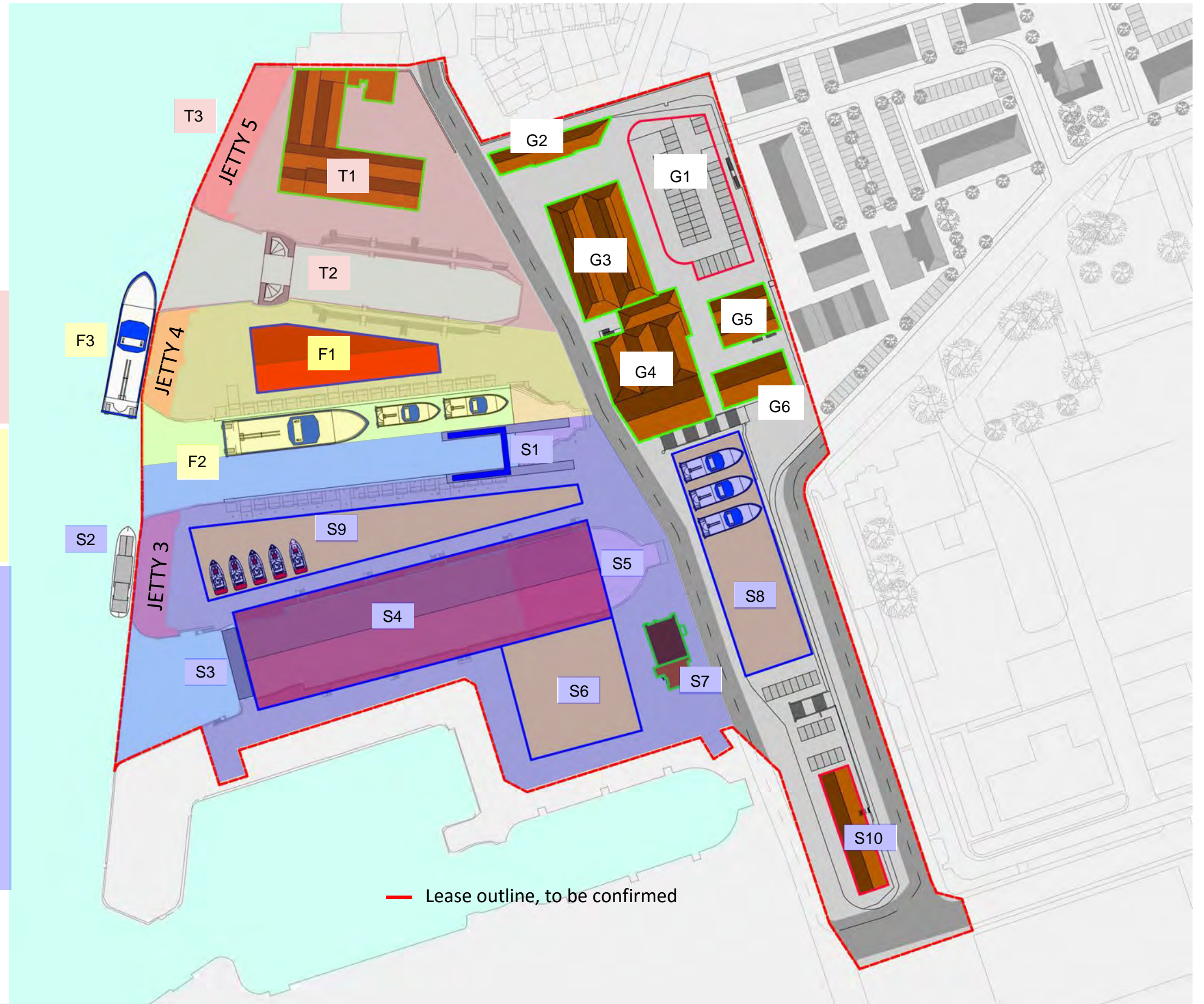
- F1 New Fish cold store
- F2 Dock 3 - New Mooring/Fendering provision
- F3 Jetty 4 - Refurbish piles & vessel moorings

Shipbuilding/Repair

- S1 Dock 3 - New Boat Hoist & suspended deck
- S2 Jetty 3 - Rebuild & vessel moorings
- S3 Dock 2 - New Caisson gate
- S4 Dock 2 - New shed over refurbished dry dock
- S5 Dock 2 - New suspended deck at end of dock
- S6 Dockyard workshops/open storage area
- S7 SO87 & 89 - Main Dock Pumphouse
- S8 Storage for larger vessels up to 200 tonnes
- S9 Storage for smaller vessels on trailers
- S10 New gatehouse/office building for dry dock

Buildings available to support South Yard

- G1 New multi storey car park
- G2 SO16 - Workshops including tunnel portal
- G3 SO23 - North Smithery
- G4 SO66 - Millwright's Shop
- G5 SO33 - Heavy Lifting Store
- G6 SO60 - Engineers Fitting Shop



— Lease outline, to be confirmed

LAYOUT STRATEGY A:

DOCK 2: COVERED DRY DOCK.

DOCK 3: TIDAL BASIN FOR TRAWLERS AND SMALL VESSEL LIFT OUT DOCK.

