Tyne Dock: the United Kingdom's greatest coal dock

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SUMMARY

Intermittent recording of the impressive historic entrances to Tyne Dock at South Shields was carried out between 1999 and 2013. Opened in 1859 by the North Eastern Railway, Tyne Dock was built to accommodate and ship the great and increasing quantities of coal brought to South Shields on the company's rail lines, with which the riverside staiths had been unable to cope. It was for a time the United Kingdom's busiest coaling facility.

The paper briefly sets out the physical and historic context of Tyne Dock within the tidal Jarrow Slake and the River Tyne, notes the extent of the complex as built and updated, and describes recording work carried out on the entrance structures, providing a description of their development and eventual redundancy as the demand for North-East coal grew and then declined.

INTRODUCTION

Lying two and a half miles from the mouth of the River Tyne, Tyne Dock (NZ 353 655) was set on the southern shore of the river, adjacent to South Shields (fig. 1), and on the eastern edge of the intertidal marsh and mudflats of Jarrow Slake. It was designed by Thomas Harrison for the North Eastern Railway Company (NER) and constructed between 1855 and 1859 by the civil engineers Jackson, Bean and Gow, providing a permanent, deep-water dock, principally for the shipment of coal. For a time, it was the largest and busiest coaling facility in the United Kingdom, and probably in the world (Addyman 1995, 16). Under the successive ownership of NER, the Tyne Improvement Commission, and the Port of Tyne Authority, it went through significant changes, both structurally and in scale of operation.

Uncertainty as to the development of the (already diminished) facility by The Port of Tyne Authority led to it commissioning an archaeological record of the entrance gates and locks. This was carried out by The Archaeological Practice of Newcastle University in 1999. Until early in this century it remained, at least potentially, a working dock, surviving in the form of a tidal basin, entrance locks, and a reduced dock-basin; there was also a wide hinterland which incorporated the remains of railway lines and demolished buildings that had been associated with the operation of the historic facility, as well as a range of modern warehouses and offices, including the new Port of Tyne Authority headquarters.

In 2009 plans were formulated by The Port of Tyne Authority to infill the remaining dock basin with spoil from excavations for the second Tyne Tunnel. This was carried out and has left the surfaces and outer part of the dock entrances on view but landlocked. In 2013, recording of the accessible surviving hydraulic machinery within the entrances — a feature of the historic working of the dock — was carried out by Wardell-Armstrong Archaeology (WAA 2014).

Fig. 1 The location of Tyne Dock: regionally (A) and locally (B).

JARROW SLAKE BEFORE TYNE DOCK

At an elbow in the lower River Tyne and overlooked by the remains of Bede's Monastery of St Paul, Jarrow Slake remained for long a remote intertidal salt-marsh and mudflat alongside a busy, working river. Richardson's plan of the Townships of South Shields and Westoe, surveyed in 1768 (fig. 2), shows it as an empty expanse bordered by fields to the south and with the south-western fringe of South Shields brushing against it. Crossing the flats in spring, Hutchinson (1787, 480) saw it at its best, with 'many acres of the margin of the Slake beautifully covered with thrift in full bloom, giving the shores the finest purple hue; and the sands provided pleasant travelling.' Even well into the next century the Slake was '…calculated to produce a general impression of solemn quiet. The church and mouldering monastic walls on the green hill sloping to the bay, the long silvery expanse of water, the general ripple of the advancing tide, the sea birds perpetually hovering on the wing or dipping in the wave & the distant view of Shields harbour, with its clouds of smoke & forests of masts, form no common combination' (Surtees 1820, 66). This area of solemn quiet — made rather more solemn by a gibbet set up in 1832 on which the body of the miner William Jobling was displayed for the murder of Magistrate Nicholas Fairless — would soon see great change.

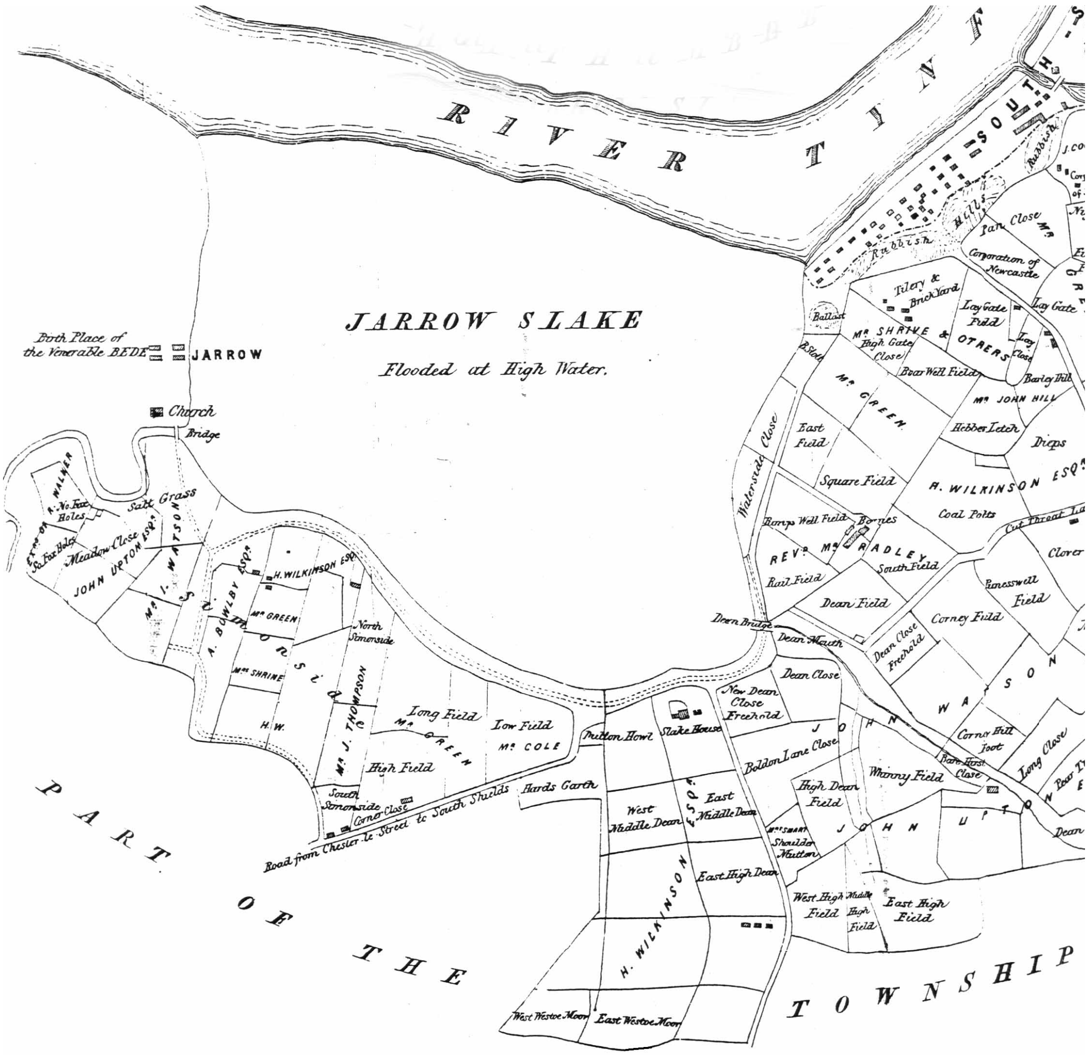


Fig. 2 A portion of Richardson's plan of the Townships of South Shields and Westoe, 1768, showing Jarrow Slake.

CHANGES ON THE TYNE

Despite its major role as a conduit for the movement of coal from North-East collieries, the Tyne was not an easy river to navigate and natural problems were exacerbated by the hand of man. Captain Phipps, who stood for a seat in Parliament in Newcastle in 1774, 'and who possessed the most consummate knowledge in maritime affairs,' must have summarised the views of many when 'he considered the Tyne capable of becoming one of the finest rivers in the world but which ignorance, inattention and avarice had converted into a "cursed horse-pond" ' (Mackenzie 1827, 740). Colliers, of which at any one time hundreds could be moving up and down the river, were at constant risk of grounding on the numerous sandbars and shoals. A loaded collier could often take weeks to get back to South Shields, re-negotiate the sand bar at the mouth of the Tyne and move into the open sea. At times, the river must have appeared like a carefully contrived — and very crowded — obstacle course.

Over the first half of the nineteenth century the realisation dawned, even to its long-standing and inattentive conservators, Newcastle Corporation, that the Tyne was becoming unserviceable. In 1816 they commissioned engineer John Rennie to look at remedies. There were basic dimensional problems: 'There is perhaps no river in Great Britain on which it is more difficult to give a satisfactory opinion as to the best mode of improving its navigation … In this river, not only is great depth wanted, but likewise great width, to accommodate the great number of ships which resort to it; these two qualities, however, are incompatible with one another' (Rennie 1816, 1).

Despite the incompatibilities, Rennie provided blueprints for addressing the problems, but they would be expensive ones. Little work of improvement ensued. In the meantime, the sheer volume of traffic, downriver staiths, and the dumping of ballast behind poorly constructed and leaking jetties, all increased. In his evidence to the Admiralty Inquiry into the River Tyne Conservancy Bill, 1849, George Brown said, 'I have been engaged as master and owner of steam-tugs used for the purpose of towing vessels up and down the Tyne; it is in many parts worse than it was thirty years ago.'.

In 1850, control of the river was taken from Newcastle Corporation and handed to a representative body, the Tyne Improvement Commission. The first act of the Commission was the construction of a great new coaling facility, Northumberland Dock, towards the mouth of the river at Hay Hole on the northern bank (fig. 1), primarily for taking coal from the Blyth area. 'This', wrote Guthrie (1880, 112–13), 'was the first occasion on which any substantial improvement, or great plan for the benefit of the Tyne, had been undertaken and successfully completed by its conservators … It seemed as if the stagnant waters of inertia were at last being moved by the modern spirit of improvement, and that the Tyne was now entering in earnest on that path of progress and development on which hitherto such feeble and faltering steps had been taken.'

And within eight years, another great new facility, Tyne Dock, had been constructed across the water on the southern bank of the river at Jarrow. Although both docks were undoubtedly signs of the 'modern spirit of improvement' noted by Guthrie, they would have been only a very partial answer to the problems of the river had not the Tyne itself been radically improved as a navigable waterway by its new conservator. As late as 1860, 'Vessels of moderate size and draught were detained for weeks after loading, unable to get to the sea at the top of high water; other vessels were thumping and grounding on the bar in vain attempts to get to sea' (Guthrie 1880, 122–3).

In 1861, under the Harbours and Passing Tolls Act of that year, The Tyne Commissioners borrowed £350,000 and began work under the direction of John Ure, their new engineer, to ease navigation along the river by very extensive dredging. In 1847, clearance at the bar had been as little as six feet (1.8 m). By 1865, this had increased to 15 feet (4.6 m) and by 1875 there was a 20-foot (6 m) channel all the way to Newcastle. Following construction of the Swing Bridge in 1876, the river beyond was soon opened out (McCord and Thompson 1998, 283).

So successful was this dredging that, subsequent to the Northumberland and Tyne Docks, no new coaling docks were provided on the Tyne until the Albert-Edward Dock was constructed in the 1880s. The Tyne, itself, became much more suitable for coaling and new staiths were opened up along its banks as far inland as Dunston (the staiths, still there today, were opened in 1893), well upstream from the site of the old Newcastle Bridge which had for so long been the limit of navigation for early colliers.

COALS TO THE TYNE

Coal-mining returned on a large scale to the lower River Tyne over the later eighteenth century, a result of the exhaustion of shallower deposits to the west, and of the development of powerful steam-powered pumps which could dewater previously inaccessible deep deposits of the Tyne Coal Basin. Coal was being transhipped into colliers at staiths and drops around the area of Jarrow Slake by the early nineteenth century. Waggonways served Jarrow Colliery (west of the Slake), won in 1803, Templetown Colliery (east of the Slake), won in 1810, and eventually St Hilda's Colliery (close to the centre of South Shields), won in 1825. In addition to these local pits, longer rail routes also developed over the first part of the nineteenth century, exploiting coal deposits (and other resources) further afield. These routes included the lengthy Stanhope and Tyne Railway (S&TR) of 1834 which terminated at impressive staiths to the east of the Slake and which brought coal from the area around Pontop, Medomsley and West Consett. The Brandling Junction Railway (BJR) followed in 1839. The development of the Durham concealed coalfield beneath the Magnesian Limestone of the coastal plateau, marked by the winning of Hetton Colliery in 1822 (which moved its coal to staiths on the Wear along the Hetton Colliery Railway), had already added enormously to the potential supply.

