

Figure 80: Schematic of a 19th century engine room including: engine casing (7) and engine room skylight (6), boiler (13), engine (18), tail rods (26) funnel (1), stokehold ventilator (5), boiler casing (8), (Image: Paasch 1901, Plate 50)

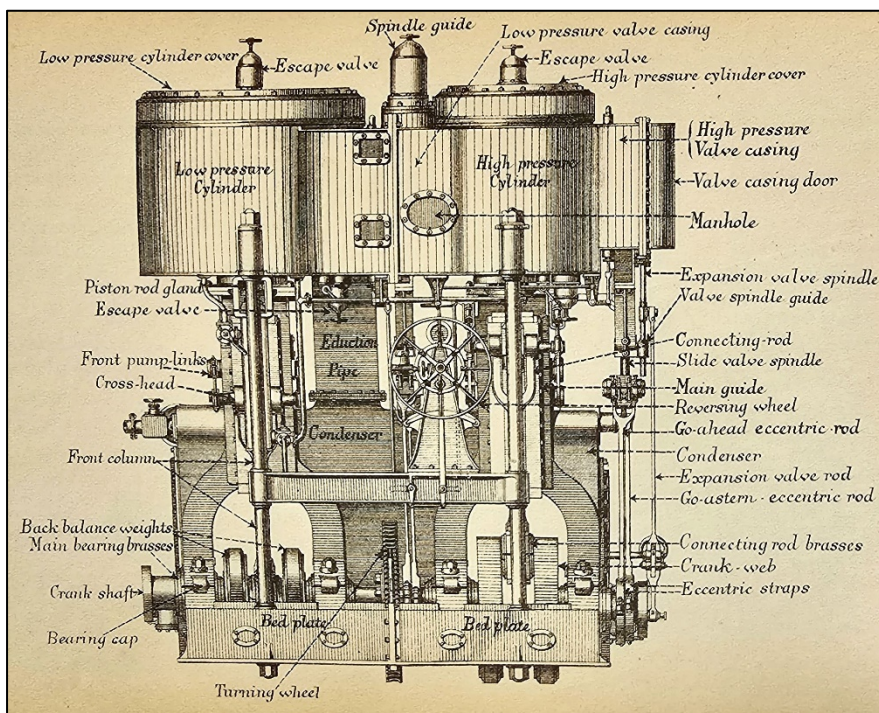


Figure 81: Schematic of a late 19th century compound engine showing escape valve (Image: Paasch 1885)

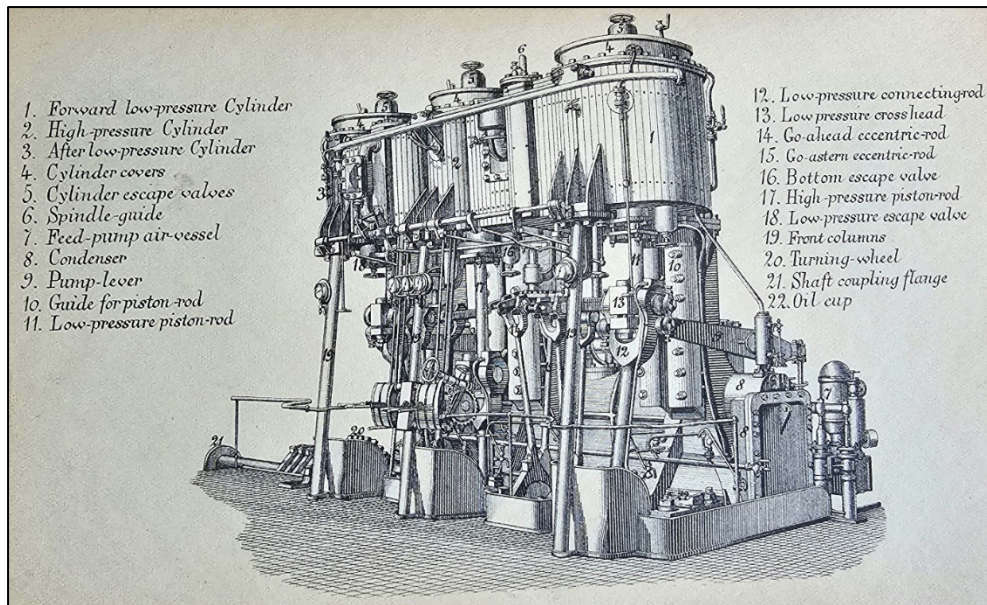


Figure 82: Schematic of a triple expansion engine (Image: Paasch 1885)

ix. Hull plating / main sheerstrake

The vessel's hull consists of overlapping metal plates, suggesting the vessel is rivetted and therefore predates c 1930s when welding was first introduced to Australia. Earlier welding was introduced internationally in c 1920s but was not widely used in Australia until after the 1930s. The vessel exhibits a prominent sheerstrake (a band used to reinforce the vessel longitudinally) at the main deck level. This is particularly evident in the bridge area where the hull is most intact (Figure 83).

Hewitt (pers comms) has suggested that the thickness of the sheer strake is highly unusual, and that it may be a reinforcing strake, for instance at the wind and water line, or a doubler where there has been abrasion or damage from fendering. Hewitt states that he has never seen a sheerstrake this thick in his experience studying and researching vessels of this period.



Figure 83: Main sheerstrake hull plating (1) on starboard side below the bridge (Image: CSIRO 2023 - Lapped Hull Plating Side cam)

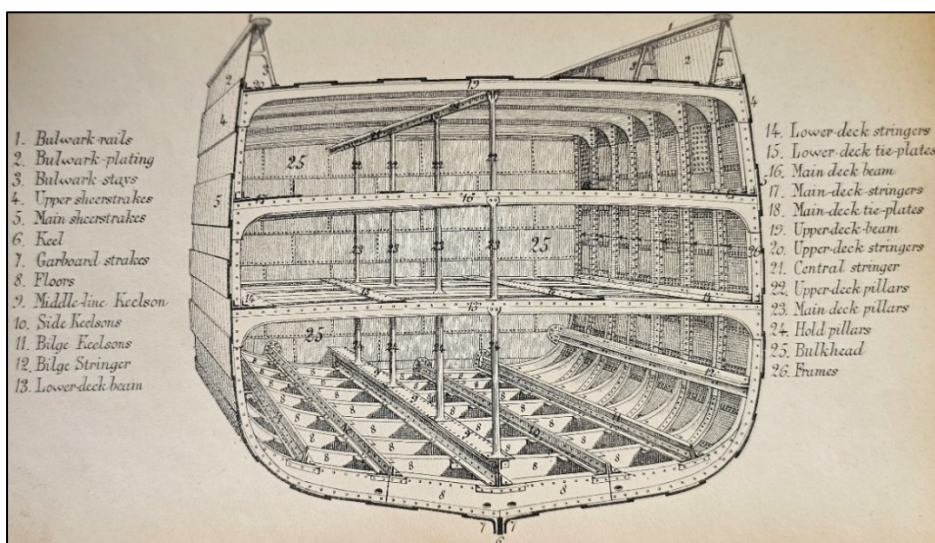


Figure 84: Schematic of 19th century three decked ship showing main sheerstrake (Image: Paasch 1885)

d. Aft Main Deck

i. Collapsed stern at aft engine room bulkhead

The vessel has collapsed again aft of the engine room bulkhead, which appears to be intact. The hull after this section has collapsed and the aft main deck beam stringer plate is still attached to the hull at the forward section but has collapsed onto the seabed further aft just before the aft of the end of the aft hatchway (see below).