DOCK 4: WET DOCK FOR MARINE TECHNOLOGY PROJECTS.



Strategy A

Dock 3 - Fishing Basin

Dock 3 has the deepest water depth and almost vertical sides which makes it the most suited of the docks to be adapted for operations requiring all tide access and always afloat cargo handling operations, without the need for gates or caissons.

Strategy A accommodates fishing vessels on the north side of the dock and on the south side it accommodates a floating fit out berth for the shipbuilding/repair operations.



Source: <http://www.freefoto.com/preview/9909-02-9197/North-Shields-Fish-Quay>

It is common for two deep-sea fishing trawlers to work together and, therefore, both trawlers will need to berth simultaneously for periods of up to 5 days. The length of the basin is sufficient to provide two berths, but it anticipated that Jetty 4 would be used for one vessel and the other vessel having offloaded its catch would then moor alongside the vessel at Jetty 4. This would allow smaller coastal trawlers to utilise the berths on the North side of Dock 3 and, if required, accommodate additional deep-sea trawlers. A new refrigerated fish store will need to be provided to the north of Dock 3 to maintain the quality of the catch prior to onward distribution by road or possibly by sea.

The proximity of the ship repair facilities in Docks 2 and 3 is expected to be beneficial to the fishing trawlers. The afloat fit-out berths along the south side are intended for use by smaller vessels so as not to compromise the operation of the north side. A 200t boat hoist system to allow for vessels to be lifted out of the water and maintained ashore is also envisaged.

Strategy A
£34,080,100*

*Excludes preliminary costs, for breakdown see Cost Estimate page

Strategy A focuses on providing a multidisciplinary environment which encompasses three marine associated industries, ie: technology, fishing and shipbuilding sectors. The strategy utilises building SO15 for the technology users and building SO87 is proposed to be refurbished to reinstate it as a working pumping station for Dock 2. The proposed buildings 5.1, 5.3, 5.4 and 5.5 highlighted in the masterplan are not included in this strategy due to the importance of open/versatile quayside space.

Dock 4 - Technology Basin

In strategy A Dock 4 and the quayside area on the approach to Jetty 5 have been allocated to the technology sector.

It is understood that the technology companies will require an area with a sufficient water depth at all times to test their equipment above and below water.

Dock 4 has the advantage that the basin and culverts can be adapted for use as a wet dock. A wet dock is provided via a radial sector gate located at the basin's entrance. This will provide around 6m water depth within the centre of the basin and will also protect the basin from external disturbances such as bow waves.

As it is envisaged that several technology companies will be using the dock at any one time, there will be a requirement to provide suitable offices and workshops for the technology companies in SO15. However, additional buildings are available to the east of this area if required.

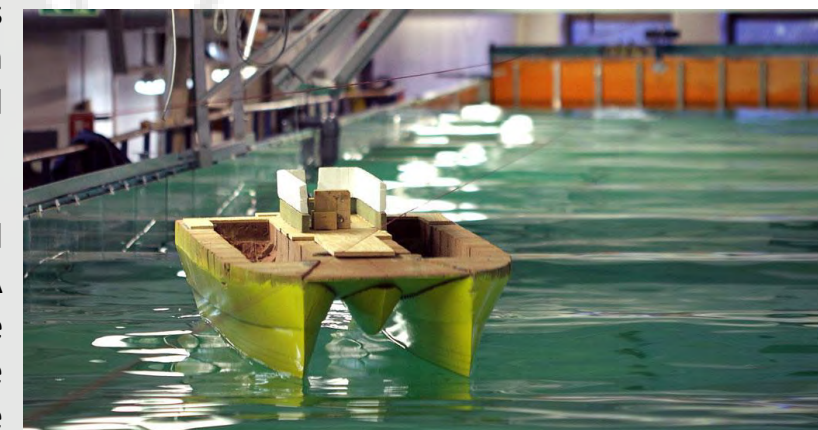
Dock 4 is the shallowest and overall smallest basin of the three docks and it is likely that it would be unsuitable for larger vessels, which would be required for the other industries. If large vessels are to berth in this area, a pontoon could be provided to protect the vessel and quay from damage.

The existing stepped geometry of the dock will probably require use of pontoons and fender frames to access the water from the quay.

Dock 2 - Ship Repair Basin

Dock 2 has stepped sides and the penstock in the flooding culvert cannot withstand a reverse water head. Without substantial additional work, the dock could only be used as a tidal dock or a dry dock. In Strategy A, this dock 2 is to be restored with a new caisson gate matching the original design dimensions and refurbished of the pumphouse to operate as a dry dock to undertake both shipbuilding and repair.

A covered area is provided so that operations are not affected during inclement weather. Within the cover, a 50t portal crane will allow major components of the vessels to be removed for replacement/repair and then replaced. At the head of the dock a suspended concrete structure permits large components to be delivered and stored. An additional workshop building has been positioned close to the head of the dock.



