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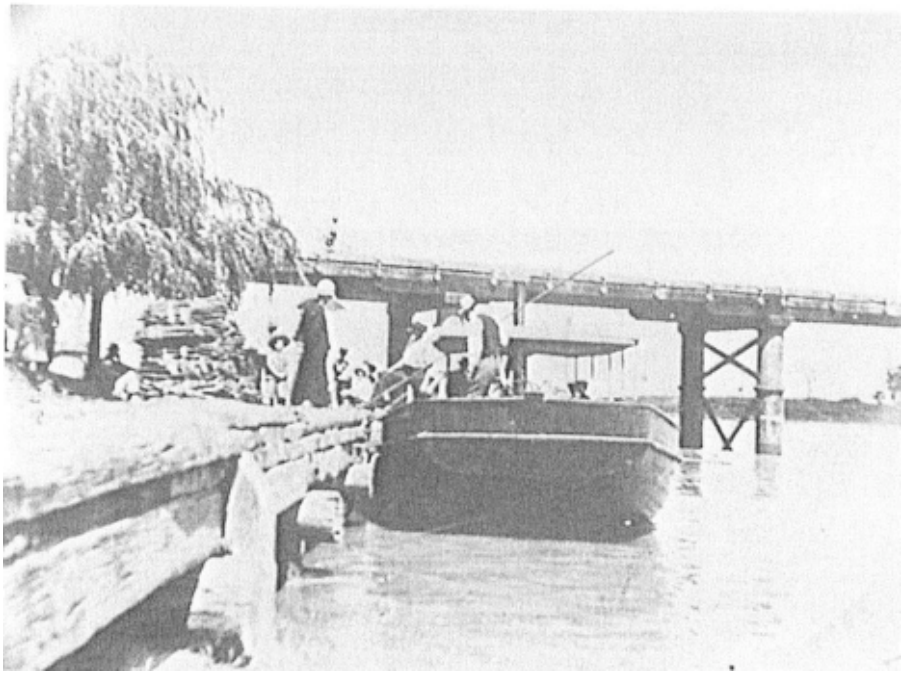
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PROPOSED WINDSOR BRIDGE REPLACEMENT
WINDSOR, NSW



MARITIME ARCHAEOLOGICAL STATEMENT OF HERITAGE IMPACT

Final Working Paper Report

October 2012

Windsor
NSW

Proposed Windsor Bridge Replacement: Maritime Archaeological Statement of Heritage Impact

Windsor, NSW

Final Working Paper REPORT

Prepared for:

Roads and Maritime Services NSW (RMS)

By:

Chris Lewczak

October 2012

J12_06

Cover Image: *"Wharf at Windsor on the Hawkesbury River near Windsor Bridge" (ca.1890 to ca.1900). The photograph shows the wharf, including the closely spaced piles (Source: Hawkesbury City Council Library Service).*

Executive Summary

The Roads and Maritime Services NSW (RMS) is seeking approval to construct a new bridge across the Hawkesbury River at Windsor approximately 35 m downstream from the current bridge. Cosmos Archaeology has been engaged by RMS to prepare a statement of heritage impact for the project for impacts to known and potential maritime archaeological relics within the project area.

Cosmos Archaeology has previously undertaken two assessments for the preliminary investigation works associated with the project. In 2008-09 Cosmos Archaeology undertook a maritime archaeological survey on the site of the known location of a wharf built in ca.1814 on the southern band of the river, to the east of the current Windsor Bridge. Archaeological remains associated with the former wharf were found to be present on the site.

In May 2012 Cosmos Archaeology also undertook a desktop maritime archaeological assessment to assess the potential for maritime archaeological remains to be present within the project area, and prepare a significance assessment of the archaeological relics. The assessment found that there was high archaeological potential within and immediately adjacent to the known archaeological remains associated with the wharf constructed in ca.1814. It also identified that these remains are considered to be of State significance. The assessment found that limited archaeological remains are likely to exist associated with a former punt crossing that operated in a similar location from ca.1810. The remains were assessed as being limited to the northern landing location, and being of local significance.

This assessment has found that:

Historical findings

- A wharf was first constructed at the initial settlement at Windsor in 1795.
- The wharf supplied the early store and military garrison and also provided transportation for crops from the surrounding farms.
- A second wharf was built at Windsor in ca.1814 and repaired in 1820 under the direction of Governor Macquarie.
- A private punt service also started in 1815 using the wharf as the southern landing.
- In 1832 the punt was taken over and operated by the Government.
- In c.1835 the location of the punt moved upstream and a cabling system was installed for the crossing.
- The bridge across the Hawkesbury River was built in 1874 with the punt service ceasing soon after.
- A temporary bridge was constructed in 1896 for the raising of the main bridge across the Hawkesbury River.
- The temporary bridge was built in six weeks, although, no other details relating to the location of the bridge is known. It is believed to be located on the upstream side of the current bridge.
- The second wharf was present on the site until the late 1930s or early 1940s.

Archaeological Investigations and archaeological potential

- A maritime archaeological survey on the site of the former wharf identified above and below water structural remains present on the site *in situ*.
- The archaeological potential at the wharf site is considered to be high in the location of the rock ballast, and moderate for an area up to 5 m around the boundary of the ballast.
- There is likely to be structural remains associated with the wharf and artefact deposits associated with the functioning of the structure, located behind the southern riverbank.
- There is considered to be moderate potential for archaeological remains associated with the punt landing on the northern side of the river on the upstream side of the current bridge associated with the relocation of the punt service in ca.1835; but a low archaeological potential along the route of the punt across the river;
- A second maritime archaeological survey was conducted in 2012 on seven anomalies identified from a side scan sonar survey of the project area and the post 1835 southern punt landing;
- The survey located timber structural remains located on the northern side of the river, close to the bank on the eastern (downstream) side of the current bridge location, possibly relating ca.1950 mooring posts or a retaining wall built in the area;
- The timber remains are not considered to have archaeological or research value;
- Four other anomalies within the river were surveyed and were either found to be sterile or continuing modern material;
- A natural sandstone rock shelf was located in the location of the southern punt landing location. This shelf was located 15 m into the river and was not considered to be part of the landing area.

Heritage significance

- The archaeological remains associated with the former ca.1814 wharf have been assessed as being of State significance.
- The significance of the archaeological remains associated with the former punt has been assessed as being of local significance.

Impact Assessment

- The project would have both a direct and indirect impact on known and potential archaeological remains associated with the former wharves and punt crossing from the placement of in-water piers and retaining walls.
- Redesigning elements of the bridge that would allow for the retention and protection of the known and potential archaeological remains has been investigated; however, impacts cannot be avoided.

Based on an understanding of the development history of Windsor, the stratigraphy of the river sediment and previous maritime archaeological surveys completed in the vicinity of the former wharf site, the following actions are recommended to progress the maritime archaeological cultural heritage component of the project.

Recommendation 1

An above and below water maritime archaeological salvage excavation should be undertaken within the area assessed to have high archaeological potential relating to the remains associated with the former ca.1814 wharf. This includes the area immediately behind the southern bank of the river that may contain land ties (also known as deadman anchors) and other structural remains.

As the project is being assessed under Section 5.1 of the EP&A Act, no permits under the NSW Heritage Act (1979) are required for the project. The excavation should, however, be conducted by a qualified maritime archaeologist after the preparation of a research design. The research design should include, as a minimum, an excavation methodology, research questions and provisions for an artefact analysis at the conclusion of the excavation phase of the project.

Excavation and other on-site investigation should be coordinated with the Aboriginal and non-Aboriginal archaeological investigations as part of a single coordinated process of examining the human history of Windsor.

An archaeological excavation report should be prepared at the conclusion of the excavation, and the report submitted to the Office of Environment and Heritage for their records.

The results of the excavation and artefact analysis should be used in on-site interpretation of the maritime history and heritage of the Windsor area, where appropriate.

Recommendation 2

Archaeological monitoring works should be undertaken as part of the early site works on the northern side of the existing bridge in the general location of the northern punt landing. This archaeological monitoring should occur during early site preparation works to record any remaining archaeological remains, relics or landscape features that remain of the former crossing.

This work should be done by a qualified archaeologist and an archaeological monitoring report should be prepared at the end of the monitoring works and submitted to the Office of Environment and Heritage for their records.

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1.0 INTRODUCTION

1.1 Background

The NSW Roads and Maritime Services (RMS) is seeking approval to construct a replacement bridge over the Hawkesbury River at Windsor, approximately 35 m downstream of the existing bridge and undertake associated road improvement and landscaping (known for this report as "the project"). The project includes:

- Construction of a replacement bridge over the Hawkesbury River at Windsor, around 35 metres downstream of the existing Windsor bridge.
- Reconstruction and upgrading of existing intersections and bridge approach roads to accommodate the replacement bridge, including:
  - Removal of the existing roundabout and installation of traffic signals at the intersection of George and Bridge Streets.
  - Construction of a new dual lane roundabout at the intersection of Freemans Reach Road, Wilberforce Road, northern bridge approach road and the access road to Macquarie Park. All roads serviced by the new roundabout would require minor realignments.
  - Realignment of the southern and northern bridge approach roads. The new southern bridge approach road would generally follow the alignment of Old Bridge Street along the eastern side of Thompson Square. The northern bridge approach road would be a new road connecting the bridge to the new dual lane roundabout.
- Construction of a shared pedestrian/cycle pathway for access to and across the replacement bridge.
- Removal of the existing bridge approach roads and then backfilling, rehabilitating and landscaping these areas.
- Demolition of the existing Windsor Bridge including piers and abutments.
- Landscaping works within Thompson Square parkland and adjacent to the northern intersection of Bridge Street, Wilberforce Road, Freemans Reach Road and the access road to Macquarie Park.
- Redevelopment of part of The Terrace to provide continuous access along the southern bank of the river and under the replacement bridge to Windsor Wharf.
- Construction of scour protection works on the southern and northern banks and around three bridge piers.
- Construction of a permanent water quality basin to capture and treat stormwater runoff from the bridge and northern intersection prior to stormwater being discharged to the Hawkesbury River.
- Architectural treatments for noise mitigation, as required, where feasible and reasonable and in agreement with affected property owners.
- Ancillary works including:

- Adjustment, relocation and/or protection of utilities and services, as required.
- Construction and operation of temporary construction, stockpiling and compound sites.

Cosmos Archaeology has previously undertaken two assessments for the preliminary investigation works associated with the project. In 2008-09 Cosmos Archaeology undertook a maritime archaeological survey on the site of the known location of a wharf built in ca.1814 on the southern bank of the river, to the east of the current Windsor Bridge. Archaeological remains associated with the former wharf were found to be present on the site.

In May 2012 Cosmos Archaeology also undertook a desktop maritime archaeological assessment to assess the potential for maritime archaeological remains to be present within the project area, and prepared a significance assessment of the archaeological relics. The assessment found that there was high archaeological potential within and immediately adjacent to the known archaeological remains associated with the wharf constructed in ca.1814. It also identified that these remains are considered to be of State significance. The assessment found that limited archaeological remains are likely to exist associated with a former punt crossing that operated in a similar location from ca.1815. The remains were assessed as being limited to the northern landing location, and of local significance.

Cosmos Archaeology has since been engaged to prepare a statement of heritage impact (SoHI) for the maritime archaeological components of the project. Biosis Research has been engaged to prepare a SoHI report for the terrestrial built heritage and historical archaeological potential for the project. Kelleher Nightingale Consulting has been engaged to prepare the Aboriginal heritage report for the project. Both of these reports are being prepared separately.

1.2 The *Study Area*

The study area for this assessment is the proposed corridor for the new bridge across the Hawkesbury River at Windsor (Figure 1). The study area for this assessment has primarily been the river sections of the proposed building corridor; however, the assessment has extended to the banks of the river where maritime infrastructure was present.

1.3 Description of the Project

Overview

The project would comprise:

- Construction of a replacement bridge over the Hawkesbury River at Windsor, around 35 metres downstream of the existing Windsor bridge.
- Reconstruction and upgrading of existing intersections and bridge approach roads to accommodate the replacement bridge, including:

  - Removal of the existing roundabout and installation of traffic signals at the intersection of George and Bridge Streets.
  - Construction of a new dual lane roundabout at the intersection of Freemans Reach Road, Wilberforce Road, northern bridge approach road and the access road to Macquarie Park. All roads serviced by the new roundabout would require minor realignments.
  - Realignment of the southern and northern bridge approach roads. The new southern bridge approach road would generally follow the alignment of Old Bridge Street along the eastern side of Thompson Square. The northern bridge approach road would be a new road connecting the bridge to the new dual lane roundabout.
- Construction of a shared pedestrian/cycle pathway for access to and across the replacement bridge.
- Removal of the existing bridge approach roads and then backfilling, rehabilitating and landscaping these areas.
- Demolition of the existing Windsor Bridge including piers and abutments.
- Landscaping works within Thompson Square parkland and adjacent to the northern intersection of Bridge Street, Wilberforce Road, Freemans Reach Road and the access road to Macquarie Park.
- Redevelopment of part of The Terrace to provide continuous access along the southern bank of the river and under the replacement bridge to Windsor Wharf.
- Construction of scour protection works on the southern and northern banks and around three bridge piers.
- Construction of a permanent water quality basin to capture and treat stormwater runoff from the bridge and northern intersection prior to stormwater being discharged to the Hawkesbury River.
- Architectural treatments for noise mitigation, as required, where feasible and reasonable and in agreement with affected property owners.
- Ancillary works including:
  - Adjustment, relocation and/or protection of utilities and services, as required.
  - Construction and operation of temporary construction, stockpiling and compound sites.

In **Figure 1** the main elements of the project are shown including the construction zone and project boundary.

In addition to the above-listed work elements, early works for further identification, salvage, recording and protection of Aboriginal and non-Aboriginal heritage, would be carried out as part of impact mitigation for the project. These early works would include:

- Salvage excavation at identified Aboriginal heritage sites on the southern bank of the river in accordance with the procedures identified in the Aboriginal heritage chapter of the Environmental Impact Statement for the project.
- Recording and protection of historic heritage in accordance with the procedures identified in the historic heritage chapter of the Environmental Impact Statement for the project.

Specific details regarding each component of the project is outlined in Section 7.1 of this report.

1.4 Objectives of the Study

The key objective of this maritime archaeological SoHI report is to:
Prepare a Statement of Heritage Impact for the impacts that the project would have on known and potential maritime archaeological remains.

1.5 Method of Approach

This maritime archaeological SoHI has been conducted in the following manner:

1. *Review relevant statutory and non-statutory heritage listings*

   A review of cultural heritage registers and state and local environmental planning policies was undertaken. A summary of the relevant statutory and non-statutory instruments is presented in Section 2.0. The heritage register listing status of the maritime components for this project has been presented for all registers and can also be found within Section 2.0.

2. *Review current and previously completed historical and archaeological assessments at Windsor*

   A review of the previously completed maritime and historical archaeological and built heritage assessments has been completed to understand the construction history of Windsor. This has included reviewing the current archaeological and built heritage assessment being undertaken by Biosis Research for this project.[1]

3. *Site inspection and current site configuration*

   Cosmos Archaeology undertook an underwater site inspection of two localities associated with the project in December 2008. This inspection will be used in this report. A side scan sonar survey of the river was prepared by RMS in June 2012 and has been used in this report. No further site inspections were carried out for this SoHI.

[1] Biosis Research Pty Ltd in association with Cultural Resources Management, (August 2012) *Windsor Bridge Replacement Project: Non-Aboriginal Heritage Report and Statement of Heritage Impact.* Report prepared for the RMS.

4. *Significance assessment*

A significance assessment has previously been prepared by Cosmos Archaeology for all known and potential archaeological remains within the maritime archaeological boundary of the study area.[2] This significance assessment has been updated and is presented in Section 6.0 of this report.

5. *Prepare a Statement of Heritage Impact*

The SoHI is presented in Section 7.0 in accordance with the guidelines set out in the NSW Heritage Office publication Statements of Heritage Impact.[3]

6. *Provide recommendations aimed to avoid, minimise or mitigate against impacts to the identified cultural heritage values identified within the project area.*

Based on the findings of the impact assessment, a series of recommendations have been devised which aim to avoid, minimise or mitigate adverse impacts to the heritage significance of all known and potential maritime archaeological remains present within the study area. These recommendations are provided in Section 8.0.

1.6 Abbreviations Used

cm	Centimetre
EPBC	*Environment Protection and Biodiversity Conservation Act 1999*
ft	Feet
LEP	Local Environmental Plan
LGA	Local Government Area
m	Metres
mm	Millimetres
REP	Regional Environmental Plan
RMS	Roads and Maritime Services NSW
RTA	Roads and Traffic Authority (NSW)
SEPP	State Environment Planning Policy
SOHI	Statement of Heritage Impact
SL	State Library (NSW)

[2] Cosmos Archaeology Pty Ltd, (May 2012) *Proposed Windsor Bridge Replacement: Maritime Archaeological Desktop Assessment, Windsor, NSW.* Report prepared for the RMS.

[3] NSW Heritage Office & Department of Urban Affairs & Planning (2002) *NSW Heritage Manual – Statements of Heritage Impact.*



Figure 1: Project Study area outlined in pink (Source: SKM).)