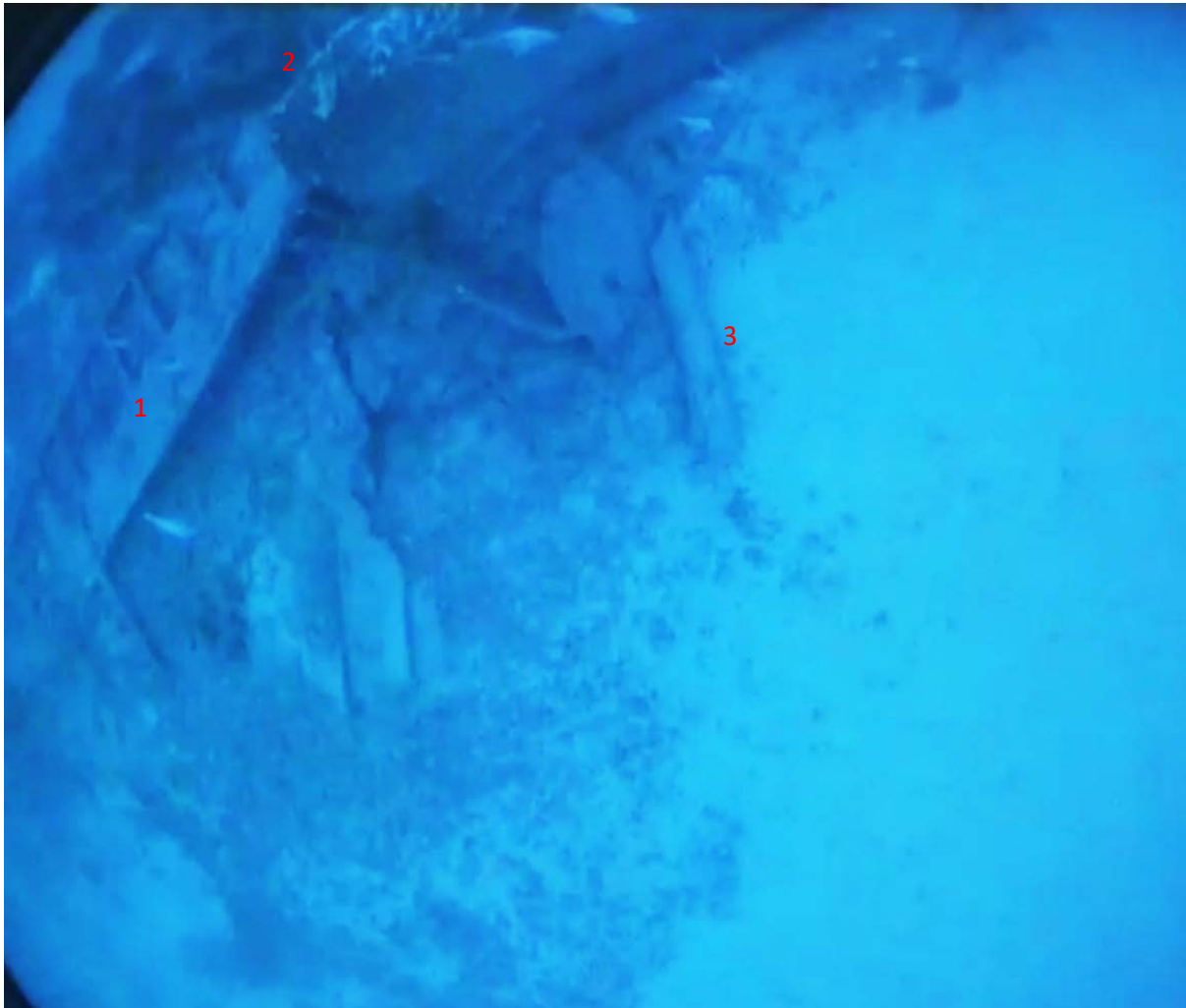


Figure 85: Starboard side collapsed stern main deck beam stringer plate (1) aft of engine room bulkhead (2). Note the remains of probable derrick crane on seabed (3) (Image: CSIRO 2023 - 07414)

ii. Rear Hatchway

A few metres aft of the engine room bulkhead is another cargo hatchway which has collapsed (Figure 86, Figure 87). The hatchway has a raised coaming and is of similar dimensions to the forward cargo hatchway. On the port side of the hatchway the decking is still intact, and a set of bitts are still in situ, whilst the on the starboard side the deck is missing.



Figure 86: View aft hatch looking forward showing hatchway (1) and mast step (2) (Image: CSIRO 2023 -)



Figure 87: Rear hatch (1) with collapsed main decking around coaming on starboard side (2). Note the bitts (3) on port side, the engine room decklight coaming (4), and possible section of a collapsed derrick crane or propeller shaft (5) (Image: CSIRO 2023 - e 2368)

iii. Aft Derrick Crane / Mast step

Aft of the main deck hatchway, the entire hull has collapsed onto the seabed. On the deck on the starboard side, there are section of what appears to be an inverted section of deck where the rear derrick crane mast once connected penetrated the deck through the mast partners. Part of this section also shows what appears to be a person sized access hatchway that goes through the deck. At the other end of this section is what appears to be a cargo winch (Figure 88, Figure 89, Figure 90).

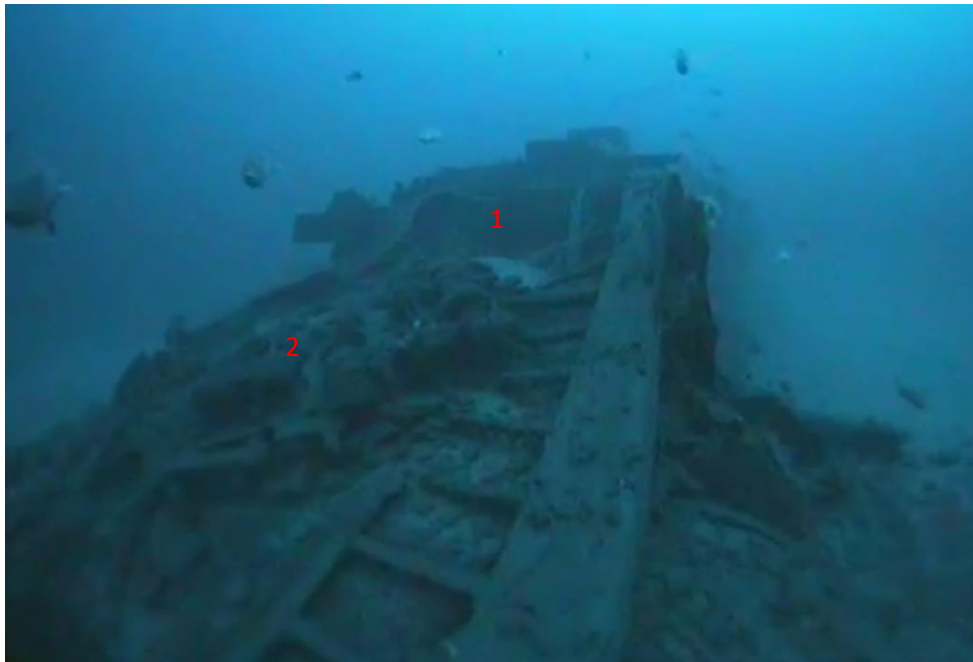


Figure 88: View facing forward toward rear hatch (1). Note remains of machinery or a section of inverted deck with attached cargo winch mast partners and access hatchway attached on deck (2) probably associated with a derrick crane (Image: CSIRO 2023 - side cam)