Source: <http://www.hib.no/studietilbud/studieprogram/mmt/>



Source: <http://dynamicco.com/wp-content/uploads/Ship-in-dry-dock.jpg>

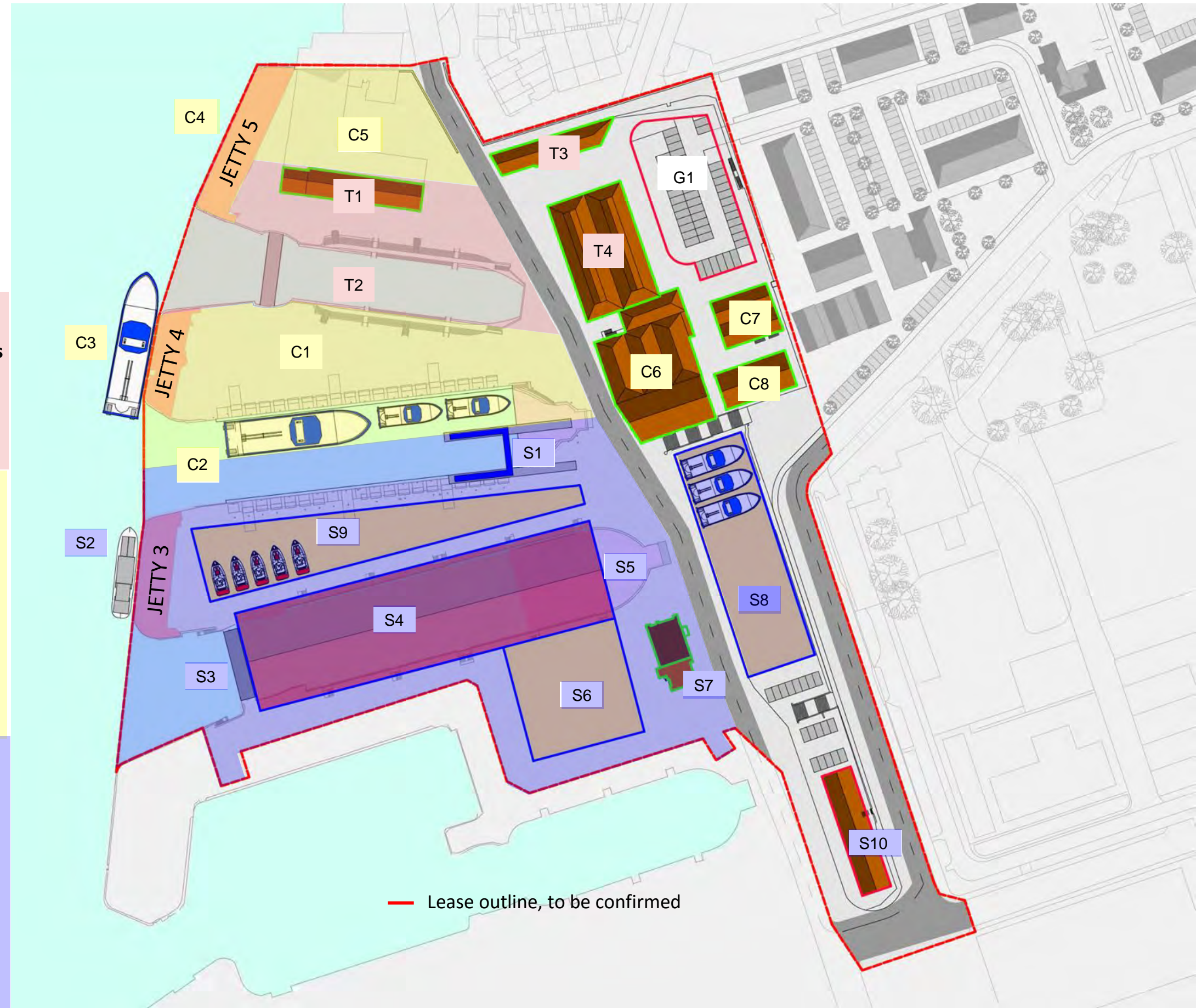


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Strategy B

LEGEND

	Technology R&D
T1	SO15 - Part of building to be demolished. Remaining for refurbish offices & workshops
T2	Dock 4 - New sill & vessel moorings
T3	SO16 - Refurbish offices
T4	SO23 - Refurbish workshops
	Marine Contractor's Yard
C1	New yard pavement
C2	Dock 3 - New Mooring/Fendering provision
C3	Jetty 4 - Refurbish piles & vessel moorings
C4	Jetty 5 - Refurbish piles & vessel moorings
C5	New yard pavement
C6	SO66 - Refurbish workshops
C7	SO33 - Refurbish offices
C8	SO60 - Refurbish offices
	Shipbuilding/Repair
S1	Dock 3 - New Boat Hoist & suspended deck
S2	Jetty 3 - Rebuild & vessel moorings
S3	Dock 2 - New Caisson gate
S4	Dock 2 - New shed over refurbished dry dock
S5	Dock 2 - New suspended deck at end of dock
S6	Dockyard workshops/open storage area
S7	SO87 & 89 - Main Dock Pumphouse
S8	Storage for larger vessels up to 200 tonnes
S9	Storage for smaller vessels on trailers
S10	New gatehouse/office building for dry dock
	Buildings available to support South Yard
G1	New multi storey car park



LAYOUT STRATEGY B:

DOCK 2: COVERED DRY DOCK.