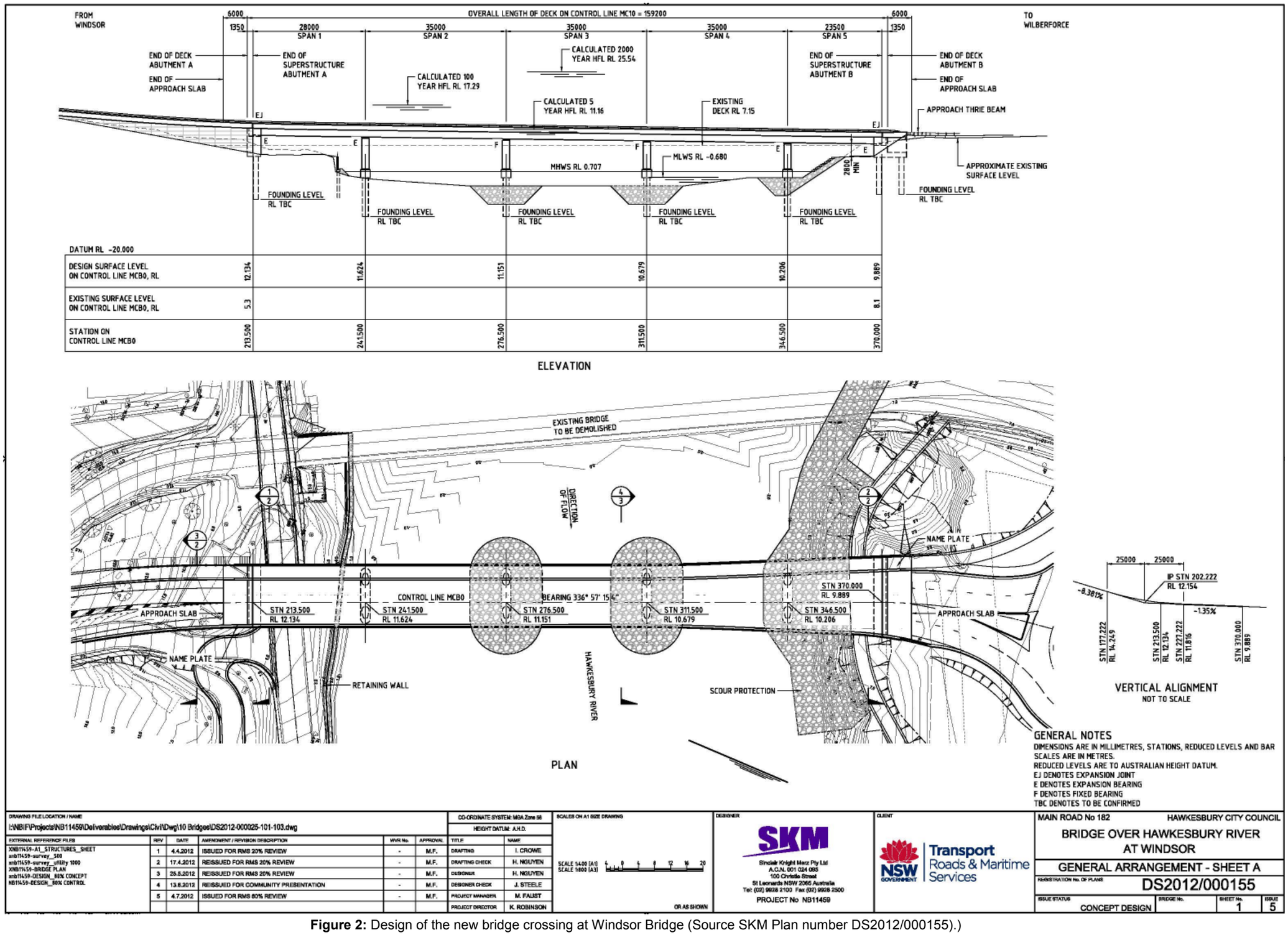


Figure 2: Design of the new bridge crossing at Windsor Bridge (Source SKM Plan number DS2012/000155).)

2.0 STATUTORY REQUIREMENTS

2.1 Introduction

In NSW heritage protection stems from the NSW *Heritage Act 1977,* the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2.2 Environmental Planning and Assessment Act 1979

The EP&A Act establishes the framework for cultural heritage values to be formally assessed in the land use planning and development assessment process. The Act requires that environmental impacts, including those to cultural heritage items and places, are considered prior to land development.

The project would be assessed under Part 5.1 of the EP&A Act.

Under Part 5.1 certain approvals are not required for a State significant infrastructure project. Those relevant to maritime heritage include:

> *(c) an approval under Part 4, or an excavation permit under section 139, of the Heritage Act 1977 ,*
>
> *(d) an Aboriginal heritage impact permit under section 90 of the National Parks and Wildlife Act 1974 ,*
>
> *(EP&A Act 1979 Part 5.1 S.115ZG)*

This provision does not mean that the relevant heritage or archaeological assessments are not undertaken, however, heritage assessments and consultation are undertaken based on the direction of the Director General's requirements (DGRs).

2.2.1 Director Generals Requirements

The DGRs for the project for the non-Aboriginal maritime heritage component require:

Impacts to State and local historic heritage (including archaeology, heritage items and conservation areas), in particular, impacts on the Thompson Square Conservation Area, heritage listed buildings and sites in the Thompson Square conservation area and the Windsor Bridge should be assessed.	*Impacts to State and local historic heritage sites are identified in Section 3 and assessed in Section 7 in this report.*
Where impacts to State or locally significant historic heritage items are identified, the assessment shall: Outline *the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the guidelines in the NSW Heritage Manual (1996*).	*Sections 7 and 8 in this report.*

Be undertaken by a suitably qualified heritage consultant*(s) (note: where archaeological investigations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria),*	*This assessment was prepared by Chris Lewczak, Senior Maritime Archaeologist, Cosmos Archaeology.*
Include a statement of heritage impact for all heritage items (including significance assessment).	*Section 6 in this report.*
Consider impacts from vibration, demolition, archaeological disturbance, altered historical arrangements and *access*, landscape and *vistas*, and *architectural noise treatment.*	*Sections 7 and 8 in this report.*
Develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime) and include the results of these excavations;	*Sections 4 and 5 in this report.*

2.3 Commonwealth Heritage Act

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) proposed 'actions' that have the potential to significantly impact on matters of national environmental significance, the environment on Commonwealth land or that are being carried out by a Commonwealth agency must be referred to the Commonwealth Government. If the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities determines that a referred project is a 'controlled action' under the EPBC Act, the approval of that minister would be required for the project in addition to the NSW Minister for Planning and Infrastructure's approval.

Based on the results of the environmental investigations carried, including heritage, out for this project, the project would impact on the Thompson Square Precinct (hereafter referred to as the Thompson Square Conservation Area), which includes parts of the project area. This is the subject of an emergency listing request under the National Heritage List to the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities. The Thompson Square Conservation Area has also been separately nominated for inclusion on the National Heritage List through standard annual nomination processes. These listings are currently under consideration by the Minister. Accordingly RMS would make a precautionary referral to the Australian Government to determine if the impacts of the project on Thompson Square constitute a controlled action under the EPBC Act.

The proposed emergency listing and the separate nomination for inclusion on the National Heritage List mentions the riverfront and the former wharves within the nomination, however, it is not clear if the nomination includes the river sections of the project.

2.4 NSW Heritage Act 1977

The NSW *Heritage Act 1977* is the primary piece of State legislation affording protection to all items of environmental heritage (natural and cultural) in NSW, including places, buildings, works, relics and moveable objects identified as significant based on the heritage values outlined in the Australia International Council on Monuments and Sites *Burra Charter*. The State Heritage Register is a statutory list of places and items of State heritage significance. Under the NSW *Heritage Act 1977,* approval is required from the Heritage Council of NSW for works that result in the alteration or modification of items listed on this register.

RMS is seeking approval for the project under Part 5.1 of the EP&A Act. A number of approvals that generally apply under other NSW legislation are not required for a project approved under Part 5.1 of the EP&A Act (EP&A Act s.115ZG). Exemptions potentially relevant to the project include approvals under Part 4 and excavation permits under section 139 of the *Heritage Act 1977*. ;

The location of the former wharves and punt crossing across the Hawkesbury River at Windsor are not listed under the NSW Heritage Act 1977.

2.4.1 Roads and Maritime Services s170 Heritage and Conservation Register

Under s170 of the NSW *Heritage Act 1977*, all State government agencies are required to identify and effectively manage heritage assets under their ownership and control. The RMS Heritage and Conservation Register has been established in accordance with this legal obligation to record all items of local or State heritage significance owned or under its control.

State government agencies must maintain the items listed on their individual Heritage and Conservation Registers with due diligence in accordance with *State Owned Heritage Management Principles* (2005).[4]

The archaeological remains of the former wharf and former location of the punt landings are not listed on the RMS s170 Heritage and Conservation Register.

The Hawkesbury River Bridge at Windsor is a listed heritage item on the RMS s170 Heritage and Conservation Register within the project study area.

2.4.2 Hawkesbury City Council Local Environmental Plan (Draft 2011)

The *Hawkesbury City Council Local Environmental Plan (Draft) 2011* provides planning and development control for the entire Hawkesbury City Council local government area. Within the Hawkesbury City LEP 2011, heritage items are found in Schedule 5 (Environmental Heritage). All of the heritage items listed in Schedule 5 are usually directly subject to Clause 5.10 (1-10) regarding heritage conservation under Part 5 (Miscellaneous Provisions) of the LEP. Under the proposed planning approval for this project, however, the planning policies would not apply.

[4] NSW Heritage Act 1977, *Section 170A – Heritage Management by Government Instrumentalities*.

For the purposes of this heritage report the LEP was searched to identify possible previously recorded archaeological and/or heritage items that are listed within the study area.

The former wharves and punt crossing at Windsor are not listed on Schedule 5 of the Hawkesbury City Council LEP.

3.0 HISTORICAL OVERVIEW AND ANALYSIS

A comprehensive history of the Windsor area has been compiled in the historical archaeological assessment undertaken by Biosis Research Pty Ltd for this project.[5] The history of the Windsor area will not be reiterated here in detail, however, aspects of the development of the Windsor area will be summarised here. Specific attention has been placed on the maritime archaeological infrastructure, function and development, in relation to the development of Windsor.

Initial Settlement

Expansion of the early Sydney colony was needed soon after settlement as soils used for farming around the colony were considered to be poor. Expansion of farming land had resulted in settlement at Parramatta; however, further arable land was needed to increase production for the growing settlement. Land grants in the greater Windsor area began in 1794 with grants being made to James Ruse and Charles Williams with 15 farming allotments directly fronting the northern side of the Hawkesbury River in the area of Wilberforce, with another seven land grants on one of the creeks further around the river (Figure 3). By this time farms had already been established at Pitt Town, to the northeast of the study area. Within five years of the establishment of this settlement there were reportedly 600 persons living in the greater area, many of whom were associated with farming, and the area was divided up into smaller agricultural settlements.[6]

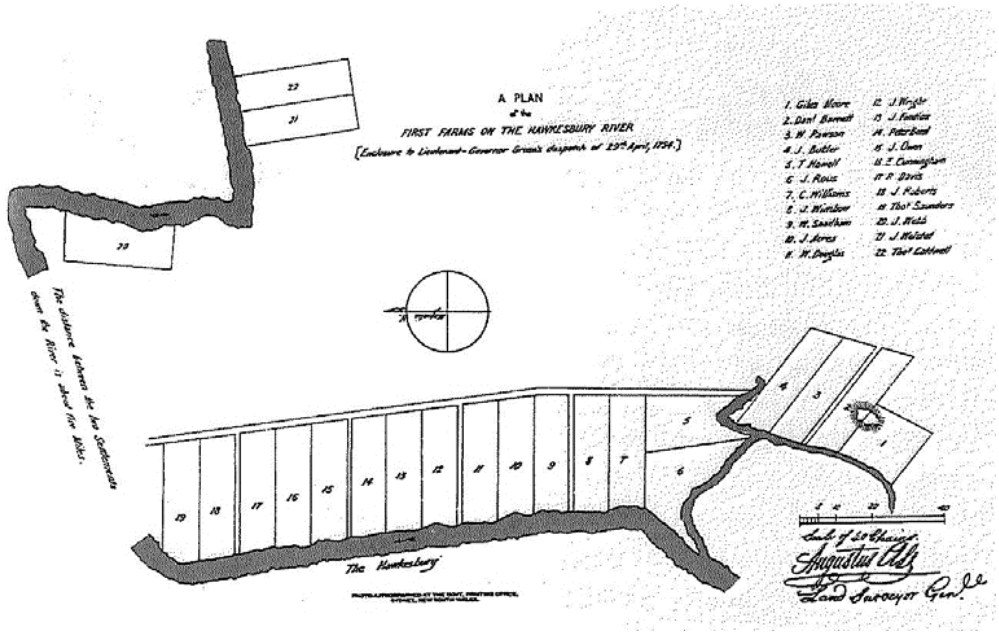


Figure 3: "A Plan of the first farms of the Hawkesbury River", at the current site of Pitt Town. (Augustus Alt 1794). Source: Rosen 1995: 14).

[5] Biosis Research Pty Ltd in association with Cultural Resources Management, (July 2012) *Windsor Bridge Replacement Project: Non-Aboriginal Heritage Report and Statement of Heritage Impact (DRAFT).* Report prepared for RMS.

[6] Biosis Research (March 2012) *Research Design to Inform the Non-Aboriginal Heritage Assessment for the Windsor Bridge Replacement Project.* Report prepared for RMS.

Original wharf

In 1795 a store and military garrison were established further to the west of the original land grants, in an area where it was recognised that boats could easily run up on the bank of the river. The site of these two early buildings is believed to be within Thompson Square, within the southern end of the study area. Included in the 1795 military garrison and store was the building of a wharf. Little is known about the construction of the original wharf.

David Collins, lieutenant-governor of NSW visited the wharf after it was built on 21 May 1795. He noted in his journal that:

> *On the 21st the colonial schooner returned from the Hawkesbury, bringing upwards of eleven hundred bushels of remarkably fine Indian corn from the store there. The master again reported his apprehensions that the navigation of the river would be obstructed by the settlers, who continued the practice of falling and rolling trees into the streams. He found five feet less water at the store-wharf than when he was there in February last, owing to the dry weather which had for some time past prevailed*.[7]

It is believed the original wharf was later destroyed by a flood in ca.1799. There is no mention from the historical record of the wharf being repaired or rebuilt at Windsor until in 1812 with the construction of what is known as the second wharf. There were several major flood events along the Hawkesbury River at Windsor after 1795, notably 1799, 1800 and 1806. It is possible that one of these events destroyed the original wharf. The earliest paintings do not show the location of the original wharf on site. An 1807 painting from the site, which cannot be reproduced due to copyright issues, does not show the original wharf. Evans' 1809 watercolour of Windsor shows a boat obscuring the believed location of the original wharf. Behind the boat is a track that leads down the hill to this location which may have served as a track leading to the first wharf (Figure 4).

With the loss of the wharf from the site, the settlement would have had to resort to either constructing a new wharf or to using the beach area to run smaller boats up on the shore to load and unload cargo. This method would have meant the smaller boats would have transported the cargo to Sydney, or transport the cargo onto larger vessels elsewhere in the river for shipment back to the main settlement.

It is difficult to imagine such an important settlement as Windsor to transport cargos to the main Sydney settlement without a wharf being present. It is possible another wharf may have been built somewhere along the southern side of the river, however, there is no information from the historical record that mentions or shows a wharf was present between the removal of the original wharf and the next wharf constructed in c.1814. A painting from the site dated to 1807 shows a possible slipway to bemay have been present on the eastern side adjoining Thompson Square. The later watercolour done by Evans in 1809 does not show the same slipway feature, however, outlined remains

[7] *An Account of the English Colony in New South Wales*, Vol. 1, :340.

of infrastructure shown in the 1807 watercolour can be seen (See Blue Arrow in Figure 4).



Figure 4: Detail of G.W.Evans watercolour of 1809 showing a boat obscuring the believed location of the original wharf and the track running down to it (*red arrow*). The possible outline of a former slipway is outlined by the *blue arrow* (ML PXD 388 V3 f7).

Second Wharf

A survey of the township of Windsor in 1812 does not clearly define the location of a wharf present on the southern side of the river, however, an anomaly is present on the western side of Thompson square (Figure 5). The contract details for the construction of the new wharf at Windsor in 1815 stated that "*shall extend the width of the Square on a line with the present Jetty or Wharf but three feet higher*".[8] It has been speculated that if the second wharf (built in ca.1814) was built to the east of the location of the first wharf, the location of the second wharf would be in the general location of where it was actually built and the anomaly present in Meehan's 1812 plan may relate to the remains of the first wharf present at the time of this survey. The limited remains of the first wharf present at the time of Meehan's survey may have been due to the wharf having been previously damaged. Anecdotal evidence from the first contract in 1814 to build a new wharf after the previous one had "washed away".[9]

With the absence of the wharf from the settlement at Windsor, boats would have returned to pulling up on the bank. There is no indication of a designated landing area shown on any maps or paintings of the area from this time, and it is likely that boats would have pulled up in an area where they could access the central township area.

[8] *Opp Cit.,* Biosis Research (August 2012).)

[9] *The Australian Almanac and General Directory 1835* : 227.

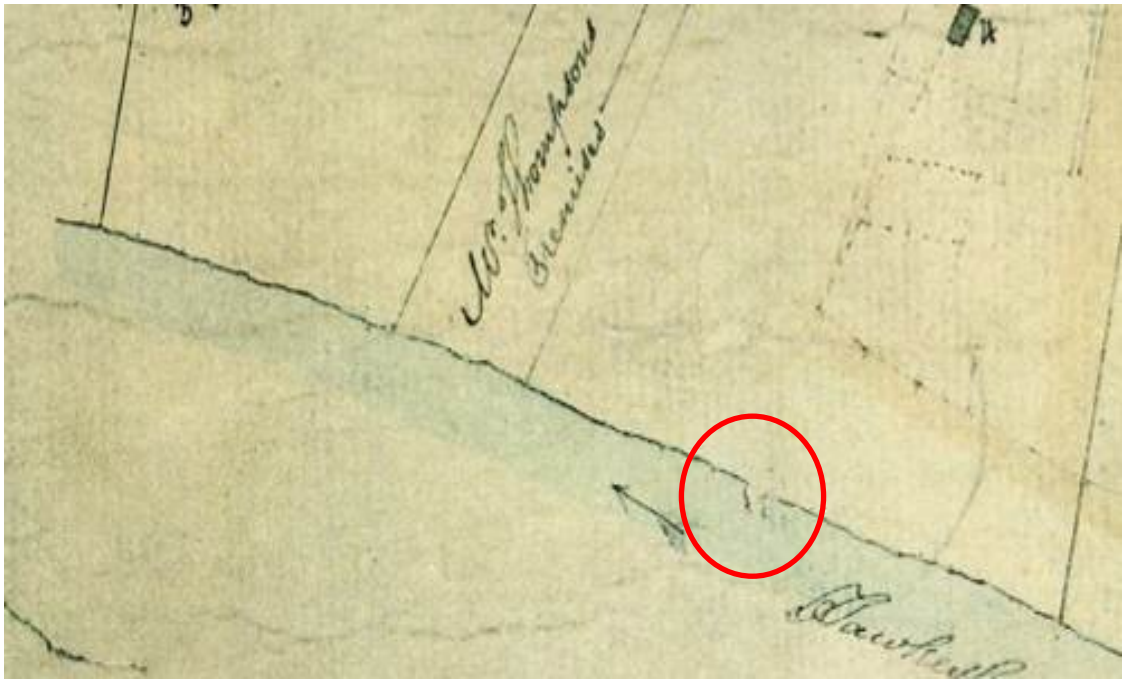


Figure 5: Detail from James Meehan's survey of 1812 with possible indication of the wharf (SRO Map SZ 529).

