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London Gateway Clearance Programme Obstruction Removal at Sea Reach No 1

Watching Brief Assessment Report



Ref: 88631.01
July 2014



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London Gateway Clearance Programme

Obstruction Removal at Sea Reach No 1: Watching Brief Assessment Report

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Summary

Wessex Archaeology was commissioned by DP World London Gateway Port to monitor the removal of an obstruction on the seabed located in the area of Sea Reach No. 1 Buoy (Zone 38), at the eastern limit of the Yantlet Channel (UKHO obstruction no 81149).

The watching brief was carried out from the 31st March to the 4th April 2014 on board the self-propelled crane barge *Atlantis* operated by Herbosch-Kiere.

In this report the material archive and records produced during recovery are analysed and synthesised in order to attempt to understand the identity of the wreck; what the remains represent; the cause of sinking and ultimately the formation processes in which the vessel came to be on the seabed.

Preliminary research indicates that the large majority of the material recovered belongs to an iron paddle steamer powered by feathering side-wheels and driven by twin grasshopper steam engines, possibly built by a Tyne and Wear shipyard. The vessel is provisionally identified as the iron paddle tug *Admiral* which sunk off the Nore in February 1872.

The variety and exceptional condition of the finds might provide the opportunity to examine the assemblage of a working vessel operating in the Thames during the mid-19th century.

The site has now been at least partially recovered, and most of the remaining material is likely to be at a depth below that of any proposed navigational or maintenance dredging.



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- The crew of the recovery vessel *Atlantis*;
- Herbosch-Kiere;
- Tony Small, Marine Supervisor;
- Michael Boyle, Site Manager and contractor's representative;
- George Dickinson, Hon Sec of the MGSM Association,
- Simon Green, Central Services Librarian at CBS Libraries, Gateshead.

Paolo Croce and Michael Murray of WA carried out the watching brief and this report was compiled by Paolo Croce and Toby Gane, with contributions by Lorraine Mephram and Quita Mould. Quality control was provided by Toby Gane. Karen Nichols prepared the illustrations and the project was managed for Wessex Archaeology by Toby Gane.



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Obstruction Removal at Sea Reach No 1: Watching Brief Assessment Report

1 INTRODUCTION

1.1 Introduction

- 1.1.1 Wessex Archaeology (WA) was commissioned by DP World London Gateway Port (hereafter London Gateway) to undertake an archaeological watching brief during a planned obstruction clearance, by means of grab dredger, undertaken by the contractor Herbosch-Kiere on behalf of the Port of London Authority (PLA).
- 1.1.2 The obstruction was located c. 33 m from Sea Reach No. 1 Buoy on a bearing of 329° (NW), at the eastern limit of the Yantlet Channel (**Fig. 1**). The coordinates of the obstruction were:

Site Co-ordinates WGS 84			
UTM z31N		DDM	
Easting	352543 E	Lat.	51 29'.47 N
Northing	5706588 N	Long.	000 52'.55 E

Table 1: Site Co-ordinates

2 BACKGROUND

- 2.1.1 On 9th December 2013 the Trailing Suction Hopper Dredger (TSHD) *Victor Horta* struck an obstruction with its drag-head at 51 29' 28.002" N, 0 52' 33.367" E (Zone 38) and was unable to remove or dislodge it. The obstruction was reported to WA under the LORDI protocol report 3414.
- 2.1.2 A diving investigation by the PLA, on the obstruction took place on 8th January 2014 and confirmed that it was not a natural feature. Steel plates and beams riveted together were observed standing up to approximately 1m proud of the sandy silt of the river bed.
- 2.1.3 The obstruction was then re-surveyed by means of a bathymetric geophysical survey carried out by the PLA on 9th January 2014 revealing an oblong anomaly of 12 x 15 x 2m at a depth of 12.45m lowest astronomical tide (LAT) (**Fig. 2**).
- 2.1.4 On 23rd January 2014 a second inspection was carried out by PLA divers. The recovery of a small number of loose finds from the river bed and the fact that sections of plates rising out of the sandy bottom were not easily dislodged suggested that there was high potential for buried shipwreck material. Diver observations also suggested a possible boiler lying under a section of bent steel. The obstruction was subsequently reported to the UKHO and is now listed as obstruction no. 81149.

- 2.1.5 The finds recovered were later identified by WA as a section of hull plate riveted to an L-shape frame and part of what is interpreted as a winch mechanism and balance weight - indicative of a possible 19th century wreck site. However, at the time of the recovery operation it was not known at what date the wreckage may have been deposited on the seabed, the extent of the wreckage or level of burial, or the type of vessel represented.
- 2.1.6 From 31st March to 5th April 2014 the salvage grab barge *Atlantis* undertook clearance activities at the site. As no documentary evidence existed regarding the feature, a watching brief was conducted by WA for the duration of the works.
- 2.1.7 The recovery operation removed approximately 80 tonnes of material and achieved a least depth of 14.66m Lowest Astronomical Tide (LAT) over the site, substantially removing the wreck and dispersing the remains. The site is no longer considered a danger for navigation and remains are now below dredge depth of 14.5m.

3 OBJECTIVES

- 3.1.1 Wessex Archaeology provided an archaeologist for the purposes of archaeological monitoring over the period 31st March to 3rd April 2015, and two archaeologists over the period 4th and 5th April. When it was realised that the volume of material recovered warranted increased archaeological resource, a second archaeologist was drafted in.
- 3.1.2 The work was undertaken in accordance with the Maritime Archaeology Methods and Procedures Document (London Gateway 2010: Appendix VII). However, this document is specifically aimed at pre-clearance, clearance and dredging phase methodologies and was considered not detailed enough to fully provide a comprehensive methodology for previously unknown heritage assets within the channel.
- 3.1.3 Therefore, a WSI for Recovery under Archaeological Supervision (WA 2012) previously successfully used for clearance operations was referred to, to add necessary detail to the methods employed. The WSI provided for an experienced maritime archaeologist to be present on the work vessel during clearance operations in order to implement the procedures to follow if material of archaeological interest was identified and further material was thought to be present on the seabed.
- 3.1.4 There is no standard methodology for clearance by grab of wreck sites on the seabed in the UK. Nevertheless, in so far as was reasonably practicable, the clearance and post-clearance archaeological assessment were conducted in compliance with standard archaeological methodologies and national guidelines (IfA 2008; SMA 1993; SMA 1995).
- 3.1.5 The aim for the Watching Brief was to recover as much archaeological information as possible from the wreck site during the recovery and removal operations which would be otherwise completely lost by the clearance activities.
- 3.1.6 The objectives of the work were:
- To create a suitable field record of the recovery process (Sections 4 and 5).
 - To characterise the site and develop conclusions on the extent, orientation, state of preservation, and formation processes of the archaeological deposit based on the material and layout of the site (Sections 5 & 6).
 - To identify any material recovered from the site that may assist in defining the type and identity of the shipwreck (Sections 5 & 6).



- To assess material recovered for archaeological importance (Section 7).

4 METHODOLOGY

- 4.1.1 The clearance was undertaken by the *Atlantis*, an 81m self-propelled marine working pontoon equipped with 25T salvage grab on contract from Herbosch-Kiere. The vessel held position using dynamic positioning. Clearance was controlled by a software interface that overlaid the bathymetric image of the clearance area and the positioning information obtained by dGPS and depth-indicating equipment on the crane.
- 4.1.2 Material was recovered to deck where it was washed with seawater from the ship's fire hoses with and then processed by a small shear cutter excavator and loaded into skips for recycling.
- 4.1.3 The area where the site is located was gridded and the grab positioned by Cartesian sectors, each sector being a 4 by 4m square. Sectors were identified by a number and a letter. It must be kept in mind that during clearance by grabbing most of the archaeological contexts are disturbed and large amounts of information held within the archaeological deposits lost.
- 4.1.4 The intention had been to record the contents of each bucket and associate each bucket load to a position obtained from the dredging software. However the sheer volume of material recovered and the large size in some cases made the search and archaeological recording of all the material impracticable on site. Whilst some diagnostic elements were selected for further investigation and retained by WA, it is estimated that one-third of the recovered material was not recorded. Also the positional control achieved was only partial as the request of the on-site WA archaeologist for a written record of the grab positions during the operations was only partly fulfilled and includes omissions.
- 4.1.5 No archaeological literature on the effect of grabbing on shipwreck deposits exists although from the process it is possible to hypothesise in this case that the recovery of elements sturdily attached to the lower hull, such as the boilers and engines, might have stressed the entire frame of the wreck causing the movement and re-deposition of material around the site. This hypothesis seems supported by the different hydrographic surveys run during and after the work (PLA 2014, report Ref. 110-343-149).
- 4.1.6 Limited passive conservation was attempted on site. Leather and wooden finds retained by WA were stored in water and fragile artefacts such as ceramics and glass carefully supported during transport to WA storage facilities where they were treated by a WA conservator. Larger diagnostic artefacts that were impossible to transport to WA storage facilities were left by the PLA at Denton Wharf.
- 4.1.7 An MCA report of wreck and salvage form with a list of the retained finds was sent to the Receiver of Wreck (RoW) by WA on behalf of the PLA on 24th April.
- 4.1.8 The documentary and material archive produced during fieldwork were analysed and synthesised in order to attempt to understand the following:
- The number and identity of the shipwrecks;
 - The section of the wreck(s) that the remains represent;
 - The causes that may have initiated the shipwreck(s);

- The formations processes in which the vessel(s) came to be on the seabed.

4.1.9 The retained material worthy of preservation will be offered to a suitable museums service for display or for further analysis. If no repository can be found for it, agreement will be sought via EH (English Heritage) and the RoW for the material to be discarded.

5 PRELIMINARY RESULTS

5.1 Finds

5.1.1 A total of 346 finds or sections of wreck were recorded. A complete inventory of the finds recorded by WA is presented in **Appendix I**. These are listed by time of recovery and ordered by bucket number. Empty buckets and buckets containing no archaeological material were not numbered.