DOCK 3: TIDAL BASIN FOR MARINE AND CONTRACTOR SERVICES.

DOCK 4: PART TIDAL WET DOCK FOR MARINE TECHNOLOGY PROJECTS.



Strategy B

Strategy B, similar to Strategy A, provides facilities for three industries: technology, Contractor/marine services and shipbuilding. SO15 and SO87 are to be refurbished and the proposed buildings 5.1, 5.3, 5.4 and 5.5 highlighted in the masterplan are not included to provide quayside space for storage.

Dock 3 - Marine Contractor

In strategy B the dock remains tidal, but unlike Strategy A, the north side of Dock 3 is occupied by a marine contractor. It is anticipated that marine plant such as flat top barges, modular pontoons, crane barges, etc. will be accommodated either within the dock, alongside Jetty 4 and 5 or lifted out for onshore storage/repair/modification.

It is envisaged that heavy lift points would be developed by the Contractor should they require them. The Contractor will have sole use of open storage areas to north of building T1 and between Docks 4 and 3.

A 200t boat hoist at the head of Dock 3 is envisaged to be the property of the ship repairers but would be available as a lift out facility for the Contractor's vessels. The southern wall would still be available for afloat fitting out of vessels for the ship repair yard that would ensure a clear access path to the boat lift. However, the paved area S9 to the south of Dock 3 could be leased in part or whole to the Marine Contractor's operation if not required by the Ship Repair Operation

Dedicated office/workshop facilities can be developed within buildings C4, C5 and C6.



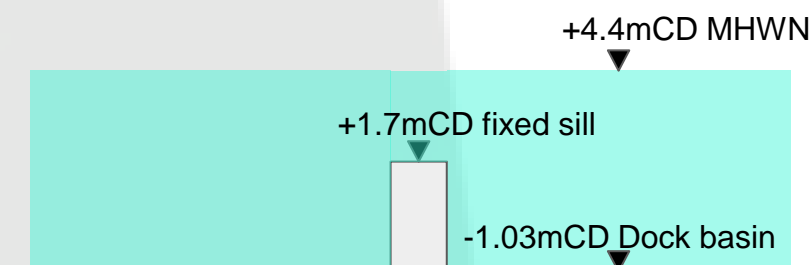
http://www.floatingplantservices.com/_files/picture_1/20130613_140142.jpg

Dock 4 - Technology Basin

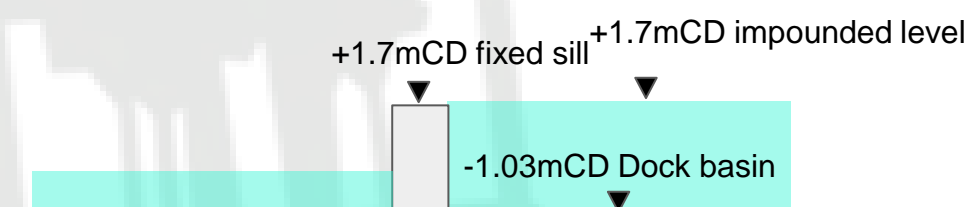
Although the purpose for Dock 4 has not changed from Strategy A with the dock and quayside area on the approach to Jetty 5 dedicated to the technology sector, the overall design has been modified and the radial gates proposed in Strategy A are substituted by a fixed sill, now making Dock 4 a tidal basin. The sill is a simple fixed height structure at +1.7mCD which will accommodate vessel draughts of up to 2.4m (with 10% clearance) over the sill at mean HW neaps and draughts of up to 2.4m within the basin (see illustrative detail below). This draught should be sufficient to satisfy the requirements of many of the technological companies at low cost.

A tidal flap gate could be considered if vessels with additional draughts have to be accommodated, but this option would considerably increase both capital and maintenance costs.

The building T1 (SO15) is to be part demolished to leave some office and workshop accommodation close to Dock 4. Additional offices and workshops can be developed in buildings T3 (SO16) and T4 (SO24).



Tidal Sill Detail at Mean High Water Neaps



Tidal Sill Detail at Low Water

Dock 2 - Large Ship Dock

The Strategy for Dock 2 is the same as Strategy A with the restoration of the basin back to a dry dock and its previous purpose of shipbuilding and repair.

The use of the area between Dock 2 and Dock 3 by the shipbuilding and repair operation could easily be transferred to the Marine Contractor in part or whole. A method by which this area can be used flexibly would probably benefit both parties. It is envisaged that the space provided in Dock 2 would be suitable for a small shipbuilding company with the possibility of building, repairing or finishing tugs, workboats, fishing vessels and even large yachts.