Macquarie Era

Windsor was one of five towns in the Hawkesbury–Nepean district named and greatly influenced in their plan and appearance by Governor Macquarie. The formation of these towns was done so to establish the administrative, government, civil and religious services required to assist with the establishment of the settlement.[10] Windsor was unique from the other four towns as there was already an established settlement at the site. Part of the formation of these towns was the establishment of a town grid system that included a central square where government buildings, including a church, school, gaol and guardhouse would be located. Windsor already had these buildings established when the town plan was drawn in 1812. Notably absent from the design was a design location for a new wharf.

Six months earlier a contract announcement was published in the *Sydney Gazette* for the construction of a new road to Windsor, bridge at South Creek and a wharf at Windsor. Appearing on 29 June 1811, the details included:

> "*Any Person willing to contract for finding Materials and building a substantial Bridge over South Creek, facing the Town of Windsor, to be 16 feet wide, level with the Banks, and about 120 feet over, including the Wharfs, to be well planked and piled, are desired to send Proposals and Plan to Captain Antill, at Government House, Sydney; or to Mr. John Howe, at Windsor, on or before 26th July next*."

[10] Biosis Research (March 2012)*: 35.*

Between 1812 and 1813 buildings that were constructed in the period from 1795 to around 1811 located within the proposed town square within the Macquarie town plan for Windsor were progressively removed. This created the boundary for formalisation for the current Thompson Square, which extended down to the river.[11]

Small cutters and sloops were the only means of transporting produce up and down the Hawkesbury River. They were called the Mosquito Fleet due to their smaller size.[12] On the route between the Hawkesbury River and Sydney they risked wreckage, seizure by convicts, being stolen from anchorages, and river floods.[13] Rough sea conditions between Broken Bay and Port Jackson could also devastate the small vessels. Any loss of boat and produce was of great consequence to the colony as the people relied on farmers for subsistence. In 1812 there were just over 100 voyages from the Hawkesbury region to Sydney, involving 21 vessels making six or seven return trips.[14]

In 1814 the contract for the building of the bridge over South Creek and new wharf was awarded to John Howe and James McGrath. The improvements were to include a graded surface down from the government store, located in Thompson Square to the wharf. A contract for the proposed works dated from 1814 describes the original construction of the design of the wharf. The contract states:

> "*The front of the Square to be* piled *with sound piles from 16 to 18 inches thick to be from three to four feet apart in the (illegible) to be three feet above the Water Mark at Spring Tides (but in a line with it). Well capped and Secured by Land-Ties to extend from side line to side line of the Square to be planked on the Inside of the Piles and then filled up to the top.*
>
> *"The Wharf to Commence from the Upper Side Line of the Square to Extend Eighteen feet from the above row of Piles* which *will be in deep water to extend fifty feet in length to be planked on the inside and filled up unless it should be thought best to plank the top and in that Case the same is to be planked and not filled up, the whole to be Capped and well secured by Land Ties as also to the Row of Piles in the Front of the Square".*[15]

Construction for this new wharf began in 1814 and was completed by 1815. Governor Lachlan Macquarie described this new structure as:

> *"A Large substantial wooden wharf or quay Constructed in the Centre of Town on the right Bank of the River Hawkesbury for the convenience of Vessels and Boats, trading to Windsor, and at which Quay Vessels of 100 tons burthen can load their Cargoes".* [16]

A second contract appears to have been prepared for the construction of either a variation to, or extension of, the 1814-15 wharf. The contract requested:

> "*To erect a Wharf or Platform in the front of Thompson's Square in the Town of Windsor in this Territory which shall extend the width of the*

[11] Biosis Research (March 2012):35.
[12] **Purtell, Jean. 1995** *The Mosquito Fleet: Hawkesbury River Trade and Traders 1794-1994,* 37.
[13] *Opp Cit.,* Purtell. 1995, 38.
[14] *Ibid.,* 40.
[15] ML MSS 106 Article 37 8 August 1814.
[16] HRA Series 1 Volume 10; 690-1.

> *Square on a line with the present Jetty or Wharf but three feet higher, the said wharf to be constructed to have two Rows of Piles without the present platform and one Row behind the whole to be secured with Land Ties and Caps and planked with sound two inch Planks, and not more than six inches wide to be spiked with five inch Spikes, and the whole of the Square to slope down from the* Crown *or Range on which His Majesty's Store stands gradually to the point of the said platform, the Bank to the Westward of the New Wharf and adjoining to that point of the River where the Punt and Ferry Boats Land is to be cut away sufficiently wide to admit of carts turning at the Landing Place".*[17]

During these construction works in 1816 a flood occurred that caused damage to the wharf. Macquarie wrote of the event on 14 November 1816:

> *"In consideration of the greater part of the Govt. Quay or Wharf already erected by the contractors having been carried away or destroyed by the late Floods of the Hawkesbury, I have this day agreed on an estimate made out and submitted to me by Mr. Greenway the Govt. Civil Architect of the additional Expense of repairing and Completing the same in solid and durable material (agreeably to a Plan thereof made out by Mr. Greenway), to allow and pay unto Messrs. Howe and McGrath the additional sum of Two Hundred and Twenty (including Twenty Pounds for Mr. Greenway's trouble in planning and directing the Work) Pounds Sterling; allowing them also for payment such Iron and Spike Nails from the stores as can be spared - with a carpenter and Pair of Sawyers off the store; the Contractors now engaging to complete the said Quay or Wharf in Eight months from this date.*[18]

The wharf was later completed in 1820.

Windsor prospered as a busy port for small river craft. Goods were unloaded at the wharf where most of the produce was to be transported by rail from Windsor to Sydney.[19] Cargoes included maize, poultry, watermelons, fruit, eggs, bark and gourds. Windsor also developed a boatbuilding industry, as did Richmond and Pitt Town. The Hawkesbury boats were smaller craft than those being built in Sydney, most being less than 50 tons, but they were suited to the river trade. In 1826 the number of recorded trips from Hawkesbury was only 26, involving six vessels, but this was due to a lack of recording as so many vessels were trading that it became difficult to track.[20]

The first images that are available of the wharf date to ca.1818 and relate to either the wharf during construction or from the damage that occurred to the wharf in 1816 (Figure 6). The engraving shown in Figure 6 is marked "W. Preston from an Original Drawing by Cap.t Wallis" and may have originally been drawn in 1816 when the wharf was damaged. This image is of interest as it appears to show the township of Windsor high up on the bank on the left, a dilapidated jetty/wharf on the same side with a vessel tied up alongside, a double ended poled vessel (the punt) with passengers crossing the River and a road on the right side stopping at the river's edge (the punt crossing). It would appear that the punt crossing on the left (south bank) is obscured by the wharf.

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[17] ML MSS 106 Article 88 24 April 1815.
[18] Diary Entry made by Lachlan Macquarie 14 November 1816 (in The Lachlan & Elizabeth Macquarie Archive [http://www.library.mq.edu.au/digital/lema/1816/1816nov.html#nov4]).])
[19] *Opp Cit.,* **Purtell. 1995**, 48.
[20] *Ibid.*, 41.



Figure 6: A View of Hawkesbury, and the Blue Mountains. / New South Wales. c. 1818. Printed beneath the image is "Engrav'd by W. Preston from an Original Drawing by Cap.t Wallis. 46th Reg.t". A watercolor drawing titled "Hawkesbury & Blue Mountains, / from Windsor".

The next available image of the wharf is from a detailed plan survey of 1835 plan of the township of Windsor showing the location and shape of the wharf. The plan shows the wharf located on the eastern side of the “reserved area” (Thompson Square) (Figure 7). A plan of “Buildings and Cultivation adjoining the town of Windsor” was created in 1842. The plan shows the location of buildings, allotments, roads and the boundary of the river in great detail, however, the wharf has not been included in the plan. A small rectangle is drawn in the general area of the wharf and is marked “Punt”, with a road or track leading to it (Figure 8). It is likely that the plan concentrated on the detail of the arrangement of the allotments and buildings and terrestrial notaries, and that the maritime infrastructure, namely the wharf, were not added in, or added later with lesser detail.

Punt

A ferry/punt crossing was in operation at Windsor from the same time as the construction of the ca. 1814-20 wharf. A punt crossing had previously been in operation in 1810, with Governor Macquarie crossing the river via a ferry during his tour of NSW. The punt crossing was known to be in operation in 1816 using the wharf on the southern bank of the river as its landing, and using a riverbank landing on the northern side. The punt crossing was a private operation that was later taken over by the Government in 1832.

The earliest description of the punt is from a report from Macquarie to Earl Bathurst in 1822 where he describes:

> *A large substantial wooden wharf or quay Constructed in the Centre of the Town on the right Bank of the River Hawkesbury for the conveyance of Vessels and Boats, trading to Windsor, and at which Quay Vessels of 100 Tons Burthen can load their Cargoes. A very Convenient Ferry has*

been established from the same Wharf to the North Bank of the River by a large Punt.[21]



Figure 7: Detail of a survey c. 1835 showing the punt and the wharf on the river's edge at the northern end of Thompson Square and a wide cutting on the northern side of the river (AO Map 5968). The wharf is highlighted by the *red arrow*, and the punt crossing by the *blue arrow*.



Figure 8: Detail of Laban-White's plan of the town in 1842 showing the wharf and punt crossing as one (circled in red). Source: Jack 2010.

[21] H.R.A. series 1, vol. 10, pp. 671-697

The punt crossing is depicted in the 1818 engraving by W. Preston from an ooriginal drawing by Cap.t Wallis of the Hawkesbury River. The image shows a row boat crossing the river in the vicinity of the building of the second wharf (See Figure 6).

The punt crossing is depicted on an 1835 plan of the township of Windsor, three years after the punt was taken control of by the Government. The punt crossing is shown to leave from upstream of the wharf, on the opposite side of Thompson Square (see Figure 7). The crossing is depicted as a straight line crossing to a possibly modified bank on the northern side of the river.

It is possible the location of the punt crossing on the southern side of the river was relocated due to the upgrading of the service to include a cable system. A report of the Hawkesbury area, including Windsor in 1828 made particular mention of the punt crossing, writing that:

> *"We must not be unmindful to observe, that we think the day is not far distant, when the punt, which is at present used as the means of intercourse between Windsor and the opposite districts, will give way to the convenience of a bridge; in the mean time we are of the opinion, by the assistance of a small windlass the punt could be worked with more facility and despatch, and considerably less labour."*[22]

The relocation of the southern landing from the wharf to a point further upstream, to the west as depicted in the 1835 plan of Windsor may have been done so to facilitate the installation of a cable ferry system away from the wharf.

A photograph of the punt crossing in operation before the construction of the bridge in 1874 shows the punt being operated on a cable system (Figure 9).

The first building of a bridge across the Hawkesbury River was completed in 1874. The bridge crossing was aligned at the foot of Thompson Square, upstream (west) of the wharf, and was originally constructed as a low level bridge. The construction of the bridge lead to the cessation of the punt service. A photograph of the opening of the wharf in 1874 shows the bridge crossing, but also shows what is thought to be the punt (Figure 10 and Figure 11).

[22] Sydney Gazette 31 October, 1828.

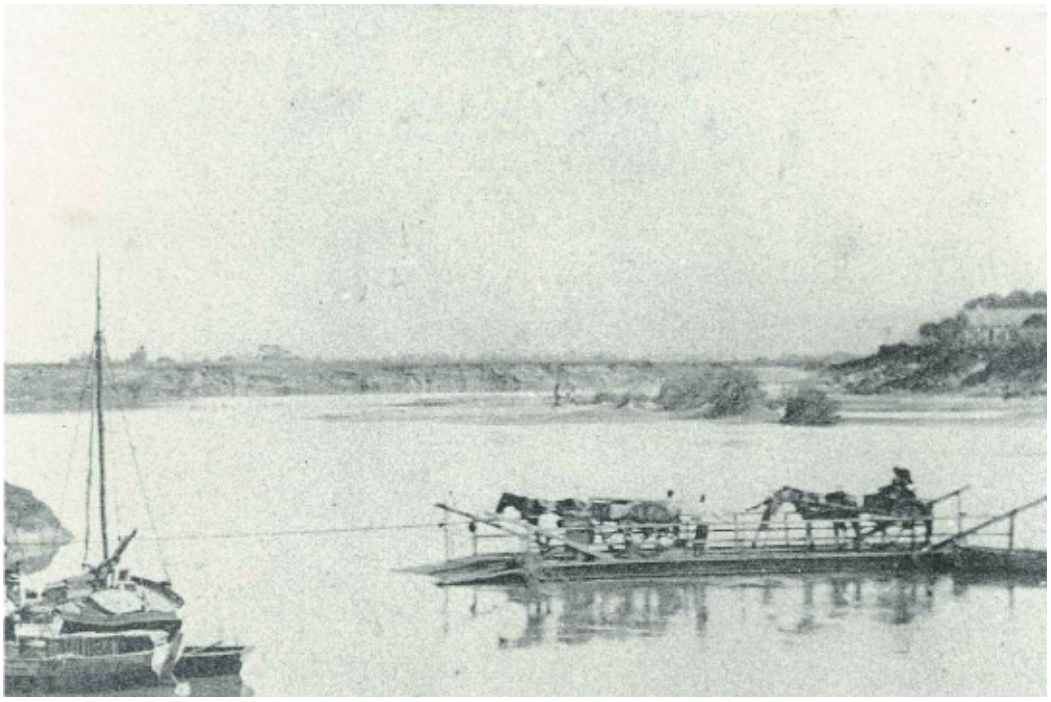


Figure 9: "Ferry across the Hawkesbury River, Windsor to Wilberforce prior to the construction of the Windsor Bridge in 1874" ca.1860-70 (Source Hawkesbury City Council Library Service).

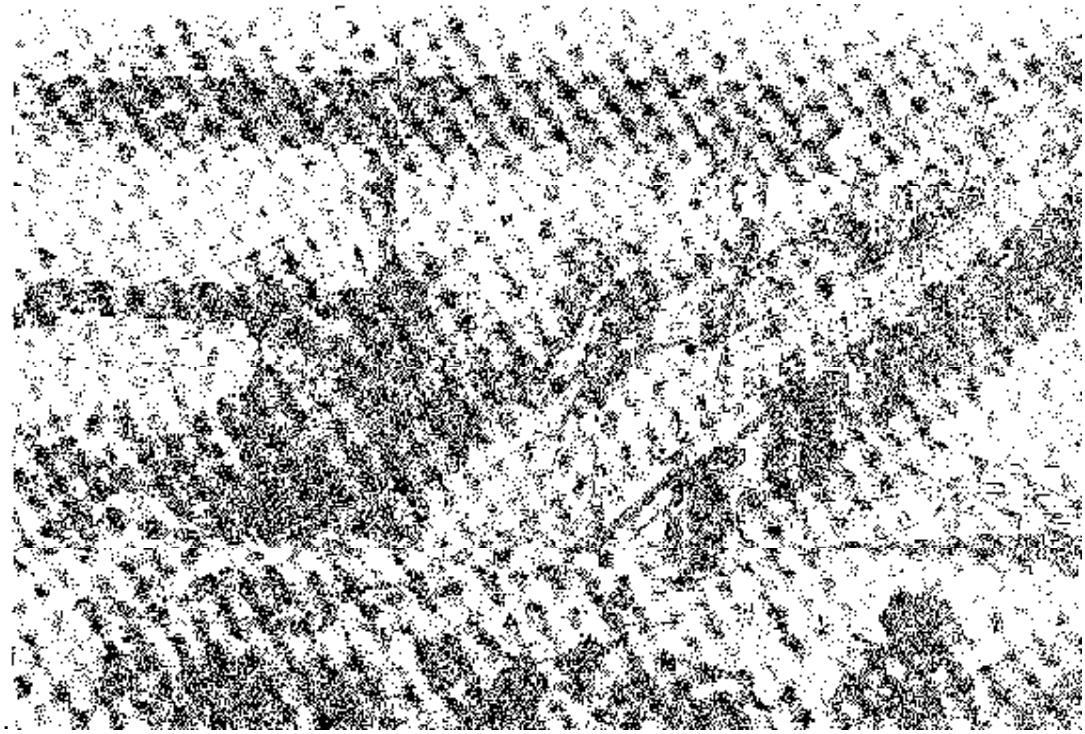


Figure 10: Opening of the New Bridge over the Hawkesbury, at Windsor, NSW. (Source: Windsor Municipal Council 1979).



Figure 11*:* 1874 photograph of the first bridge across the Hawkesbury River at Windsor. The remains of the cable anchor posts of the former punt can be seen to the left of the bridge on the northern bank of the river (*circled in red*) (Source Hawkesbury City Council Library Service).

A hydrographical survey of the Hawkesbury River in 1890 includes a detailed survey of the wharf, showing that the wharf was not rectangular in shape, but had an angled western end to the wharf that was not previously shown on the earlier plans (Figure 12). By this time the bridge across the Hawkesbury River had been constructed and the punt crossing likely ceased operation. The design reason for this angle is unclear. It is possible the wharf was extended or the western end was modified to allow for additional shallow drafted vessels to berth at the wharf.

As it faced upstream it may have served to deflect water flow around the wharf thereby reducing the risk of damage to the structure during floods. It is also possible this section was constructed to allow for shallower draft vessels, such as the punt, to berth at the wharf and leave the outer edge of the wharf that was in deeper water for larger draft vessels. The outer edge of the wharf is approximately 80 ft long, which the landward side of the wharf is approximately 90 ft. The width of the wharf is 20 ft (Figure 12). The wharf appears on a west-northwest to east-southeast orientation with a track leading down from the eastern side of Thompson Square.