5.1.2 Finds recovered included parts of the propulsion system, deck fittings, large sections of hull plating, part of the bow, domestic material, personal belongings, anchors and chains. Some of the finds were in excellent condition and it is thought that large parts of the vessel were preserved in deep fine-grained sediment prior to clearance. The finds were recovered in almost pristine condition showing no corrosion and almost no concretion suggesting that most of the vessel had been buried or sunk within the River bed not long after the wreck event.

5.1.3 These anaerobic conditions of deposition led to the survival of organic material that is relatively rare in the archaeological record such as leather and wood. Other material within the assemblage includes iron, copper, brass, lead, pewter, bone, pottery, glass, rubber.

5.2 Engine

5.2.1 Parts of two engines and two boilers were salvaged between 31st March and 1st April. This machinery probably constitutes the most conspicuous features of the obstruction as shown on the PLA survey undertaken on 9th January (**Figure 1**).

5.2.2 The following parts of the propulsion system of the vessel were recovered:

- **WA3007, WA3009:** Two identical horizontal double return flue boilers (**Plate 1**). These are made of iron. The furnace ends contain two firebox access hatches with the hatch-door still *in situ*. The end shape is roughly circular (diameter 2.6m, thickness 9mm) tapering to a convex shaped end. A few stays and plates are joined with single riveting, as is the central smoke uptake. The dimensions are 4.7 x c. 2.6m. The boilers seemed to be fairly complete at the time of the recovery which excludes a boiler explosion as a cause of sinking. According to George Dickinson, Honorary Secretary of the Markham Grange Steam Museum Association and author of '*Climbing out of the Port Hole - The Rebuilding of Reliant's Port Engine*', these boilers are relatively early (George Dickinson, pers. comm.).
- **WA3044, WA3046:** Two single cylinder engines (diameter c. 850mm) with jet condensers coupled below (**Plate 2**).
- **WA3017, WA3022:** Two parts of feathering side paddle wheel (radius 1920mm, width 1230mm) both with some of the floats still in place (**Plate 2**). At least one of the sections belongs to the starboard wheel. It is unclear if the two sections are part of the same or opposing wheels.



- **WA3012, WA3016:** Part of the main drive shaft including the engine crank shaft (length 4.10m) with crosshead and starboard paddle shaft (c. 3.4m) and crank arm. The latter was recovered still attached to the section of paddle wheel. Considering that the main shaft was divided into three parts (to allow for the ship to flex during service) the port shaft is likely to be still on the seabed.
- **WA3025:** The coupling wheel to couple the engines with part of the engine frame (**Plate 3**).
- **WA3045, WA3048:** Three engine beams, one of which still retained the pivot at one end.
- **WA3047, WA3050:** Two fragmented air/vacuum pumps (internal diameter c. 460mm).
- **WA3061, WA3196, WA3210:** Fragments of at least two engine bedplates.

5.2.3 The propulsion system of the vessel consisted of two feathering side paddle wheels propelled by two single cylinder “grasshopper” beam engines. These side lever machines are still called grasshoppers even though the beam pivots are fixed to the engine bedplate, whereas a ‘true’ grasshopper has the beam at the top of the engine on a swinging column (Thomas 1991).

5.2.4 No manufacturer marks were recorded on any of the propulsion system material.

5.2.5 Large quantities of coal and firebricks were recovered contextually in relation to and within the boilers. Some of the bricks had distinctive marks (HEDDON/RAMSAY) indicating that the bricks were manufactured in the Newcastle area (Sallery 2014).

5.2.6 Numerous copper pipes associated with the steam engines were recovered.

5.2 Hull

5.2.1 Large amounts of the structural elements of the vessel were recovered on 2nd April. Although it is probable that they belonged to a single wreck, the general disposition of the features on the seabed is unclear.

5.2.2 Large sections of the hull including shell plating, frames, bracket frames and stringers were recovered. The plates were riveted with single line pan headed rivets with a diameter of c. 26mm. Floors and stringers were made of L sections (c. 70mm each side) used singularly or assembled to make T bar, double T bar and Z bar. All the hull sections recovered showed clinker laid shell plating with single riveted lapped joints. Chain riveted butt plates were also observed in large numbers.

5.2.3 A sample section of the hull was temporarily stored on the deck in order to allow detailed recording (**WA3080**). The section consisted of three iron floors and three longitudinal elements still retaining the wooden ceiling (planks are 420mm wide) in place. The spacing between the floors was 430mm and plate riveting spacing was 150mm. The maximum moulded dimension of the floors at the centre line was 330mm and sided dimensions were c. 140mm with each floor doubled meaning that two frames of c. 70mm were placed alongside each other. Drain hole spacing was c. 170mm. The maximum beam was 3.70m. No plates were attached at the point of recovery.

5.2.4 The following parts of the hull were also recovered:



- **WA3152:** A long section (c. 5 x 9 x 1.7m) of hull with riveted plating. Visible were nine floors, the keelson and two side keelsons, wash plates, a grated iron plate and possible ceiling planking. The turning of the plates at one end suggests this is a garboard strake and indicates that the section broke along the keel bar (Thomas 1991: 50). The keel bar is missing. The shell is internally covered by bitumen and butt plates are present. On the keelson there is a possible pulley or an attachment for a pillar (**Plate 4**).
- **WA3119:** A large section of hull (c. 4 x 8 x 1.5 m) with five floors, a stringer and three ceiling planks were still kept in place by lumps of river sediment. Some unidentified machinery (**WA3127**) with two long copper pipes was also recovered during the same grab.
- **WA3119b:** A hull section with at least three plates including a garboard plate was loosely attached to the above section (**WA3119**).
- **WA3216:** A small section of the keel with garboard and first board plate was recovered. They measure c. 3.90m x 0.65m x 9mm and show the same riveting pattern and traces of bitumen seen in the previous sections.

5.2.5 The two iron manufacturing firms “FRAZERS AND ROBERTS & Co LTD” and “ABBOT” were found stamped on two iron floor frames (**WA9053 and WA3086**).

5.2.6 Elements of the lower bilge were covered internally and in some place externally with the bituminous substance seen previously. In some places this was very irregularly spread forming heaps. A spanner (**WA3121**) and a small round opening were found covered by the bituminous material in the hull section (**WA3119b**).

5.2.7 Traces of possible anti-oxidation red lead paint were noted on some of the plating.

5.2.8 Wooden decking or ceiling planking of different sizes was recovered. No fastenings were noticed on any of the planks and few of the timbers presented tapered ends.

5.2.9 Other recovered material relating to the hull includes:

- **WA3011:** Deck Beam 4.57m long with curved seat interpreted as a possible slot for one of the boilers.
- **WA3004:** Deck Beam 5.60m long ending with wrought iron knees recovered from the same area of the boilers.
- **WA3014:** Door or inspection hatch opening with an anti-slip gridded surface. The rectangular opening measures c. 0.80 x 0.50m.
- **WA3144:** The very end of the prow where the port and starboard deck stringers meet. A deck hook remains in place.
- **WA3156:** Possible bulkhead section with four frames and stringer with plating and three brackets.
- **WA3188:** Section of wooden gunwale c. 2.5 x 0.2 x 0.07m with iron external rail and iron plating attached by rivets. On the upper side there is one small iron bollard (190 x 160mm) with the base fixed by four iron nails. The position of another bollard is indicated by four holes of the same size. Between the two

bollards a possible metal support for a wooden post or stanchion. The rounded almost elliptical shape of the gunwale might indicate that it was located at the stern of the vessel.

- **WA3153:** Wooden beam c. 2.0 x 0.2 x 0.3m reinforced with metal string or rail attached to iron riveted plate. One end tapers assuming rounded shape. On its surface are present two hole patterns: one being a rectangle composed of five holes delineating three sides; the other being a line of at least 14 holes. It is interpreted as possibly part of the belting or gunwale.

5.3 Anchors and machinery

- 5.3.1 Two anchors were recovered on 1st April (**WA3068, WA3071**). From the iron stocks, curved arms, fluke shapes and dimensions these are identified with two nineteenth century Admiralty pattern anchors. They differ in dimensions. The small one has a shank c. 2m long and flukes measuring 300 x 430mm including the bill, whilst the larger of the two has a shank of c. 2.90m and flukes measuring 520 x 610mm. Dimensions of the latter are close to a 28 cwt (hundredweight) Admiralty anchor (Curryer 1999). The small anchor still retained the shackle and chain with studded link.
- 5.3.2 A wooden windlass with part of the chain still coiled on the barrel was recovered (**WA 3145**). The wooden barrel (2.3m long and diameter c. 400mm) is octagonal in shape in the centre and retains the iron whelps. The size of the links of the chain attached to the windlass are different from the anchor chain found.
- 5.3.3 A small bilge hand-pump made of brass was recovered and retained (**WA9031, plate 7**).
- 5.3.4 An iron ladder was grabbed by the clearance vessel and photographed still in the bucket. Unfortunately the ladder fell back into the water whilst the grab was bringing it onto deck (**WA3088**).
- 5.3.5 **WA3130, WA3187** might have been part of two small crab winches. Each winch, manually operated, consisted of two axles in between two uprights. The presence of two broken curved spars on **WA3187** might suggest that this winch was used as hoist device.

5.4 Pottery & Glass Vessels

- 5.4.1 The pottery and glass were examined by WA finds specialist Lorraine Mephram.
- 5.4.2 Small quantities of pottery and vessel glass were recovered; these are listed in **Appendix II** and discussed below, with particular reference to any chronological evidence.