By the 1850s, the transhipment of coal at South Shields had reached breaking point. 'The facilities for shipping at South Shields at the command of the North-Eastern Railway Company have, for some time, been so limited that it has been necessary to work night and day throughout the whole year; and even then the requirements of the trade could not be satisfied' (Harrison 1859, 496). Coal began to be diverted to the new Sunderland South Dock, opened in 1850 on the Wear (Sinclair and Carr 1990, 11). Clearly, something had to be done.

PLANS FOR A COAL DOCK ON JARROW SLAKE

By the middle of the century, coal-docks served by rail were spreading across the region: Seaham, constructed for Lord Londonderry, was in use by 1831; Hartlepool was opened in 1840; and Sunderland's South Dock opened in 1850. However, the only new dock on the River Tyne, Northumberland Dock, opened in 1857, was on the north bank and could not readily exploit the Durham Coalfield.

The notion of building a coaling dock on the intertidal Jarrow Slake, only a short distance from the mouth of the river, had been raised periodically from at least the early nineteenth century. None of these schemes came to fruition, one of the recurrent issues being the Admiralty's longstanding concern over the possible effects upon the speed and depth of current in the main river course by enclosing a large part of the Slake; Simon Temple's 1803 proposals to build a dock (and naval arsenal) on the Slake was an early casualty. Two subsequent proposals for the construction of docks led to the passing of Acts of Parliament in 1837 and 1847. Both schemes were aborted: the first because of its links to the Stanhope and Tyne Railway which was in severe financial difficulties; the second due to its disastrous links with George Hudson, the (soon to be deposed) Railway King (Sinclair and Carr 1990, 11). Although little headway was made, preliminary excavations for the latter scheme began in 1849 before the financial collapse of the project.

In the early 1850s, Thomas Elliot Harrison, the first of a notable family of railway engineers, and the engineer for the Stanhope and Tyne Railway (Sinclair and Carr 1990, 15), produced estimates to show that a dock at South Shields and on the Slake was not only necessary but would be a secure commercial venture (Addyman 1995, 27). Despite protests and impractical requirements from the Admiralty, problems were circumvented and the Parliamentary Act for the construction of the dock was passed in 1854; this was the same year that Harrison helped to bring about the amalgamation of a number of railway companies to establish the North Eastern Railway (NER) — a major reason for the success of the construction and subsequent operation of the dock.

TYNE DOCK

CONSTRUCTION AND OPENING

Tyne Dock was constructed between 1855 and 1859 for the NER by the civil engineering company Jackson, Bean and Gow which had been amalgamated specifically to undertake this large and demanding project to the design of T. E. Harrison. The new dock was located at the eastern end of the Slake, set against the extensive Jarrow Chemical (Alkali) Works, established on the site in 1843. A plan prepared for the chemical works shows their relationship and provides a detailed view of Tyne Dock soon after it was completed (fig. 3). A detailed description of the construction of the docks was provided by Harrison (1859).

Water was let into the dock basin in December 1858, the first vessel entered in January 1859, and the dock was formally opened for traffic on 3 March 1859. A large and very lively painting by John Scott, hanging in South Shields Museum and Art Gallery (accessible online at http://www.bbc.co.uk/arts/yourpaintings/paintings/the-opening-of-tyne-dock-34768), shows the opening ceremony viewed from the River Tyne: colliers, tugs, a steam yacht, and the entrance pier are decked out with pennants flapping briskly in a stiff breeze which also whips the smoke away from the adjacent stacks of Jarrow Chemical Works. The full extent of the docks and outlying areas taken in by the works covered just a little over a half of the former area of the Slake (72.5 out of a total of 141.6 ha).

COMPONENTS OF THE DOCK

On completion, the structure and layout of Tyne Dock provided the basis for its development into the largest facility of its kind in the United Kingdom — and thereby probably in the

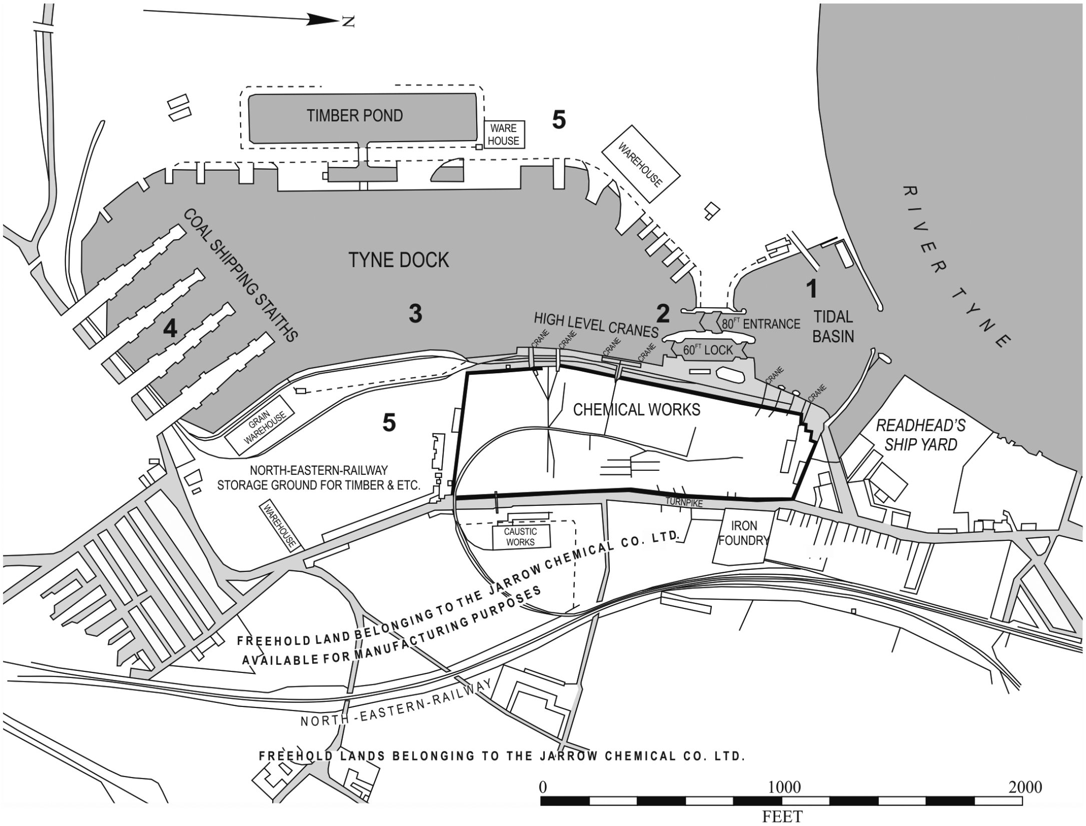


Fig. 3 Transcription of a 'Plan of Jarrow Chemical Works and Premises, Tyne Dock, South Shields', showing Tyne Dock soon after 1859. Numbers in bold locate the five components of the facility.

world — over the later nineteenth and early twentieth century. It comprised the following main components which are numbered on figure 3:

1. *Tidal Basin*: 9.5 acres (3.84 ha) in extent, incorporating piers, quays and associated appliances.
2. *Entrances:* initially two entrances were provided, one a tidal entrance 80 feet (24.3 m) wide, the other a lock fitted with two sets of gates 60 feet (18.3 m) wide.
3. *Dock Basin:* 50 acres (20.2 ha) in extent, with component quays and jetties equipped with cranes and other appliances; as opened, it had space for 500 vessels.
4. *Staiths:* four staiths located at the southern end of the main basin; initially two staiths were in operation for coal export, two others completed to above high water level, one of which was fitted out for the removal of ballast. Structurally, the staiths linked the main dock basin and land area.
5. *Land Area:* included offices, warehouses and other storage facilities, as well as many miles of railways, sidings and associated features such as embankments, viaducts and bridges.

THE SUCCESS OF TYNE DOCK

Tyne Dock revolutionised the movement of coal at South Shields: it had deeper berths than those at the nearby BJR and the S&TR staiths and provided great improvements in the handling of coal. At the old staiths, waggons had to be turned through 90 degrees to reach the staiths and were then individually lowered on to the collier; at Tyne Dock, the waggons ran to and from the staiths by gravity and coal was delivered to the collier via a spout. It was estimated that the cost of transporting coal through the dock was one fifth of that through the S&TR staiths (Sinclair and Carr 1990, 11).

By the early twentieth century, the figures for the movement of coal through the Tyne Dock were staggering: between 1907 and 1914, it shipped over 7 million tons a year, approaching 20,000 tons a day; this was up to 93 vessels a week, loaded from over 12 thousand waggons. No other dock in the world shipped as much (Addyman 1995, 16).

Goods other than coal also went through the dock. The movement of imported iron ore into the Tyne began in the 1860s. By early in the twentieth century, Tyne Dock was unloading around 400,000 tons a year. The Sutherland Quay on the riverside next to the Tyne Dock entrances was commissioned in 1942 to deal with ore. New cranes, hoppers and conveyers established on the quay in 1953 allowed 1,500 tons of iron ore to be unloaded every hour.

Timber, commonly from the Baltic and mainly used for pit props, also provided the basis for very substantial movements through Tyne Dock which had a number of prop jetties within the basin. Soon after it opened, much of the west side of the facility was set aside for timber storage; this included a number of storage ponds (fig. 3). This storage extended to the east of the dock in the early twentieth century. Grain was also moved through the dock and was stored in warehouses which, by the twentieth century, could hold up to 25,000 tons.

DECLINE

With the decline of coal mining in the North East, iron ore became the major commodity moved through the dock, handled on the Iron Ore (formerly Sutherland) Quay. By the mid 1960s, any other movements were in steep and terminal decline and facilities were being lost. In 1966, No. 1 Grain Warehouse was demolished, and in 1967 the Sixty Foot entrance was blocked and the coal staiths closed. The last operational movement of coal through the dock was in March of that year (Groundwater 1998, 111). In 1974 the dock basin was reduced to around half its original extent and Consett Steel Works transferred the import of ore from Tyne Dock to the River Tees. The Iron Ore Quay was converted to general cargo handling. By the late 1970s, the brick railway-arches extending from the staiths at the south of the dock were demolished and other links to the dock were cut with the demolition of the railway bridge at Dean Road in South Shields. The final filling of the reduced dock basin was carried out in 2010.

THE ENTRANCES TO TYNE DOCK

ARCHAEOLOGICAL RECORDING

In 1999, uncertainty on the part of The Port of Tyne Authority over the future of the partially infilled inner basin of Tyne Dock (reduced from 20.2 to 11 ha by 1974) led to archaeological recording of the entrance structures, the last surviving coherent components of the coaling facility. This was carried out by The Archaeological Practice of Newcastle University and included detailed survey of the structures (Archaeological Practice 1999). Further photographic recording of the entrances was carried out by the successor organisation to the Archaeological Practice in 2009, following the decision by The Port of Tyne Authority to use the now derelict dock basin to hold spoil from the excavation of the second Tyne Tunnel. In 2013, Wardell Armstrong Archaeology recorded the last accessible mechanisms of the extensive hydraulic system (WAA 2014).

THE ENTRANCES TODAY

A detailed description of the entrance structures (as surveyed in 1999) is included later in this paper. In summary, the entrances lie between the infilled dock basin to the south and the open tidal basin and the River Tyne to the north. Surviving components of piers to either side of the entrances are attached to the Factory Quay and River Wall to the east, and to the line of the old Prop Jetty and the Iron Ore Quay to the west. Although the original plan and form of the entrances to Tyne Dock can be established, subsequent alterations — most radically the addition of a third entrance in the 1890s — changed their appearance considerably. Figure 4 shows the entrances as surveyed in 1999; the names and abbreviations for the structural components are included in this plan. The terminology is used throughout although, strictly speaking it does not apply to the description of the entrances as constructed in 1859 which had only two waterways:

Eastern Pier	EP	Western Pier	WP
Eastern Middle Pier	EMP	Western Middle Pier	WMP

THE ENTRANCES AS CONSTRUCTED IN 1859

The entrances were located over an area of solid clay, as established by boreholes, thus avoiding the many dissections of the subsoil in the Slake caused by former stream courses and filled with mud, sometimes to a depth of over 21 m (Harrison 1859, 492). As constructed, Tyne Dock had two entrances; the Sixty-Foot Lock and the Eighty-Foot Tidal Entrance (fig. 5A). These were formed of three structural elements of considerable scale and complexity:

- Two masonry piers, one to either side of the entrances (EP and part of the WMP);
- A masonry central island-pier which formed the eastern side of the Eighty Foot Tidal Entrance and the western side of the Sixty Foot Lock entrance (EMP).