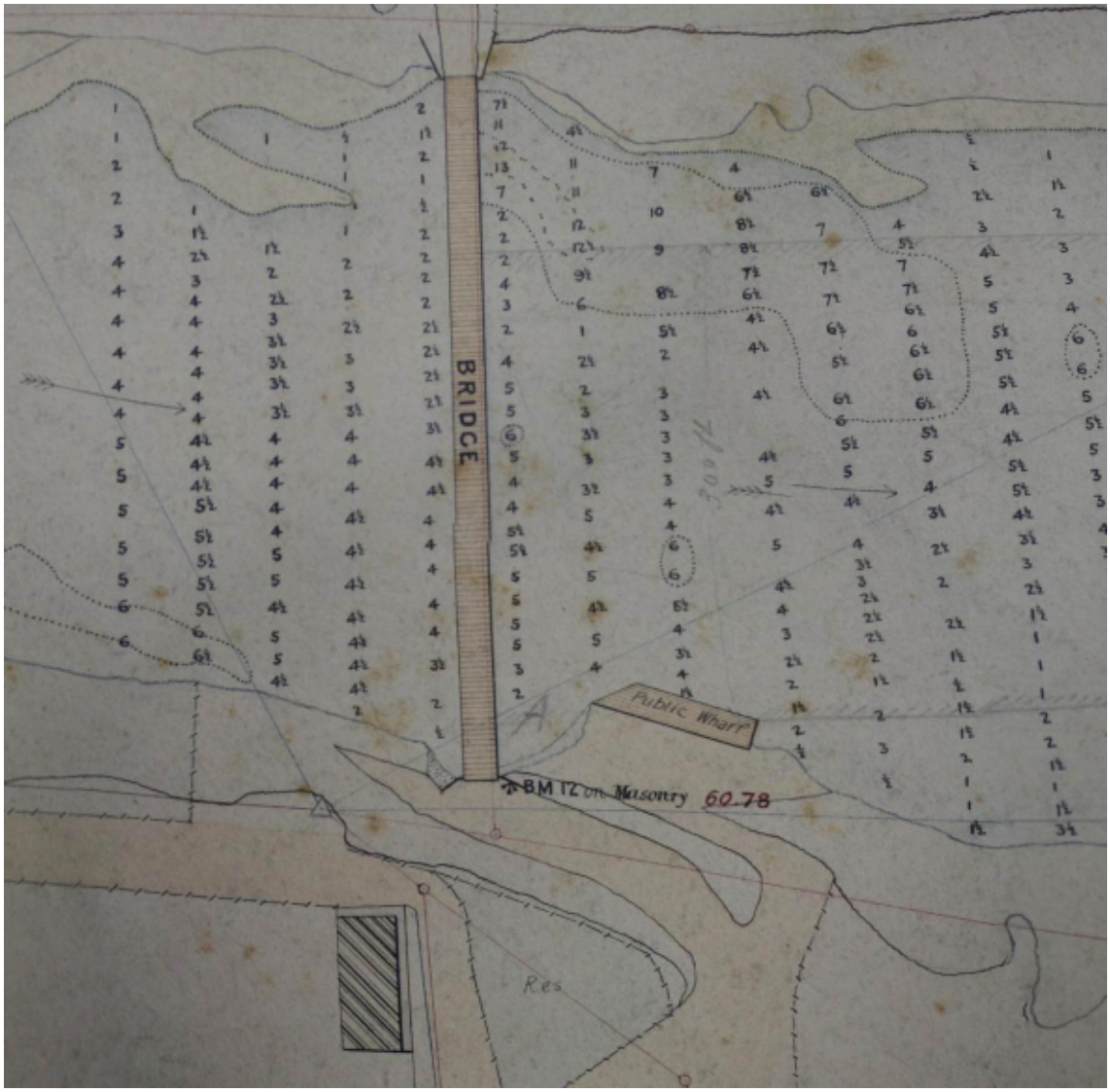


Figure 12: Plan of part of the Hawkesbury River at Windsor (1890). Soundings are shown in feet and reduced to L.W. Spring Tides. (Source State Archives of NSW X1080- 74/12).

The first photograph to show the early wharf dates between 1874 and 1897. The photograph is taken from the northern side of the river looking back at the township of Windsor and the wharf. The angled end of the wharf can clearly be seen, as well as a vessel docked at the wharf (Figure 13). From the limited information available in this photograph it appears that the wharf was of a round timber pile construction, with a flat timber deck. The angled section of the wharf appears to be level and of similar construction to the remainder of the wharf (Figure 13).



Figure 13: Part of an undated panorama showing Thompson Square in the later part of the nineteenth century. The wharf can be seen to the left of the bridge in this photograph. Remains of the cable system associated with the former crossing can be seen in the far right of the image. ML SPF after Biosis Research (March 2012).

In 1897 the bridge crossing the Hawkesbury River at Windsor was modified and raised on the same alignment as the original. This was done to repair the original bridge and to raise it so it would not to be easily cut off by rising flood waters. For the raising of the bridge, a temporary bridge was built across the river. Little is known about the location of this bridge; however, a description of the works for the raising of the bridge provides an insight into the temporary bridge. The article in the *Windsor and Richmond Gazette* in April 1897 states that:

> *"The construction of a temporary bridge was commenced on September 9, 1896, this bridge to carry traffic during alterations to permanent bridge. The temporary bridge, which was 460 feet long, was completed and opened in six weeks."*[23]

Given the location of the wharf in relation to the original bridge, it is possible that the temporary bridge was placed upstream, on the western side, of the bridge. A concept design of the new bridge at Windsor shows a "temporary bridge" located on the upstream, western, side of the current bridge (Figure 14). This design was not followed; however, the concept plan does show the potential plan to put the temporary bridge on the upstream side of the bridge.

A temporary bridge across the river would have been built close to the alignment of the first bridge to use the road approaches to and from the bridge. The limited space between the southern end of the bridge and the wharf may have made it difficult to accommodate a temporary bridge.

In 1880-1881 there were at least 12 vessels operating at Windsor from the Colo and Macdonald Rivers, Wisemans Ferry, Webbs Creek and Lower Hawkesbury.[24] The paddle-steamer *Alma*, 28 tons gross, was built in 1855 in Balmain and made its first trip

[23] *Windsor and Richmond Gazette*, 11 April 1897 p:6
[24] *Opp Cit.,* **Purtell. 1995**, 49.

to Windsor in 1881.[25] Alma was the first vessel for the new 'Balmain Steam Ferry & Tug Company' and was described as 'a very smart little steamboat', later being used for trade by John Jurd.[26] The vessel was adapted to carry horses and carriages plus 80 passengers. It was sold in 1886 to J. G. Barden who used its machinery to build the *St Albans*, which sunk in deep water. Although Donald Roberston bought the vessel and attempted to re-float it, there are no records of the steamer being salvaged.[27]

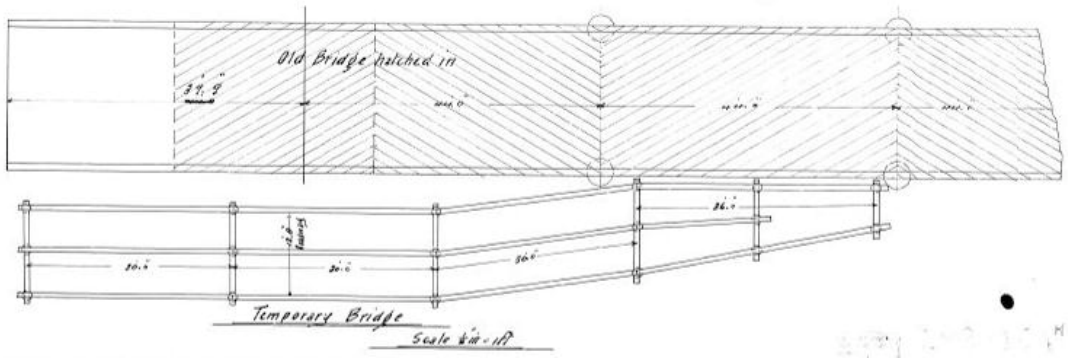


Figure 14: Proposed plan for the new (upgraded) bridge across the Hawkesbury River at Windsor showing a proposed temporary bridge located on the upstream side of the existing bridge (Source Crown Plan 80/385).



Figure 15: Photograph of the Windsor Bridge from the southern side of the Hawkesbury River dated between 1874 and 1896. Piles or mooring posts associated with the wharf can be seen

[25] *Opp Cit.,* Purtell. 1995, 60.
[26] *Ibid*, 168.
[27] *Ibid*, 60.

in the lower right corner of the photo where the small boat is moored. Source: State Library of NSW (http://acms.sl.nsw.gov.au/item/itemLarge.aspx?itemID=392444).

The vessel *John and Herbert* was used by Jerry Woodbury and William Woodbury from Wiseman's Ferry in trading to Windsor during the 1870s and 1880s.[28] Its cargo included melons, maize, poultry, eggs and sundries.[29] Later it was known as *John and Herbert* and came from Lower Hawkesbury with melons.[30] Another vessel that traded to Windsor during this time was *Victory*, from Wiseman's ferry and Macdonald River,[31] trading maize and sundries.[32]

In January 1881 it was reported by the *Hawkesbury Australian* that 70,000 pounds of produce had been delivered to Windsor, but three years later this declined to less than a quarter.[33] This was a result of large shipping companies forming in the 1880s whose steamers could go directly to Sydney, as well as the silting up of the river after floods. Windsor was declining. Silting was causing problems for even small craft, and in the following years two vessels lost most of their cargo after becoming stranded. Conditions worsened in 1902 when a severe drought further reduced river traffic to Windsor wharf.[34] Windsor was never able to re-establish as a port and the sand banks of the upper reaches remained permanent obstacles. Larger vessels were forced to use Churchill's wharf at Sackville. Success of the Hawkesbury Steam Navigation Company in 1885 lead to an increasing number of cargoes being taken directly to Sydney.

In the late 1890s petitions were made to the government from the residents of Windsor and surrounds for the dredging of the Hawkesbury River. Public sentiment regarding the river were highlighted at a public meeting in 1897, where it was noted the river had never been dredged at Windsor, and the river was silting up to the point where only smaller craft could use the wharf. The hydrographical survey of the Hawkesbury River in 1890 shows that the Mean Spring Low river levels in the vicinity of the wharf and in the middle of the river ranged between two feet and five feet, with a deep section of the river present on the northern side of the river to the east of the road bridge, where water depths are rated at 10 ft and deeper.

As far as is known no dredging took place as a result of this petition and the reasons for not doing so can only be surmised. In 1888 a railhead and wharf facilities were in operation at Brooklyn on the Hawkesbury River. This location was closer to the mouth of the river, and the rail infrastructure that was immediately adjacent to the wharf. At this time, lighters, smaller draft vessels that ferried cargo from wharves to larger vessels located in deeper water, were being run from the Windsor wharf to Lower Portland.[35] Smaller vessels continued to trade to Windsor from the beginning of the 20th century, but they were soon made redundant by road transport. Windsor thrived for many decades as one of the main ports on the Hawkesbury River, but changing river

[28] *Opp Cit.,* Purtell. 1995, 48, 177.
[29] "Arrivals of River Craft" The Australia, Windsor, Richmond, and Hawkesbury Advertiser. 31st March 1877.
[30] "Arrival of River Craft at Windsor Wharf" *Hawkesbury Chronicle and Fermers Advocate*. 1st April 1882.
[31] *Opp Cit.,* Purtell. 1995, 49, 185.
[32] "Arrival of river Craft at Windsor Wharf" *Hawkesbury Chronical and Farmers Advocate*. 30th July 1881.
[33] *Opp Cit.,* Purtell. 1995, 49.
[34] *Ibid,* Purtell. 1995, 50.
[35] Ibid, Purtell. 1995, 51.

conditions and easier methods of transport inevitably lead to the relinquishment of trading.[36] It is very likely therefore by the late 19th century, the role of Windsor as a serious commercial port had become redundant.

Three later photographs dating from between ca.1890 to ca.1905 show the wharf from a closer vantage point, showing the angled section of the wharf having been removed, or degraded and collapsed, with only the rectangular section of the wharf remaining (Figure 16 and Figure 17). In both photographs the deck of the wharf appears to be in a degraded state, with sections of the decking either buckled or possibly missing in places. The third photograph was taken on the wharf looking along it (Figure ***19***). In the photograph the outer end of the wharf can be seen, including whaler bracing. The distance between the piles is difficult to determine from the photograph, however, from the close proximity of the whaling braces (attached between rows of piles on a wharf), the piles appear to be placed very close together.

The date for the removal of the wharf is not known. From documentary evidence, the wharf appears in photographs of Windsor in 1935, and possibly in the first 1947 aerial photograph of Windsor; however, the wharf does not appear in the 1955 aerial photograph (Figure 20 to Figure 22). It is thought that the wharf was left to disintegrate and may have been collapsed gradually until a flood washed loose and exposed remains of the wharf downstream.

Summary

- A wharf was first constructed at the initial settlement at Windsor in 1795.
- The wharf supplied the early store and military garrison and also provided transportation for crops from the surrounding farms.
- A second wharf was built at Windsor in ca.1814 and repaired in 1820 under the direction of Governor Macquarie.
- A private punt service also started in 1815 using the wharf as the southern landing.
- In 1832 the punt was taken over and operated by the Government.
- In c.1835 the location of the punt moved upstream and a cabling system was installed for the crossing.
- The bridge across the Hawkesbury River was built in 1874 with the punt service ceasing soon after.
- A temporary bridge was constructed in 1896 for the raising of the main bridge across the Hawkesbury River.
- The temporary bridge was built in six weeks, although, no other details relating to the location of the bridge is known. It is believed to be located on the upstream side of the current bridge.
- The second wharf was present on the site until the late 1930s or early 1940s.

[36] Austral Archaeology August 2011: p.33.

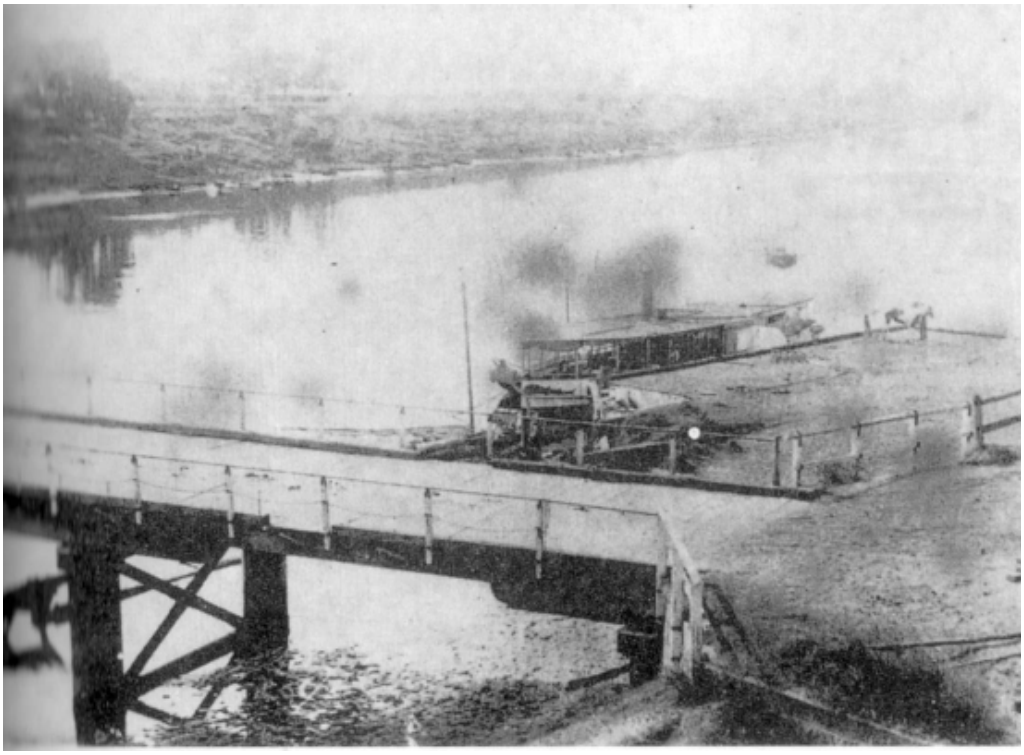


Figure 16: The wharf beside the Windsor Bridge, not dated. Reproduced in Bowd, D. G., *Up the Windsor Road from Baulkham Hills*, Library of Australian History, Sydney, 1986.

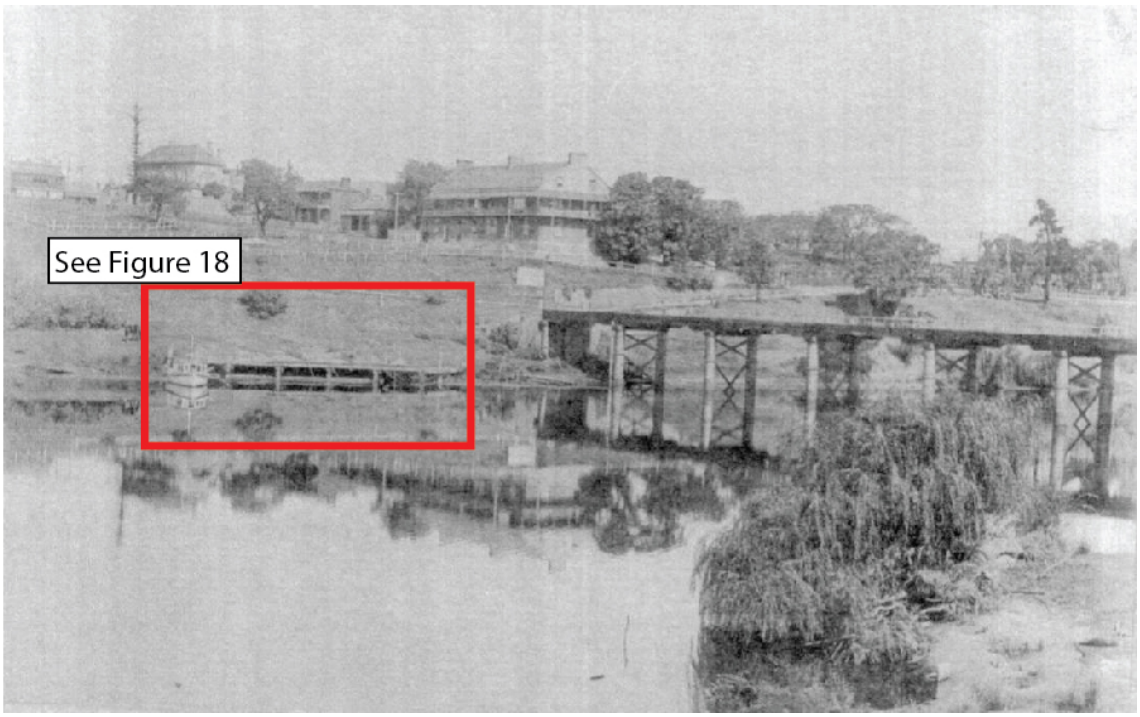


Figure 17: The wharf beside the Windsor Bridge (no date). (Source: Mitchell Library Small Picture File – Windsor).