Pottery

- 5.4.3 Pottery recovered amounts to 70 sherds, which includes three complete vessels. The assemblage comprises four groups of material:
- *Blue and white transfer-printed flatwares in a single decorative pattern (one complete plate, plus 30 sherds):* the complete plate (**WA9121**) is dinner plate size, and the other sherds all appear to belong to the same form. The pattern is 'Albion'. The pattern name was used by several different potters, but this variant, featuring a romantic river scene within a border of vignettes separated by foliage, was a common pattern popular in north-east England from at least the 1840s, and was used, for example, by Robert Maling of Newcastle-upon-Tyne (Coysh and Henrywood 1982, 18). Two backstamps, one on the complete plate and one other, are identical; they combine a transfer printed stamp (GRT within a circle, beneath a crown, and above a banner reading ALBION)

with an impressed circular mark (TURNBULL STEPNEY POTTERY), and have been identified as the mark of G.R. Turnbull of Stepney Street, Ouseburn, Newcastle-upon-Tyne, working c. 1863-75 (*ibid.*: 371).

- *Teawares with simple blue banded decoration (complete cup, plus 16 sherds)*: these are utilitarian cups and saucers with simple decoration of three narrow blue bands around the rims. One of the saucers has an impressed backstamp TURNBULL, thus indicating the same supplier for both teawares and dinner plates.
- *Stoneware containers (13 sherds)*: these are all in feldspathic-glazed stonewares (feldspathic of 'Bristol' glazes on stonewares were introduced in the 1830s), and some sherds show the orange-brown colouring of ochre dip, generally confined to the upper parts of vessels, above the shoulder. Two vessels are represented, a narrow-mouthed cylindrical flagon with a strap handle (**WA9055-63**); and a second cylindrical vessel, round-shouldered, but lacking any other diagnostic features, either a flagon or jar (**WA9126-9**). The flagon bears a proprietary mark on the shoulder (G SIMMONS Phoenix GRAVESEND). G Simmons is listed at the Phoenix tavern, Albion Street, in the 1851 Gravesend and Milton Directory, but does not appear in Kelly's 1882 directory (by which time the licensee at the Phoenix was Philip Smith).
- *Miscellaneous sherds (one complete vessel, plus eight sherds)*: the complete vessel is a whiteware jug (**WA9122**), of the kind used in washstand jug and bowl sets, with moulded decoration. A metal (tin or pewter?) trim has been added to the rim, and originally supported a metal lid, now missing. On the base is a relief 'Staffordshire knot', with the monogram WB 24, possibly the mark of William Brownfield of Cobridge, Staffordshire, during the period 1850-71 (Godden 1964: 10) (**Plate 5**).

5.4.4 Also amongst this group are two sponged ware vessels, a cylindrical mug (**WA9123**) and a wash-bowl (**WA9124-WA9125**). Sponging as a decorative technique was used from the early 19th century, but became more common in the 1830s and 1840s with the introduction of cut sponges; it was a cheap form of decoration, requiring minimal skill, and in the mid to late 19th century sponged wares were the cheapest vessels available with decoration. Both vessels are in pearlware, a white-bodied earthenware developed by Josiah Wedgwood in the 1770s, and produced until the 1840s.

5.4.5 Two joining sherds from a whiteware cup (**WA9064-WA9065**) carry a stamped mark (COMMONWEALTH [DOMIN]ION LINE LTD). The Commonwealth and Dominion Line, a passenger and cargo shipping company, was formed in January 1914. In June 1916 it was taken over by the Cunard Line, and became the Cunard Line Australasian Service, Commonwealth & Dominion Line Ltd, but the company remained largely autonomous within the Cunard structure. Commonwealth and Dominion officially rebranded itself as 'Port Line Ltd' in November 1937.

5.4.6 Two other miscellaneous pottery sherds comprise one fragment from a glazed red earthenware vessel, possibly the lid from a bread crock (**WA9130**), and a fragment of probable sanitary ware (toilet bowl; **WA9132**).

Glass

5.4.7 The glass recovered comprises five complete bottles and two other bottle fragments; one complete drinking vessel and parts of two others; an oil lamp; and one miscellaneous fragment.

5.4.8 Three of the complete bottles are soda bottles of similar form; these are 'flat egg' bottles in pale greenish glass, with 'blob' tops. The origin of the ovate 'egg' bottle is slightly obscure;

it is sometimes referred to as a 'Hamilton' bottle after William Hamilton who took out a patent for the production of soda and other mineral waters in 1809, using bottles of this form, although it is fairly clear that the form was in use prior to that date, probably at the end of the 18th century (Talbot 1974: 37-9). The 'flat egg', a variant with a flattened base, is thought to have been introduced around 1870, although there is no firm evidence for this, and the earliest reference appears to be in 1897; the form reached the height of its popularity during the Edwardian period (*ibid.*: 44). One of the flat egg bottles (**WA9134**) carries an embossed proprietary mark (BUSFIELD'S / SPECIAL SUPER / GUISELEY), from W Busfield & Company of Guiseley, West Yorkshire, a company in operation at least from the early 20th century (not found in 19th century trade directories) until very recently. A small fragment of another soda bottle (**WA9133**) has the embossed mark 'SUPER', and almost certainly represents a second Busfield's bottle. The other two flat egg bottles (WA9145-6) are unmarked; they retain their corks *in situ*; the corks are marked WEBB & Co / LIMITED / [ISLI]NGTON GREEN / LONDON, a company founded by John Webb in 1818 (Hannon and Hannon 1976).

- 5.4.9 There are two complete wine (or possibly port) bottles (**WA9135, WA9144**); one is embossed with the mark IMPERIAL QUART on the base; this still has the cork *in situ*. A bottle base (**WA9091**) may represent a third bottle of the same type.
- 5.4.10 The three drinking vessels comprise a complete cylindrical tumbler (**WA9177**), and two partial wine glasses (**WA9118, WA9119**). The wine glasses are both of the same form, with faceted ogee bowls and double blade knops.
- 5.4.11 The oil lamp (**WA9141**) comprises a globular oil reservoir in an opaque white glass. It was found with a metal valve (**WA9142**) and suspension chain (**WA9143**).

5.5 Leather

- 5.5.1 Leather finds recovered from the site amount to 28 elements, and comprises principally of fragments of a range of footwear, along with the peak from a cap or a visor and a fastening strap from a case or satchel.
- 5.5.2 The leather was assessed by leather specialist Quita Mould on 3rd June.
- 5.5.3 A minimum of fourteen individual items of footwear were recognised.
- 5.5.4 All the footwear was noticeably worn and of adult male sizes ranging from Adult size 5(38) to 9(43), with nearly half being size 8(42). No pairs were noted. No complete items of footwear were recovered but two boots, a top boot and a "Wellington", were sufficiently well preserved.
- 5.5.5 A wide range of footwear was represented including tall 'leg' boots (top boot of calf height and a 'wellington' boot), practical, working footwear of types worn by labourers' ('derby' boot and a wooden soled shoe or clog) and dress shoes (oxford shoe, balmoral boots and elastic-sided boots of ankle height). The dress shoes of styles worn by men about town, office and shop workers etc. suggest that a variety of passengers are represented by this footwear rather than simply the working crew aboard ship. All the styles appear to have been made of bovine leathers with the majority having uppers made of leather with the grain side facing outward, known as 'ooze' leather at that time, but later termed 'suede' (Swann 1982: 55). One shoe, a balmoral boot of ankle height, had stitching from a repair patch that once covered a broken area at the great toe joint of the upper perhaps suggesting the wearer had suffered from a bunion.

- 5.5.6 The leather footwear was constructed using two principal construction methods using either wooden pegs or small metal rivets (tacks). No hand stitched welted constructions were present that would have been used on expensive bespoke footwear at that time. The pegged and the riveted constructions suggesting a less expensive range of footwear. The two types of wooden pegged construction found (Goubitz 1984: Figure 5 constructions 9 and 10) were both used during the 19th century. Riveted (nailed) constructions using either iron (steel) rivets or brass rivets were employed during the second half of the 19th century and were commonly used throughout the first half of the 20th century (Salaman 1986: 157). Wooden pegging had also been used to attach heels and repair soles to some shoe bottoms of riveted constructions. The D-shaped stacked leather heels were low (ranging between 1in and 1 ¾ inches in height). Several of the shoe bottoms survived intact with their individual components still adhering so that some details of their internal construction (such as the presence or absence of midsoles) were obscured. In addition, a wooden soled shoe, a clog, was also present with iron nails reinforcing the edge of the sole and badly deteriorated remains of an upper of ankle height.
- 5.5.7 The constructions used, bottom shapes and upper styles all indicate a date in the mid Victorian period, more particularly the third quarter of the 19th century, with certain features suggesting a date in the 1860s-70s.
- 5.5.8 The remains of one shoe (Shoe 3), an oxford shoe, front-lacing through five pairs of lace holes, with a pointed/oval toe might be of slightly later date than the rest, possibly belonging to the late Victorian period (c. 1885+, Swann 1982: 51).

5.6 Miscellanea

5.6.1 Other finds include:

- **WA3180:** A Cylindrical concrete mooring and long chain with studded links which are believed to be part of the old buoy that was located in a position very close to the area where the vessel operated. The chain was cut by the machine operating on the deck and was likely to be more than 15 m long.
- **WA3059, WA3197:** Two cylindrical drums of wood interpreted as pieces of a single mast or spar. They both measure 200mm diameter and one ends with a simple tenon joint.
- **WA9026** was identified with a vaginal douche. This item made of rubber reads *Omega Spray Ingram* on the body and dates to the first 40 years of the 20th century (South Kensington Science Museum Inventory number A626910). It was produced in England and a rubber patch shows that it was repaired.
- **WA9032:** A brass knob of a door with door lock possibly recovered from the wheelhouse or one of the cabins.

6 DISCUSSION

6.1 Archaeological record

Engines

- 6.1.1 The parts of the engines recovered are identified as parts of two single-cylinder 'grasshopper' side-lever engines. Engines of this type, a modified version of the side-lever engine, were fitted in small craft, generally tugs (Griffiths 1997).