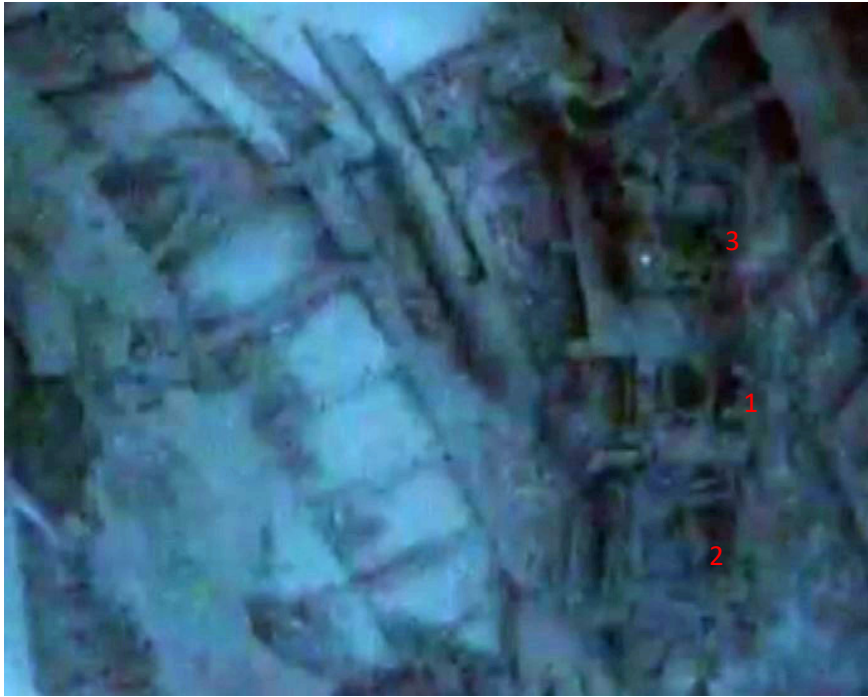


Figure 89: Derrick crane mast collar in deck (1) with access hatch (2) on aft side and cargo winch (3) on forward side (Image: CSIRO 2023 - 2266)



Figure 90: Rear extremity of the remaining port side of the stern hull deck beam stringer plating (1) showing possible hatchway or mast step (2). Note the lower hull framing extending to the coal pile (Image: CSIRO 2023 -)

iv. Stern

At the extremity of the site, the hull and deck plating finishes and is replaced by an extensive area of aggregate (that appears to be coal). At the very end of this pile is a cylindrical object (Figure 91, Figure 92) but it is unclear if this piping, a length of derrick crane or possibly part of the drive shaft or propeller shaft. There is an extensive scatter of aggregate which covers the entire width of the vessel, and which extends out to the port side. It appears that the entire stern section of the vessel has snapped off or collapsed during the wrecking event and is missing from the site (Figure 93).



Figure 91: Stern extremity of the wreck facing forward. Note the lack of any sternpost, rudder or propellor (Image: CSIRO 2023 - Stern extent facing forward - side cam)

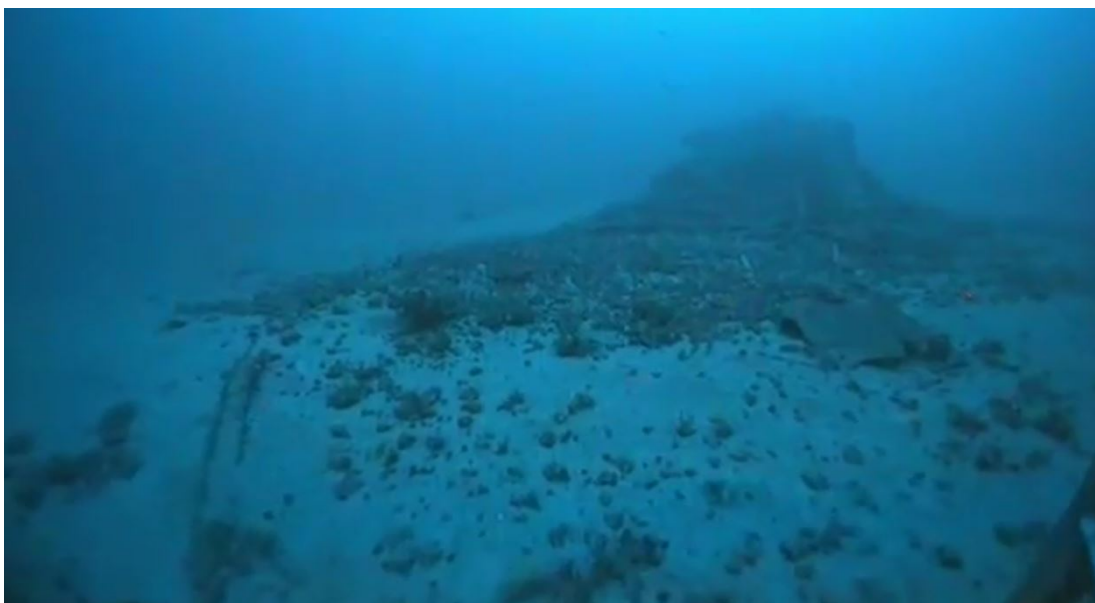


Figure 92: Stern extremity of the wreck facing forward. Note the lack of any sternpost, rudder or propellor, and the remains of either a derrick crane or possible drive shaft (Image: CSIRO 2023 - Stern extent facing forward - side cam2)

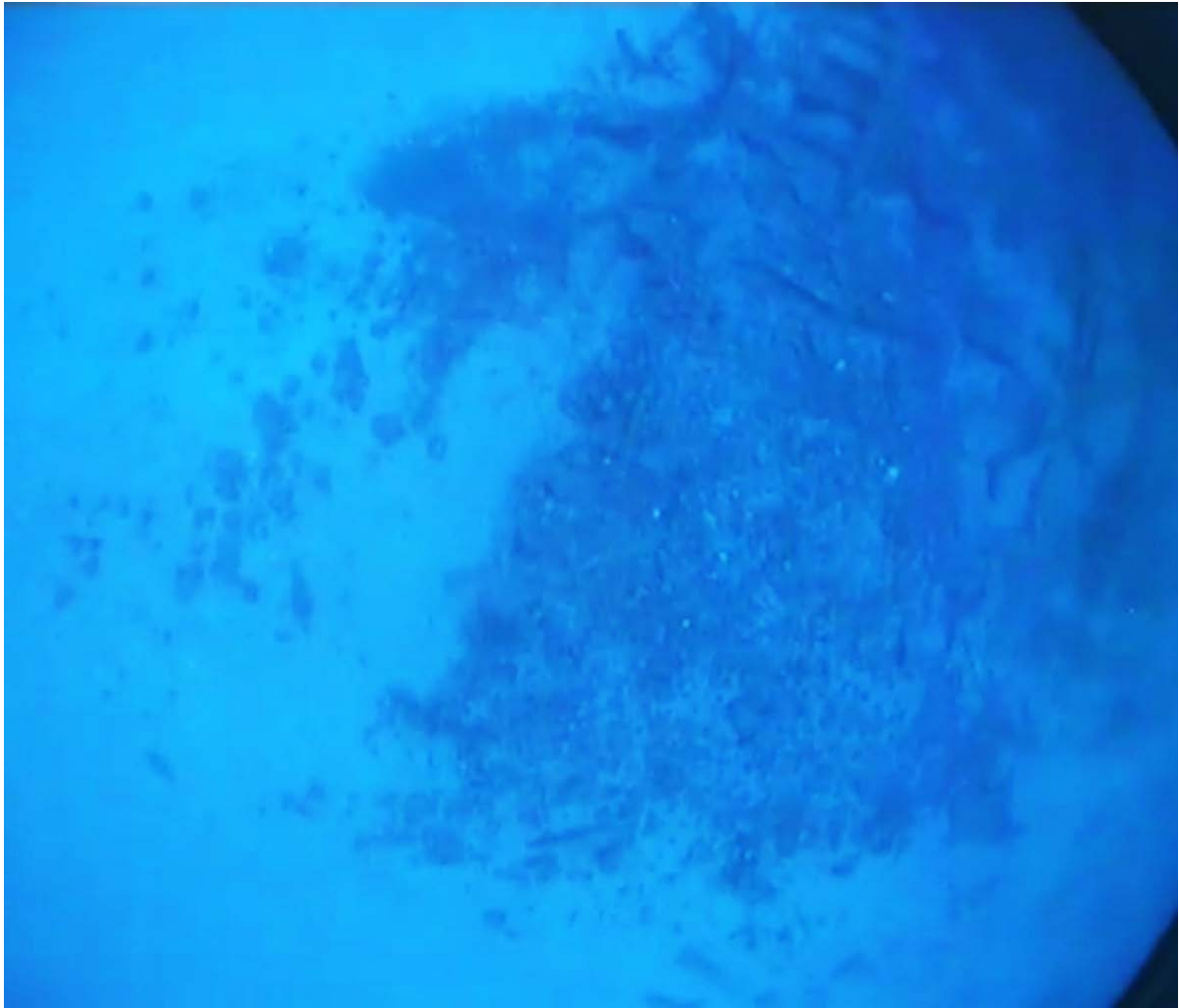


Figure 93: Extent of the aggregate scatter at the stern end of the site showing the last extent of the hull near the top of the image (Image: 10726)

An interim site plan is included below (and will be replaced with inked version in the final comprehensive version of this report).