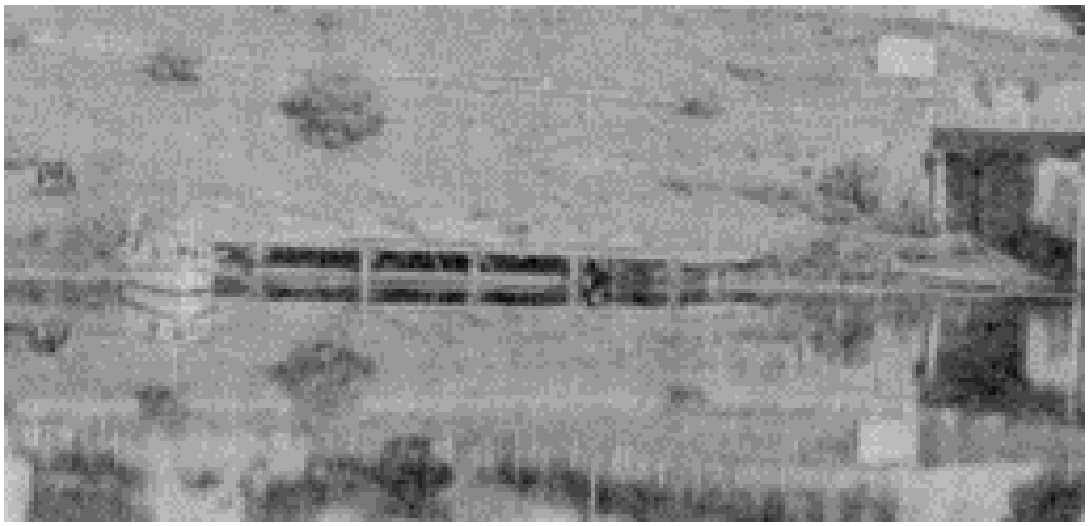


Figure 18: Zoomed image of the wharf beside the Windsor Bridge (no Date). (Source: Mitchell Library Small Picture File – Windsor).

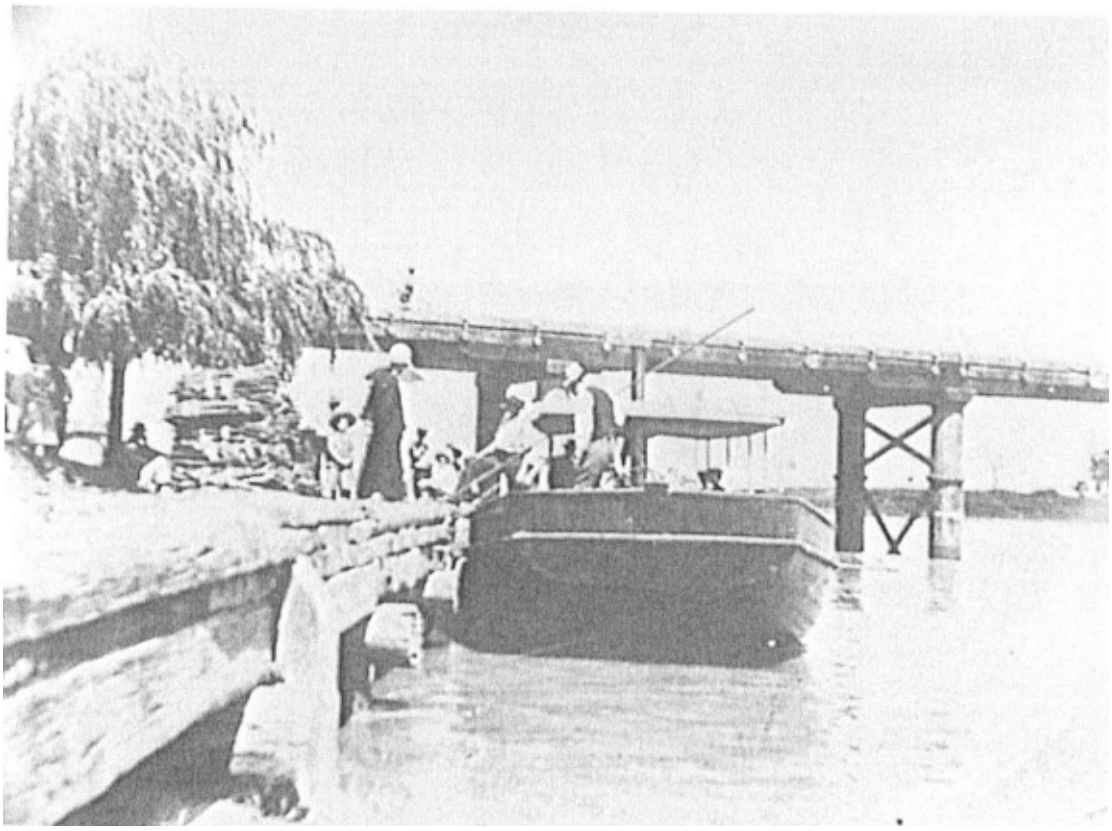


Figure 19: "Wharf at Windsor on the Hawkesbury River near Windsor Bridge" (ca.1890 to ca.1900). The photograph shows some of the below deck components of the wharf, including the closely spaced piles (Source: Hawkesbury City Council Library Service).



Figure 20: Zoomed section of "*Bridge Across the Hawkesbury River, Windsor, New South Wales, ca. 1935*." The ca.1814 wharf can be seen clearly still present on the site (Source National Library of Australia http://nla.gov.au/nla.pic-vn4655530).

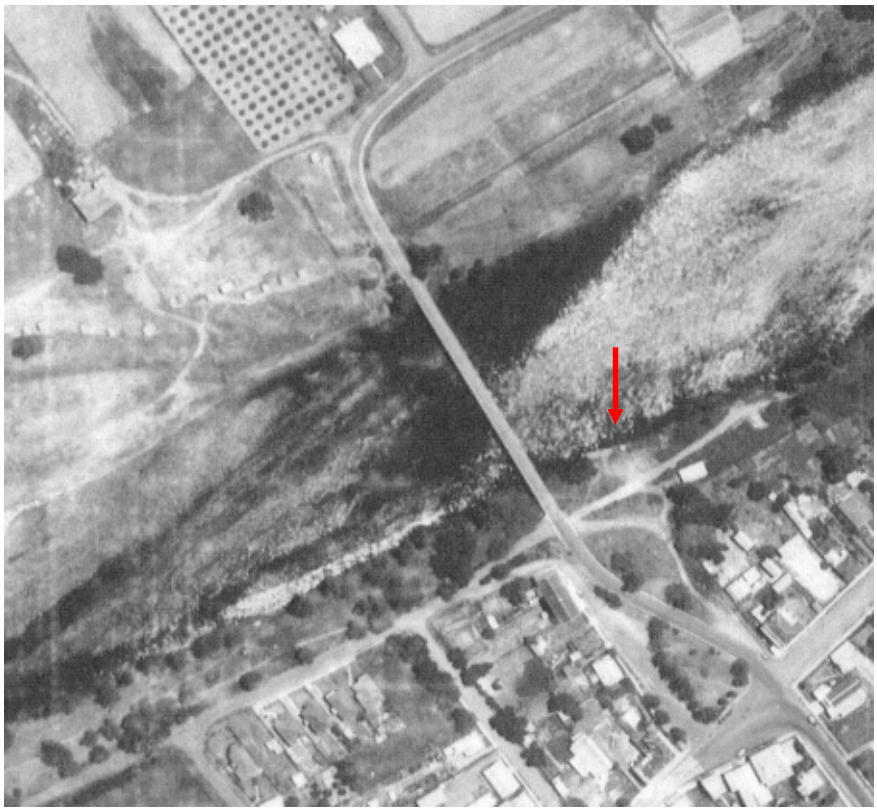


Figure 21: 1947 aerial photograph of Windsor showing the location of the second wharf (*red arrow*).



Figure 22: 1955 aerial *photograph* of Windsor showing the location of the second wharf (*red arrow*).



Figure 23: Flood damage after the motor boat regatta, Windsor, Hawkesbury River, NSW, 1949 (Source NLA http://nla.gov.au/nla.pic-vn4654154).

4.0 Maritime Archaeological Survey Work

4.1 Maritime Archaeological Survey (Cosmos Archaeology 2009)

Cosmos Archaeology undertook a maritime archaeological survey in the location of the ca.1814 wharf on the southern side of the Hawkesbury River, to the east of the current road bridge in December 2008. An underwater survey was conducted as part of early stages of a proposed new bridge crossing over the Hawkesbury River at Windsor. A series of transects were established in the general area of the former wharf to investigate if relics relating to the former wharf were present, or had the potential to be present on the riverbed.

Nine 20 m transects were set out and recorded during the inspection between the bridge and the 1980s wharf (see Figure 24). The transects were evenly spaced to ensure that this area was sufficiently examined for below water remains of the wharf.

The search for the possible remains of the punt ramps and associated features was confined to the north bank, where a diver swam around in the shallows feeling for a hard sloping surface. No search was conducted on the south bank as the river bed has been reclaimed and any remains of the punt ramp may be buried under the fill and the recently laid Gabion walls.

Above the low water line on the southern riverbank between the bridge and the existing wharf it was noted that it had been recently modified with the installation of a gabion wall. This has resulted in a near vertical retaining wall closer to the bridge with the gradient lessening with distance downstream to a point close to the existing wharf where the wall ceases (Figure 25). The thick vegetation on and around this wall prevented any further examination of the southern side of the riverbank.

The above water remains of a wharf structure are present on the southern side of the river to the east of the Windsor Bridge. The remains are located 38 m to the east of the bridge and 34 m to the west of the current wharf situated at the eastern end of the study area (see Figure 24). The extant remains are present in two adjacent areas; the first group consists of remnant timber beams, and the other of a single pile. There are also remains of a retaining wall further to the east.

The first group, three timber beams, including a possible deck beam, are parallel to the riverbank, and rest on two walers (Figure 26).[37] The deck beam is 5.2 m long, 0.25 m wide and 0.20 m thick. This beam rests on top of the walers with no visible fastenings attaching them (Figure 27). There are the remains of fastening holes in the middle of the beam above where the beam intersects the two walers, implying the beam may have been fastened to another section of the wharf positioned on, or in, the riverbank.

At either end of the deck beam are walers. On the eastern side of the deck beam there is only one timber waler remaining, while on the western side there are two. The timbers on both sides run back into the riverbank, possibly attached to a buried portion

[37] A waler is a piece of timber placed horizontally to strengthen a structure. In a wharf or jetty, these are usually placed running either side of piles, connecting two or more piles together below a headstock (which sits on top of the piles).

of the wharf. The two timbers on the western side of the deck beam are both 2.9 m long and 0.3 m wide, and are crescent shaped, being 0.25 m at the thickest point in the middle. Both timbers appear to be from the same rounded log that has been halved, and spaced 0.4 m apart (Figure 28 and Figure 29). There are two large iron bolts that connect each waling timber together, one approximately 0.4 m in front of the deck beam, and the other at the river end of the timbers (Figure 30). The inside sections of both waler beams have also been carved out immediately around the location of the bolts. This is likely where the beams would have been bolted through the piles. A recess has also been cut into the top of the wale beam. The recess is located approximately 1.2 m in front (river side) of the deck beam, measuring 0.35 m wide and 0.05 m deep. This may have been for the placement of another deck beam across the timbers (Figure 31).

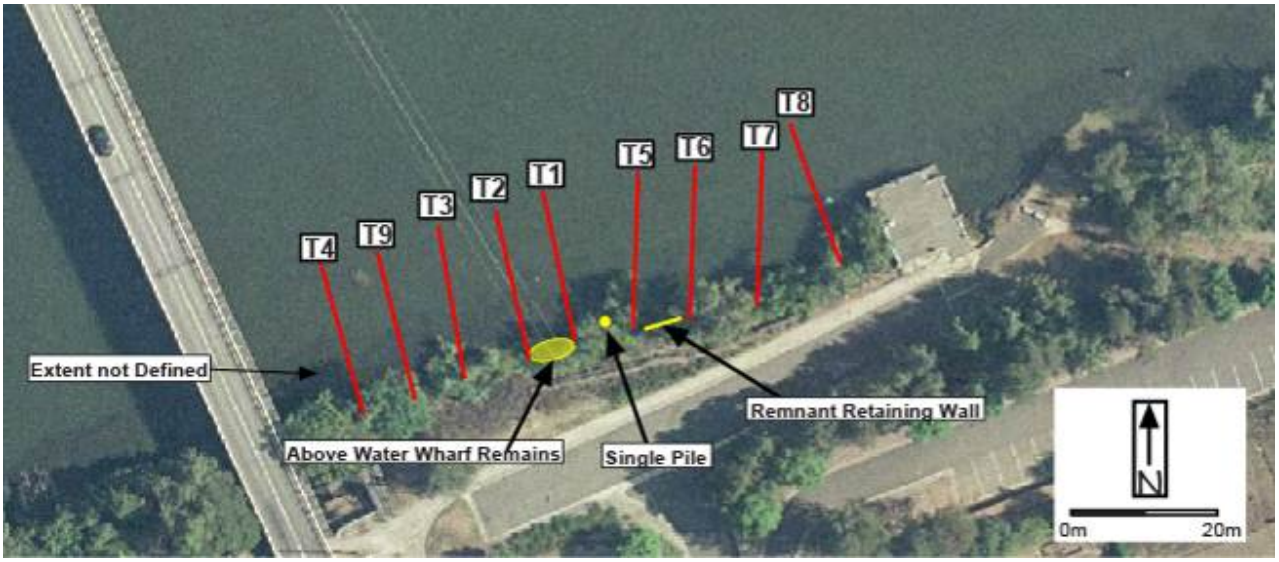


Figure 24: Location of the recorded above water features identified in the 2008-9 survey.



Figure 25: Gabion wall recently constructed above the location of the former wharf site (Photo: Cosmos Archaeology).



Figure 26: Structural remains present of the former wharf. Scale in 200 mm increments (Photo: Cosmos Archaeology).



Figure 27: Remains of a deck beam resting on two walers. Scale in 200 mm increments (Photo Cosmos Archaeology).



Figure 28: Two waler beams on the western side of the wharf remains. Scale in 200 mm increments (Photo Cosmos Archaeology).



Figure 29: Remains of the two walers on the western side of the wharf remains (Photo Cosmos Archaeology).





Figure 30: Fastening remains present on the two waler beams on the western side of the wharf remains (Photo Cosmos Archaeology).



Figure 31: Recesses cut into the top of the walers (red arrow). Probable location of another deck beam. Note also the location of another waler in the centre of the photo (red circle) (Photograph: Cosmos Archaeology).

The timber on the eastern side is also crescent shaped, being 2.5 m long x 0.35 m wide, and is approximately 0.20 m thick at the middle of the beam. There are two fastening holes drilled into the side similar to those opposite timber, the first 0.4 m in front of deck beam, and the other at the other end of the timber remains (Figure 32 and Figure 33). There is also a less defined recess cut into the top of this waler, approximately 1 m in front of the deck beam.



Figure 32: Remains of the singular waler on the eastern side of the wharf remains. Scale in 200 mm increments. (Photograph: Cosmos Archaeology).



Figure 33: Location of drilled holes for the location of bolts (no longer present). Scale in 200 mm increments (Photograph: Cosmos Archaeology).

Approximately 5 m to the east of these structural remains another singular wale beam protrudes from the riverbank (see Figure 31). Only a small section of this timber still remains with no other timbers located around it.

To the east of these structural remains is a single pile. The pile was located close to shore, and was difficult to access. The pile is 0.3 m in diameter and stands approximately 1 m tall from the riverbed.

A section of a former retaining wall was also visible in the riverbank. The retaining wall is located approximately 20 m to the west of the existing wharf at the eastern end of the study area, and approximately 15 m to the east of the extant above water wharf remains (Figure 24). The retaining wall consisted of two iron girders 2 m apart with two timber cross pieces (Figure 34). The "I" shaped iron girders stand 1.5 m above the riverbank, and are 0.20 m wide (Figure 35). The two timber cross pieces are approximately 2.5 m long x 0.30 m wide and 0.11 m thick, and are spaced close together. Material behind the wall consists of dressed sandstone blocks, bricks and broken up concrete deposited up the riverbank. A concrete cap has been placed over the top of the fill at one stage, possibly to create a surface or to contain the backfilled material (Figure 36).



Figure 34: Remains of the retaining wall to the east of the above water wharf remains. Scale in 200 mm increments (Photograph: Cosmos Archaeology).



Figure 35: Iron girder that forms part of the retaining wall present on the riverbank. Scale in 200 mm increments (Photograph: Cosmos Archaeology).



Figure 36: Example of the fill present behind the retaining wall. Scale in 200 mm increments (Photograph: Cosmos Archaeology).