- 6.1.2 The engine arrangement, with a single cylinder and a jet condenser coupled below, is similar to the one described in the article “The Story of the Tyne Tugs” published in the Smith’s Dock journal in May 1933 and showed in **Plate 2**.
- 6.1.3 Similar engines were still being built and fitted at the beginning of the 20th century in vessels such as the *Reliant*, a paddle tug built in 1907, and in the *Eppleton Hall*, built in 1914. Although it cannot be excluded that this kind of engine was fitted in vessels other than tugs, it was a very common method of propulsion for paddle tugs because “in disconnecting paddle wheel tugboats, gear was usually fitted to enable the wheels to be disconnected from each other, and each engine worked independently, to facilitate the manoeuvring of the vessel” (Sennet 1911).
- 6.1.4 The large cylinders of the engines were set vertically on top of the jet condenser spraying sea, canal or river water into the exhaust steam to condense it (**Plate 2**).
- 6.1.5 The diameter of the cylinders is consistent with a 30”-33” bore cylinder that could have been fitted in tugs of c. 100-150 gross tons (grt) (c. 30-40m long).

Boilers

- 6.1.6 All the manufacturer marks found on the firebricks are consistently from the Newcastle area and this indicates the Tyne, or possibly the Wear, as potential areas of construction for the boilers. It is also possible that the bricks were replaced during the boilers life time.
- 6.1.7 Boilers fitted in Tyne tugs, described in the article in the Smith’s Dock journal published in 1933, match closely with the two recovered. A sketch reproducing an original working drawing (Smith’s Dock Journal May 1933: 71) of a Tyne tug’s boiler describes a double return flue boiler, single rivetted with dimensions at fore end 7’ 11” x 7’ 4” (c. 2.4x 2.2m) and parallel sides of 11’ (c. 3.3m). The slight difference in dimensions could be explained by the fact that the shapes of the boilers of the Tyne tugs were adapted to the space available in the hull of the tug and “consequently each boiler assumed a curious shape” (Smith’s Dock Journal May 1933) (**Plate 1**).
- 6.1.8 On Tyne tugs the two boilers were usually placed aft of the engines (Smith’s Dock Journal May 1933).

Hull

- 6.1.9 The hull is shallow draft, almost flat bottomed vessel suited for shallow water operations.
- 6.1.10 The dimensions of the hull and construction technique adopted are consistent with a small vessel of 100-150 grt.
- 6.1.11 The plate dimensions vary from 3.02 x 0.65m (riveting spacing 110mm and 470mm across) to 3.90m x 0.65m suggests early construction. In the 1840s the largest plates that could be rolled economically were 10ft long by about 2ft 9in wide (Corlett 1990). Also the single riveted lap might be an indication of an early construction as in larger vessels single riveting was abandoned for double riveting and became rare towards the end of the nineteenth century. Nonetheless, small vessels continued to be single riveted (McCarthy 2005).
- 6.1.12 The construction details of the section of hull plating (**WA3152**) and the small section with the keel still attached to the garboard plate (**WA3119b**) shows a similar arrangement (zigzag riveting with 1” rivets) to the amidships section detailed in the plans for the steel screw tug *Simla* that was built in 1898 (Thomas 1991).



- 6.1.13 With regard to the bituminous material found across the sections of hull it is known that the inside of the hull was often painted with pitch or asphalt in order to prevent plating erosion due to bilge water present in the bottom of the vessel (Corlett 1990). It is possible that a barrel of asphalt was stored in the hold at the time of the sinking and this would explain the reason why some artefacts were found covered by the bituminous substance and why it was not evenly spread.
- 6.1.14 Iron manufacturer's marks found on two of the floors belong to two companies operating in the Gateshead area in the later 19th century listed in the "list of the mills and forges in the United Kingdom" and included in the "Mineral Statistic of the United Kingdom of Great Britain and Ireland for the year 1871". Those manufacturers were 'Frazers and Roberts' based at Felling Shore and 'Abbot' at Gateshead Park.
- 6.1.15 John Abbot & Co was founded in the 1820s and survived until the 20th century when the firm went into liquidation in 1909. In 1889 the Company was described as "iron manufacturers, boiler builders, anchor manufacturers, chain makers, hydraulic engineers, brass founders, brass finishers, coppersmiths, plumbers, gasfitters and smiths." (Tyne and Wear Archives Service 2001-2014 ref. DX711 accessed online June 2014).
- 6.1.16 Frazers, Roberts & Co, formed a limited company of that name in 1866 (McQueen 2013). There is no mention of the firm amongst the Tyneside Industries in 1889 but a company with a very similar name, Robert Frazer & Son is mentioned as having "large transaction as iron and steel merchants" and producing a very diversified output including bar and sheet iron, steel and iron rails and fastenings, bolts, nuts and rivets (Tyneside Industries 1889).
- 6.1.17 From the evidence it is possible that the vessel was built and launched at Gateshead, on the southern bank of the River Tyne, exactly where the L sections for the floors of the vessel were manufactured. Gateshead, along with North Shields and South Shields, was one of the principal centres for tug boat building from the very early days (Thomas 1991), although other shipbuilding centres in the North-East, such as Sunderland, can not be discounted.
- 6.1.18 The evidence of personal items present on board at the time of the sinking suggests that a rather sudden episode lead to the deposition of the wreck on the seabed but due to the circumstances of the recovery it was difficult to identify any evidence of damage that may have occurred at the time of sinking and the cause of the shipwreck, based on the evidence available, remains unclear.

Anchors

- 6.1.19 It is difficult to ascertain if the anchors belong to the same assemblage. Whilst a number of anchors, sometimes as large as 50 cwt (Thomas 1991), were stowed in large tugs it is unlikely that a 28 cwt was on-board a 100 - 150 grt vessel.
- 6.1.20 The large anchor is more likely to be related to another vessel that may or may not have been involved in the tug's sinking.

Pottery and Glass

- 6.1.21 Approximately 80% of the pottery and personal items were recovered during operations on 2nd April.
- 6.1.22 Material recovered in the same bucket loads as the pottery, such as a capstan and the actual bow of the vessel, seem to suggest that most of the pottery was located around the

bow area of the vessel. That said, it must be kept in mind that the grabbing process may have rearranged the archaeological deposits relating to the wreck.

- 6.1.23 The pottery and glass has revealed slightly conflicting evidence in terms of chronology. There are items which appear to belong to the early Victorian period (sponged pearlware ware mug and wash-bowl), to the later 19th century (dinner plates and teawares supplied by Turnbull of Newcastle-upon-Tyne), and to the early 20th century (flat egg soda bottles, Commonwealth & Dominion Line cup).
- 6.1.24 At least two of the identified suppliers (Turnbull, and Busfield of Guiseley) would fit with an origin for the vessel in north-east England, while others (Simmons of Gravesend, Webb of Islington Green) are clearly more local to its final position.
- 6.1.25 The overall character of the assemblage is utilitarian – a simple (and probably cheap) range of serving wares, a range of beverage containers, both for alcoholic and soft drinks, and a few other functional pieces.

6.2 Documentary research

6.2.1 The following sources were consulted:

- NRHE;
- Tyne Tugs & Tug Builder database (accessed from <http://www.tynetugs.co.uk>, May 2014);
- Dictionary of Disaster at Sea during the Age of Steam;
- Newspaper (accessed from <http://www.britishnewspaperarchive.co.uk>, May 2014);
- Notices from the Gazette official public record (accessed from <https://www.thegazette.co.uk>, May 2014);
- UKHO;
- Lloyds Registers;
- Trinity house;
- RoW;
- Gateshead Libraries;
- Grangeham steam museum;
- Clydebuilt Ships Database (accessed from <http://www.clydesite.co.uk>, May 2014);
- Thames Tugs website (accessed from <http://www.thamestugs.co.uk>, May 2014).

6.2.2 From preliminary documentary research a suitable candidate for the identification of the shipwreck is the paddle tug *Admiral*. This vessel is a Tyne built paddle steamer with engines that correspond well with the ones recovered. The dimensions of the ships are similar.

- 6.2.3 Absence of a clear cargo supports the identification of the vessel as a paddle tug rather than as a coastal steamer or a collier of small dimensions but it is possible that the vessel had been salvaged after sinking. Paddle tugs were a quite a common vessel type on the Thames since their introduction in 1830s, the first paddle tug to be seen in the Thames was the *Lady Dundas*, which also arrived from the Tyne and Wear (Thomas 1991).
- 6.2.4 The *Admiral* was an iron paddle tug built by T. Hepple & Son of Low Walker, Newcastle in 1870. The tug was owned by Daniel S. Mitchell of Gravesend and was of c. 100 grt, with the registration number 63555. According to the Shields Daily Gazette of Tuesday 13th February 1872, “the screw steamer *Rajah*, for the north, was in collision below the Nore on Sunday, and sank the tug *Admiral* and afterwards fouled the ship *William Davis*, for Glasgow, doing damage to her bows, and carrying away her own mainmast and funnel. Both vessels returned to London for repairs”.
- 6.2.5 As reported by Freeman’s Journal on 13th February (accessed online, May 2014) the accident was witnessed by Captain Dunne (of *Countess of Dublin*) who saw twelve miles off the Nore that “a serious collision had taken place between a large screw collier (*Rajah*) and the steam tug *Admiral* and a large ship (*William Davis*) bound for Glasgow which she had in tow. In the collision the *Admiral* was sunk and the bows cut clean off the ship”. It is here suggested that from the position that he witnessed the incident (12 miles off the Nore) “Captain Dunne put all steam on the *Countess*, and when near enough to render assistance lowered his boats. By this means he was able to save the crew of the *Admiral* (seven in number)”. The exact circumstances described in the article are unclear and it is possible that the distance of 12 miles reported was not the position he witnessed the accident from but the position where the collision took place, although the first interpretation would provide a better justification as to why Captain Dunne “put all steam on”.
- 6.2.6 The position of the shipwreck is c. 1.2 nm from the location of the Nore Light Vessel before the light was moved to about two miles eastward in 1925 at a position close to that currently held by Sea Reach Buoy no. 1.
- 6.2.7 The reason why the Nore light vessel, so close to the accident, is not mentioned in any of the journals and did not intervene in the rescue of the survivors, is not explained. The Nore light vessel was administrated by Trinity House of London and it is possible that some information was recorded on the logbook of this ship. Unfortunately all the records pre-1940s were destroyed in a fire during World War Two.
- 6.2.8 The iron manufacturers mark found on two frames indicates the banks of the river Tyne as the area where structural components of the hull were manufactured and possibly assembled. The mark FRAZERS AND ROBERTS & Co LTD suggests 1866 as the *terminus post quem* for the construction of the vessel. Although there is the possibility that the floors with the mark are part of a repair that was made after the launch of the vessel this is unlikely and not supported by the available evidence.
- 6.2.9 The date range (later 19th century) and provenance (Newcastle-upon-Tyne) assessed for some of the pottery (dinner plates and teawares supplied by Turnbull) are also consistent with the date and provenance of the *Admiral*. It is conceivable that the mug and wash-bowl belonging to the early Victorian period could have been still in use in the 1870s, but the later cup and bottles clearly post-date the sinking of the *Admiral* in 1872, and are therefore likely to be intrusive to the site.
- 6.2.10 The evidence from the shoes is broadly consistent with the date of the proposed identification of the *Admiral*. However, the number of the persons reported as the crew on