Strategy B
£30,241,200*

*Excludes preliminary costs, for breakdown see Cost Estimate page



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Strategy C

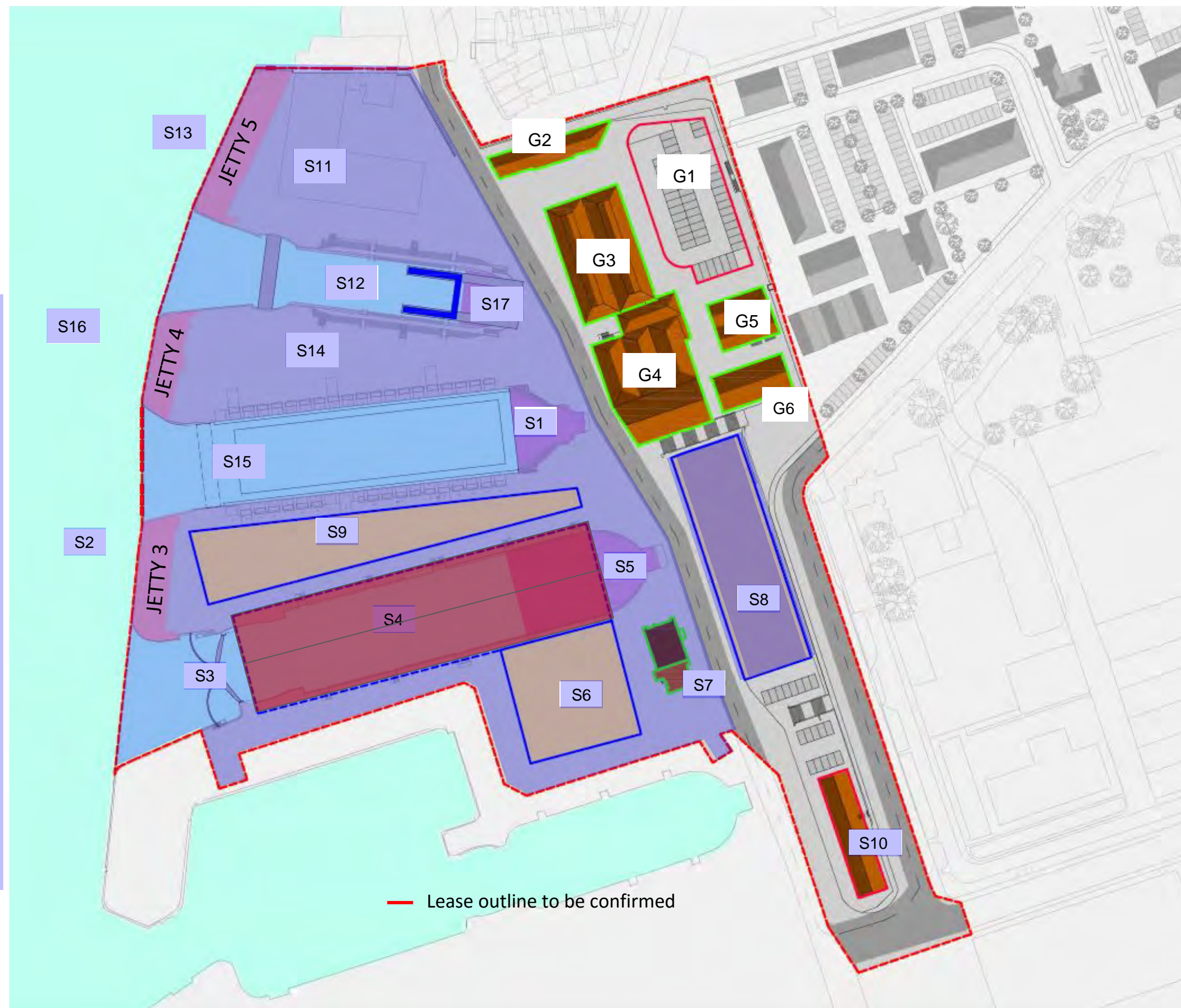
LEGEND

Shipbuilding/Repair

- S1 Dock 3 - New suspended deck
- S2 Jetty 3 - Refurbish piles & vessel moorings
- S3 Dock 2 - New Caisson gate
- S4 Dock 2 - New shed over refurbished dry dock
- S5 Dock 2 - New suspended deck at end of dock
- S6 Dockyard workshops/open storage area
- S7 SO87 & 89 - Main Dock Pumphouse
- S8 Open or covered area for shipyard
- S9 Open or covered area for shipyard
- S10 New gatehouse/office building for dry dock
- S11 SO15: Building to be demolished
- S12 Dock 4 - New sill & vessel moorings
- S13 Jetty 5 - Refurbish piles & vessel moorings
- S14 New yard pavement
- S15 Dock 3 - New Mooring/Fendering provision
- S16 Jetty 4 - Refurbish piles & vessel moorings
- S17 Dock 4 - New Boat Hoist

Buildings available to support South Yard

- G1 New multi storey car park
- G2 SO16 - Workshops including tunnel portal
- G3 SO23 - North Smithery
- G4 SO66 - Millwright's Shop
- G5 SO33 - Heavy Lifting Store
- G6 SO60 - Engineers Fitting Shop



LAYOUT STRATEGY C:

DOCK 2: DRY DOCK FOR SHIPBUILDING AND REPAIR.
DOCK 3: FLOATING DRY DOCK FOR SHIPBUILDING AND REPAIR.
DOCK 4: TIDAL WET DOCK FOR SHIPBUILDING AND REPAIR.