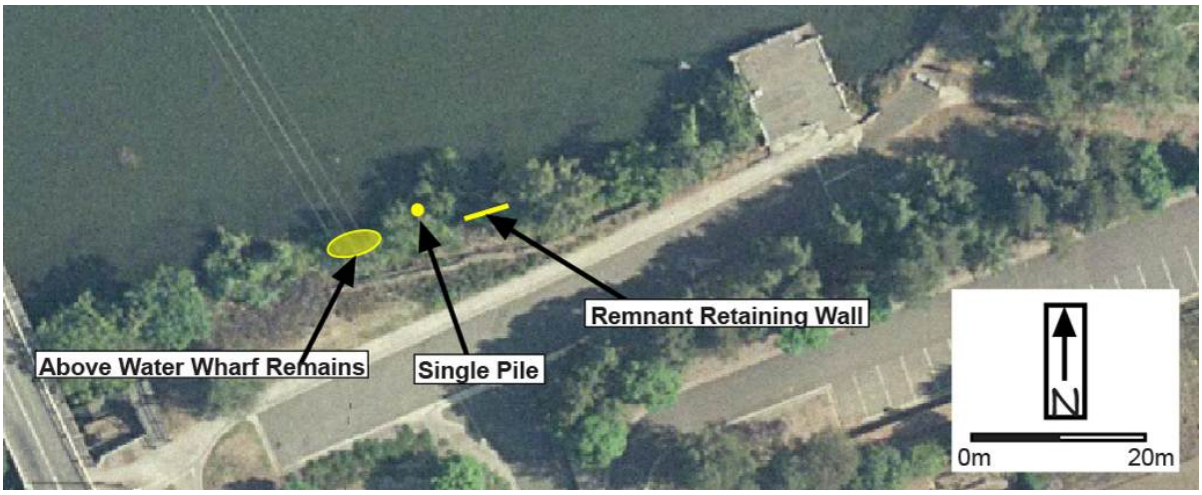


Figure 37: Location of former wharf remains identified from the above water survey.

A brief examination was made on the northern bank adjacent and downstream of the bridge for any evidence of the punt site. Though there was evidence of a cutting, it angles towards the water ending at the base of the bridge abutment. This suggests that the cutting may have been made during the building of the bridge to assist in its construction. Thick vegetation precluded any detailed examination of the area.

Below the low water line limited structural remains or other relics were recorded; however, rock ballast was present in a very defined location. The recording of very few timber remains or other relic remains on the riverbed could not be attributed to the general survivability of this material underwater, but was attributed to poor water visibility at the time. Timber remains were located in one of the transects (T9).

The timber beam was similar to those seen on the above water remains, measuring 2.0 m long x 0.3 m wide x 0.3 m thick and snapped at the near shore end. A single bolt was present within the beam that also included a square washer, which was also similar to the bolt and washers recorded on the above water remains (Figure 38).

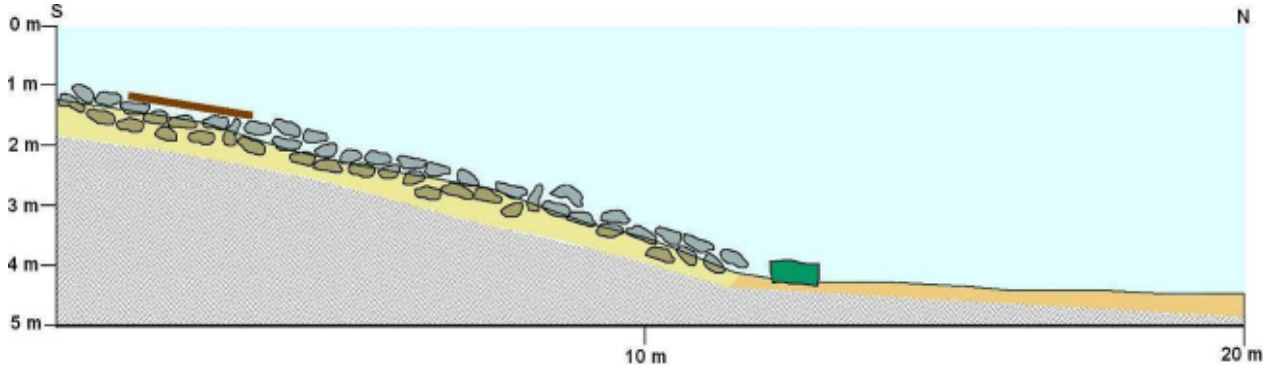


Figure 38: Profile drawing of Transect 9.

The archaeological survey also recorded rock rubble present in transects 1 to 6, including transect 9 (Figure 39). The rock began at the toe of the southern bank and extended out 12 m. The rocks were rounded, like river cobbles, and were predominantly sandstone. There was the occasional 'mudstone' type rock in the mix. The maximum size of these rocks was around 0.3 m. This indicates that they were very likely collected and deposited by hand as opposed to some mechanical means such as a dump truck or excavator. If this were the case, then this rubble would most likely have been deposited anytime between the late 18th and early 20th centuries. The dimensions of these cobbles are reminiscent of what sailing ships would carry as ballast. It is possible that this rock was also transported to the area by vessel rather than brought, and/or deposited from land. It is unlikely, however not impossible that the sandstone was a re-use stone from a former structure and redeposited as ballast for the former wharf. The size of the sandstone suggests it may have been quarried as a particular size to be used as ballast.

Ballast was used in wharf construction during the 18th and early 20th centuries around piles, which could not penetrate with sufficient depth into harder substrates, which gripped the timbers and kept them from 'floating'. This was done primarily as the existing or available pile driving technology was not adequate for the task. The rock was deposited around the piles after they had been driven in to help 'weigh' them down; effectively compacting the riverbed around the piles helping to hold the piles in position.[38] Ballast was also deposited around lattice or box jetties – where piles were checked into bed logs. This was a common form of timber jetty/wharf construction in Australia prior to the 1850s.[39]

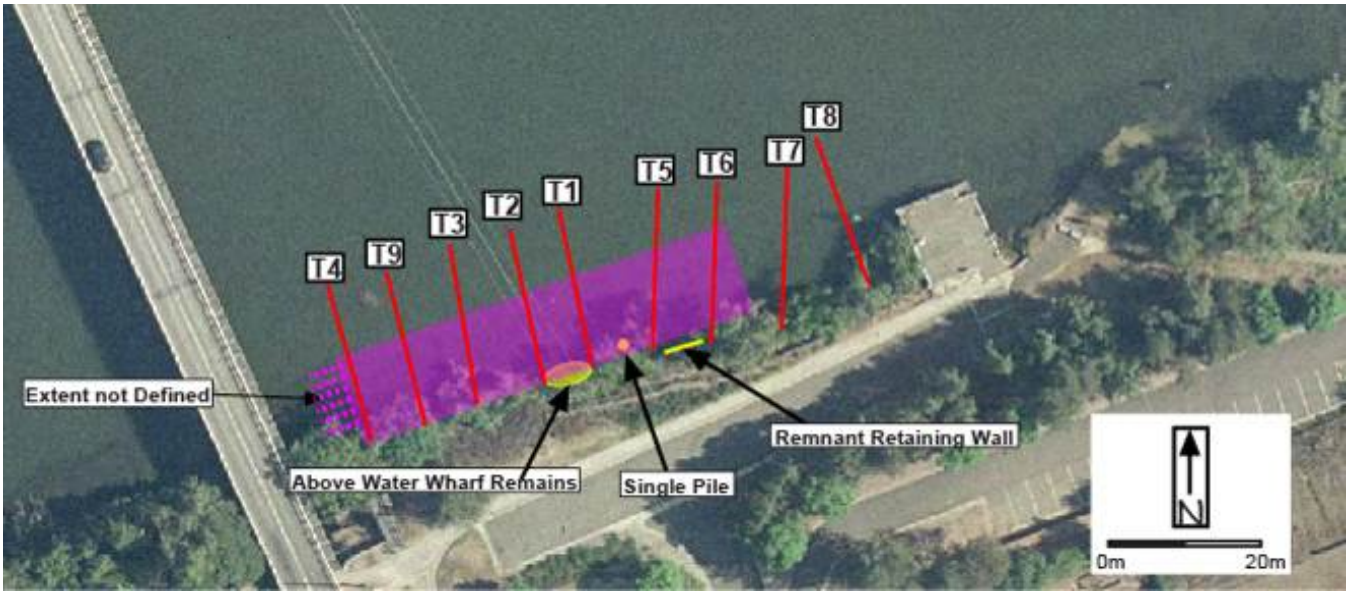


Figure 39: Plan showing the location of the ballast rock (*in pink*) recorded during the field survey in 2008/09.

The ballast extended out from the riverbank approximately 12 m. Ballast was likely deposited just beyond the outermost piles, to assist in the stability of the structure, so it can be inferred

[38] For a similar example of a small river wharf see **Cosmos Archaeology June 2006** *River Heart Phase 1: Maritime Archaeological Investigation*. Prepared for Ipswich City Council (in section 4.2.2 of this report). For an example of a large wharf complex see **Cosmos Archaeology May 2000** *Demolition of Pier 6/7, Walsh Bay Maritime Archaeological inspection Preliminary report.* Prepared for Tropman and Tropman Architects.

[39] **Cosmos Coroneos, 2004** 'The Maritime History and Archaeology of Port Arthur'. In *A Harbour Large To Admit a Whole Fleet*. Port Arthur Occasional Papers No. 1.

that the edge of the wharf was approximately up to 10 m (30 ft) out from the present configuration of the river bank.

No ballast was recorded on or below the riverbed in transects 7 and 8, located on the eastern side of the study area, close to the present day wharf. It is believed the eastern edge of the wharf would have been around the location of Transect 6, where ballast rock was recorded. The ballast extended upstream towards the bridge, past where the extant above water timber wharf remains were observed. This is likely due to additional ballast being deposited to assist with supporting the piles of the wharf to prevent scouring. Another possibility is the ballast may be associated with the original 1795 jetty, which appears to have been in the same area. Figure 38 shows the interpolated extent of the ballast recorded during the field survey.

The attribution of the remnant timber and steel retaining wall on the southern bank is not certain. It most likely dates from the second half of the 20th century. It may have formed part of a river wall, which passed underneath the last upgrade of the wharf, but much more likely was constructed after the wharf fell into disrepair, using elements of the wharf in its construction and in the fill behind it.

4.2 Side Scan Sonar Survey

A side scan sonar (SSS) survey was carried out along the Hawkesbury River within and immediately adjacent to the existing bridge and proposed new bridge at Windsor (Figure 43). The survey was carried out by RMS Hydrographical department in June 2012. The images were collected using a mounted unit attached to the rear of the survey vessel.

A SSS can be used to identify man-made objects or other similar features on a riverbed. A SSS uses a mounted or towed sonar dragged behind a vessel that sends out sound (acoustic pulse or ping) downward and outwards towards the riverbed as the vessel travels along a predetermined survey transect (Figure 40). The sound is then reflected off the riverbed and any other objects that are present. The strength of the sound that is reflected from the material on the riverbed depends on the material itself. For example rock is highly reflective and has a strong return, while sediment types such as clay are not and have a very weak return. The data is converted into a grey scale map of the surveyed area, with highly reflective material indicated as light grey and less reflective material is shown in black. The recording of a scan is done with a differential global positioning system so the accurate positions of any anomalies detected in the scan can be relocated.[40]

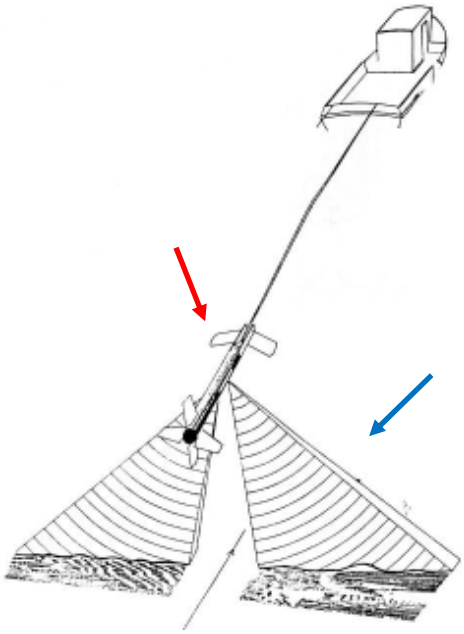


Figure 40: Example of a towed Side Scan Sonar (*red arrow*). The *blue arrow* shows the acoustic sonar – or ping) that is sent out from the sonar. (Source: Dean et al. Archaeology Underwater: 137).

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Objects that are vertical or are present above the riverbed, such as a vertical pile in Figure 41, cast an acoustic shadow. This is where the area behind the vertical object cannot be recorded as there is an object blocking the sound path. Once all of the survey transects are completed, the data is processed and each transect, or swathe, is stitched together to create a mosaic of the study area. The data collected will overlap with each transect, and the image is pieced together. Through this process individual areas of pixels may be lost, and appear as solid white areas (See Figure 42).

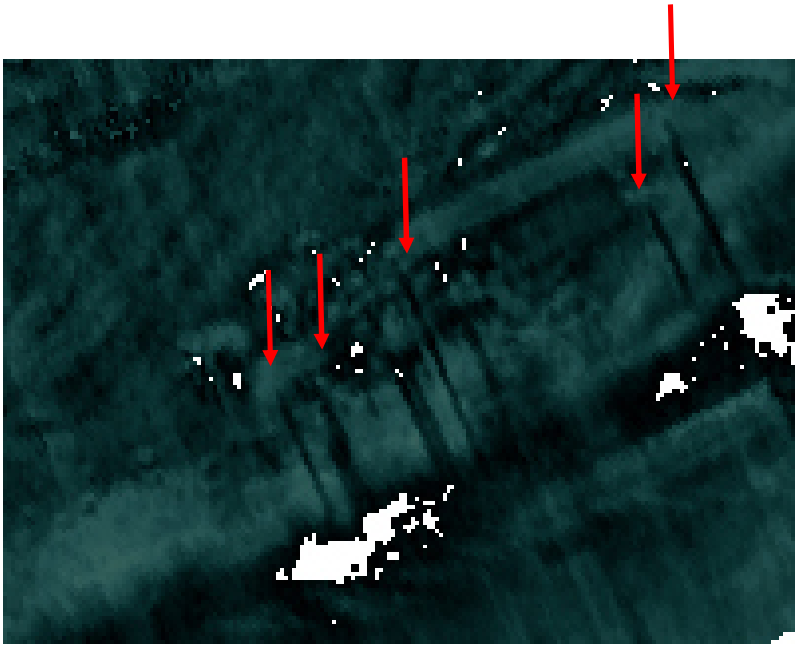


Figure 41: Example of where vertical objects, in this case piles, cause what is known as an acoustic shadow – shown but the dark shadow – that blocks the sound wave from collecting data behind it.

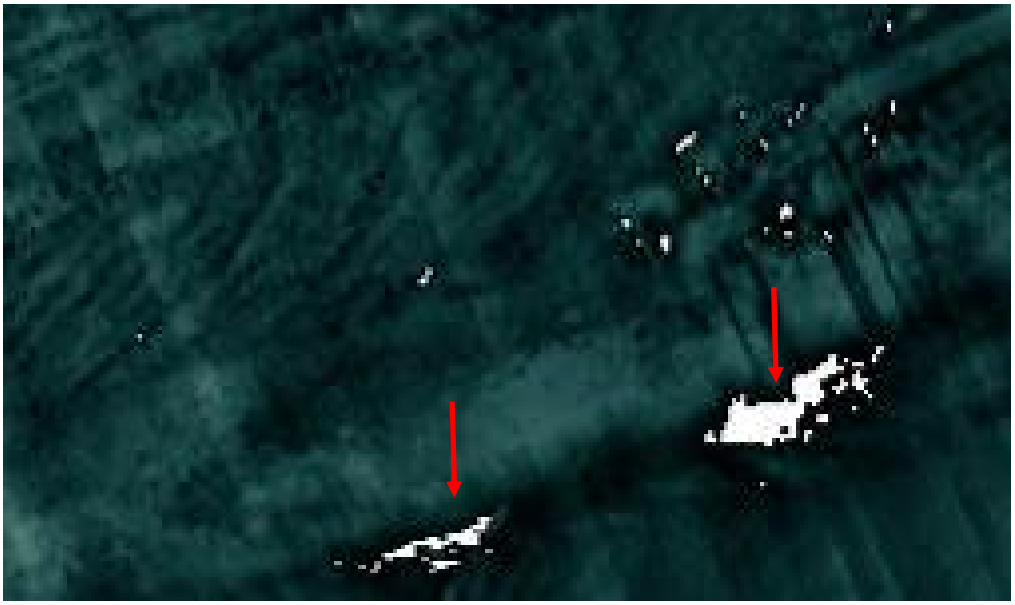


Figure 42: Example of white pixilation where data has not been captured and processed.

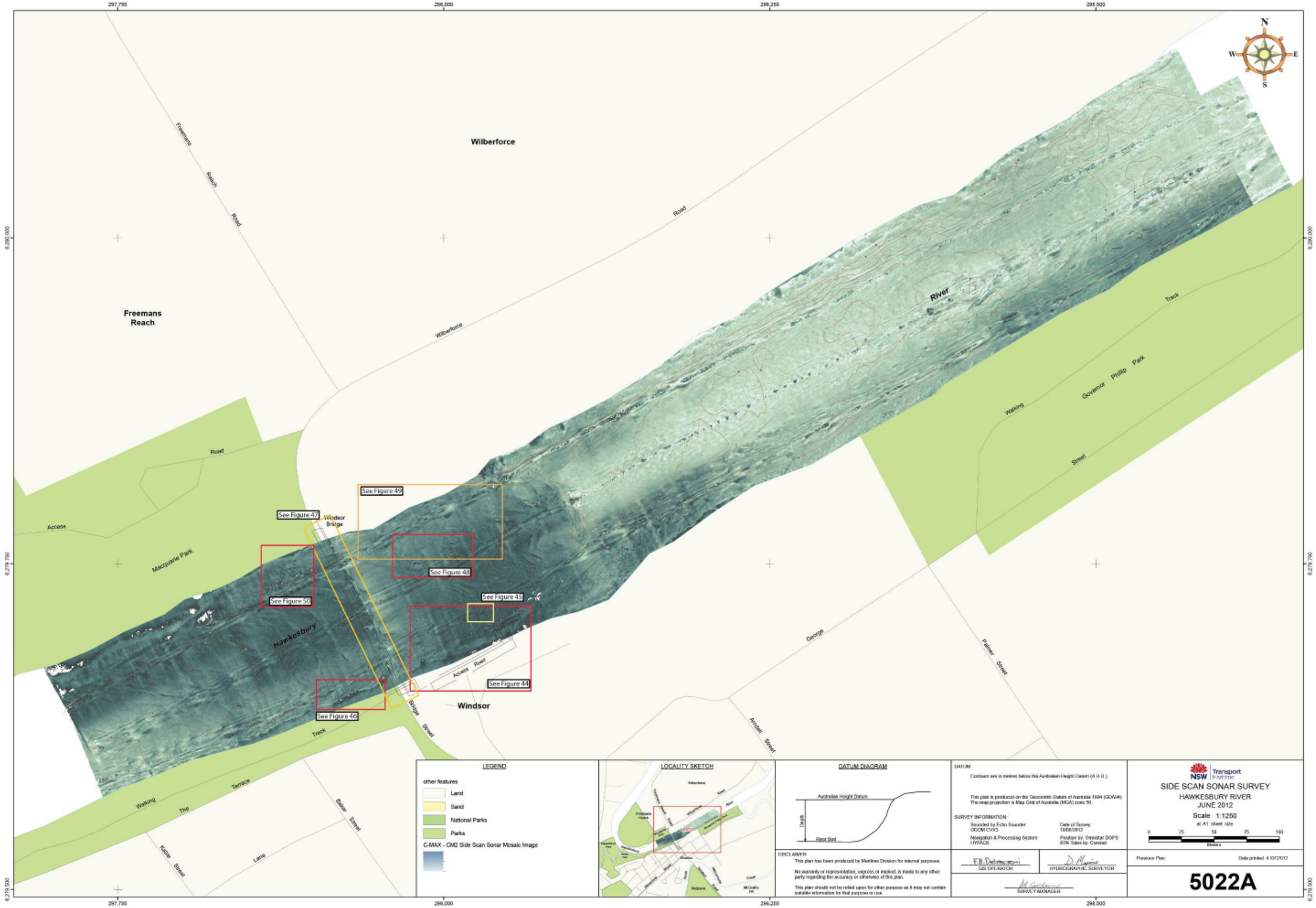


Figure 43: Side Scan Sonar results (Source: RMS Hydrographical department in June 2012).