board the *Admiral* is seven and the number of the individual items of footwear recognised within the assemblage is fourteen. It is possible that each member of the crew had spare working and a pair of more formal footwear on board at the time of the incident.

- 6.2.11 During the recovery operation, the existence of later intrusive material on the site was made evident by the presence of plastic bags and modern bottles along with archaeological material within the same bucket loads. It is also possible that some of the material had been washed in by currents and trapped around the prominent seabed features constituted by the wreck site.
- 6.2.12 Considering the high concentration of marine traffic, wreck sites and collisions that took place in the Thames it is possible that some of the finds belong to other vessels.

6.3 Results

- 6.3.1 The salvaged ship is an iron riveted paddle steamer (with feathering wheels), likely to be Tyne built, possibly a tug, dating to the second half of the 19th century.
- 6.3.2 A possible identification of the wreck with the iron paddle tug *Admiral* which sank in 1872 is suggested but further documentary research is recommended to help confirm this.

7 STATEMENT OF IMPORTANCE

7.1 Rarity

- 7.1.1 The most celebrated example of a steam tug was the *Old Trafford*, later *Reliant*, which had been on display in the National Maritime Museum of Greenwich until 1996. In 2001 the museum controversially decided that the tug assemblage was to be disposed of or dispersed as it was too costly to preserve (<http://www.rmg.co.uk/about/press/national-maritime-museum-collections-reform-project>). The two engines, built in 1907 by Hepple & Co., were retained and are now separately visible at the National Maritime Museum and at the Markham Grange Steam Museum.
- 7.1.2 *Eppleton Hall*, built in 1914, is the last surviving Tyne built paddle tug and it is fitted with two grasshopper engines (Porter 2001). *Eppleton Hall* is currently berthed in San Francisco.
- 7.1.3 The engines of 19th century Tyne tugs were all fitted by hand and for most paddle tugs there are no plans so this example provides important information that might help to document the Tyne shipbuilding tradition.
- 7.1.4 Paddle tugs were an emblematic vessel type for the UK in general and the Thames' maritime history. They were first invented in the North of England and their history and development is closely connected with British maritime history and the evolution of maritime industries during the 19th century. The wreck represents an interesting example of a working boat not very often represented amongst merchant or naval maritime collections.
- 7.1.5 The rarity of the Sea Reach 1 wreck site and material is therefore considered: **High**.

7.2 Survival/Condition

- 7.2.1 The removal of an historic wreck by means of grab is, by its nature, destructive. The evidence gathered during the watching brief indicates that large sections of the wreck were preserved in good condition before the commencement of the clearance operation. It



is thought that most of the wreck was likely to be buried in fine silty sediment which provided an optimal environment for the survival of the vessel's structure and artefacts.

- 7.2.2 The presence of organic material, in particular leather, is particularly significant since the existence of a late 19th century footwear assemblage in the archaeological record is relatively rare. Should it prove possible to confirm the identification of the wreck and its date of loss, the importance of a closely dated assemblage would be significantly increased for those studying footwear of this period as the assemblage could provide a 'snapshot' of the fabrication techniques and some of the styles in common use at the time.
- 7.2.3 The condition of the remains of the wreck still *in situ* is hard to assess. As c. 80 tons of material was grabbed and the anomaly lowered by c. 2.2m it is likely that sections of the material left on the seabed are not coherent and may be scattered.
- 7.2.4 The condition of some of the individual artefacts recovered (i.e. WA9144: the bottle of port with the cork still in place) is excellent. The condition of the remaining wreck material is likely to have been severely compromised by the clearance operation, but there will undoubtedly be further archaeological material surviving.
- 7.2.5 The survival/condition of the material at the site is considered: **Medium/High**.

7.3 Potential

- 7.3.1 The following material was not recovered during the operations and it is likely to be amongst the debris remaining on the seabed:
- Engines accessories, pumps, part of main frames and remaining engine bedplate. The latter would be riveted to the keel or to the bottom hull plates (George Dickinson, pers. comm.).
 - Possible partial paddle and shaft.
- 7.3.2 The presence of intrusive material and elements such as the 28 cwt anchor highlight the possibility that more than one wreck is represented in the assemblage. The evidence gathered during the clearance by grabbing is consistently pointing towards the vessel identification put forward in this report, i.e. the *Admiral*.
- 7.3.3 The potential for significant archaeological information to be provided by the Sea Reach one site is considered: **High**.

7.4 Recommendations

- 7.4.1 Although the remaining debris on the seabed is likely to contain valuable archaeological data a further dive inspection is no longer considered to be a requirement as the site is below dredge depth and it is no longer a danger to navigation.
- 7.4.2 A record of the site has been made in the PLA Wreck Database and charted as appropriate. Further dredging in the vicinity of the site by London Gateway Port will be in accordance with the provisions set out in the Archaeological Protocol for dredging activities.
- 7.4.3 It is recommended that further dredging activities within 50 m of the wreck position should be undertaken only if accompanied by a programme of archaeological monitoring.



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APPENDIX I: FINDS LIST

Object No.	Description	Photo No.	Bucket No. - Date Recovered
WA3001	plating with pan-head riveting	WA1020	1 - 31-Mar-2014
WA3002	h-shaped steam pipe with copper flanging	WA1024	2 - 31-Mar-2014
WA3003	connecting rod	WA1025	2 - 31-Mar-2014
WA3004	transversal beam with smithed knees - possible room near boiler room	WA1027	3 - 31-Mar-2014
WA3005	oarlock shaped connecting rod - not identified	WA1042	3 - 31-Mar-2014
WA3006	small 4 spoke wheel	WA1033	3 - 31-Mar-2014
WA3007	boiler #1 , horizontal , double tubular, egg-shaped end	WA1034; WA1050 to WA1065	4 - 31-Mar-2014
WA3008	curved plate with flanged pipe and possible manhole, flush riveting (possibly upper front part of the boiler)	WA1045	5 - 31-Mar-2014
WA3009	boiler #2 , horizontal , double tubular, egg-shaped end, hatches attached	WA1079	6 - 31-Mar-2014
WA3010	firebricks	WA1088	6 - 31-Mar-2014
WA3011	floor/beam with curved seat possibly for boiler	WA1084	7 - 31-Mar-2014
WA3012	shaft with crank and engine crossbeam connecting rod	WA1089, WA1096, WA1115, WA1116	8 - 31-Mar-2014
WA3013	copper terminal and ceramic fragment	WA1104	8 - 31-Mar-2014
WA3014	deck or bulkhead plate with inspection hatch – anti-slip surface	WA1106, WA1127	8 - 31-Mar-2014
WA3015	firebrick	WA1114	8 - 31-Mar-2014
WA3016	shaft with rotation crank	WA1126	9 - 31-Mar-2014
WA3017	wheel #1	WA1123, WA1134	9 - 31-Mar-2014
WA3018	crank shaft detail	WA1120, WA 1121	9 - 31-Mar-2014
WA3019	hatch	WA1127	9 - 31-Mar-2014
WA3020	copper piping -discharge pipe	WA1131	9 - 31-Mar-2014
WA3021	feed valve	WA1141	9 - 31-Mar-2014
WA3022	wheel #2	WA1144 to WA1151, WA1337 to WA1350	10 - 31-Mar-2014
WA3023	connecting rod	WA1153	10 - 31-Mar-2014
WA3024	hatch , possible injection valve slot	WA1155	10 - 31-Mar-2014
WA3025	coupling wheel to couple engines	WA1165, WA1174	11 - 31-Mar-2014
WA3026	Wooden beam with I shape, composite metal base and two connecting rods attached. Possibly engine room beam.	WA1169, WA1182, WA1188	11 - 31-Mar-2014
WA3027	eccentric strap details)	WA1168	11 - 31-Mar-2014
WA3028	I shape	WA1198	12 - 01-Apr-2014
WA3029	curved plating with chain riveted butt plate	WA1202, WA1203	13 - 01-Apr-2014
WA3030	curved plating with I shape	WA1207	13 - 01-Apr-2014
WA3031	deck stanchion or paddle stay	WA1208	13 - 01-Apr-2014
WA3032	chain - studded links	WA1212	14 - 01-Apr-2014
Appendix II	soda bottle	WA1215	14 - 01-Apr-2014
WA3034	3x plating	WA1218	15 - 01-Apr-2014
WA3035	coal		15 - 01-Apr-2014
WA3036	pipng with flanged end	WA1221	16 - 01-Apr-2014
WA3037	timber fragment	WA1223	16 - 01-Apr-2014
WA3038	possible pump/piston fragment	WA1224	16 - 01-Apr-2014
WA3039	possible hull plank and frame	WA1225, WA1230	16 - 01-Apr-2014
WA3040	hull section with frames and plating and butt plate	WA1228	17 - 01-Apr-2014
WA3041	wire iron splice	WA1229	17 - 01-Apr-2014
WA3042	small copper cap	WA1233	17 - 01-Apr-2014
WA3043	shoe with nails	WA1234, WA1235	17 - 01-Apr-2014
WA3044	cylinder #1	WA1240, WA1242, WA1247, WA1476 to WA1485	18 - 01-Apr-2014
WA3045	side levers	WA1249 , WA1235	18 - 01-Apr-2014