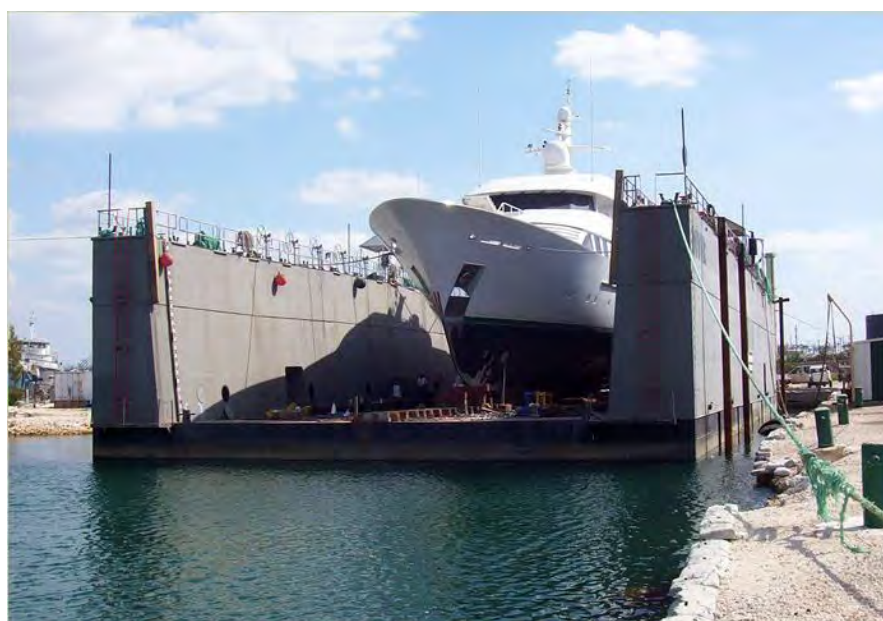


Strategy C

Unlike the first two strategies Strategy C focuses on one industry, shipbuilding and repair, for all three docks. Each dock has the potential capability of being effective for this industry with only some reasonably minor modifications. If this strategy was adopted, it would suit a medium to large shipbuilders/repair company.

Dock 3 - Shipbuilding/Repair Dry Dock

In Strategy C Dock 3 is designated as a ship repair dock. The available all tide water depth and the vertical sides mean that Dock 3 can either be used to berth a floating dry dock of up to 25m beam or with the addition of a new caisson gate and refurbishment of the penstocks once again become an operational dry dock. Jetties 3, 4 and 5 will be used for larger vessels to complete their fitting out afloat.



<http://www.hegerdrydock.com/images/projects/floating10a-lg.gif>

Dock 4 - Shipbuilding/Repair Part Tidal Basin

Dock 4 is the shallowest of the three docks and, therefore, would only be suitable for small vessel repair. As a result the basin is proposed to be used as a lift in/out area for vessels up to 20m. A boat hoist system is provided at the head of the dock to lift and move the vessels to a land storage area in the south of the site.

To ensure that the vessels do not ground a tidal sill has been suggested. The sill will be a fixed height of +1.7mCD that will accommodate vessels with a draught of up to 2.4m (with 10% clearance) over the sill at mean HW neaps and accommodate vessels with a draught of up to 2.7m within the dock during low tide. Deeper draught vessels could enter the dock during spring tide high water periods for the purposes of accessing the boat lift

If vessels with a deeper draught need to be accommodated during the full tidal cycle within the basin, a half tide flap gate could be deployed to permit vessels with up to 3.75m draught to be accommodated within the dock during periods of low water. If vessels of greater draught have to be accommodated during low water periods sector gates, as shown in Strategy A will be required.

Building S11 (SO15) is demolished completely and the small vessel workshops, stores and offices will be developed in Buildings G2 (SO16) to G6 (SO60) inclusive.

Dock 2 - Large Ship Dock

The Strategy for Dock 2 is the same as Strategy A with the restoration of the basin back to a dry dock and to previous purpose of shipbuilding and repair. The dry dock gates for this dock can be either a caisson or mitre gates. For this strategy, mitre gates are shown, which are likely to have a higher CAPEX cost but lower OPEX compared to the caisson.

The main large vessel workshop will be housed in new building S6 and the offices in S10 (5.1). Additional office/storage space can be provided on the quayside areas on approach to Jetty 3 (area S9) and the at beyond the head of the dock at area S8.

The pumphouse S7 (SO87 & SO89) will be used to drain Docks 2 and 3.

Strategy C
£30,094,200*

*Estimate based on floating dock option, Excludes preliminary site costs, for breakdown see Cost Estimate page