Two of these structures, the eastern attached pier (EP) and central island pier (EMP), survived almost completely when surveyed in 1999. Much of the third component, the western attached pier (part of the WMP), had been subsumed within later construction work in the 1890s when the entrances were radically altered.

The Sixty-Foot Lock

The lock had an internal length (sill to sill) of just over 262 feet (79.8 m) and an internal width (in the central basin) of 100 feet (30.5 m). The eponymous 'Sixty Foot' was the distance between the gates. Both of the longitudinal walls of the lock were straight, with a batter to the waterline. The lock allowed the movement of vessels between different water levels. Colliers

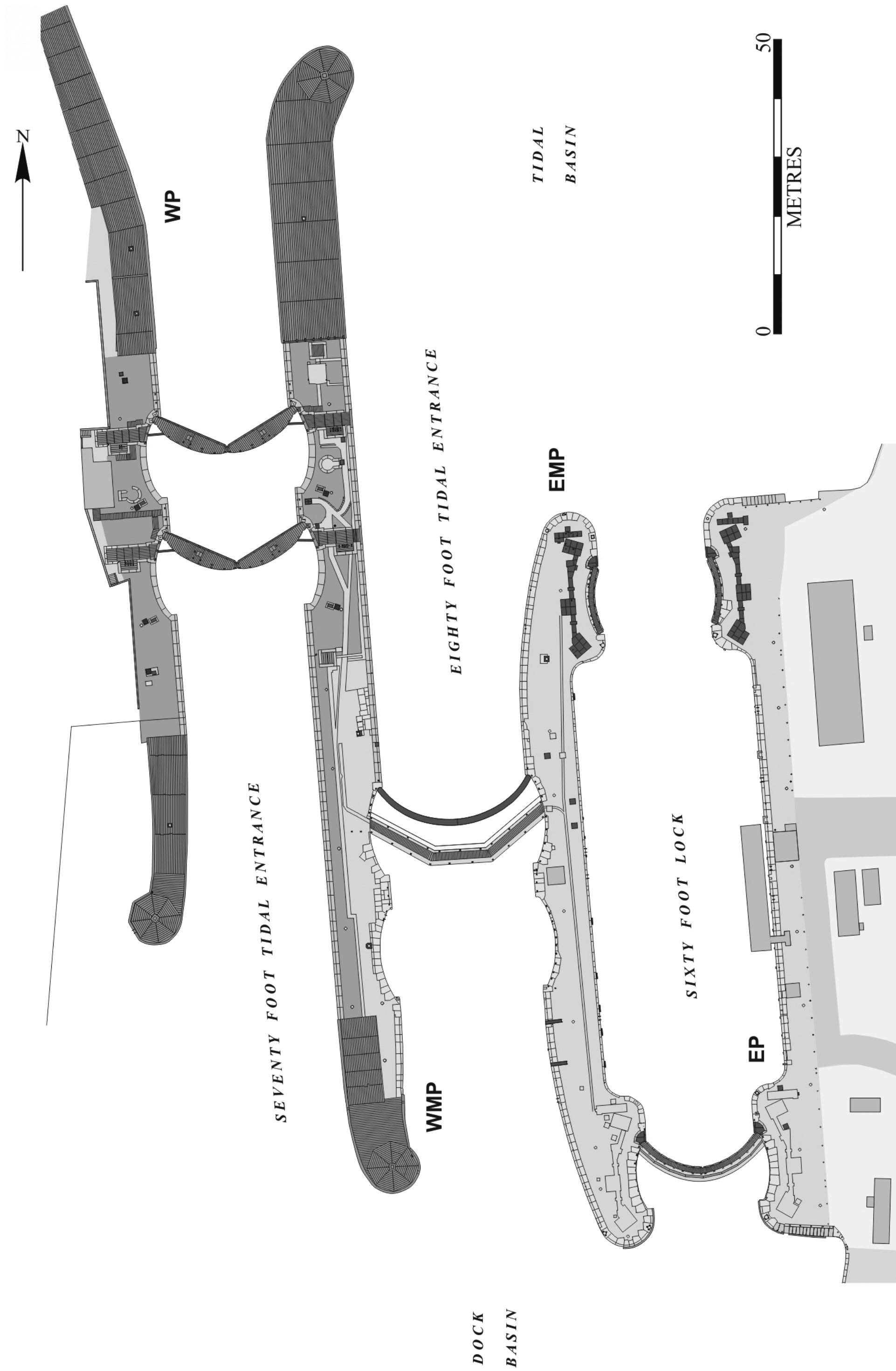
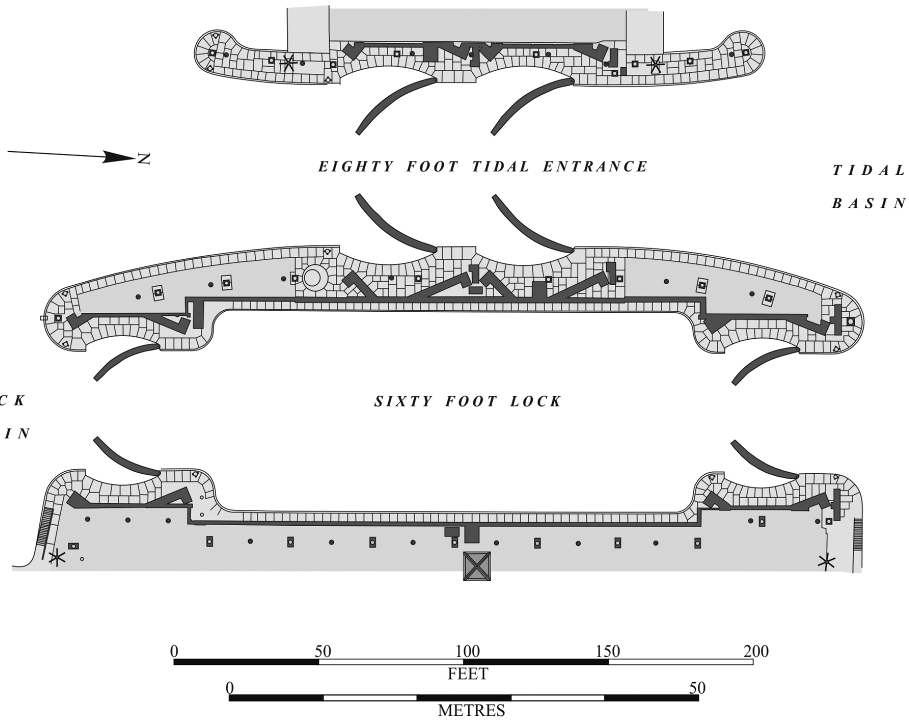


Fig. 4 Plan of the entrances to Tyne Dock as surveyed in 1999 by The Archaeological Practice.

A



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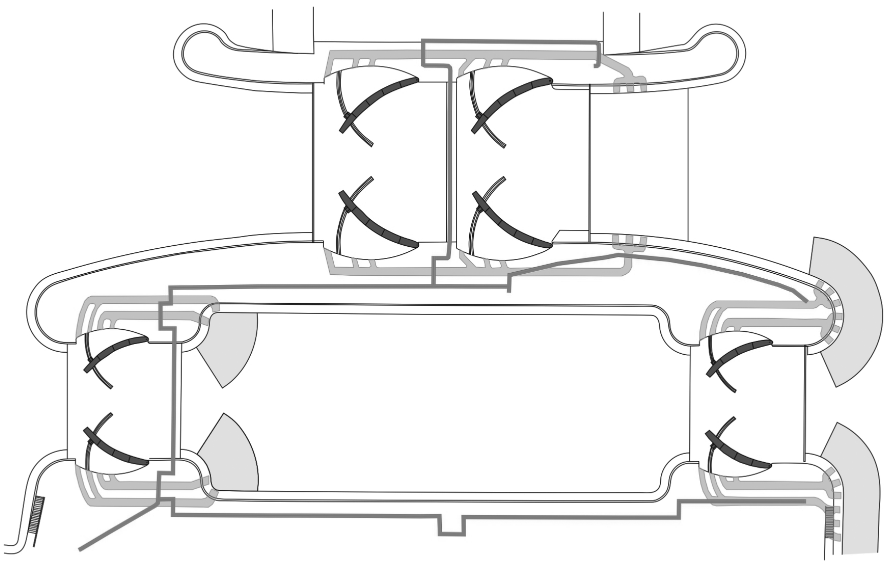


Fig. 5 Entrances to Tyne Dock (Sixty-Foot Lock and Eighty-Foot Tidal Entrance) as constructed. It is a transcription from plate 7 of Harrison (1859). A: Plan of the entrance piers. B: Sluices (pale tone) and hydraulic systems (thin, dark line) within the piers and also showing masonry aprons around certain edges of the Sixty Foot Lock.

entered the lock from the Tidal Basin; in 1859, Harrison (1859, 504) said that 'six full-sized colliers or eight ordinary vessels could be admitted at one time'. Once they were within the lock, the external gate was closed and sluices connecting the basin and the lock were opened (fig. 5B). This flooded the lock (previously at river level) to the height of water in the dock (maintained at around the level of prevailing high tide). The gates between the dock basin and the lock were opened and the colliers could proceed into the basin for loading. At the next high tide, water lost to the Tyne was returned to the dock through the Eighty-Foot Tidal Entrance. Of course, the movement of vessels could be carried out just as readily in the opposite direction.

The Eighty-Foot Tidal Entrance

As constructed, the entrance was 80 feet (24.4 m) wide with two pairs of gates set towards the centre of the piers. Both of the longitudinal walls of the entrance tapered away from the centre point between the gates and were slightly battered to the waterline. The Eighty-Foot Entrance did not generally function as a lock as the basin was very small and normally operated at high tide when water levels between the dock basin and the river were balanced.

Fabric of the Entrances

The major component of the structures was sandstone cut into large ashlar blocks. A small amount of granite was used on areas subject to intense mechanical wear, for instance around the gate hinges. Massive inverted masonry arches formed the gate sills of both entrances. Profiles across the Sixty and Seventy-Foot Entrances on these sills can be seen on fig. 6. Almost all of the water edges had a half-round kerb, again of sandstone, and the majority of the dock surfaces were covered in substantial sandstone slabs, although areas of the central island were surfaced in concrete from initial construction.

Hydraulics

An holistic approach was taken to operating the dock, and hydraulics were used extensively, powering not only sluices and gates but also four ballast cranes and other goods cranes along the quays (fig. 3). Two 25-horse-power engines powered the cranes, and smaller engines or pumps, geared through shafting, powered the entrance gates. The system was provided by Sir William Armstrong from his Elswick Engine Works. Harrison estimated that the whole system cost under £5000 (Harrison 1859, 514). Sluices and entrance gates could be operated manually by capstan if the hydraulic system failed.