Object No.	Description	Photo No.	Bucket No. - Date Recovered
WA3046	cylinder #2	WA1256 , WA1268, WA 1351 to WA1356, WA1486 to WA1490	19 - 01-Apr-2014
WA3047	pump #1	WA1273, WA1277, WA 1359 to WA1364	20 - 01-Apr-2014
WA3048	side lever	WA1285	20 - 01-Apr-2015
WA3049	crosshead	WA1285	21 - 01-Apr-2015
WA3050	pump #2	WA1292, WA1460 to 1465	21 - 01-Apr-2014
WA3051	possible piston from air pump/bilge pump #2	WA1289	21 - 01-Apr-2014
WA3052	possible piping cock	WA1295	21 - 01-Apr-2014
WA3053	plating	WA1303	22 - 01-Apr-2014
WA3054	2x wooden planks	WA1303	22 - 01-Apr-2014
WA3055	copper piping / possible copper strum box	WA1308	23 - 01-Apr-2014
WA3056	wooden plank and plating	WA1313, WA1311	23 - 01-Apr-2014
WA3057	porthole for possible injection valve	WA1312	23 - 01-Apr-2014
WA3058	box keelson (?)	WA1312	23 - 01-Apr-2014
WA3059	mast with scarf (?)	WA1318	24 - 01-Apr-2014
WA3060	section of hull	WA1320, WA1326	24 - 01-Apr-2014
WA3061	engine/pump base	WA1324	24 - 01-Apr-2014
Appendix II	brass hand pump still attached to plank	WA1376	25 - 01-Apr-2014
WA3063	long wooden plank	WA1379	25 - 01-Apr-2014
WA3064	numbers of wooden plank fragment - deck planking or ceiling	WA1378	25 - 01-Apr-2014
WA3065	brick	WA1381	25 - 01-Apr-2014
WA3066	wooden plank of different sizes , no fastening	WA1385	26 - 01-Apr-2014
WA3067	animal vertebra and ceramic fragments	WA1393	26 - 01-Apr-2014
WA3068	adm pattern anchor #1	WA1386, WA1452, WA1453	27 - 01-Apr-2014
WA3069	wooden ceiling or decking , iron plates	WA1390	27 - 01-Apr-2014
WA3070	shoes		27 - 01-Apr-2014
WA3071	adm pattern anchor #2	WA1396, WA 1408, WA1466 to WA1468	28 - 01-Apr-2014
Appendix II	ceramics, oil lamp	WA1406, WA1407	28 - 01-Apr-2014
Appendix II	small decorated plank	WA1401	28 - 01-Apr-2014
WA3074	chain - studded links	WA1402	28 - 01-Apr-2014
WA3075	valve	WA1403	28 - 01-Apr-2014
Appendix II	glasses and soda bottles x6	WA1409	28 - 01-Apr-2014
WA3077	brass gaskets	WA1410	28 - 01-Apr-2014
WA3078	plating	WA1411	28 - 01-Apr-2014
WA3079	paddle wheel float	WA1412, WA1469 to 1475	29 - 01-Apr-2014
WA3080	hull section with 3 frames and reversed frames, floors , keel , wooden ceiling still attached, bitumen in the bilge	WA1416, WA1429 to 1451	30 - 01-Apr-2014
WA3081	brick	WA1420	30 - 01-Apr-2014
WA3082	frames	WA1422	30 - 01-Apr-2014
WA3083	coal wooden fragment and iron plates	WA1422	30 - 01-Apr-2014
WA3084	hull plating , single riveted (pan head rivets) , clinker built , chain riveted butt plate	WA1495	31 - 02-Apr-2014
WA3085	frame	WA1494	31 - 02-Apr-2014
WA3086	section of hull with four frames, butt plate	WA1503, , WA1513, WA 1514, WA1525	32 - 02-Apr-2014
WA3087	curved rod	WA1501	32 - 02-Apr-2014
WA3088	iron ladder - fell into water	WA1500	32 - 02-Apr-2014
WA3089	hull plate small	WA1510	33 - 02-Apr-2014
WA3090	floor	WA1511, WA1512	33 - 02-Apr-2014
WA3091	head of hammer	WA1705	34 - 02-Apr-2014
WA3092	plate	WA1520	34 - 02-Apr-2014
WA3093	curved rod	WA1522	34 - 02-Apr-2014



Object No.	Description	Photo No.	Bucket No. - Date Recovered
WA3094	timbers		34 - 02-Apr-2014
Appendix II	section of hull with butt plate and four floors	WA1526, WA1528	35 - 02-Apr-2014
WA3096	rod, squared section (curved metal bar ?)	WA1527	35 - 02-Apr-2014
WA3097	two long hull plate	WA1531, WA1530,	36 - 02-Apr-2014
WA3098	fragment of timber with lead sheet	WA1532	36 - 02-Apr-2014
Appendix II	ceramic pitcher entire	WA1707 to WA1709	36 - 02-Apr-2014
Appendix II	ceramic bowl with sponge blue decoration	WA1541	36 - 02-Apr-2014
WA3101	floor	WA1550, WA1553,WA1554	37 - 02-Apr-2014
WA3102	two long hull plate	WA1549, WA1551	37 - 02-Apr-2014
WA3103	tapered long timber	WA1552	37 - 02-Apr-2014
WA3104	timber planks (ceiling), small and long	WA1557, WA1565	38 - 02-Apr-2014
WA3105	plates	WA1561	38 - 02-Apr-2014
WA3106	manhole door with handle	WA1561, WA1571	38 - 02-Apr-2014
WA3107	modern plastic rubbish bag	WA1565	38 - 02-Apr-2014
WA3108	l shaped frames	WA1562, WA1563	38 - 02-Apr-2014
WA3109	curved rod	WA1560	38 - 02-Apr-2014
WA3110	bricks		38 - 02-Apr-2014
WA3111	crosshead connection and connecting rod	WA1566, WA1569	38 - 02-Apr-2014
WA3112	transmission cable with ring		38 - 02-Apr-2014
WA3113	shoe	WA1562, WA1563	38 - 02-Apr-2014
WA3114	long plate	WA1568	39 - 02-Apr-2014
WA3115	curved floor with hull plating (very bent)	WA1573, WA1574, WA1575, WA 1576	40 - 02-Apr-2014
WA3116	plating and floors	WA1580	41 - 02-Apr-2014
WA3117	cylinder valve plug	WA1579	41 - 02-Apr-2014
WA3118	coals	WA1581	41 - 02-Apr-2014
WA3119 - WA3119b	large section of iron riveted -pan head - hull , clinker built , possibly side of the ship, covered by bituminous substance, possible hatchway visible, rounded end - gunwale, floors and frames - z bar	WA1582, WA1583, WA1574, WA1587, WA1588, WA1589, WA1590, WA1596, WA1601, WA1609, WA1603, WA1604, WA 1612, WA1613, WA1623, WA1631, WA1641	42 - 02-Apr-2014
WA3120	copper piping	WA1644	42 - 02-Apr-2014
WA3121	spanner , concreted in the bituminous substance	WA1594, WA1595, WA1616	42 - 02-Apr-2014
WA3122	coals		42 - 02-Apr-2014
WA3123	timber fragments	WA1599, WA1631, WA 1656, WA1657	42 - 02-Apr-2014
WA3124	frames	WA1593,WA1599, WA1644, WA1658, WA1659, WA1661	42 - 02-Apr-2014
WA3125	grated iron plate for ceiling or decking	WA1597, WA1614, WA1624	42 - 02-Apr-2014
WA3126	brass support with two rivets and hole (not identified)	WA1608, WA1611	42 - 02-Apr-2014
WA3127	machinery with copper pipes and gauges (not identified - injection valve and centrifugal governor ?)	WA1646 to WA1649, WA1710 to 1713	42 - 02-Apr-2014
WA3128	rod, squared section (curved metal bar ?)	WA1660	42 - 02-Apr-2014
WA3129	iron plating, same curved end as in bucket #42	WA1678, WA1679, WA1687 to WA1690	43 - 02-Apr-2014
WA3130	crab winch	WA1680, WA1685	43 - 02-Apr-2014
WA3131	manhole door with handle	WA1714	43 - 02-Apr-2014
WA3132	frames	WA1683	43 - 02-Apr-2014
WA3133	margin plate (of double bottom ?)	WA1669	44 - 02-Apr-2014
WA3134	possible diagonal tie plate (bent)	WA1798	44 - 02-Apr-2014
WA3135	frames	WA1700	44 - 02-Apr-2014
WA3136	wooden planks	WA1703	44 - 02-Apr-2014
WA3137	coals	WA1703	44 - 02-Apr-2014
WA3138	iron double knee, decorated with tryglyph, rod and	WA1715 to WA1718,	45 - 02-Apr-2014