Several known and potential cultural anomalies have been identified in the SSS data. On the southern side of the river, the location of the known ballast wharf can be seen. This site was identified during the archaeological survey in 2008-9. The dark features located on the western side of the known location of the former wharf are unknown; however recent flooding events on the river may have deposited debris in the area, including tree branches or similar.

Current standing piles associated with the current landing and pontoon location to the east of the bridge can clearly be seen by the dark "shadow" that is created (Figure 44 and Figure 45). These appear as long shadows due to the height of the pile above the riverbed.

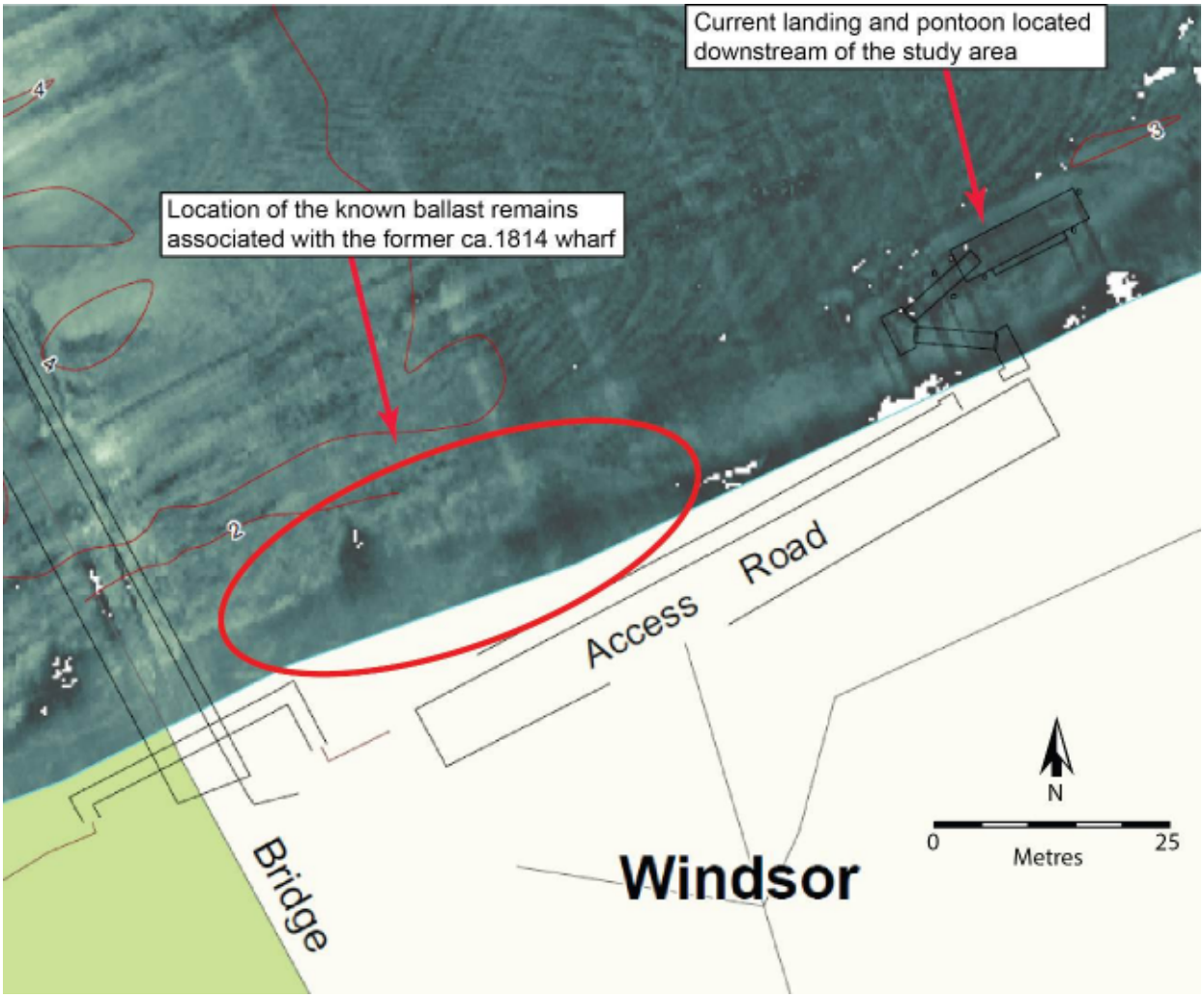


Figure 44: Remains of the known location of the former ca.1814 wharf and current pontoon wharf on the southern bank of the Hawkesbury River.

Also located within this area to the northwest of the current pontoon wharf is an anomaly that is similar to an exposed ballast mound. The concentration of rock in this area cannot be described from the general geomorphology of the sediments that are present on the site, and may be an introduced feature (Figure 45).

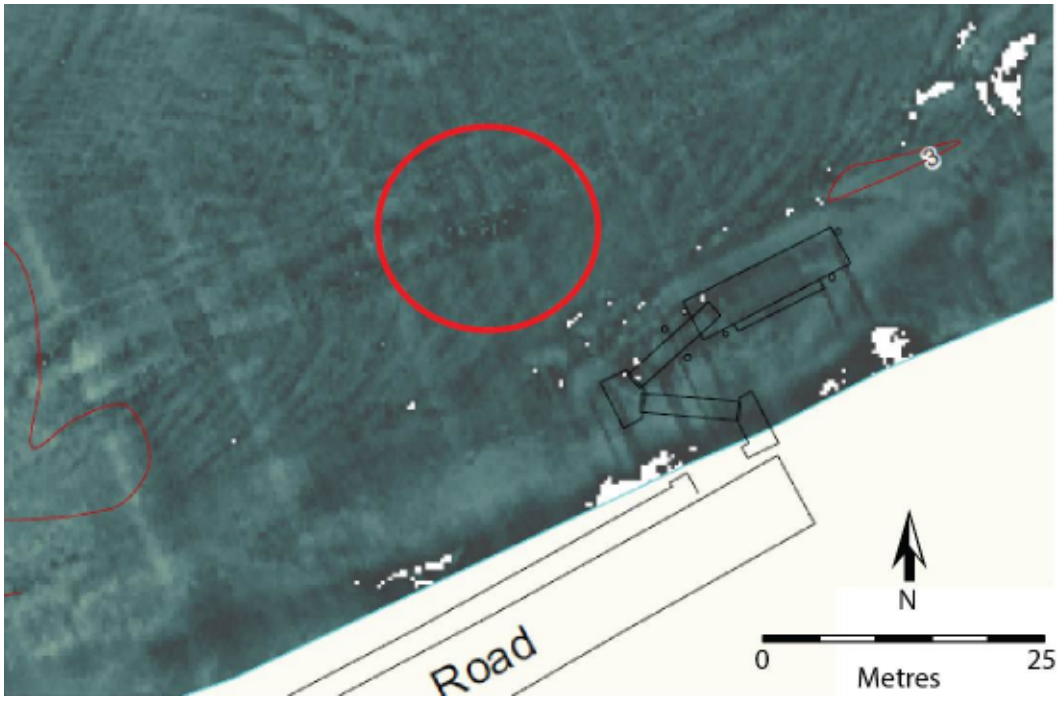


Figure 45: Anomaly located to the northwest of the current pontoon wharf in the vicinity of the former ca.1814 wharf.

Approximately 30 m upstream of the current bridge a large almost linear anomaly can be seen. This feature is in the location of the former post 1835 punt crossing, however, it is difficult to determine from the anomaly if this is a natural or cultural feature (Figure 46).

In the midsection of the river, localised scouring and deposition can be seen immediately along the downstream, eastern, side of the current bridge (Figure 47)

Three anomalies are present on the downstream side of the bridge closer to the northern side of the river. Two of these anomalies are close to each other with the third located further to the east. These may be associated with floating debris deposited in the river since the last flood event. This cannot be determined accurately from the images in the survey results; however, it is possible these anomalies may be close to the location of one of the in-water piers (Figure 48).



Figure 46: Anomaly located on the southern bank of the Hawkesbury River upstream of the current bridge. This anomaly is in the general location of the southern landing of the post ca.1835 punt crossing.

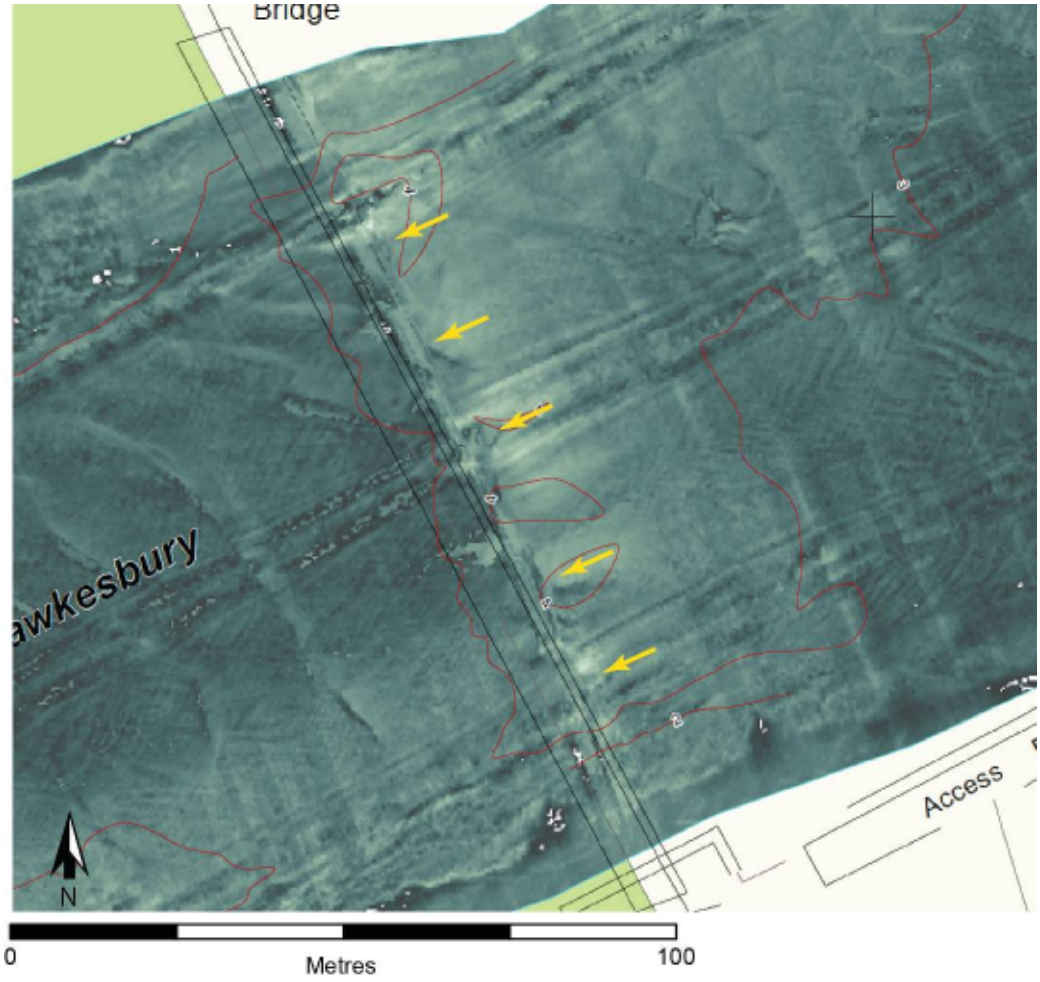


Figure 47: Deposition within the river immediately downstream of the current bridge (*yellow arrows*). These are likely to be deposition caused by the location of the piers of the current bridge.

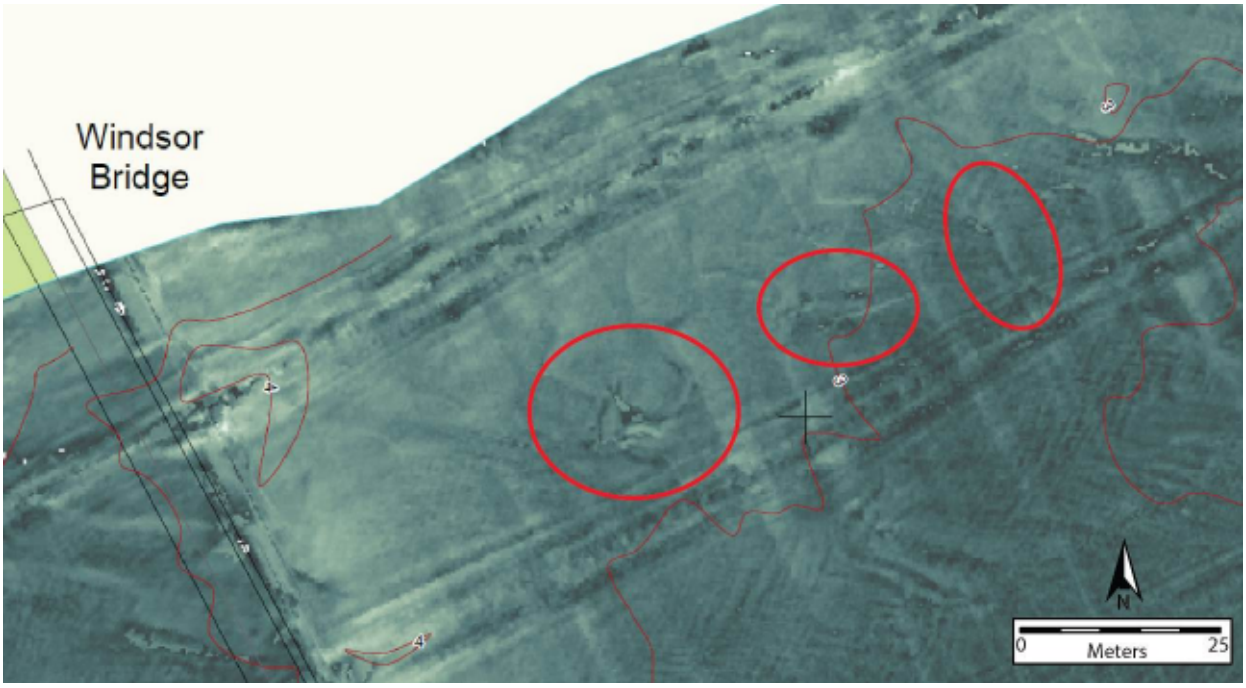


Figure 48: Three potential anomalies present close to the northern bank downstream of the current bridge.

Closer to the northern bank of the river there are several potential anomalies approximately 30 m from the downstream side of the current bridge. They are spread over approximately 50 m. Being close to the bank these anomalies may be associated with trees or other recent debris, however, this area was once used for mooring of smaller boats after the completion of the first bridge crossing. Cultural material in this area may relate to former moorings. Approximately 100 m further downstream the series of features observed are most likely associated with trees growing on the river bank (Figure 49).

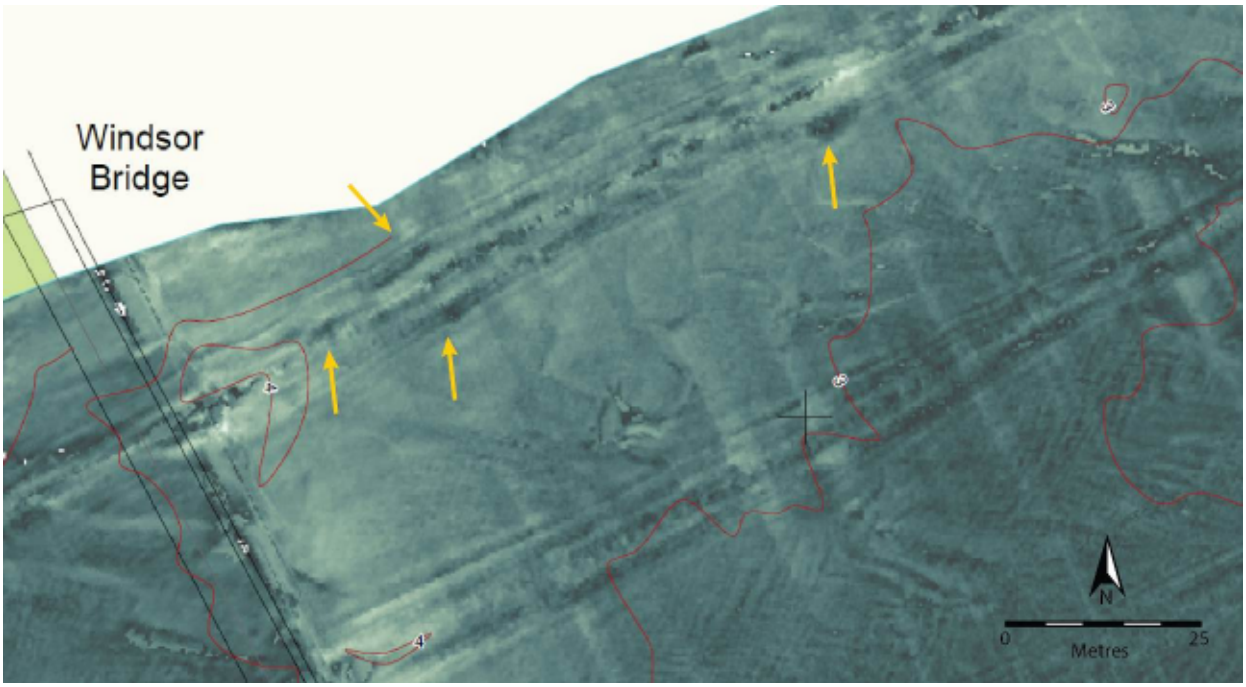


Figure 49: Anomalies located close to the northern bank of the river downstream from the current bridge.