In August 2013, Wardell-Armstrong Archaeology (WAA 2014) was commissioned by the Port of Tyne Authority to record the gate-operating machinery at the northern end of the western pier of the Sixty-Foot Lock (the EMP), prior to the final infilling of the entrances. This was the last remaining location in which hydraulic machinery was accessible following the concreting-over of the access-plates on the northern end of the EP. The gates of the Sixty-Foot Lock, and parts of the hydraulic mechanisms, are replacements of the originals (see below), installed in the 1920s (The Archaeological Practice 1999, 28). The machinery compartments were covered over at this time with non-slip steel access plates. One of the plates held the inscription 520 CARRICK AND WARDALE ENGINEERS 1924 GATESHEAD ON TYNE. This

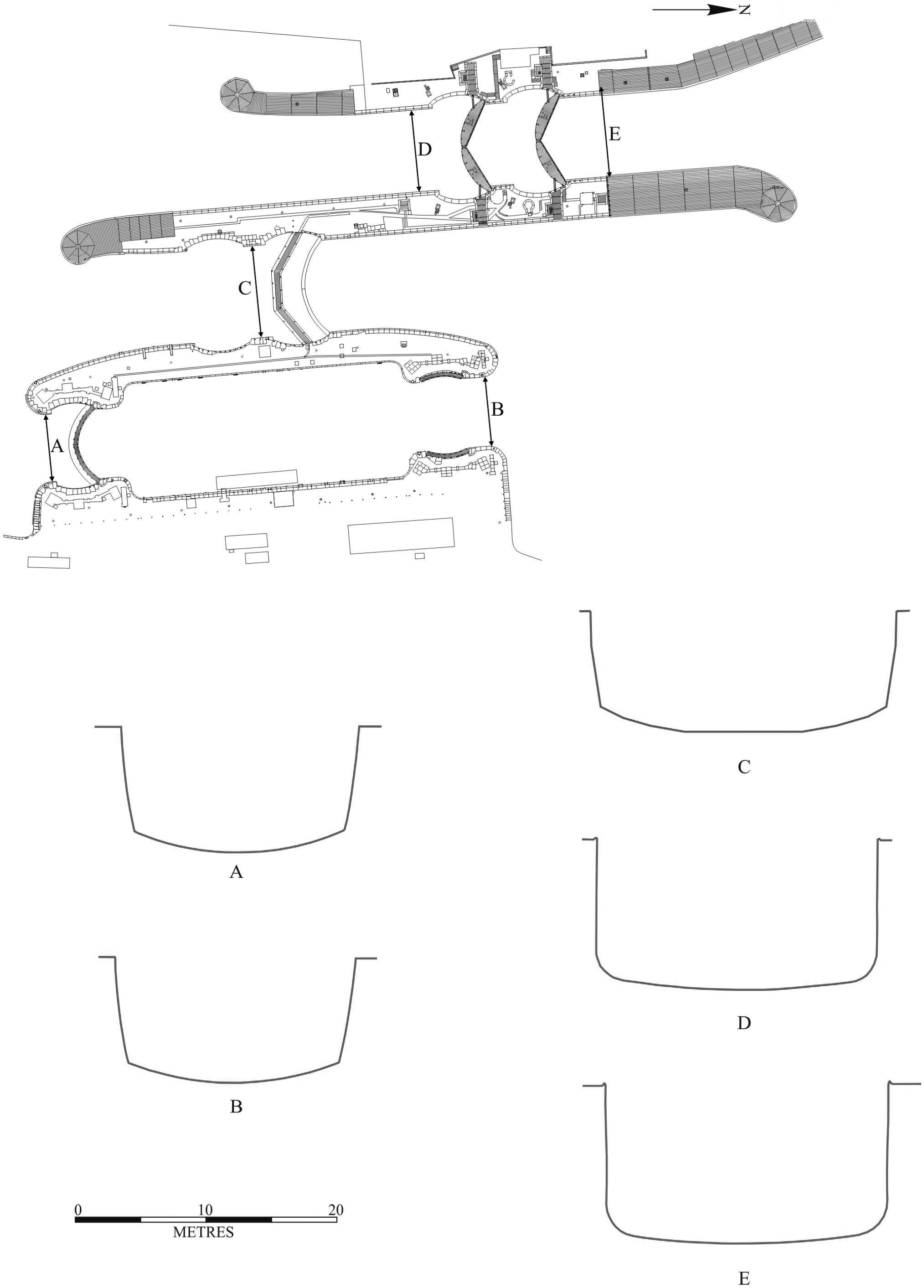


Fig. 6 Plan and profiles through the Sixty, Eighty and Seventy Foot entrances.

company was a longstanding engine works, based in Redheugh. The machinery within the compartment — of which the northern block, or at least its housing, may be original — was complete, although suffering heavily from corrosion, particularly the winding chains and some of the drive-shafts.

The three-cylinder hydraulic engine or pump in a compartment towards the middle of the gate (fig. 7) was connected through a series of gears to a drive-shaft powering chain winches set to north and south. Each winch was attached to its opposite number on the adjacent pier across the entrance by chain. To open a gate, two opposing winches wound in. To close it, the two remaining winches wound in. Should the hydraulics fail, provision had been made for manual operation by two capstans, one towards the north and one towards the south end of the compartments.

Gates

Entrance gates to both the Sixty-Foot Lock and the Eighty-Foot Tidal Entrance, as originally installed, were supplied by Robert Stephenson (a close professional associate of Harrison) from his Forth Engineering Works in Newcastle. They were of riveted wrought-iron plate construction and were operated by hydraulic machinery set in the piers. As mentioned above, the gates of the Sixty-Foot Lock were replaced in the 1920s. Fig. 8 shows the north-west gate of the Sixty-Foot Lock fastened back in its recess, as recorded in 1999. The Eighty-Foot Tidal Entrance was closed as a waterway at the same time; the southern gates were removed and the northern gates truncated, fixed in the closed position, and a concrete blocking wall or dam was set between the recesses.

Dock furniture

As originally conceived, there were no major structures on the entrances, although the Customs House and the Dock Manager's Office stood immediately adjacent to the east, and the extensive hydraulic equipment was initially covered flush with the dock surfaces with stone slabs. The tender document (Appendix 2) mentions Yorkshire landlings ('as specified') as covers over the hydraulic machinery; presumably this was a type of flagstone. They were replaced in the 1920s with steel plates on the Sixty-Foot Entrance. Furniture on the dock entrances consisted of mooring posts or bollards, 'mushrooms' (pulley wheels) and capstans. A small hut stood on the central pier next to the north gate of the Sixty-Foot Lock. Gas lights were also set on the piers and along the quayside. Fig. 9 shows the Sixty-Foot Lock, probably in the 1920s (and certainly after 1924), with steel plates over the hydraulic compartments on the right. The view is to the south-east with The Customs House and the Dock Manager's Office beyond the entrance.

THE ENTRANCES AS ALTERED IN THE 1890S

The Seventy-Foot Tidal Entrance

As colliers and other freighters became larger, with consequently greater draughts, a new, deeper entrance was required to allow access to Tyne Dock. In 1888, only a short time before his death, T. E. Harrison was asked by the NER to report on the requirements for this new entrance; this resulted in the construction, in 1894, of the Seventy-Foot Tidal Entrance, a

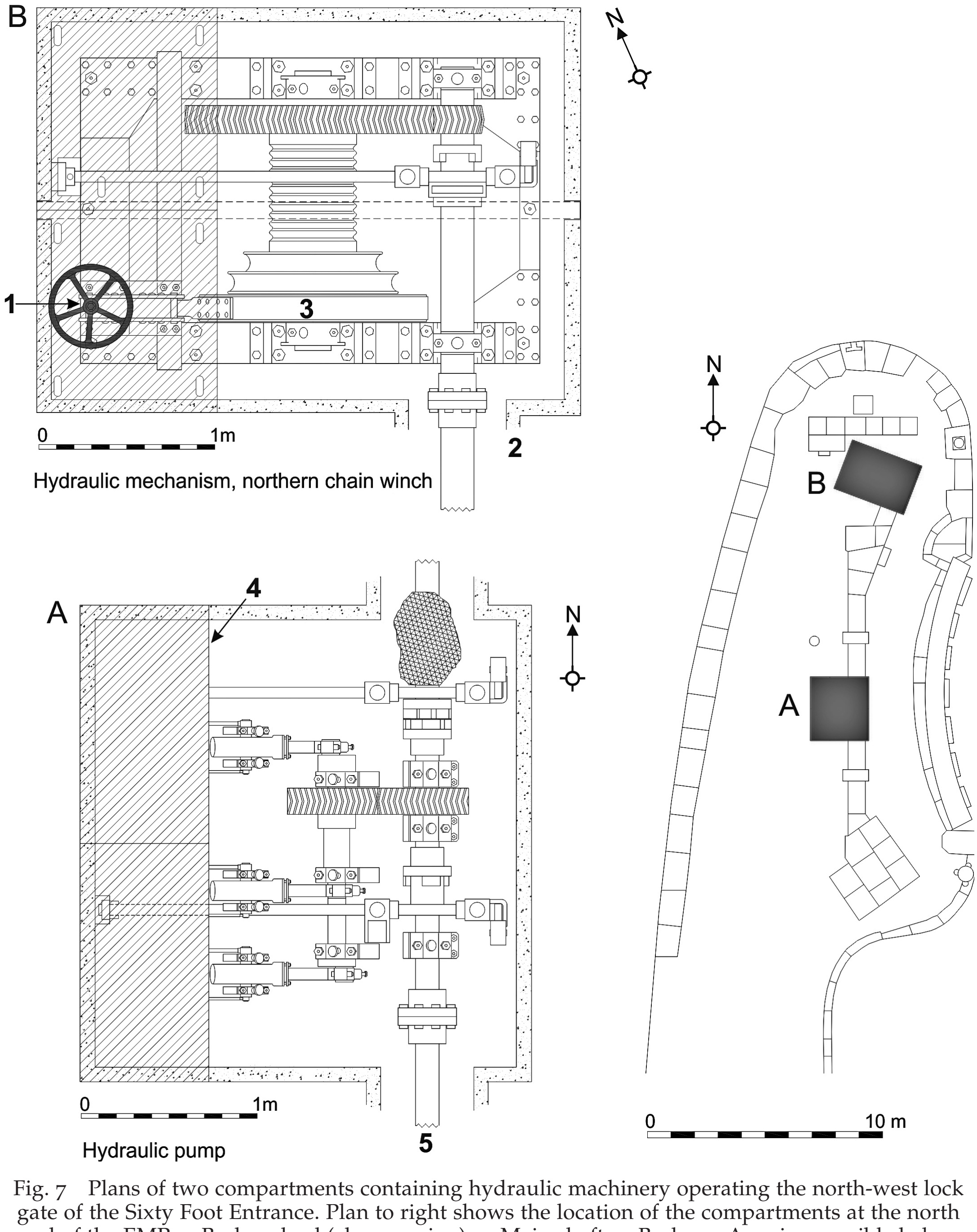


Fig. 7 Plans of two compartments containing hydraulic machinery operating the north-west lock gate of the Sixty Foot Entrance. Plan to right shows the location of the compartments at the north end of the EMP. 1. Brake wheel (above casing); 2. Main shaft; 3. Brake; 4. Area inaccessible below steel cover plates; 5. Main shaft. Cover plates not removed shown in oblique hatching. Wardell-Armstrong Archaeology 2014.

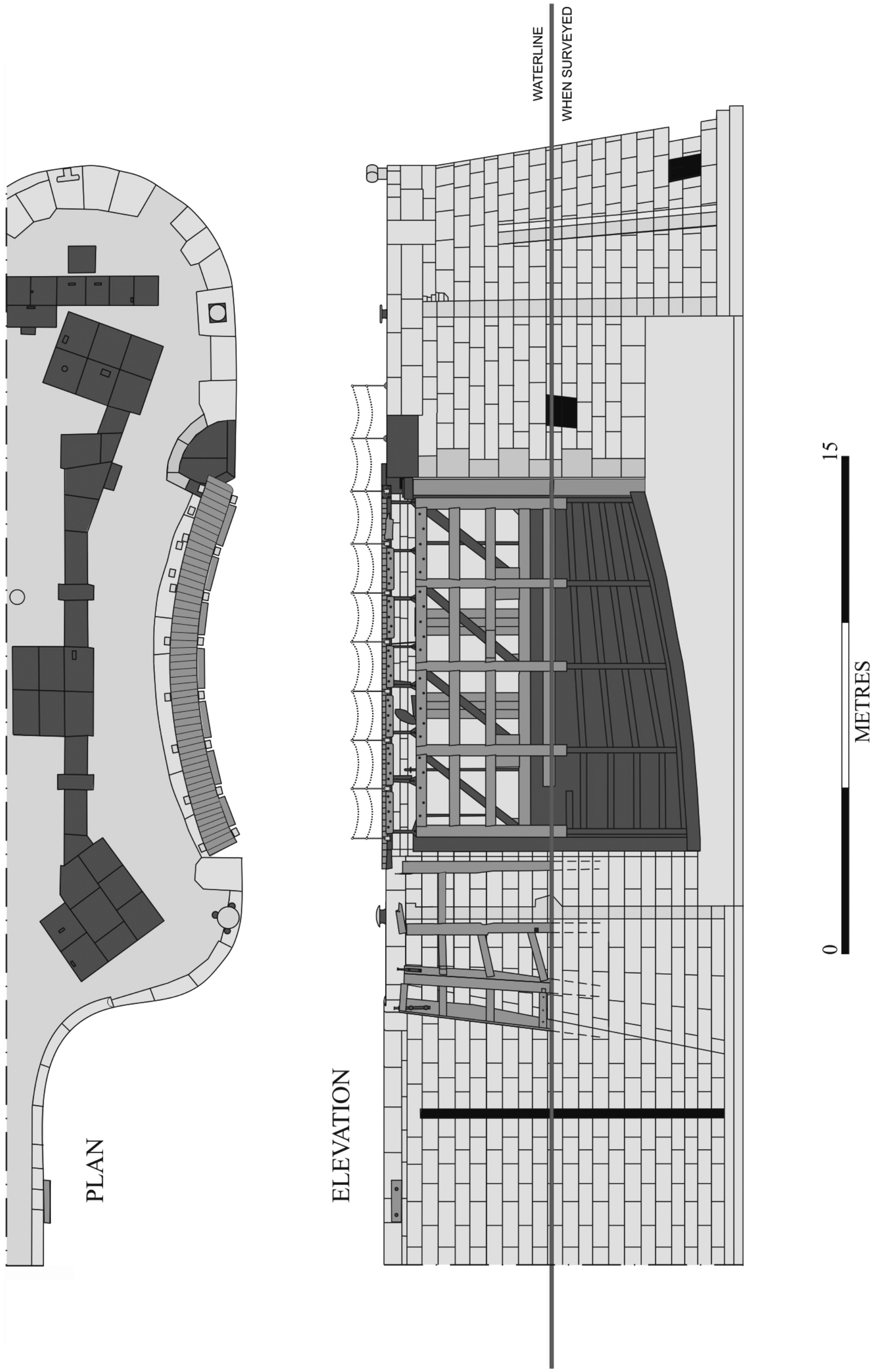


Fig. 8 Central island pier (EMP) of the 1858 dock. Plan and elevation showing the east face of the northern gate. Drawing compiled from survey and archival sources.