Object No.	Description	Photo No.	Bucket No. - Date Recovered
	small thick plate attached	WA1723 to WA1726	
WA3139	iron splice	WA1719	46 - 02-Apr-2014
WA3140	hull plates and butt plate	WA1722	47 - 02-Apr-2014
Appendix II	door lock	WA1730	48 - 02-Apr-2014
WA3142	door hook and catch	WA1731	48 - 02-Apr-2014
WA3143	leather hat peak	WA1733	48 - 02-Apr-2014
WA3144	bow - riveted	WA1735 to 1737,WA1765 to 1767	48 - 02-Apr-2014
WA3145	windlass and chain	WA1741, WA1745,WA1747, WA1753, WA1756, WA1758 to WA1764	48 - 02-Apr-2014
Appendix II	ceramic fragments, cup, and dish (complete) with markings	WA1748, WA1749,WA1757	48 - 02-Apr-2014
WA3147	I shape frames	WA1769	49 - 02-Apr-2014
WA3148	hull plates	WA1769	49 - 02-Apr-2014
WA3149	wood plank	WA1769	49 - 02-Apr-2014
WA3150	grated iron plate for ceiling or decking	WA1770	49 - 02-Apr-2014
WA3151	floor	WA1771	49 - 02-Apr-2014
WA3152	long section of hull with riveted - pan head - plating, nine frames and three stringers and grated iron plate for ceiling, bitumen, stays connection on stringer , plates curved , bracket frames	WA1772, WA1773, WA1774, WA1777, WA1778, WA17781	50 - 02-Apr-2014
WA3153	wooden beam reinforced with metal string attached to iron riveted plate (gunwale)	WA1785, WA1790,WA1791, WA1793, WA1795, WA1796,WA1797, WA1798	51 - 02-Apr-2014
WA3154	hub of paddle wheel	WA1786, WA1787	51 - 02-Apr-2014
WA3155	Possible keeper for shaft (not identified)	WA1786 , WA1974	51 - 02-Apr-2014
WA3156	Possible stem bulkhead , four frames and stringer / keel, plating and three brackets	WA1801 TO WA1825, WA1828	52 - 02-Apr-2014
WA3157	copper piping with flange	WA1825	52 - 02-Apr-2014
WA3158	thick riveted plate with possible manhole	WA1859	53 - 03-Apr-2014
WA3159	plate with curved end	WA1866 to WA1868	54 - 03-Apr-2014
WA3160	plate	WA1866 to WA1868	54 - 03-Apr-2014
WA3161	frame and floor I shape	WA1870, WA1871	55 - 03-Apr-2014
WA3162	two long riveted plates	WA1878,WA1879	56 - 03-Apr-2014
WA3163	small wooden planks		56 - 03-Apr-2014
WA3164	leather, possibly cover	WA1882	56 - 03-Apr-2014
WA3165	long wooden beam and planks	WA1888	57 - 03-Apr-2014
WA3166	gear with pin	WA1889	57 - 03-Apr-2014
Appendix II	boot	WA1895, WA1909	58 - 03-Apr-2014
Appendix II	bottle with cork and content	WA1896, WA1897, WA1911	58 - 03-Apr-2014
WA3169	large wooden beam and small planks	WA 1898, WA1899, WA1903	58 - 03-Apr-2014
Appendix II	vaginal douche rubber container	WA1900, WA1901, WA1909, WA1979	58 - 03-Apr-2014
Appendix II	five fragment of shoes	WA1909, WA1977	58 - 03-Apr-2014
WA3172	rectangular frame	WA1902, WA1909	58 - 03-Apr-2014
Appendix II	shoe fragment	WA1904, WA1908, WA1909	58 - 03-Apr-2014
WA3174	concretion made of reeds , clothing and metal rods	WA1905,WA1906, WA1923, WA1924	58 - 03-Apr-2014
WA3175	rope	WA1907	58 - 03-Apr-2014
Appendix II	brass button	WA1910	58 - 03-Apr-2014
WA3177	iron plate	WA1914	59 - 03-Apr-2014
WA3178	small plank with bevelled angle	WA1914	59 - 03-Apr-2014
WA3179	I-shapes and riveted plates	WA1915, WA1916, WA1917, WA1925	59 - 03-Apr-2014
WA3180	buoy concrete mooring and chain	WA1928, WA1929, WA1931, WA1932, WA1934, WA1939	60 - 03-Apr-2014



Object No.	Description	Photo No.	Bucket No. - Date Recovered
WA3181	Possible floating of paddle wheel (?)	WA1943, WA1946	61 - 03-Apr-2014
WA3182	possible knee, hinge for floating of paddle wheel	WA1944, WA1945	61 - 03-Apr-2014
WA3183	two l-shapes	WA1948	61 - 03-Apr-2014
WA3184	long tie plate	WA1969, WA1970, WA1972	62 - 04-Apr-2014
WA3185	butt plate	WA1971	62 - 04-Apr-2014
WA3186	iron riveted plate	WA1975	62 - 04-Apr-2014
WA3187	Possible crab winch fragment	WA2000 to WA2004	63 - 04-Apr-2014
WA3188	gunwale possibly stern with bollard or support for stanchions	WA2005 to WA2008	64 - 04-Apr-2014
WA3189	large wooden beam reinforced with metal string and iron sheeting	WA2009, WA 2010, WA 2011, WA2012, WA2018	64 - 04-Apr-2014
WA3190	small plank with circular hole	WA2013, WA2015	64 - 04-Apr-2014
WA3191	iron riveted plate	WA2017	64 - 04-Apr-2014
WA3192	chain	WA2020	65 - 04-Apr-2014
WA3193	bottle of beer (modern) and ceramic fragment	WA2029	65 - 04-Apr-2014
WA3194	animal bone	WA2030	65 - 04-Apr-2014
WA3195	copper piping and valves	WA2033, WA2037, WA2038	65 - 04-Apr-2014
WA3196	possible fragment of engine base plate	WA2029	65 - 04-Apr-2014
WA3197	wooden post , mast fragment	WA2030	65 - 04-Apr-2014
WA3198	ball of resin	WA2035, WA2036	65 - 04-Apr-2014
WA3199	gunwale and iron plating with bollard (wa2055)	WA2039, WA2040, WA2055 to 2059	66 - 04-Apr-2014
WA3200	bollard	WA2039, WA2040, WA2041	66 - 04-Apr-2014
WA3201	clothing , possibly hemp	WA2042	66 - 04-Apr-2014
WA3202	shoe complete	WA2044	67 - 04-Apr-2014
WA3203	iron riveted plates	WA2046	68 - 04-Apr-2014
WA3204	small brass piping wit hinge	WA2047	68 - 04-Apr-2014
Appendix II	leather strap	WA2049	68 - 04-Apr-2014
WA3206	iron riveted plates , clinker built	WA2050	69 - 04-Apr-2014
WA3207	copper piping with brass soldering	WA2053, WA2052	69 - 04-Apr-2014
WA3208	two bottle of beer	WA2054	69 - 04-Apr-2014
WA3209	butt plate	WA2062, WA2063	69 - 04-Apr-2014
WA3210	Possibly base plate of engine	WA2069 to 2071, WA2084, WA2085	70 - 04-Apr-2014
WA3211	butt plate	WA2073	71 - 04-Apr-2014
WA3212	shackle with strap	WA2074	71 - 04-Apr-2014
WA3213	copper piping with bolted end	WA2076	71 - 04-Apr-2014
Appendix II	animal bone	WA2077	71 - 04-Apr-2014
WA3215	copper pipe	WA2083	72 - 04-Apr-2014
WA3216	keel section	WA2091	unknown

APPENDIX II: FINDS RETAINED BY WA

Object No.	Material	Description
WA9001	Leather	Shoe
WA9002	Leather	Shoe
WA9003	Leather	Shoe
WA9004	Leather	Shoe
WA9005	Leather	Shoe
WA9006	Leather	Shoe
WA9007	Leather	Shoe
WA9008	Leather	Shoe
WA9009	Leather	Shoe
WA9010	Leather	Shoe
WA9011	Leather	Shoe
WA9012	Leather	Shoe



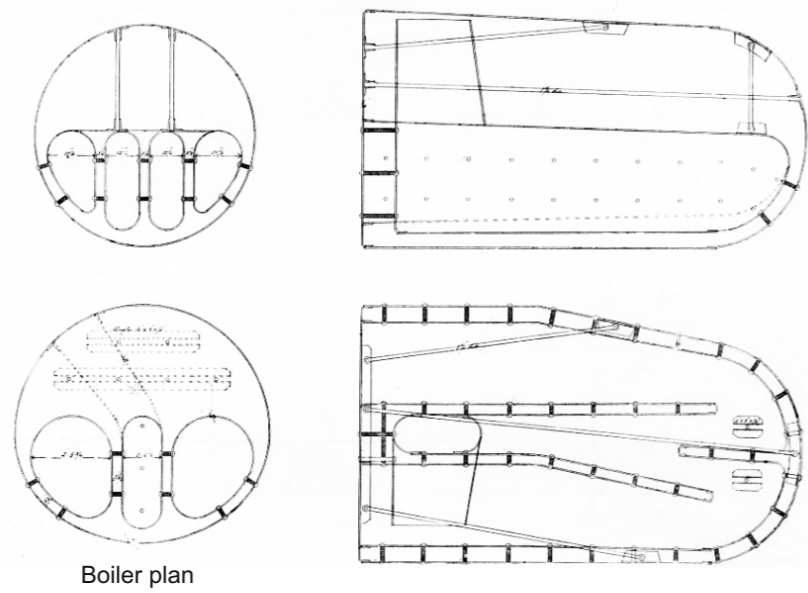
Object No.	Material	Description
WA9013	Leather	Shoe
WA9014	Leather	Shoe
WA9015	Leather	Shoe
WA9016	Leather	Shoe
WA9017	Leather	Shoe
WA9018	Leather	Shoe
WA9019	Leather	Shoe
WA9020	Leather	Shoe - boot
WA9021	Leather	Shoe
WA9022	Leather	Shoe
WA9023	Leather	Shoe
WA9024	Leather	Shoe
WA9025	Leather	Shoe
WA9026	Rubber	Vaginal Douche
WA9027	Leather	Peak of cap
WA9028	Leather	Shoe
WA9029	Animal bone	Animal bone
WA9030	Animal bone	Animal bone
WA8001	Bitumen	Sample
WA8002	Rubber	Sample Gasket
WA9031	Wood and brass	Hand pump
WA9032	Wood and brass	Door lock
WA9033	Steel	Spanner
WA9034	Brass	Valve
WA9035	Brass	Valve
WA9036	Brass	Valve
WA9037	Brass	Valve
WA9038	Brass	Small pipe
WA9039	Leather	Strap / Belt
WA9040	Copper	Pipe
WA9041	Copper	Pipe
WA9042	Copper	Pipe
WA9043	Iron	Rivet
WA9044	Copper	Rivet
WA9045	Copper	Rivet
WA9046	Iron	Rivet
WA9047	Iron	Rivet
WA9048	Iron	Rivet
WA9049	Iron	Rivet
WA9050	Iron	Shackle and iron bar
WA9051	Brass	Metal box for engine oil (?)
WA9052	Iron	Rectangular frame , hawsehole
WA9053	Iron	Iron L-shaped floor with manufacturer mark
WA9054	Wood	Timber
WA9055	Pottery	Ceramic fragment
WA9056	Pottery	Ceramic fragment
WA9057	Pottery	Ceramic fragment
WA9058	Pottery	Ceramic fragment
WA9059	Pottery	Ceramic fragment
WA9060	Pottery	Ceramic fragment
WA9061	Pottery	Ceramic fragment
WA9062	Pottery	Ceramic fragment
WA9063	Pottery	Ceramic fragment
WA9064	Pottery	Ceramic fragment
WA9065	Pottery	Ceramic fragment
WA9066	Pottery	Ceramic fragment
WA9067	Pottery	Ceramic fragment
WA9068	Pottery	Ceramic fragment