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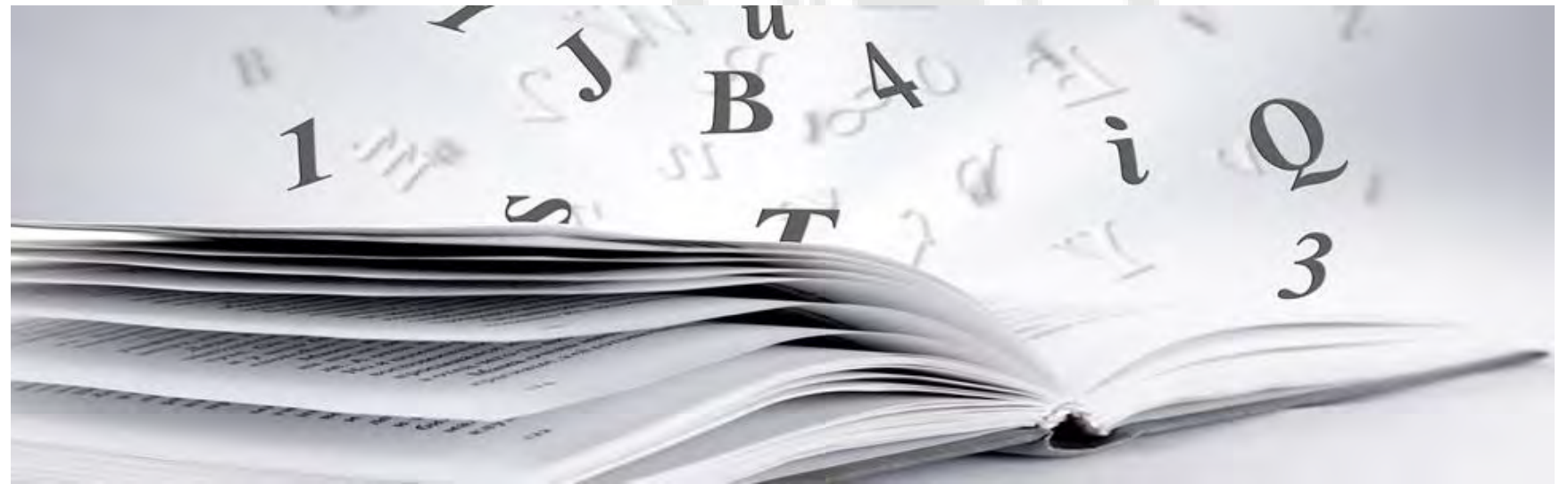
Cost Estimate

A high level cost exercise has been undertaken to review the financial implications of the proposed strategies. Costs have been calculated based on a mixture of previous projects, contractor estimates and general civil engineering pricing books (including SPONs). The estimated costs are for an indication only, further investigations and contractual involvement are required to produce a more accurate estimate. It is anticipated that the construction of the scheme would take approximately 3-5 years.

Jetty/ Dock No.	Preliminary Costs	Strategy A	Strategy B	Strategy C
Dock 2	Minor repairs to blockwork to prevent further deterioration. Works for tidal dock only. Assume 15% of blockwork requires repair 723m ² @ £25/m ² + dredging = £310k.	Repairs, new caisson, reinforced suspended deck, covered dock area with portal crane = £9.90M	Repairs, new caisson, reinforced suspended deck, covered dock area with portal crane = £9.90M	Repairs, New mitre gate, fendering, reinforced suspended deck = £10.63M
Jetty 3	Either: Demolish (concrete deck & piles assuming 6 weeks work) £1M. Or Option 2 Create new jetty over the old £1.5M.	Marine furniture for use as a berthing jetty included in additional items below.	Marine furniture for use as a berthing jetty included in additional items below.	Marine furniture for use as a berthing jetty included in additional items below.
Dock 3	Minor repairs to blockwork to prevent further deterioration. Works for tidal dock only. Assume 15% of blockwork requires repair 600m ² @ £25/m ² + dredging = £365k	Reinforced suspended deck, fish store, boat hoist substructure, fendering = £2.93M	Reinforced suspended deck, boat hoist substructure, fendering = £2.18M	Reinforced suspended deck, fendering = £1.43M (excluding floating dock cost)
Jetty 4	Repair existing steel piles. Estimate based on carbon wrap repair Jetty 4, 450m ² @ £100/m ² + railings 50m @ £150/m = £52.5k	Marine furniture for use as a berthing jetty included in additional items below. Resurfacing = £18.5k	Marine furniture for use as a berthing jetty included in additional items below. Resurfacing = £18.5k	Marine furniture for use as a berthing jetty included in additional items below. Resurfacing = £18.5k
Dock 4	Minor repairs to blockwork to prevent further deterioration. Works for tidal dock only. Assume 25% of blockwork requires repair 353m ² @ £25/m ² + dredging = £256k	Repairs, new radial sector/mitre gates = £2.06M No allowance has been made for the additional equipment required for the marine technology companies.	new fixed sill = £528k. No allowance has been made for the additional equipment required for the marine technology companies.	New concrete tidal sill, boat hoist substructure and boat hoist = £1.16M
Jetty 5	Repair existing steel piles. Estimate based on carbon wrap repair Jetty 4 780m ² @ £100/m ² + railings 80m @ £150/m = £90k	Marine furniture for use as a berthing jetty included in additional items. Railings £12k.	Marine furniture for use as a berthing jetty included in additional items. Railings £12k.	Marine furniture for use as a berthing jetty included in additional items. Resurfacing £33.5k.
General Costs for Area 5	Costs provided by William Ward Associates for site preparation works which are not included in the above e.g making listed buildings weather-tight, upgrading services-, fencing- roadways = £13.55M	Costs provided by William Ward Associates for Area 5 "New Build and Fit out" = £11.44M	Costs provided by William Ward Associates for Area 5 "New Build and Fit out" includes half demolition of SO15 = £10.40M	Costs provided by William Ward Associates for Area 5 "New Build and Fit out" SO15 building demolished = £9.36M
Additional	N/A	Services extended to dock areas, studies, refurb penstocks and culverts, marine furniture etc = £2.04M	Services extended to dock areas, studies, refurb penstocks and culverts, marine furniture etc = £2.04M	Services extended to dock areas, studies, refurb penstocks and culverts, marine furniture etc = £2.04M
20% Contingency	£3,224,700	£5,680,100	£5,040,200	£5,015,700
Total	<u>£19,348,200</u>	<u>£34,080,100</u>	<u>£30,241,200</u>	<u>£30,094,200</u>