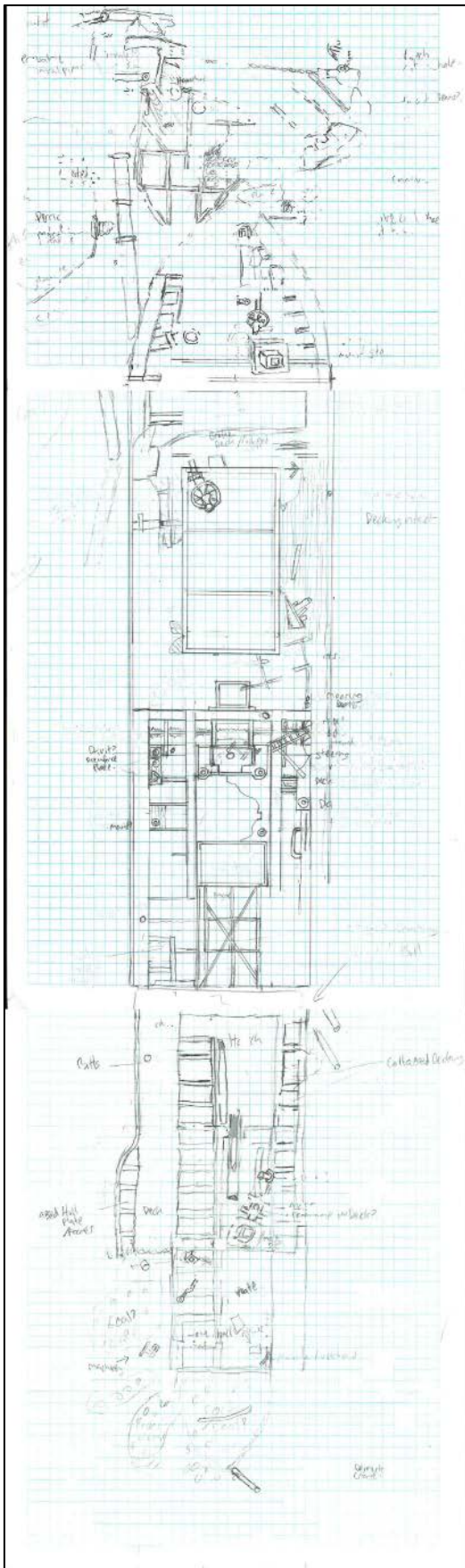


Figure 94: Interim site plan of the wreck site (Image: B Duncan, Heritage NSW Nov 23)

2. DISCUSSION

a. Summary of the archaeological evidence:

The vessel was constructed of rivetted iron or steel plates which postdates the vessel after the mid-1860s – 70s, but probably predates or is contiguous with the use of welding (which was introduced into Australia sometime between the 1920s-30s)

The vessel was at least 73.72 m length and 9.4m beam and at least 8 m high (based on the multibeam survey and echosounder data). It was steam powered possibly by a compound or triple expansion steam engine and demonstrates coal bunkers below deck on either side of these features. Diesel engines were being more widely introduced into Australia from the 1910s onwards.

The vessel carried two admiralty pattern bower anchors, with balled ends and at least one with a removable stock. Bow shackles were used to secure the anchors to the anchor chain but it is unclear whether the chain is single or stud link. The anchors were fished up onto the deck possibly using cat or fish davits, as no cathead was observed on the remaining forecastle deck. At least one anchor was partially rigged for setting (as it was shackled to the chain), but the stock was missing. The rigging of the unstocked anchor may suggest that the vessel was used in coastal regions rather than offshore voyages, as it had to be ready at short notice to drop anchor (?)

The remains of a deck and deck structures located above the main deck indicates a raised bridge/ deck from which the vessel was steered. The remains of handrails suggest that these were located on raised deck above decks which were fitted bulkheads, suggesting that the vessel may also have had a pilot's deck for navigating the vessel. A deckhouse with holes in the roof located on the bridge deck suggest this was a small cookhouse. The design of the bridge deck, boiler coaming and engine coaming skylights was in use at least from 1880s – early 1900s (possibly to the 1930s)

The vessel had a well deck between the bow and bridge, which is a design that was later being phased out by the 1950s.

The vessel appears to be a three-island ship, with raised forecastle, bridge and (possibly) stern poop decks (noting that the stern of the vessel is missing).

The vessel probably predates the introduction of containerisation into vessels in the mid-1950s, as evident by the presence of at least one (possibly two) derrick crane structures on the wreck. There were at least two cargo holds, one fore and one aft with the indications of another hatchway forward of well deck hatchway. This would suggest that this setup may also have been reflected aft (where the stern is missing) suggesting that the vessel may have had four cargo hatchways, one on either side of each derrick crane.

Extensive deposits of aggregate both outside and inside the wreck, particularly at the stern and port side, are of similar shape and size to aggregate found in the location of coal bunkers under the bridge deck, suggesting that the vessel may have been carrying coal.

Iron or steel radial lifeboat davits were mounted on the sides of the boiler and possibly engine coamings. Iron radial davits were fitted for lifeboats from 1838 onwards and were common by the late 19th century (Craine 1949). By the early twentieth century radial davits were being replaced with mechanical and hinged davits were being introduced in the 1920s/ 30s (Barrand and Green 1932).

The design of the vessel and size of the vessel suggests a construction period of 1880s-1930s period, and it is most probably a coastal steamer rigged with derrick cranes fore and aft. A schematic of a 1930s derrick crane cargo vessel is shown below (Figure 95). Although it does not exactly match the archaeological remains discovered (e.g., the deckhouse is missing), it represents a best fit for most of features.