Object No.	Material	Description
WA9069	Pottery	Ceramic fragment
WA9070	Pottery	Ceramic fragment
WA9071	Pottery	Ceramic fragment
WA9072	Pottery	Ceramic fragment
WA9073	Pottery	Ceramic fragment
WA9074	Pottery	Ceramic fragment
WA9075	Pottery	Ceramic fragment
WA9076	Pottery	Ceramic fragment
WA9077	Pottery	Ceramic fragment
WA9078	Pottery	Ceramic fragment
WA9079	Pottery	Ceramic fragment
WA9080	Pottery	Ceramic fragment
WA9081	Pottery	Ceramic fragment
WA9082	Pottery	Ceramic fragment
WA9083	Pottery	Ceramic fragment
WA9084	Pottery	Ceramic fragment
WA9085	Pottery	Ceramic fragment
WA9086	Pottery	Ceramic fragment
WA9087	Pottery	Ceramic fragment
WA9088	Pottery	Ceramic fragment
WA9089	Pottery	Ceramic fragment
WA9090	Pottery	Ceramic fragment
WA9091	Glass	Bottle bottom
WA9092	Glass	Glass fragment
WA9093	Pottery	Ceramic fragment
WA9094	Pottery	Ceramic fragment
WA9095	Pottery	Ceramic fragment
WA9096	Pottery	Ceramic fragment
WA9097	Pottery	Ceramic fragment
WA9098	Pottery	Ceramic fragment
WA9099	Pottery	Ceramic fragment
WA9100	Pottery	Ceramic fragment
WA9101	Pottery	Ceramic fragment
WA9102	Pottery	Ceramic fragment
WA9103	Pottery	Ceramic fragment
WA9104	Pottery	Ceramic fragment
WA9105	Pottery	Ceramic fragment
WA9106	Pottery	Ceramic fragment
WA9107	Pottery	Ceramic fragment
WA9108	Pottery	Tea cup complete
WA9109	Pottery	Ceramic fragment
WA9110	Pottery	Ceramic fragment
WA9111	Pottery	Ceramic fragment
WA9112	Pottery	Ceramic fragment
WA9113	Pottery	Ceramic fragment
WA9114	Pottery	Ceramic fragment
WA9115	Pottery	Ceramic fragment
WA9116	Pottery	Ceramic fragment
WA9117	Glass	Glass complete
WA9118	Glass	Glass
WA9119	Glass	Glass
WA9120	A. Bone	A. Bone vertebra
WA9121	pottery	Complete plate
WA9122	pottery	Complete pitcher
WA9123	pottery	pottery fragment
WA9124	pottery	pottery fragment
WA9125	pottery	pottery fragment
WA9126	pottery	pottery fragment



Object No.	Material	Description
WA9127	pottery	pottery fragment
WA9128	pottery	pottery fragment
WA9129	pottery	pottery fragment
WA9130	pottery	pottery fragment
WA9131	pottery	pottery fragment
WA9132	pottery	pottery fragment
WA9133	Glass	glass fragment
WA9134	Glass	bottle
WA9135	Glass	bottle
WA9136	Brass	button
WA9137	brass	bottle rim
WA9138	brass	chain
WA9139	brass	chain
WA9140	brass	chain
WA9141	pottery	oil lamp
WA9142	brass	oil lamp starter
WA9143	brass	oil lamp support - chandelier
WA9144	Glass	bottle intact with cork - possibly port
WA9145	Glass	bottle intact with cork - soda
WA9146	Glass	bottle intact with cork - soda
WA8003	concretions	concretions - 2 scuppers



A: Top view



B: Front view



C: Side view



Boiler plan from Smith's Dock Journal May 1933: 71.
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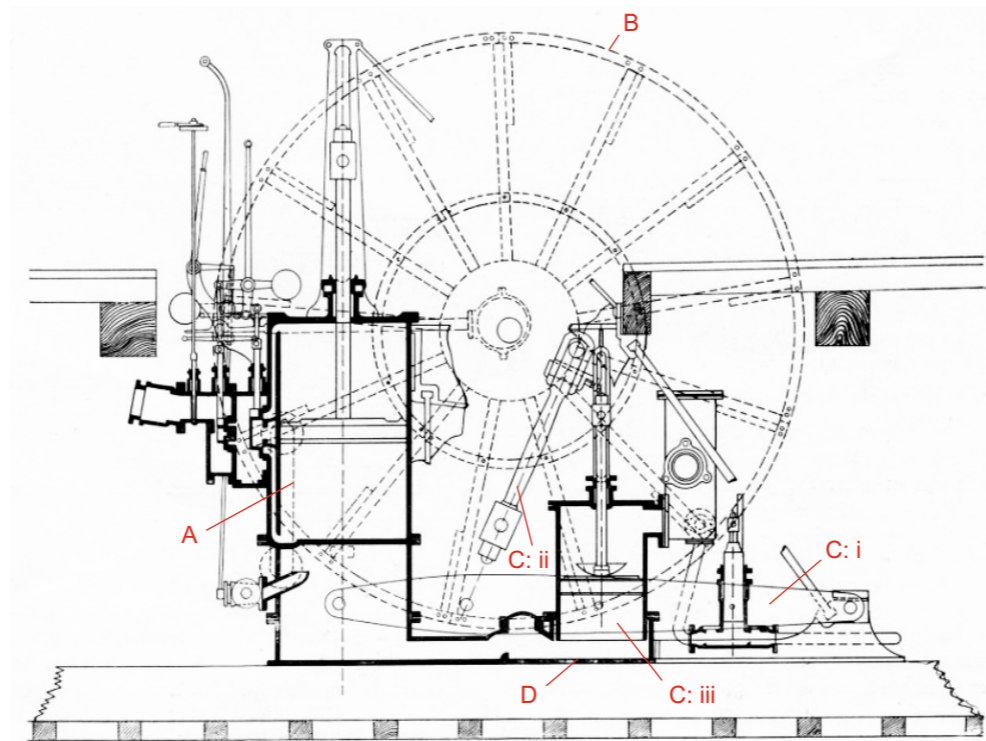
A: WA3044 cylinder



B: WA3022 paddlewheel



C: WA3048 side lever beam (i), WA3049 crosshead (ii) and WA3050 pump (iii)



D: WA3210 bedplate

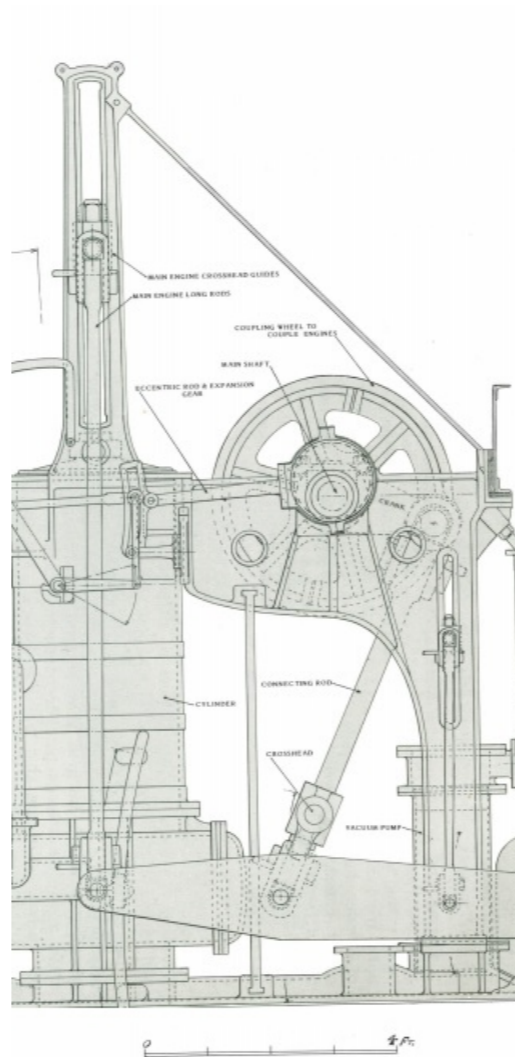


Plan from Smith's Dock Journal May 1933: 70.
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A: Front view



B: Side view



C: Top view



Plan from Thomas 1991: 199.
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A: WA3152



B: WA3152 detail


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Plate 5: WA9122 whiteware jug



Plate 7: WA9031 bilge pump



Plate 6: WA9141 oil lamp

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