Fig. 9 A photograph of the north gates of the Sixty-Foot Lock looking south-east with the Custom House and Dock Manager's Office beyond the entrance. Probably taken in the mid 1920s. With thanks to the Port of Tyne Authority.

project carried out by the NER and supervised by the engineer Sir John Wolfe Barry (Addyman 1995, 30). This new Entrance, constructed to the west of the Eighty-Foot Entrance (fig. 4), had a high-tide depth of water on its sill of 32 feet (9.7 m), as opposed to the 25-foot (7.6 m) depth of the Eighty-Foot Entrance.

The introduction of the third entrance left the two eastern piers substantially as they had been constructed in the 1850s. The third, western pier (WMP) was, however, radically transformed. Firstly, it was disengaged from solid ground and became an island. The western edge was completely replaced with new stonework and timber extensions were added to north and south. The fabric and character of the central eastern face and of the southern arm running from the gates remained as constructed in the 1850s but they were subsumed within the work of 1894. As completed, the 'new' pier was *c.* 643 feet (196 m) long, including timber extensions, with a central core of stone 426 feet (130 m) long. The timber extensions to the north and south were respectively *c.* 148 feet (45 m) and *c.* 100 feet (30.5 m) long.

In addition to the disengagement and alteration of the original western pier, an entirely new engaged pier was constructed to form the western face of the Seventy-Foot Entrance. This consists of a central masonry section 213 feet (65 m) in length, containing recesses for the two western leaves of the entrance gates flanked to north and south by timber extensions; that to the south was a discrete feature *c.* 115 feet (35 m) in length, that to the north formed a part of the riverside frontage and extended around to the Iron Ore Quay.

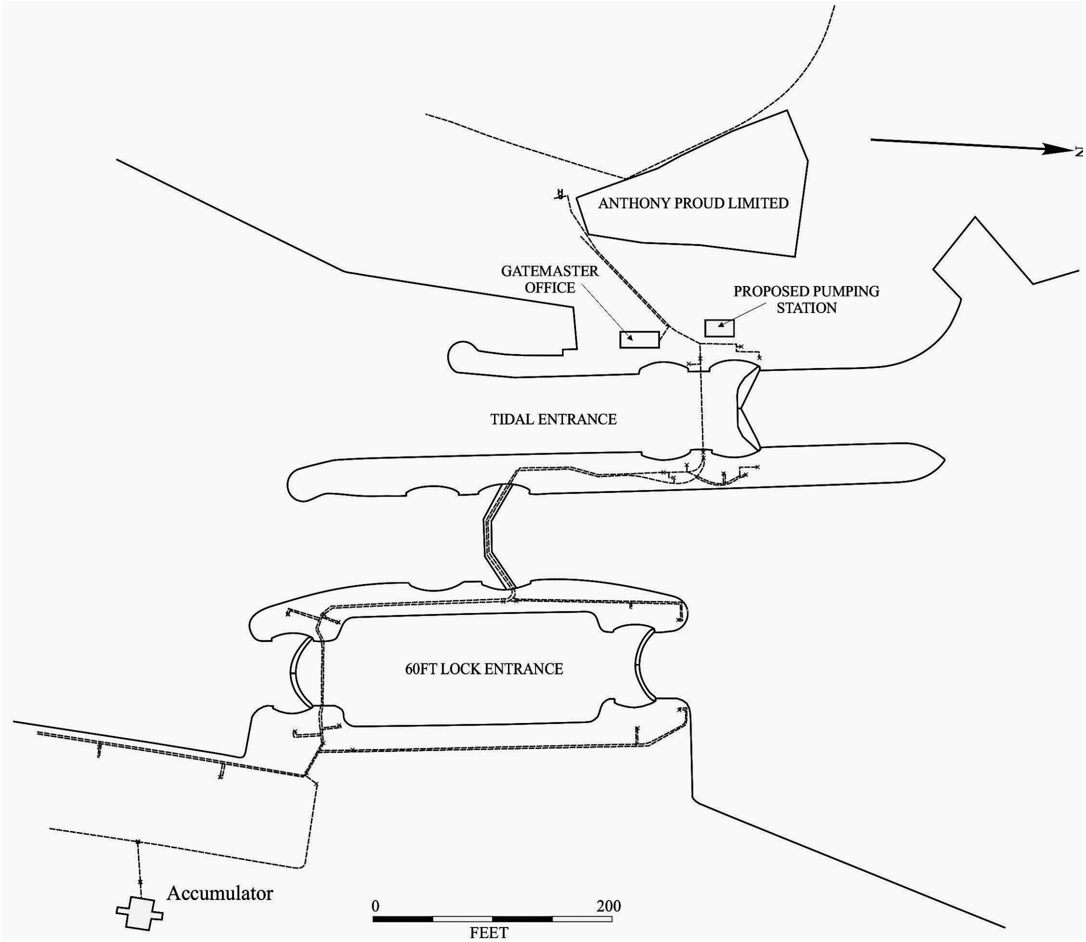


Fig. 10 Plan of Tyne Dock entrances subsequent to construction of the Seventy-Foot Entrance in 1893 and the blocking of the Eighty Foot Entrance in 1923, showing the adaptation to the original hydraulic system required (Tyne Improvement Commission, undated). Hydraulic pipes shown in broken line.

Fabric

A characteristic of the new construction was the use of granite both in monolithic blocks and in the form of stone setts as a surfacing on areas of the dock. However, the majority of the new structure was still of sandstone, much of which, where used as surfacing, was of margined ashlar.

Hydraulics

The original system was updated and extended to supply the new entrance. Fig. 10 shows the system subsequent to the opening of the Seventy-Foot Entrance and the closure of the Eighty-Foot Entrance in 1923 with a concrete wall — quite a late stage in the operation of the dock. No hydraulic machinery was available for inspection on either the WMP or the EP.

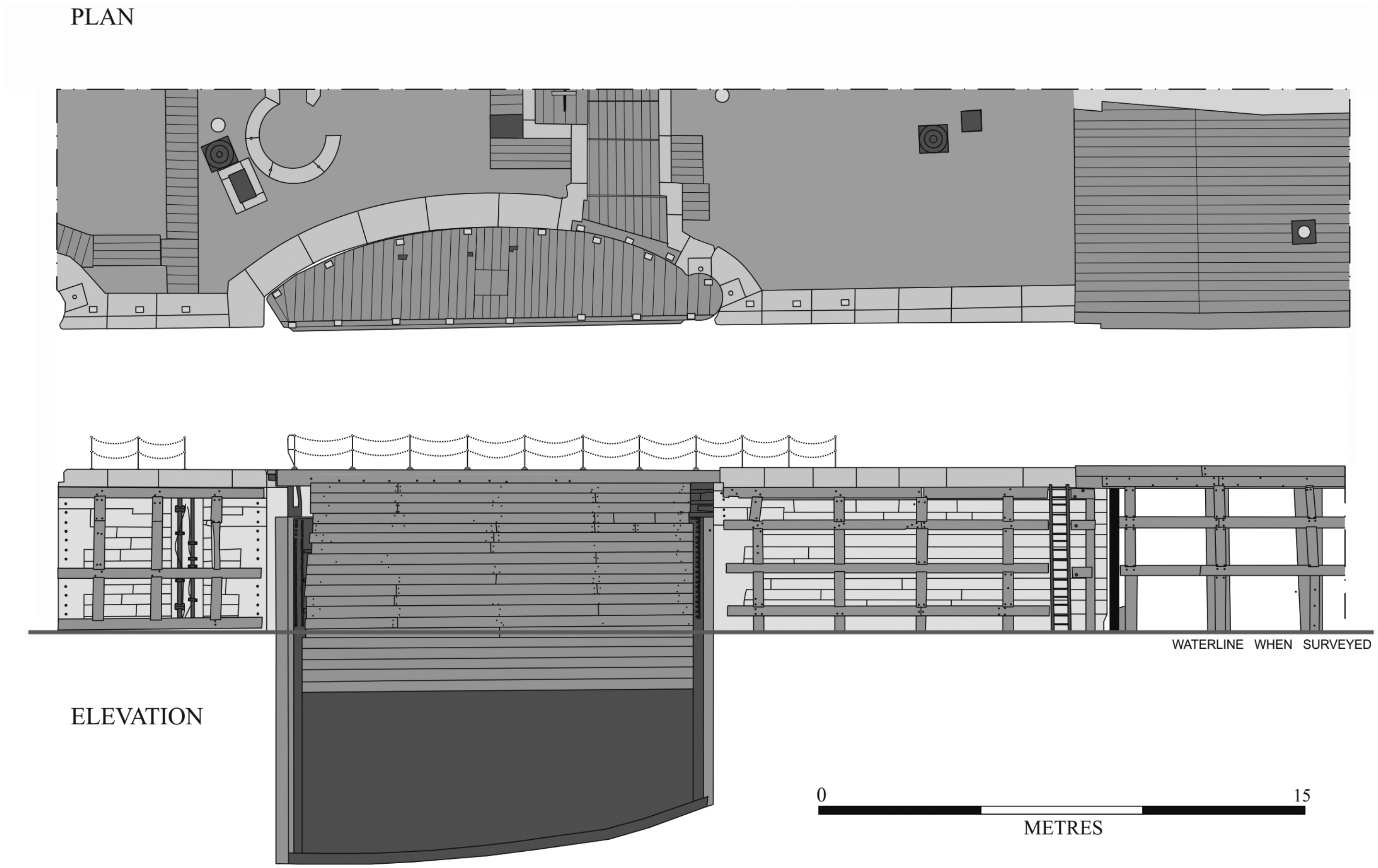


Fig. 11 Plan and partial elevation of a portion of the WP of the Seventy-Foot Entrance 1894. The elevation shows the eastern face of the area around the north gate. The drawing is compiled entirely from survey apart from the lower area of the gate taken from engineering sources.

Fig. 12 Photograph from 1935 showing the north-east gate of the WMP being floated along the Seventy Foot Entrance for refurbishment. With thanks to the Port of Tyne Authority.

Gates

The gates used on the Seventy-Foot Entrance were of a very different design to the earlier entrance gates. The greatest difference can be seen in plan (fig. 11); the front (river) face of each leaf is flat, whereas the rear of the gate is curved to fit the recess in the dock. The gates mounted in the entrance are the originals of 1894. At some time, the southern gates received a new walkway. Fig. 11 shows one of the gates set in its recess, as recorded in 1999. Fig. 12 shows the eastern outer gate being floated out of the entrance for refurbishment in 1935.