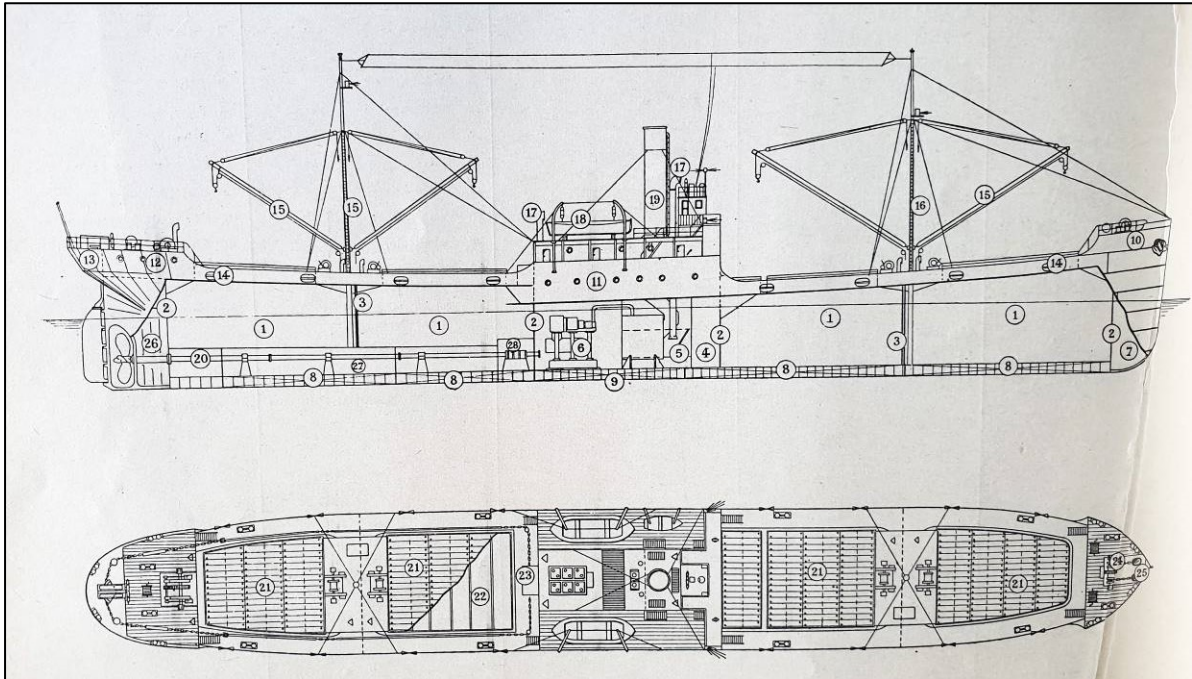


Figure 95: Schematic of a twentieth century coastal steamer (Image: Bataille and Brunet 1937)

b. Site formation Processes

The bow section of the vessel has collapsed, probably as a result of a catastrophic impact as the bow struck the seabed first on sinking. This appears to have caused the forecastle decking to break free from the hull where it slid forward over bow and ended up inverted on the seabed – predominantly on the port bow side.

This caused what appears to be a derrick crane to collapse forward over the port bow, which wrenched the mast step up out of the hull, which also collapsed the forward well deck probably around a forward cargo hatch (as it was less supported than the surrounding deck).

Some of this damage may also possibly have been caused when a massive wave swept across the vessel. It is clear from historical accounts of the *Nemesis* that the vessel was probably swept clean at the bridge level, as component of the bridge and hatches were found washed ashore on the NSW coast (Brisbane Telegraph, 16 July 1904 p 5; Sydney Morning Herald, 13 July 1904). This is also evident by the lack of the upper remains for the charthouse and steering platform, which are completely missing on the wreck above their lower coamings.

The stern of the vessel appears to be completely missing aft of the aft mast or derrick crane or has substantially collapsed. This caused the vessel to collapse again just aft of the engine room bulkhead, which has caused the aft hatchway area to collapse onto the seabed.

This suggests that:

- There may have been an explosion on board the vessel in this area (possible from coal gas igniting);
- The stern of the vessel tore free during the sinking incident, possibly as a result of the aft mast/ derrick crane toppling forward during the sinking process (i.e., the mast step may have been pulled from the hull, causing the vessel to sink)
- The vessel's stern may have risen up out of the water and into the air when the bow was sinking, causing the stern to detach (noting that coal carrying vessels were usually at the end of their life and prone to catastrophic collapse or opening of plates during gales);
- The vessel may have been sunk by an external explosion – possibly from a mine or torpedo;
- Another alternative suggested by maritime historian Dr Peter Taylor (pers comms) is that the wreck may have been depth charged during WWII when it may have been identified by echosounder pinging and confused for an enemy submarine:
 - *When we found, and dived the Queensland (1876), the stern was as flat as a tack. It had been depth-charged during WW2, which may have caused the extensive damage. The first 15 metres of the bow was intact, but on its side, with the highest part being the steam engine which stood at least 7 metres high (Taylor pers comms).*

c. Identification of the Shipwreck: Comparison with SS *Nemesis*

i. Location

The previous historical location of the SS *Nemesis* in the NSW Maritime Heritage Database was listed as being off Wollongong. This initial location for the wreck was based on historical reported sinking descriptions of the site when it was last observed off Wollongong by the SS *Marloo* before going missing in 1904 Heritage NSW (2023). It is possible that the strength of the gale in which it was caught radically affected the location of the vessel that may account for the inaccuracy of this location, especially given that the vessel's actual sinking location was not known but was based on the debris being washed ashore at Cronulla and other locations in the southern Sydney region after the event. The wreck was located approximately 25km off Port Kembla

There are five other vessels known to have wrecked in the Port Kembla area: These are:

- HMAS *Adelle*: Examination vessel that was wrecked on the Breakwater at Port Kembla (43m long);
- SS *Bombo*: Steamship rolled over when struck by wave between Wollongong and Port Kembla (42 m long);
- *Clio*: Timber ketch wrecked off breakwater Port Kembla
- *Gabriella*: 1327 ton steel Motor vessel sank in Port Kembla and later scuttled out to sea;
- *Hero*: Iron steam tug was wrecked off Port Kembla in 1960 (32m long);

None of these vessels match the length or material types of the discovered shipwreck.

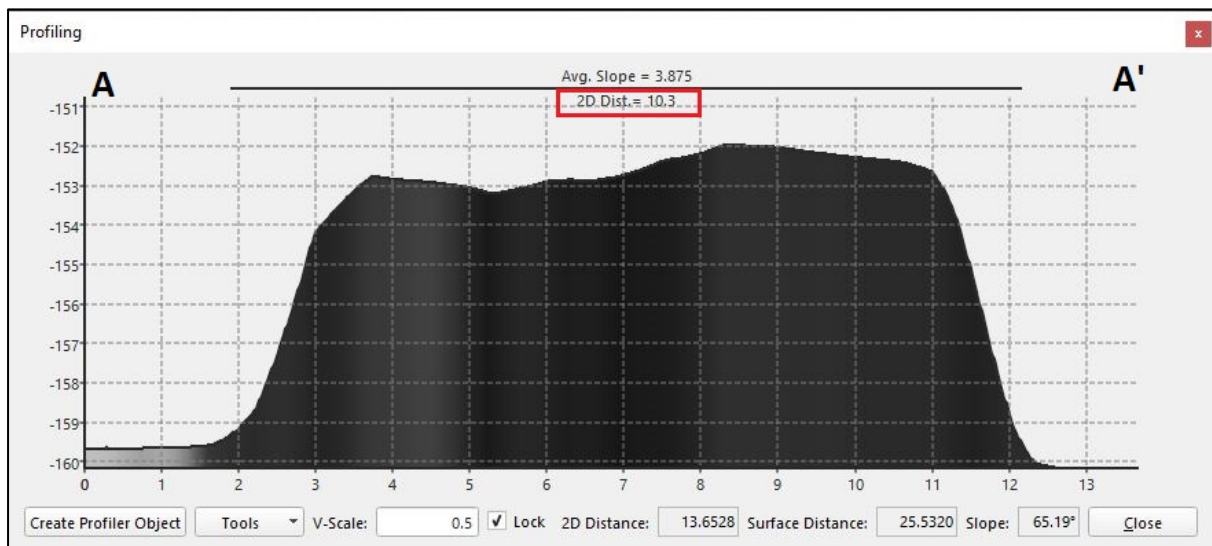


Figure 96: Cross section profile of the wreck showing height and approximate width of the wreck (Image: CSIRO 2023 - 2023).