GLOSSARY OF TERMS



Source: www.foreclosuredeals.com



Glossary

Afloat	Floating on the water; water-borne.
Ashlar	A square-hewn stone. Masonry consisting of block of stone, finely square dressed to given dimensions, and laid in courses with thin joints.
Barge	A floating flat-bottomed vessel used to carry cargo from a port to shallow-draft waterways. Barges are usually moved via towboats/tugs.
Berth	<ol style="list-style-type: none">1. A place for securing a vessel.2. To secure a vessel at a berth.
Bollard	A short vertical post used on a ship or a quay, principally for mooring.
Borehole	Any hole drilled or dug in the sub-surface for the purpose of extracting or investigating the material at that particular point.
Caisson	A caisson is a form of lock gate consisting of a large floating iron or steel box.
Catamaran	A double-hulled vessel.
Chart Datum (CD)	See CHART SOUNDING DATUM
Chart Sounding Datum	Datum to which soundings and drying heights on a chart are referred. It is usually taken to correspond to a low water stage of the tide. Often shortened to CHART DATUM.
Culvert	Closed conduit used to convey water from one area to another.
Dock sill/sill	The foundation at the bottom of the entrance to a dry dock or lock against which the caisson or gates close.
Draft/Draught	The depth to which a vessel is submerged.
Dredge	The process of removing sediment from harbour or river bottoms for safety purposes and to allow for deeper vessels.
Dry dock	A dock providing support for a vessel, and means for removing the water so that the bottom of the vessel can be exposed.
Fender Piles	Piles on the outer edge of the wharf/jetty to absorb energy from berthing vessels.
Fishing Trawler	Commercial fishing vessel designed to operate fishing trawls.
Fleet	Number of ships owned by the same line.
Gantry Crane	Track-mounted crane utilized in the loading and unloading of breakbulk cargo, containers and heavy lifts.
Jetty	A landing stage or small pier at which boats can dock or be moored.
Length Overall	The maximum length of a vessel's hull measured parallel to the waterline.
Mean low water (MLW)	Lowest average level water reaches on an outgoing tide.



Glossary

Moor	To attach a ship to the shore by ropes.
Non-Tidal Basin	An enclosed basin separated from tidal waters by a caisson or flood gates. Also called WET DOCK.
Ordnance Datum (OD)	Vertical datum used by ordnance survey as the basis for deriving altitudes on maps.
Pier	A structure extending into the water from a shore or a bank which provides berthing for ships, or use as a promenade or fishing pier.
Pointing	The filling and finishing of mortar on the outer part of a joint where the bedding mortar has been raked back from the masonry face.
Pontoon	A floating flat-bottomed vessel to float machinery such as cranes, capstans, etc.
Port	Harbour area where ships are docked
Quay	A structure along a shore or bank which provides berthing for ships and which usually provides cargo handling facilities.
Rendhex Pile	Box hexagonal pile, formed of two back to back sheet piles
Ro-Ro	Short for roll on/roll/off . A ro/ro ship is designed with ramps that can be lowered to the dock so vehicles can drive on and off.
Scour	The underwater removal of bed material by waves or currents.
Tidal basin	A basin without a caisson or gate in which the level of water rises and falls with the tides.
Tidal range	The difference in height between consecutive high and low waters.
Towboat	A snub-nosed boat with push knees used for pushing barges.
Trawl	The net used for trawling
Trawling	A method of fishing that involves pulling a fishing net through the water behind one or more boats.
Tugboat/ Tug	Boat that manoeuvres vessels by pushing or towing them.
Unmoor	To remove the ropes that attach a ship to the shore.
Wet dock	See NON-TIDAL BASIN.
Wharf	See <i>Quay</i> .



Abbreviations and acronyms

AOD	Above Ordnance datum
CD	Chart Datum
CEFAS	Centre of Environment Fisheries and Aquaculture Science
EA	Environment Agency
EIA	Environmental Impact Assessment
FDC	Flood Defence Consent
LIDAR	Llght Detection And Ranging
LOA, O/A, OA	Length Overall
M.H.W.N.	Mean High Water Neap
M.H.W.S.	Mean High Water Spring
MIC	Microbiologically Influenced Corrosion
M.L.W.N.	Mean Low Water Neap
M.L.W.S.	Mean Low Water Spring
MMO	Marine Management Organisation
MoD	Ministry of Defence
NAABSA	Not Always Afloat But Sometimes Aground
NDT	Non-destructive Testing
OD	Ordnance Datum
PCC	Plymouth City Council
ppm	Parts per million
QHM	Queen Harbour Master
UXO	Unexploded Ordnance
VHF	Very High Frequency
VR	Victoria Regina