Dock furniture

Features dating to the 1890s phase of construction of the Seventy-Foot Entrance include bollards (a new, more curvilinear type), pulley wheels and winches. Rectangular sluice openings on the top of the dock are edged with granite, as are the hydraulic compartments. The keyhole-shaped features on the piers are placed in locations where there were formerly navigation masts.

SURVEY OF THE ENTRANCES

This section describes the entrances as surveyed in 1999 by The Archaeological Practice prior to the infilling of the basin to the south, when the area was still an active part of the docks. It has been updated with certain information provided during further recording by The Archaeological Practice in 2009. Fig. 13 provides a key to the description.

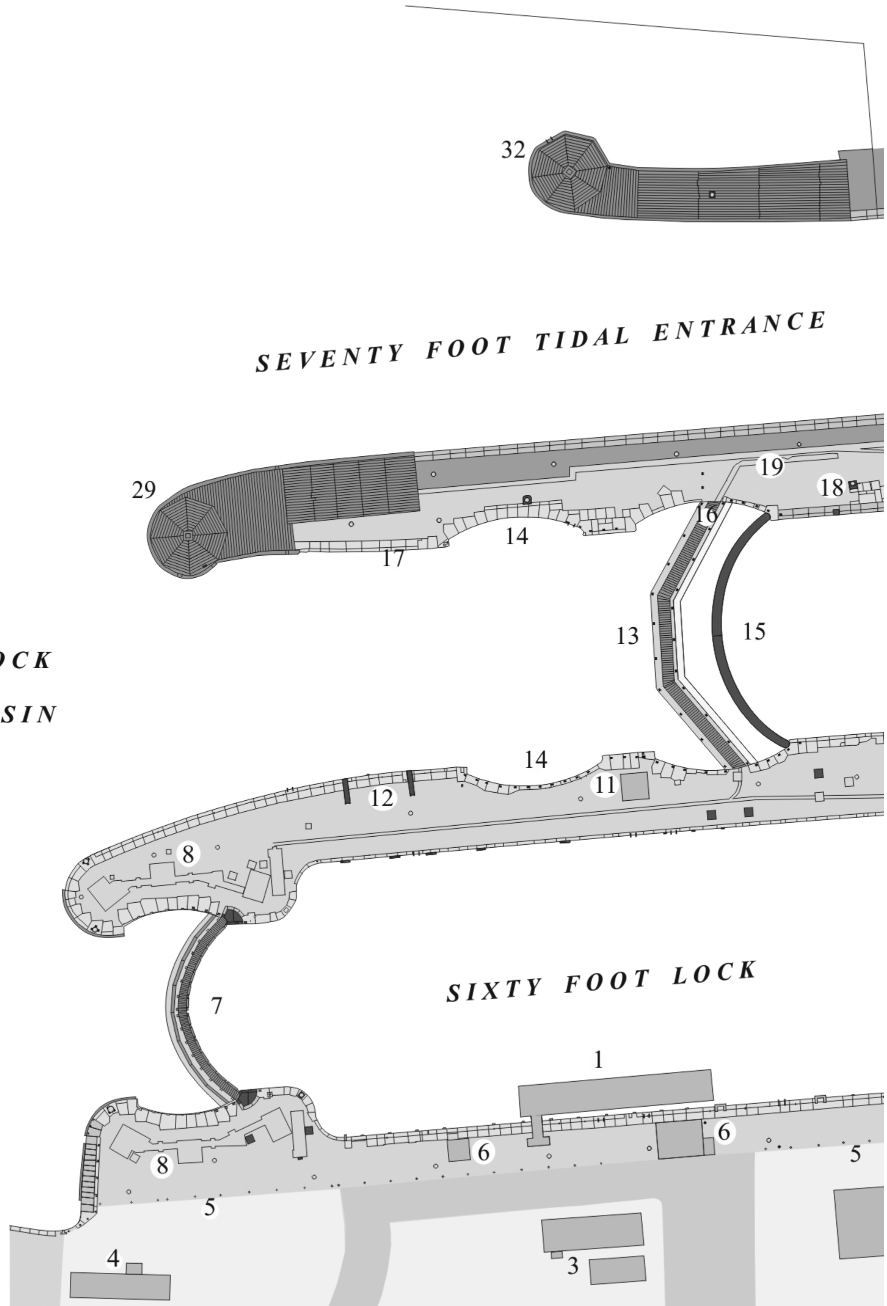
THE SIXTY-FOOT ENTRANCE

Formed of the EMP and the engaged EP, this is entirely of the first phase of construction, dating to the 1850s. By 1999, the entrance was closed, the northern gates fixed open and the southern gates fixed shut. The basin formed by this closure served as a dock for a range of vessels including the Tyne Harbourmaster's launches (*Lynceus*, *Norman Forster*, and *Bewick*) moored at a floating jetty [1] and for Tyne Foy Boats moored at the south end of the dock. All of the buildings that had been associated with the EP (the Customs Office and the Dock Manager's Office) had been demolished well before 1999 and had been replaced by a range of temporary buildings including a substantial timber unit for Tyne and Wear Marine Engineering Co [2] and portakabins for the crews of the Harbourmasters launches [3] and Tyne Foy Boats [4]. A line of stanchions [5] ran the length of the engaged pier to the west of these structures, demarcating the nominal extent of the pier itself. Two modern fuel containers for the Harbourmasters Launches were set on the eastern edge of the entrance [6].

The southern lock gates [7], fixed closed and with a concrete collar set around them to the south, provided the only pedestrian access in 1999 between the EMP and the EP. The associated hydraulic winding compartments and sluice inspection chambers on each side of the southern entrance gates were concreted flush with the pier surfaces [8]. The northern gates to the lock [9] were open, but they were fastened back in their recesses and considerably decayed. The associated hydraulic winding compartments and the sluice inspection chambers [10] on the EMP retained non-slip steel covers, made by Carrick and Wardale Engineering of Gateshead in 1924, replacements of the original covers which were probably of stone. A modern floodlight tower [11] stood centrally on the EMP and there was a set of boat davits [12] on the western edge of the pier within the Eighty Foot Entrance. Substantial stone steps ran up the north and south faces of the EP.

THE EIGHTY-FOOT TIDAL AND SEVENTY-FOOT TIDAL ENTRANCES

The Eighty-Foot Entrance was closed with a substantial concrete wall [13] running between the recesses for the northern set of gates. As with the Sixty-Foot Lock, this former entrance was used to moor a range of private boats both north and south of the blocking wall. The entrance was a part of the original 1850s design but was altered in the 1890s when the third entrance was added to the west. This alteration in design disengaged the WMP from the land and considerably altered its form. The EMP was left untouched by the adaptation until the removal of the original lock gates for the Eighty-Foot Entrance and the insertion of the concrete wall across the waterway. The southern entrance gates have been completely removed and their recesses left vacant [14]. The northern entrance gates are almost certainly original and, although cut down extensively, survived in a fixed closed position [15].


32
SEVENTY FOOT TIDAL ENTRANCE
29
19
18
16
14
17
DOCK
BASIN
13
15
14
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12
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SIXTY FOOT LOCK
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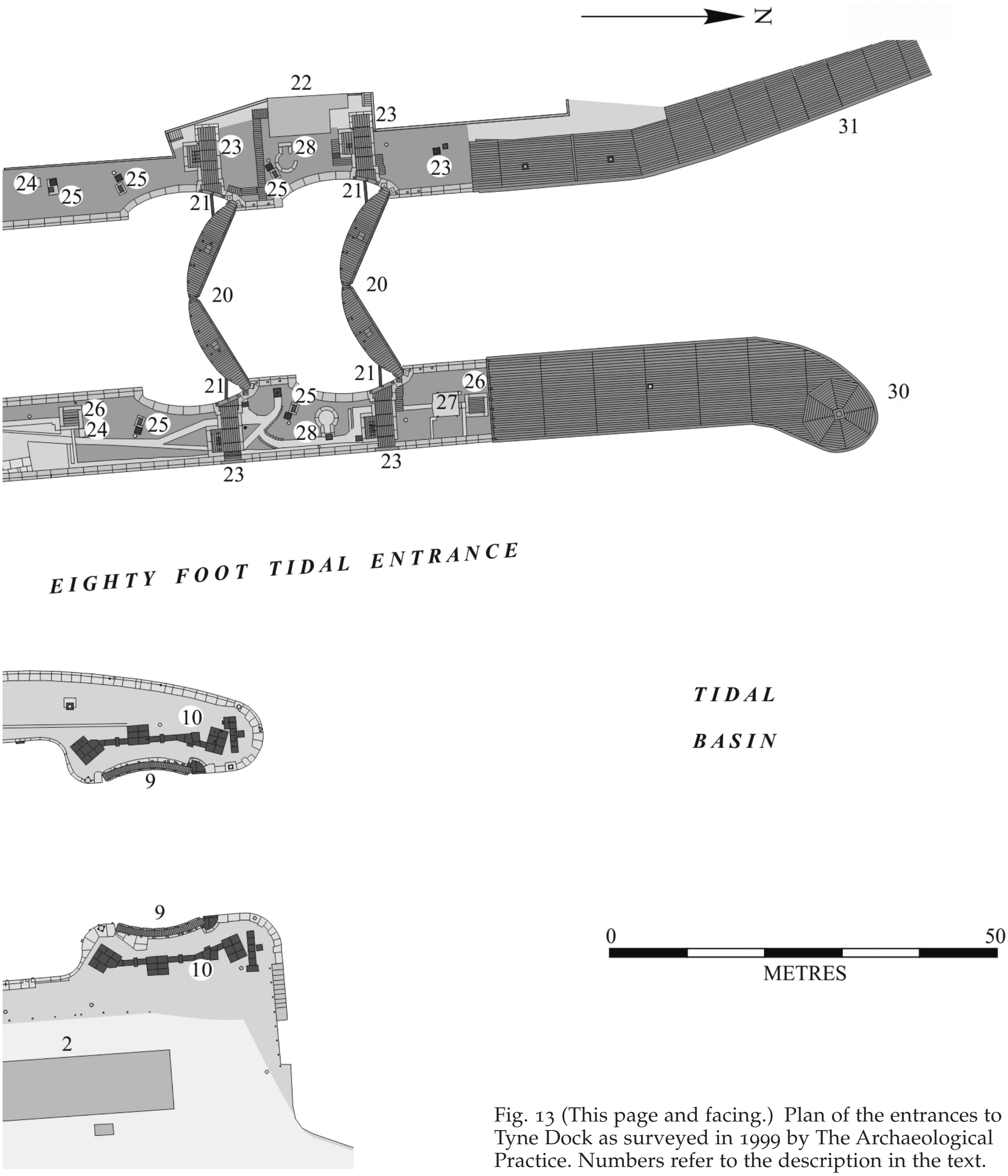

Fig. 13 (This page and facing.) Plan of the entrances to Tyne Dock as surveyed in 1999 by The Archaeological Practice. Numbers refer to the description in the text.

The hydraulic system for the gates and for the sluices was run across the Eighty-Foot Entrance on the concrete dam [13] set in a planked channel [16]. The WMP is an amalgam of 1850s work, 1890s work and twentieth-century timber-ended piers which have been replaced several times. The 1850s work was subsumed into the 1890s stone fabric but can be identified along the south-eastern portion of the masonry pier [17]. The remainder of the horizontal surface stonework of the pier (except for a discrete area of sandstone slabs to the north of the eastern gate recesses, which fossilises the curve of the 1850s pier to the north of the eastern gate recesses [18]) is of granite, either in the form of edge-blocks with a bullnose kerb, or in the form of setts. The majority of the vertical faces of the structure are of margined sandstone ashlar. The courses of the hydraulic equipment and other conduits [19] are visible as channels (infilled with concrete) in the surface of the dock; one length of this channelling has been edged with setts.