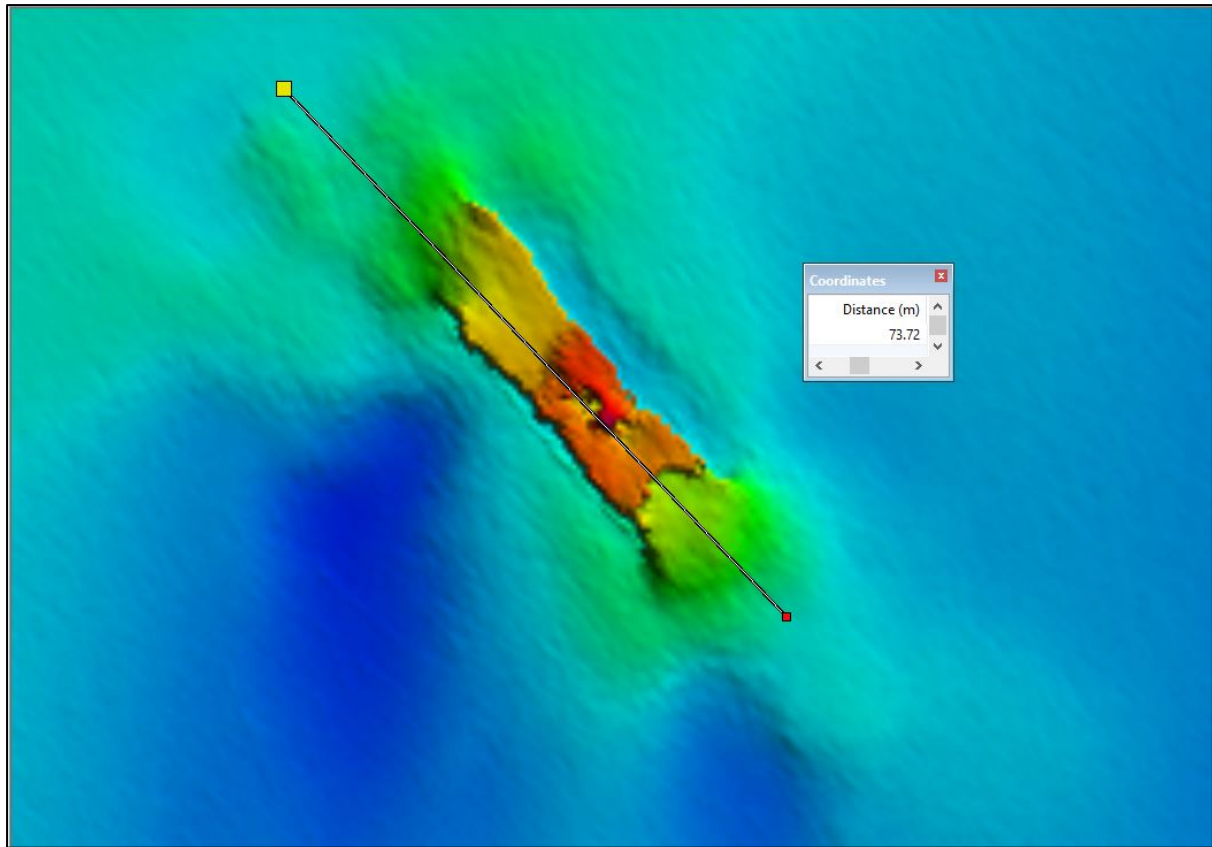


Figure 97: Multibeam image of wreck showing the length of the wreck (Image: CSIRO 2023 - 2023).

The initial dimensions obtained using multibeam sonar (73.2m long x 9.4m wide x c 7.5m high) are consistent with the SS *Nemesis* (historically known measurements are: 73.21m long x 10.37m beam x 5.471m depth), which was sunk by in a gale in 1904. However it must be noted that the multibeam sonar longitudinal measurements are partially based on the extent of the debris field around wreck site, and not necessarily on in situ or intact known sections of the wreck.

ii. Type of Ship

The wreck appears to be a coastal freighter of the pre- containerisation period (pre 1940s), when derrick cranes were used to unload cargos, as evidenced by the presence of two probable derrick crane masts and steam winches typically used to operate them. The derrick cranes are located on the well deck (Figure 34) and stern (Figure 89) areas of the wreck, which is typical of most coastal freighters of the period which had derricks mounted amidships close to the hold hatches. This is consistent with the location of the *Nemesis*' derrick mast mounting locations (**Error! Reference source not found.**,Figure 103,).

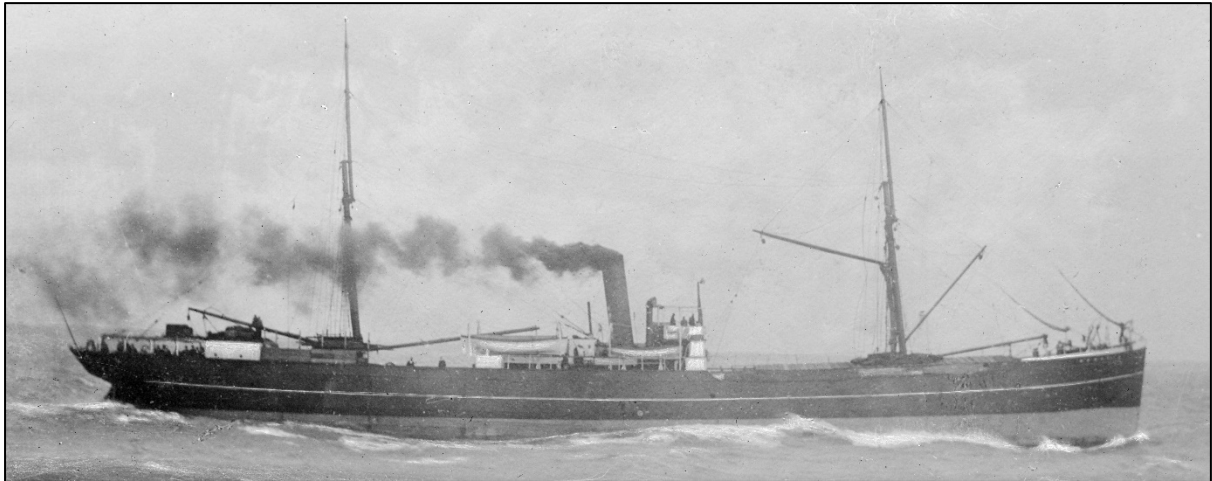


Figure 98: SS Nemesis in c 1900 (Image: Green 1900 (#9939649678507636) BW v slv gr005472)

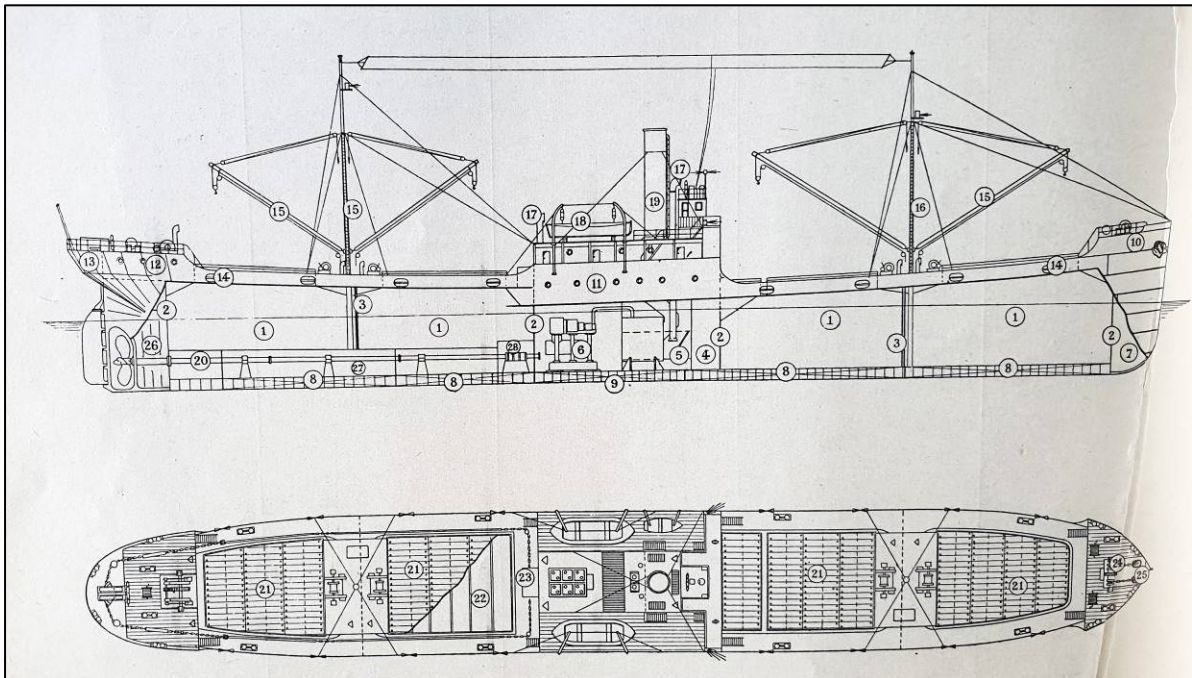


Figure 99: Schematic of a twentieth century coastal steamer (Image: Bataille and Brunet 1937)

Bow Area

The anchors on the *Nemesis* in photos (Figure 100) and paintings (Figure 101) dating to the early 1900s appear to be admiralty pattern anchors with straight stocks with ball ends, bow shackles and (possibly) stud link chain. The anchors are stowed on a raised forecastle deck with a length of chain leading to the hawsehole (which are identical to those observed on the wreck – see Figure 3, Figure 4, Figure 8). Davits were used to fish and cat the anchor and are similar with that observed in the bow wreckage (see Figure 11, Figure 12). The wreck has evidence of a collapsed foredeck (Figure 8, Figure 9, Figure 10, Figure 11, Figure 13), a probable bosun's locker hatchway (Figure 17, Figure 20) and associated relics (Figure 15, Figure 16); and a possible steam winch used to operate a derrick which was probably mounted on well/ main deck (Figure 28, Figure 29). This is consistent with the configuration of the bow remains of the wreck.

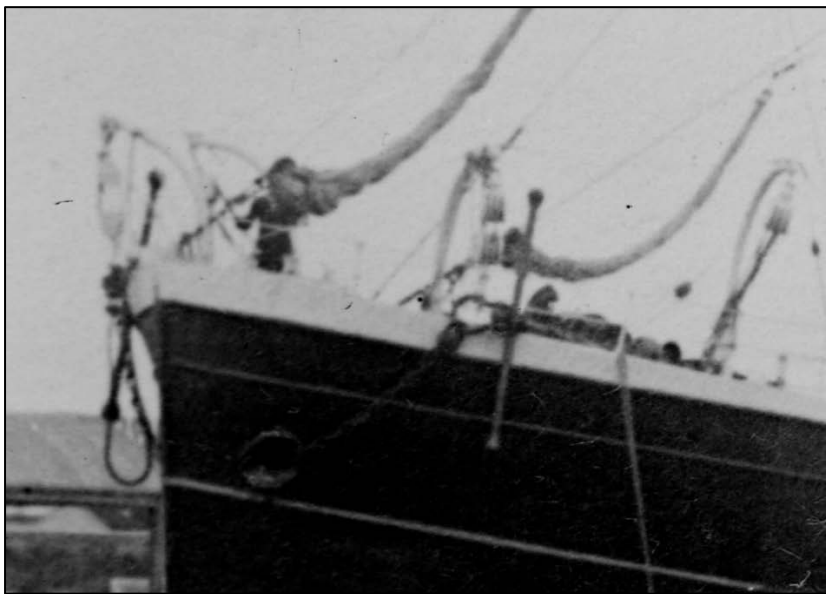


Figure 100: Anchor and Hawsepipe Bridge (Image: Green c 1900 (# gr005471), Nemesis at Wharf BW v SLV collection gr005471 cropped)



Figure 101: Painting showing anchor and fishing apparatus, and deck machinery and hawsehole configuration (Image: After Green c 1900 (#wp004986))

Well deck

The presence of the forward derrick crane on the well deck is consistent with the SS *Nemesis* painting (Figure 102). The forward derrick crane mast on the wreck has collapsed forward across the bow and is lying on the port side (Figure 18, Figure 24, Figure 25, Figure 26, Figure 27), and the remains of the mast step are located inside the well deck (Figure 28, Figure 29, Figure 30, Figure 31, Figure 32). The configuration and fittings of these derrick crane features and the cargo winches located in the bow (Figure 28, Figure 29) and in the well deck cargo hatchway (Figure 34, Figure 35); matches the rigging components of the foremast fittings and cargo winch locations on the *Nemesis* (Figure 102, Figure 103). This is consistent with the original design of the *Nemesis* as a coastal cargo trader, and the configuration of the derrick masts within the found wreck also matches that vessel.

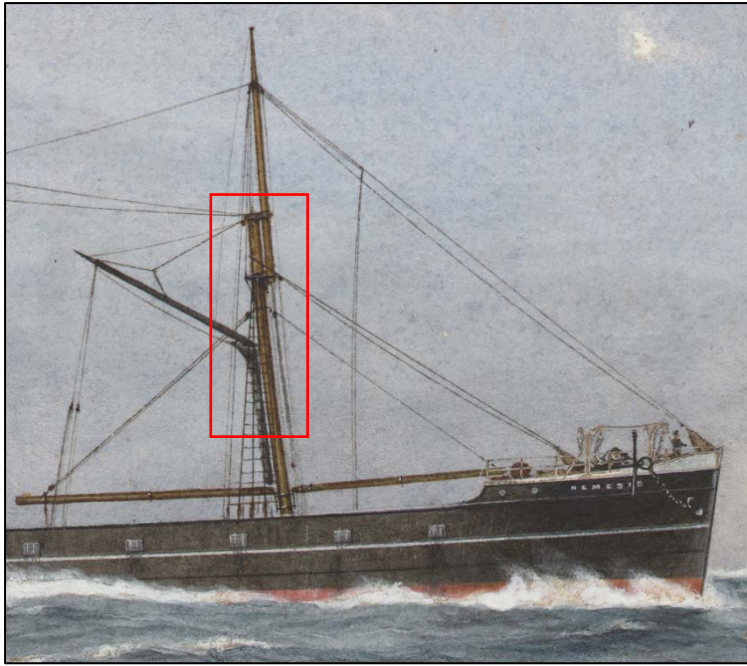


Figure 102: Bow area of Nemesis showing scalloped transition from forecastle deck to well/ deck below the bow (Image: After Green c 1900 (#wp004986))

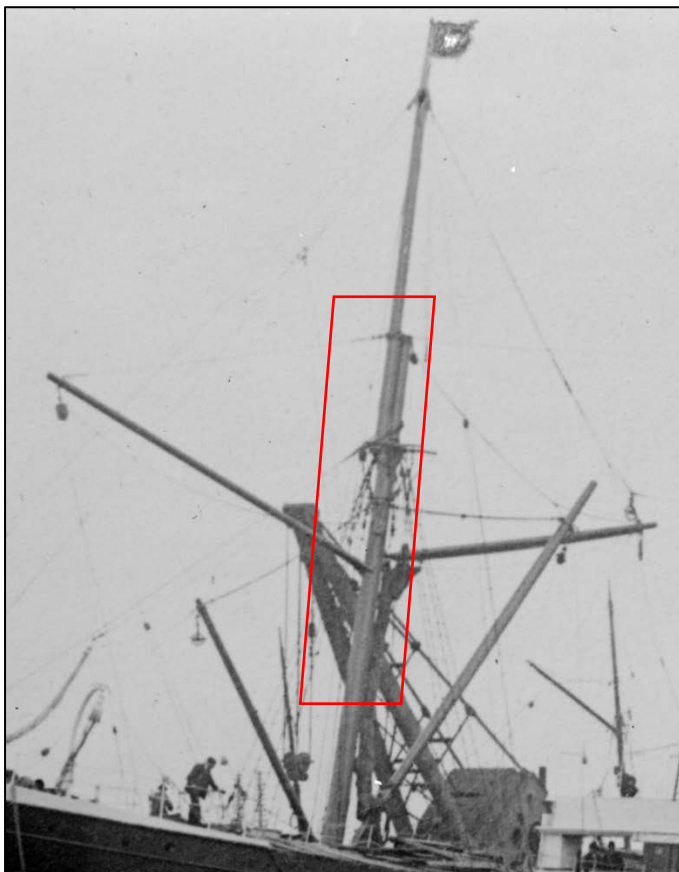


Figure 103: Comparison of section of Nemesis mast bow with derrick crane on wreck (Image: Bridge - Green c 1900 (#gr005471) - Nemesis at Wharf BW v SLV collection gr005471 cropped)

The presence of scalloped edges on the well deck bulwarks (Figure 39, Figure 40) at the aft starboard side of the well deck match the well deck bulwarks features and location shown on various images of the *Nemesis* (Figure 104, Figure 105). A mooring port, leading to a bitt (Figure 45, Figure 46, Figure 47) evident in this location on the wreck also aligns with a similar feature in the painting (Figure 104).