The Seventy-Foot Entrance was in use in 1999 and it remained in use until 2009 to provide access to the River Tyne and to the North West Quay from the dock basin. The gates of the entrance [20] were operated by rams [21], originally powered from the extensive hydraulic system but latterly from a small power house [22] on the WP. Each of the hydraulic rams for the gates is sunk within the WP or the WMP; their machinery compartments [23] are covered with planks. Control consoles for the gates, also planked, extended to the south of each ram compartment. Handles for controlling the gates and sluices, seen in 1999, were all removed by 2009. Two winches [24] on the WMP and the WP worked via five pulleys [25], two on the WMP and three on the WP, providing alternative means of closing the gates if the rams had failed. Planked-over square sluice-compartments lay to the south and north of the lock gates on the WMP [26]. A rectangular footing [27] of uncertain origin, lay to the north of the sluice

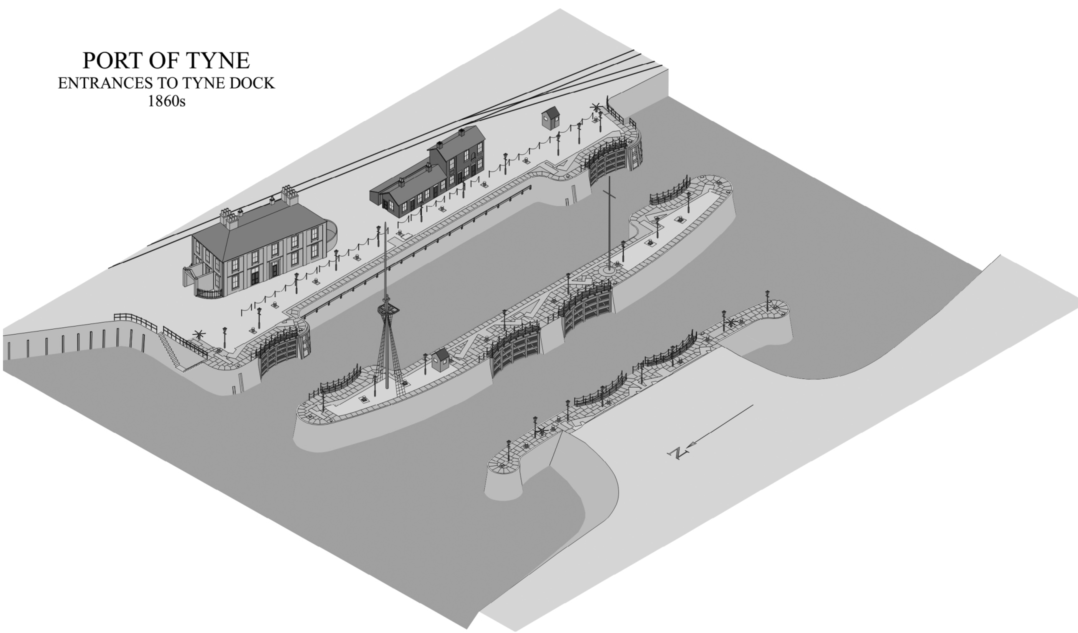

Fig. 14 Isometric view of the entrances soon after opening. Looking south-east.

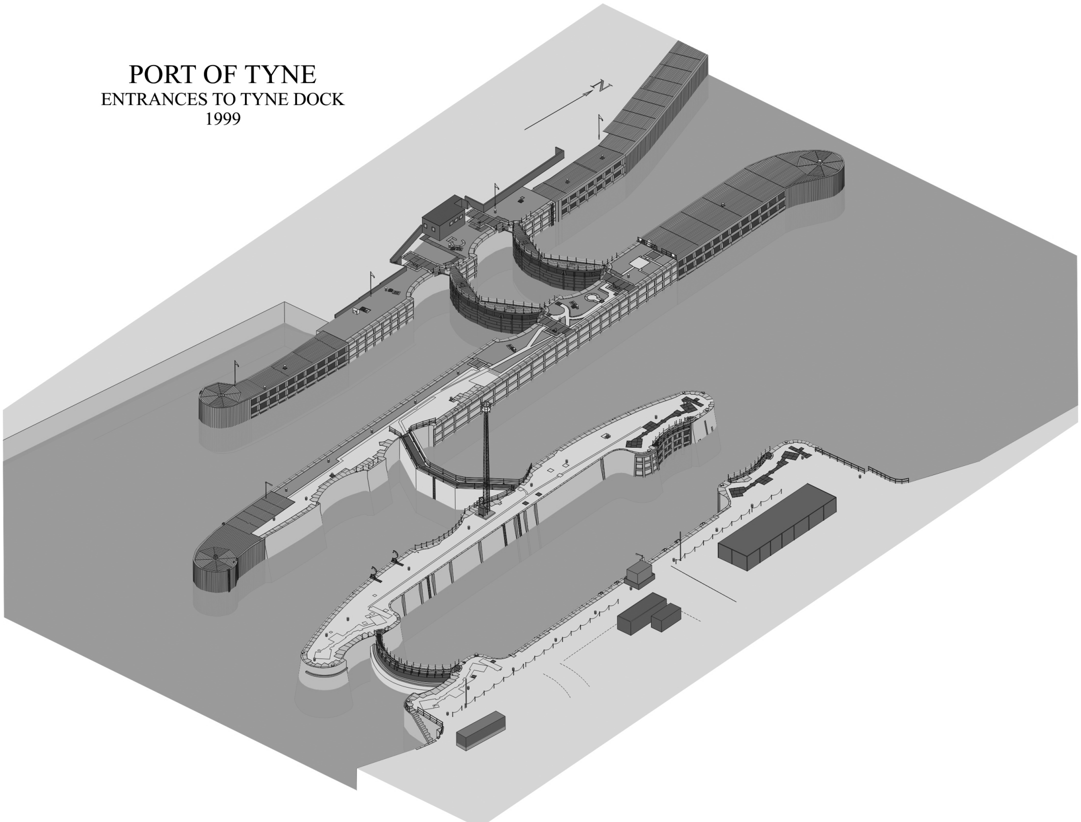

Fig. 15 Isometric view of the entrances in 1999. Looking north-west.

compartment. Two keyhole-shaped outlines, formed of granite blocks [28] opposite each other on the WP and the WMP, marked the former location of navigation masts.

Both piers forming the Seventy-Foot Tidal Entrance had timber extremities to north and south [29], [30], [31]; all of these had been altered and replaced a number of times since 1894.

In addition to the plan, two isometric projections of the docks were also prepared in 1999. Fig. 14 is a view looking to the south-east. It shows the entrances as they would have appeared soon after the dock was opened in 1859. Fig. 15 shows the entrances looking north-west, as they appeared in 1999, with one waterway; both the Eighty Foot and Sixty Foot Entrances had been blocked, leaving only the Seventy Foot Entrance operational.

CONCLUSIONS

Despite the undoubted success of waggonways, keels and colliers in moving massive quantities of North-East coal to distant markets in the course of the eighteenth century, an ever increasing demand meant that transport systems came under strain. It was the ability of engineers to tackle problems in interconnected, sometimes even radical ways, and the willingness of coal owners, rail owners and (increasingly) of shareholders to make massive capital investments to finance new infrastructures, that eased this strain and changed the face of coal transport in the North-Eastern Coalfield over the nineteenth century.

George Stephenson's Hetton Colliery Railway of 1822 is considered to be the World's first fully integrated coal transport system, running from collieries exploiting Durham's concealed coalfield to staiths specifically constructed for the line on the River Wear. It heralded a period of intense competition between newly-founded rail companies striving to exploit the maximum area of the coalfield, and between port authorities eager to attract more coal to their staiths. Key to success in this competition was the integration of the new railway technology with updated transhipment facilities and improved navigable waterways, preventing bottlenecks at the staith in the progress of coal to market.

Tyne Dock illustrates all of these developments. Firstly, it was the successor to a number of coal staiths along the southern bank of the lower River Tyne around South Shields which, by the middle of the nineteenth century, had become inadequate to meet the demands placed on them by the increasing output of the Durham Coalfield and the increasing facility of railways to speedily deposit this commodity next to navigable water. Tyne Dock, a part of the amalgamated NER, was able to cope with this abundance; instead of being a victim of success, it was simply successful, and remained so for many years.

However, this ability to cope with the arrival of coal and its transhipment into colliers would have been to no avail if the River Tyne, the next leg of the trip to market, had still been inadequate to the task. Longstanding problems with the navigability of the river, some inherent, some man-made, were addressed by an extensive dredging campaign along its course, ultimately taking in all the tidal length of the river to Ryton (which allowed increased competition with Tyne Dock) carried out by the Tyne Improvement Commission from 1860. The river became a brisk, efficient waterway.

Although Northumberland Dock and Albert Edward Docks (on the north bank of the Tyne) operated on a comparable scale, Tyne Dock was the greatest and most successful of these three massive coaling facilities. From its opening in March 1859 it allowed the transhipment of coal from rail waggons into colliers with unprecedented speed and economy. During its peak years, it moved more coal than any other dock in the World.

The original appearance of the five defined components of Tyne Dock as constructed (the tidal basin, dock basin, staiths, entrances, and the terrestrial hinterland) have been almost entirely erased by the decline of the facility within a busy port. Substantial physical remains of only one of the five components survives: the entrances. The tidal basin does remain but is of little real significance as an archaeological feature; the dock basin has now been entirely filled; the four great finger staiths, perhaps the most characteristic feature of Tyne Dock, were demolished in the 1960s; and the land area has lost all of its railway lines and brick warehouses. This leaves the entrances which, although significantly altered from their original mid-nineteenth-century design, are essentially complete, albeit partially landlocked and buried.

ACKNOWLEDGEMENTS

The writers would like to thank staff of the Port of Tyne Authority who helped with the physical and archival study of the dock in 1999. Staff of the Archaeological Practice who carried out survey and recording in 1999 and 2009 included Louise Barker, Chris Lucas and Alan Rushworth. The recording of the hydraulic machinery by Wardell-Armstrong

Archaeology in 2013 was carried out by Kevin Mounsey and Don O'Meara and the archive report was prepared by Fiona Wooler. Figs. 1, 3–6, 8, 11 and 13–15 were prepared by Tony Liddell, and fig. 7 by Adrian Bailey of Wardell-Armstrong Archaeology.

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APPENDIX 1

SUMMARY HISTORY OF THE SITE

1803	Temple proposes to apply to Parliament for an Act to convert the Slake into a public dock and naval arsenal, but is successfully opposed by the Admiralty.
1834	Company formed to develop docks in 30 acres of the Slake.
1837	Company formed to develop docks in part of the Slake; incorporated in Act of Parliament.
1839	Act obtained to build a dock of 20 acres at the east end of Jarrow Slake, authorising capital of £150,000.
1847	Hudson empowered by Act of Parliament — Jarrow Dock Act — to raise capital of £200,000 for docks scheme incorporating 74 acres of Slake, incl. a 40-acre dock.
1849	Work on excavations begins on 24 Feb. by Richard Cail of Newcastle, but suspended upon Hudson's demise.
1850	Tyne Improvement Commission is constituted by Act of Parliament.
1851	An independent company is formed to develop docks in 100 acres of the Slake, but the scheme fails due to opposition by the York, Newcastle and Berwick Railway, the precursor to the NER.

1854	NER promotes Bill for the acquisition of 138 acres of land for docks and associated facilities; powers are granted to the Jarrow Railway & Dock Co., subsequently 'purchased' by NER.
1855	Tenders received by 18 May for construction of the docks — Jackson, Bean & Gow win the contract.
1855	Construction work begins.
1856	Proposal by Jackson, Bean & Gow, in connection with Tyne Dock, for railway sidings at their quarry near South Shields.
1857	Northumberland Dock on north bank of River Tyne opens.
1858	Jackson, Bean and Gow are awarded a contract for a Gasworks building — this would serve for lighting until 1895–96.
1858	Water is allowed into the dock basin.
1859	First vessel entered the dock, 22 January; formal opening, 3 March.
1865	Tender invited for first warehouse. Pelaw to Tyne Dock railway line authorised; first grain warehouse added by 1865.
1872	No. 4 staith brought into use with 10 spouts by dispensing with hydraulic ballast cranes.
1880	Simonside warehouses built.
1889	Jackson awarded contract to complete No.1 staith.
1881	No 1 staith commissioned.
1893	Dunston staith opens.
1894	New deep water entrance brought into use: 70 ft wide, depth of water on the sill is 32 ft at ordinary Spring tide, 27 ft at ordinary neap tide.
1895–96	Electricity generating station installed and used to light the entire Dock.
1900	By the early 20th century Tyne Dock handled about 40% of the river's tonnage, peaking at an average 68.3 million tons annually between 1900–09.
1923	New gates installed at the 60ft entrance.
1924	Opening of Dunston's second staith led to decline of Tyne Dock; by this time it had shipped more coal and coke than any other dock in the world.
By 1930	60 ft (24 ft 6 ins H.W.O.S.T.) and 70 ft (32 ft 9 ins H.W.O.S.T.) entrances remain open. 4 coal staiths open with 42 spouts. 15 warehouses and transit sheds; 215 acres of land for storage of mainly timber; 5 acres of timber ponds; 55 electric, hydraulic and steam cranes.
1934–36	Repairs made to 70 ft entrance gates.
1936	Act of Parliament obtained for the purchase of Tyne Dock by the TIC.
1937	Purchase of the Tyne Dock by TIC from LNER.
1940	800 ft long N-W quay opened by TIC.
*c.*1940	Standage area in the terrestrial part of the dock extended westwards.
1942	Deep-water, reinforced concrete, riverside quay completed.
By 1948	2 coal staiths remain open, with space for 8 vessels. 8 warehouses and two transit sheds, 32 miles of sidings and 1000 wagons available for internal dock use; 33 fixed electric and hydraulic quay cranes, 3 steam and 4 diesel mobile cranes.
1954	Iron Ore Quay becomes fully operational.
1966	No1 grain warehouse is demolished.
1967	60 ft (Inner) entrance closed and sealed with concrete; repairs made to 70 ft entrance. Coal staiths closed. Last movement of coal in March of this year.
By 1974	Dock basin reduced to 11 ha. (*c.* 27 acres) , approx. half its original size; staiths demolished; North-West Quay (243 m) and Factory Quay (196 m — on east side) still operational but main facility now the Iron Ore Quay and Handling Plant on the river front (formerly the Sutherland Quay). Iron Ore Quay — 264 m concrete quay, dredged to 10.51 m below chart datum with five grabbing cranes and other facilities.