The tying of ropes on the bollards (Figure 46) is consistent with a vessel which had derrick cranes as these would have been used to stop the derrick crane booms moving around when at sea by tying their control stays to the deck.



Figure 104: Scalloped bulwarks, mooring ports and cargo rigging shown at the aft extremity for the starboard side (Image: Green c 1900 (wp004986))



Figure 105: Details of scalloped foredeck bulwarks reduced around forward hatch 1 (1) (Image: After Green c 1900 (# gr005471) Nemesis at Wharf BW v SLV collection gr005471)

Located close to this same area, the archaeological remains of what is likely to be a water pump (Figure 49) aligns to a hand pump shown on a construction piping plan for the Nemesis (Figure 106, Figure 107). A horizontal pipe leading to a vertical pipe flange (Figure 61, Figure 62) on the wreck is in the same location as an airpipe shown in the same piping construction plan leading up to the bridge structure, which may possibly be for a steam whistle? (Figure 107).

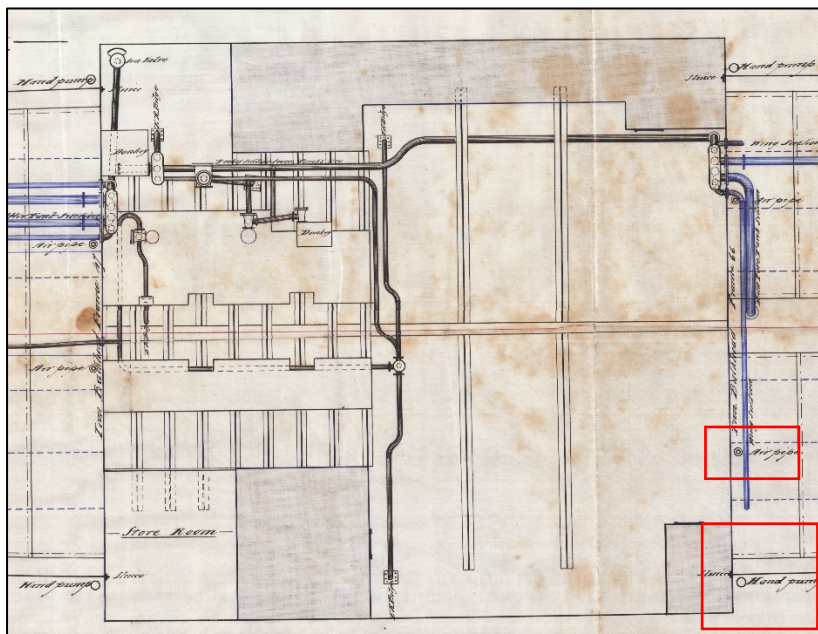


Figure 106: Location of hand pump, sluice and airpipe forward of bridge bulkhead area in a piping plan of the vessel (Image: LRF 1879 (#LRF-PUN-STK902-0133-P_0001))

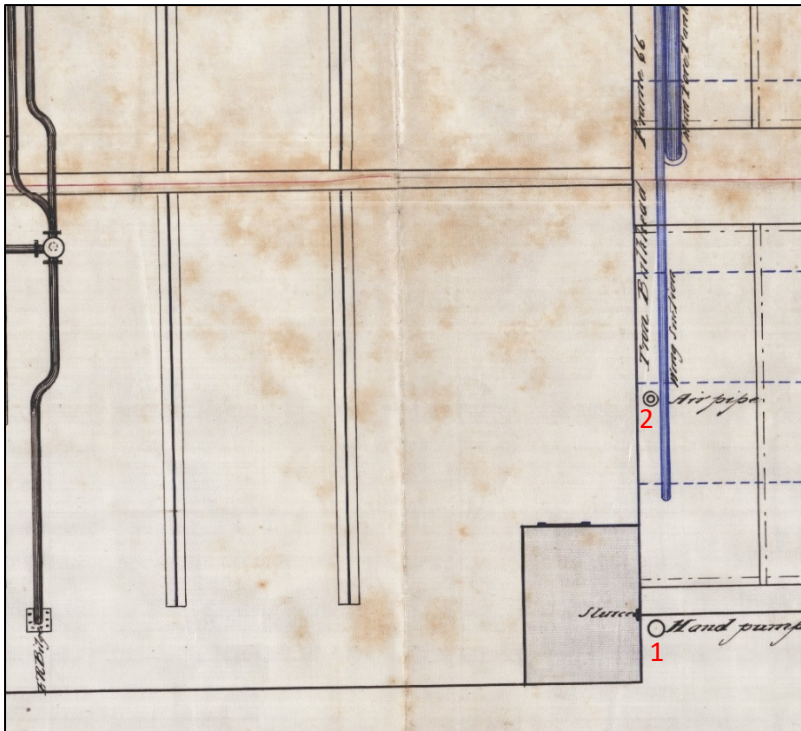


Figure 107: Closeup of location of hand pump in front of the forward starboard side of the bridge (1) and piping for the bridge area showing the airpipe on the forward starboard side (2) (Image: LRF 1879 (#LRF-PUN-STK902-0133-P) - Handpump sluice Bridge piping plan LRF-PUN-STK902-0133-P)

The wreck has evidenced the remains of one and possibly two cargo hatchways on the stern main deck (Figure 37) with another smaller access hatchway directly forward of the bridge bulkhead (Figure 43). This conforms exactly to the hatches shown in longitudinal construction plans for the *Nemesis* (Figure 108).

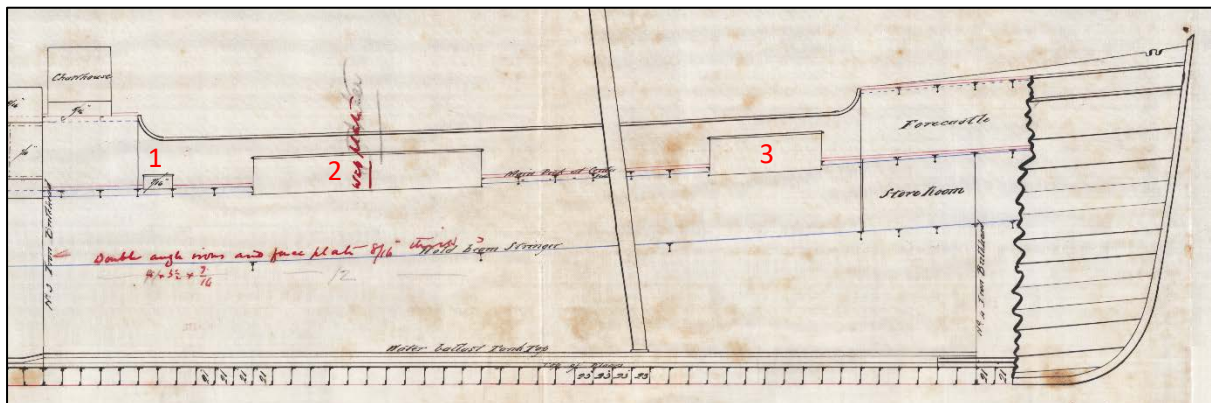


Figure 108: Location of forward hatches, including inspection hatch (1); second cargo hatch (2) and first cargo hatch (3) (Image: LRF 1880 (#LRF-PUN-STK902-0132-P))