1974	Consett Steel Works transfer import of steel to the Tees — Iron Ore Quay converts to general cargo.
1977	Tyne Dock Railway Arches removed.
1983	Railway bridge at Tyne Dock end of Dean Road, South Shields, dismantled.
2009–10	Infilling of the surviving portion of dock basin with spoil derived from excavations for the new Tyne Tunnel.

APPENDIX 2

TENDER FOR DOCKS AT JARROW SLAKE

(The only surviving copy of the pro-forma tender for the construction of Tyne Dock, as signed by George Adamson. National Archives, Class: Rail 527/Item 561)

DOCKS AT JARROW SLAKE

To the Directors of the North Eastern Railway Company

George Harrison of Hartlepool do hereby propose to make and complete the whole of the works necessary for the completion of the Docks so far as specified, with Shipping Jetties and Approaches, a shown on the different Plans, and as fully specified with specification shown to us and to keep the whole of the works hereby contracted for in complete repair for a period of Twelve Calendar Months after the same shall be completed and opened for the use of the public, and to find and provide all the requisite materials, except Iron Rails, Chairs, and Sleepers, according to the Plans, Sections, and Drawings, and Specifications, within the period, and on the terms and conditions mentioned and contained in the draft Contract exhibited to us for the sum of £344,475 and I have hereinafter set forth the Price of the different descriptions of work at which the aggregate amount of this Tender is computed, (etc.)

Witness my Hand this 16th Day of May 1855

George Adamson

The following are the Prices at which the Sum of £344,475 is computed, and at which agree to execute all Extra or Additional Works, or to have Deductions made from, or Addition made to Estimate.

			PRICES £	s	d
EARTHWORK	Price of excavation from any part of the Works north of the Turnpike Road, whether in the Dock or otherwise, and deposited in embankments at the sides, and in the approaches to the Low Level, as specified; including such other Works, temporary or permanent, as are comprised under this head in the Specification (Excavation Measurement)	per cubic yard	–	1	0
	Price of excavation from any part of the Works south of the Turnpike road, and depositing it in the embankments forming the approaches to the Jetties,or in the approach to the Low Level, or in the embankments at the western side of the Dock, including all Trimming and Soiling of Slopes, as also such other Works, temporary or permanent, as are comprised under this head in the Specification (Excavation measurement)	do.	–	–	10

BRICKWORK	Brickwork in Walling, set in Lias Lime	do.	0	19	0
	Ditto do. do. Cement	do.	1	5	0
	Ditto in Square Arches, set in Lias Lime, including Centres	do.	1	1	0
	Ditto do. do. Cement do.	do.	1	6	0
	Ditto in Askew Arches ,set in Lias Lime, including Centres	do.	1	2	0
	Ditto do. do. Cement do.	do.	1	7	0
	Brickwork (Radiated Bricks), set in Cement, in 5 feet Culvert, interior measurement, 9 inches thick	per running foot	–	17	0
	Ditto do. 14 inch thick	do.	1	3	0
	Ditto in 6 feet 6 inches Culvert 9 "	do.	1	2	0
	Ditto do. do. 14 "	do.	1	10	0
	Ditto in 4 feet Culvert 14 "	do.	1	10	0
	Ditto do. 9 "	do.	–	15	0
	Ditto in 3 feet Culvert 14 "	do.	–	12	0
	Ditto do. 9 "	do.	–	9	0
	Ditto in 2 feet Culvert 4 "	do.	–	2	6
	Price of well-burnt hard Bricks, delivered at any part of the Work	per thousand	1	5	0
	Ditto of Blue Lias Mortar	per cubic yard	0	12	0
	Ditto of Best Light Cement	per bushel	–	2	0
	Ditto of Fine Ground Possuolano	per ton	3	12	0
STONEWORK JETTIES AND BRIDGES	Ashlar Stone Work in Springing Courses	per cubic foot	–	1	4
	Ditto in Dressed and Quoins of Jetties	do.	–	1	4
	Ditto in Mouldings and Copings	do.	–	1	5
	Ditto in Parapets	do.	–	1	4
	Ditto in Square Arches, including Centres	do.	–	1	4
	Ditto in Askew do. do.	do.	–	1	5
	Ashlar Facing to Piers and Abutments, Rock-faced	do.	–	1	6
	Ashlar Stones in Foundation Courses	do.	–	1	2
	Blocking Course Walling, Block-in-course measurement only	do.	1	10	10
	Price of Rubble Work, Snecked or Fitted in the Face, set in Lias Mortar	per cubic yard	–	12	0
	Price of Rubble Work, as specified under the head of 'Rubble Work or Common Walling', set in Lias Mortar	do.	–	8	0
	Price of Rubble Work in Backing to Arches, ditto.	do.	–	7	0
STONEWORK IN LOCKS AND QUAY WALLS	Ashlar Stone in Footings of Quay Walls, set in Lias Lime	per cubic foot	–	1	1
	Ashlar Face Work in Quay Walls, Entrance, Basin, &c., as specified, set in Pozzuolano Mortar	do.	–	1	4
	Coping to Quay Walls, Locks, and Entrance Basin, &c., including Dowells, as specified, set in Pozzuolano Mortar	do.	–	1	5
	Ashlar Stone in Footing Courses of Locks, set in Pozzuolano Mortar	do.	–	1	3
	Ashlar Work in Inverts and Flooring of Locks, as specified, set in Pozzuolano Mortar	do.	–	1	4
	Ashlar Work in the Side Walls of the Locks, as specified	do.	–	1	3
	Ditto in sides of square Culverts, Sluice Wells, Covers, and between bottom of Culvert and Foundation Course, Backing in Hollow Quoins, &c, as specified	do.	–	1	2
	Price of Rubble Work in Quay Walls, snecked or fitted in the face, as specified, and set in Lias Mortar	per cubic yard	–	12	0

	Rubble Work in Quay Walls, not snecked or fitted in the face, and throughout the Works of the Locks and Entrance Basin when faced with Ashlar, as specified, and set in Lias Mortar	do.	–	8	0
	Yorkshire Landlings for Covers, over the Sluice Wells and Hydraulic Machinery, as specified	per superficial foot	–	0	10
	Hollow Quoins of Aberdeen Granite, polished and set	per cubic foot	–	5	0
	Granite Ashlar in the pointing sills, dressed and set	do.	–	4	6
	Ditto in any square form do. do	do.	–	4	3
	Granite in Steps and Landings to Stairs at	per cubic foot	–	4	0
	Price of a single 18 inch Drain	per running foot	–	1	8
	N.B. The above Schedule prices are to include the cost of other such Works, Temporary or permanent, as are stated to be comprised in the Specification under the respective heads.				
CONCRETE	Price of Concrete, in any part of the Work, as specified in Lias Lime	per cubic yard	–	5	6
	Do. of 12 inch Glazed Earthenware Pipes	per running foot	–	1	6
	Do. of 9 inch do. do.	do.	–	1	0
	Do. of 9 inch do. Ashphalted, as per sample	do.	–	1	6
	Do. of Metalling Approach Roads, including Paved Water Channels, as specified	per superficial yard	–	3	6
	Price of Flagging and Kerb Stone, as specified	do.	–	6	0
	Do. of paving, as specified	do.	–	5	0
TIMBER WORK	The Price of American White Rock Elm Fender Poles, dresses &c., as per Specification, not exceeding 15 feet	per cubic foot	–	4	0
	Price of best Middling Memel, or Red Wood Baltic Timber, in piles, driven, and not exceeding in length 15 feet	do.	–	3	0
	Baltic Wood Timber in piles, driven, and not exceeding in length 15 ft.	do.	–	3	0
	Ditto do. not exceeding in length 20 feet	do.	–	3	2
	Ditto do. 35 feet in length, and driven from 20 to 25 feet	do.	–	3	6
	Ditto do. 40 feet in length do.	do.	–	3	9
	Ditto do. 50 feet in length do.	do.	–	4	6
	Price of Larch or Beech Piles, driven, not exceeding in length 10 feet, nor less than 10 inch diameter		–	2	9
	Ditto do. not exceeding 20 ft in length	do.	–	3	0
	Ditto do. not exceeding 30 ft in length	do.	–	3	3
	Ditto do. not exceeding 40 ft in length	do.	–	3	6
	Price of best Middling Memel, or Red Wood Baltic Timber, framed and pit up in the Timber River Walls and Pier Heads, in Waling, Bracings, Sills, &c.	per cubic foot	–	3	3
	Ditto in Sills and Cross Sills for Foundations of Jetties and Quay Walls	do.	–	3	0
	Price of 3 inch Memel Deals laid down for the Platforms in the Timber River Walls, &c., including Spikes	per superficial foot	–	–	9
	Price of 2 inch Battens laid under Concrete for Quay Walls	do.	–	–	6

	Price of 3 inch Memel Deals laid down in Foundations of Jetties and Quay Walls	do.	–	–	9
CAST IRON	The Price of Cast Iron in Mooring Posts	per ton	8	0	0
	Ditto do. in Drainage Pipes	do.	8	0	0
	Ditto do. in every other situation	do.	9	0	0
WROUGHT IRON	The Price of Wrought Iron Work in Pile shoes and Hoops	per cwt.	1	5	0
	Ditto do. in Screw Bolts, Plates, Keys &c., fixed	do.	1	15	0
	Ditto do. in Bars	do.	1	0	0
CLAY PUDDLE	The Price of well-tempered Clay Puddle	per cubic yard	–	1	9
PERMANENT WAY	The Price of laying the Permanent Way complete, including Ballasting, Finding Keys and Pins, Cutting Rails, Laying in Points and Crossings, Turnouts, and every Contingent Work	per running yard of single way	–	5	0
	Laying the Way with Sleepers, exclusive of Ballast	do.	–	2	0
	Price of Ballast laid down and spread	per cubic yard	–	1	6
	Ditto Wrought Iron Twisted Pins, as per pattern	per cwt.	1	7	0
	Ditto Oak-compressed Keys do.	per thousand	5	10	0
	Coating for Covering Arches of the Composition, as per Specification	per superficial yard	–	–	9
DOCK GATES	The Price of Cast Iron in every situation	per ton	9	0	0
	Ditto Wrought Iron in Plates, as specified	per cwt.	1	12	0
	Ditto do. in Roller Axles	do.	2	0	0
	Ditto do. in Screw Pillars, connecting Links, Cross-head and Screws	do.	2	2	6
	Price of Wrought L Iron	do.	1	15	0
	Ditto do. T Iron	do.	1	12	6
	Ditto do. Iron in Bolts, Nuts, and Washers	do.	2	0	0
	Ditto do. In any other Situation	do.	2	0	0
	Price of Brass, for Screw-pillars, Anchor-plates, Pivot-piece, Axle-box, &c.	do.	3	10	0
	Price of Green Heart Timber for Heel-post, Meeting-post, and Sill	per cubic foot	–	7	0
	Price of 3 inch Oak Planking for Footway	per superficial foot	1	19	0

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