Thirty metres upstream of the current northern side of the bridge localised scouring can be seen. This is likely from a stormwater outlet or similar concentrated runoff that is entering the river in this location (Figure 50).



Figure 50: Localised scouring caused by a stormwater drain or similar in this area.

4.3 Maritime Archaeological Underwater Survey (2012)

An additional underwater survey was conducted in October 2012 on the potential anomalies identified in the side scan sonar survey. This survey was conducted by Chris Lewczak (Senior Archaeologist) Cosmos Archaeology Pty Ltd, David Nutley (Maritime Archaeologist) and commercial dive company Gray Diving Services.

Seven anomalies were identified to need a visual inspection. These were:

- Three anomalies located in the middle of the river (anomalies Mid River 1, 2 and 3); and
- Anomalies near the northern bank of the river, downstream from the current bridge, requiring at least three circular searches (anomalies North Bank 1, 2 and 3);
- One anomaly identified to the northeast of the known remains of the former wharf, possibly being a ballast or rock deposit (known as South River 1).

Once on site, it was determined that anomaly Mid River 2 was a modern mooring and would not require inspection.

It was also decided to undertake two underwater transects in the approximate location of the southern punt landing, located on the southern side of the river, approximately 20 m upstream from the current bridge.

4.3.1 Recording Process

David Nutley (Maritime Archaeologist with commercial diving qualifications) carried out the investigation and the commercial dive team under the direction of Chris Lewczak. Diving was conducted with Surface Supplied Breathing Apparatus (SSBA) from a dive boat. The inspection complied with OH&S requirements.

The following constraints were considered in the investigation methodology:

- Water visibility was expected to be close to 0 m and so it was not guaranteed that photography or video could be obtained.
- Poor water visibility would limit the information obtained from archaeological remains.
- Vessels operating in the area may have an influence on the conduct of the investigation.

The investigation was conducted under two separate survey methodologies. The first was to undertake seven underwater circular surveys on the known location of each anomaly identified from the side scan sonar search. Circular searches are carried out in deep water or areas where visibility is low. Circular searches were carried out to a radius distance of 10 m. The diving vessel anchored within 2 m of the known recorded location of the anomaly, with the diver attached a survey line that had 2 m increments marked out on it to weight the line down onto the seabed. The survey line would snag any features protruding from the seabed, resulting in the diver circling back onto the survey line and then onto the features that was snagged. The diver could then record the distance from the centre of the search area (anchor position) and the compass bearing.

The diver also carried out a series of circular searches at every 2 m around the centre point (i.e. at a distance of 2 m, 4 m, 6 m, etc.) to conduct a visual and physical inspection of the area in an attempt to locate the anomaly.

The second type of underwater survey methodology were underwater survey transects. These surveys used 20 m weighted survey line. A transect was formed by attaching a 20 m weighted line from a nominated location on the edge of the riverbank. The line was reeled out on the riverbed its full distance. The diver swam along the line noting artefacts observed/felt on the

surface as well as riverbed composition. The survey line had lead weights attached every 2 m that were numbered so the diver knew the distance along the transect if any features were to be recorded.

4.3.2 Findings

Circular Search 1 (Mid River 1)

Recorder: Chris Lewczak

Location: 56 H N6279750 E0297979

Time in: 9:34am *Time Out*: 9:42 *Total Time*: 10 min

Max Depth: 4.2 m Vis: 0.3m

This circular search was undertaken on Middle River 1 anomaly (Figure 51). The riverbed in this location consisted of a sandy bed, and was relatively flat. The diver conducted the search starting at 2 m and heading out. No evidence of the anomaly was present, or any evidence of local scouring or other features that may attribute to the anomaly identified in the side scan sonar survey. It is possible this anomaly may have been a tree branch, or similar material, that has since moved further down river.

Circular Search 2 (Mid River 3)

Recorder: Chris Lewczak

Location: 56 H N6279771 E0298027

Time in: 9:45 am *Time Out*: 9:56 *Total Time*: 11 min

Max Depth: 2.4 m Vis: 0.3m

This circular search was undertaken on Mid River anomaly 3 (Figure 51). The location of this anomaly was on a localised sand bar within the river, with the depth of water only 2.4 m at the centre point of the survey. The river bed was very sandy and was undulating, with sand ripples present along the riverbed of a height up to 0.5 m from the peak to the trough.

The diver located localised scouring occurring around a boulder outcrop. Inspection of the boulder identified the feature to be natural, with no evidence that the boulder had previously been used as mooring or other feature. No other features or cultural material were identified during this survey.

Circular Search 3 (North River 3)

Recorder: Chris Lewczak

Location: 56 H N6279808 E0298007

Time in: 10:04 am *Time Out*: 10:18 *Total Time*: 14 min

Max Depth: 2.4 m Vis: 0.3m

This circular search was the first survey undertaken along the northern bank of the river, downstream from the current bridge (Figure 52). The diver noted a lot of debris, consisting mostly of tree branches and other vegetation remains. Heading away from the bank of the river there was a steep batter, approximately 1 m deep, leading from the bank towards the middle of

the river. The riverbed at the top of the batter consisted of a silty clay composition, with the riverbed composition changing to a sandy material at the bottom of the batter and away to the centre of the river.

A dense deposit of tree branches and other vegetation material was present. The diver inspected the material to identify any cultural material or other worked timer remains that may have been present. No cultural material was identified during this survey. The anomalies detected by the side scan sonar survey in this area were likely the tree debris noted by the diver.

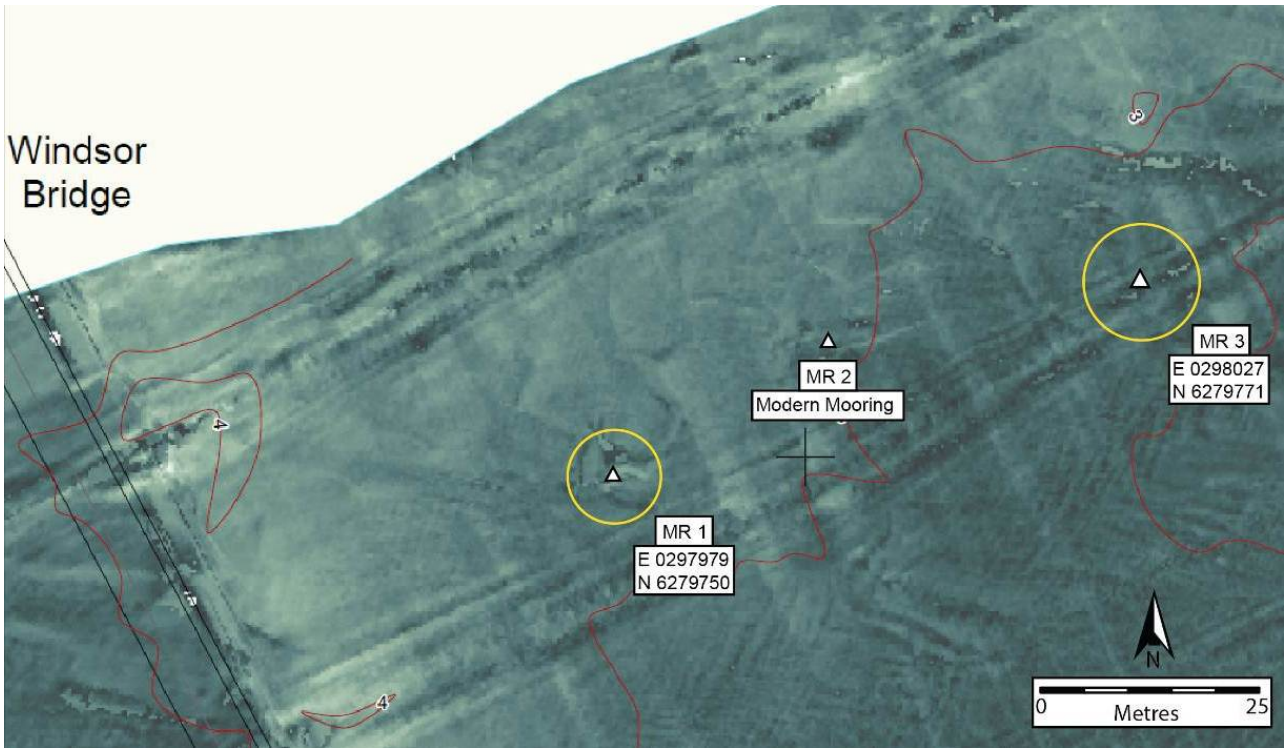


Figure 51: Location of the anomalies Mid River 1 (MR 1), Mid River 2 (MR 2) and Mid River 3 (MR 3) circular searches (white triangles) and the area covered in each search (yellow circle).

Circular Search 4 (North River 2)

Recorder: Chris Lewczak

Location: 56 H N6279795 E0297992

Time in: 10:22 am *Time Out*: 10:36 *Total Time*: 14 min

Max Depth: 2.1 m Vis: 0.3m

This search was conducted 15 m to the west of Circular Search 4, conducted near to the northern bank of the river, downstream from the current bridge (Figure 52). The diver found tree and other vegetation debris remains in the area, similar to the previous circular search.

The diver located a timber beam exposed out of the riverbed. Approximately 0.5 m of the timber beam was protruding from a step batter located away from the riverbank. The timber beam was approximately 0.2 m thick. A second timber beam was located protruding approximately 0.2 m out from the steep batter on the riverbank on an angle.

More timber sections were identified on the riverbed at the bottom of the steep bank, including timber planks joined by bolts to a post. The diver was not able to move the section located as it had been covered over and continued back into the steep batter below the riverbank.

The location of the timber remains, the tree branch and other vegetation debris is likely to have been the anomaly detected by the side scan sonar in this location.

Circular Search 5 (North River 1)

Recorder: Chris Lewczak

Location: 56 H N6279790 E0297980

Time in: 10:41 am *Time Out*: 10:50 *Total Time*: 9 min

Max Depth: 2.0 m Vis: 0.3m

This circular search was the third search conducted below the northern bank of the river downstream from the current bridge directly across from the known remains of the ca.1814 wharf (Figure 52). The area was littered with tree branches and other vegetation debris, with a similar steep slope present away from the riverbank leading down towards the middle of the river. The riverbed at the top of the batter consisted of a very silty sand, with a stiff sand riverbed.

A single timber post was located sticking directly out of the riverbed at the base of the batter, 4 m to the west from the centre point. The post was approximately 0.2 m thick and protruding 0.4 m out from the riverbed.

No other timber remains or other cultural remains were present within the survey area. The single timber post present in this area was different to that recorded in circular search 4.

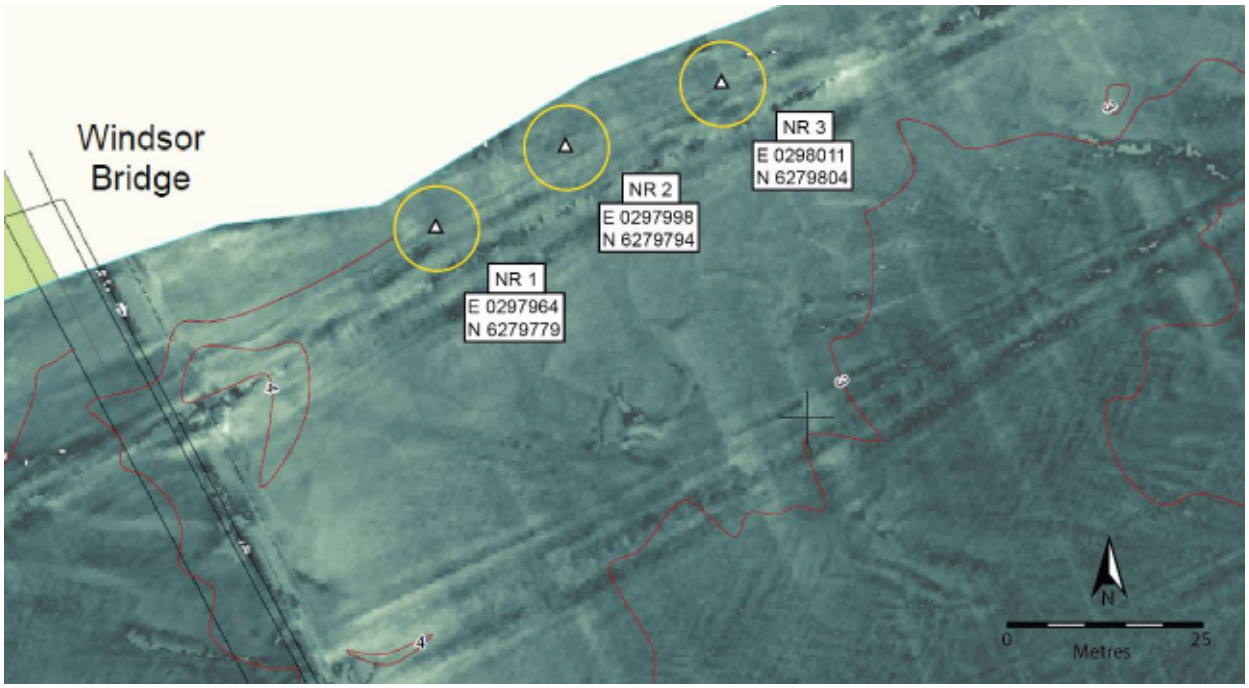


Figure 52: Location of the anomalies North River 1 (NR 1), North River 2 (NR 2) and North River 3 (NR 3) circular searches (white triangles) and the area covered in each search (yellow circle).

Circular Search 6 (South River 1)

Recorder: Chris Lewczak

Location: 56 H N6279711 E0298026

Time in: 11:02 am *Time Out*: 11:13 *Total Time*: 11 min

Max Depth: 2.0 m Vis: 0.3m

This search area was located to the northeast from the known remains of the former ca.1814 wharf, located directly north into the centre of the river from the western edge of the current pontoon landing (Figure 53). The riverbed in this section of the river consisted of a sandy bed with undulating sand ripples approximately 0.5 m in height, with the swales leading down river.

The anomaly seen in the side scan sonar was identified as a shopping trolley. No other cultural material was observed in this area.

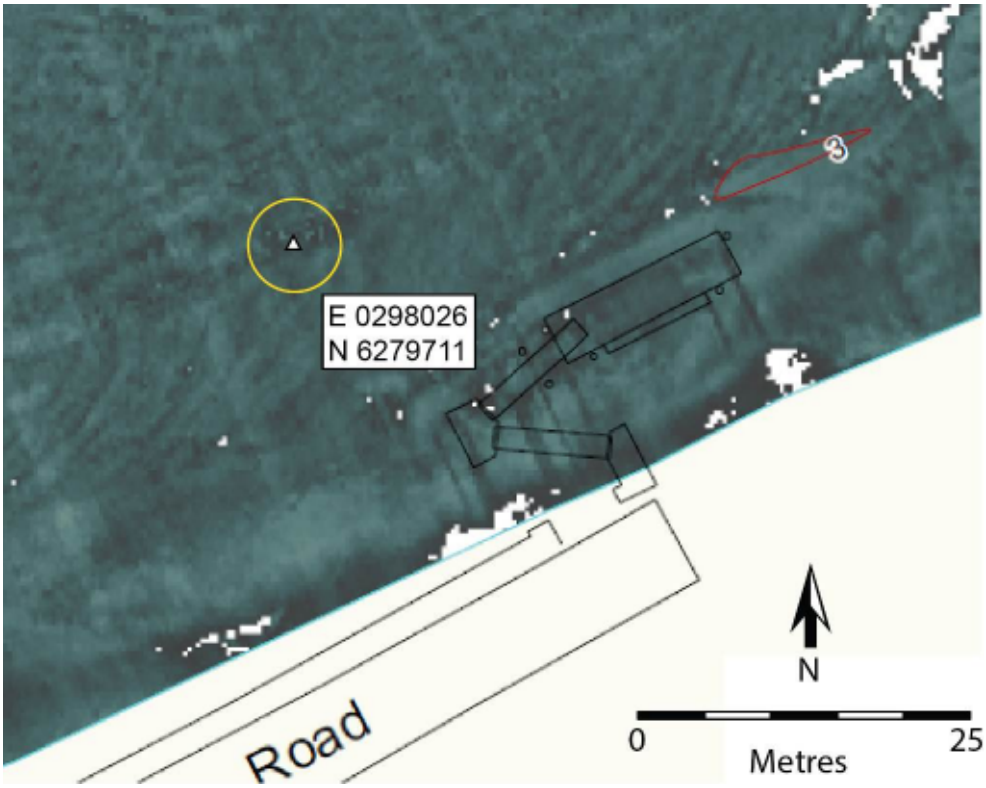


Figure 53: Location of the anomaly South River 1 circular search (white triangle) and the area covered in the search (yellow circle).

Transect 1

Recorder: Chris Lewczak

Location: 56 H N6279665 E0297924

Time in: 12:15 am *Time Out*: 12:31 *Total Time*: 16 min

Max Depth: 2.8 m (@ 20 m) Vis: 0.3m

This transect was placed on the southern side of the river, to the west (upstream) of the current bridge, in the area believed to be where the southern punt landing was located (Figure 54). The side scan sonar results show a platform or ledge present in this area. The transect was

placed at the base of the riverbank in the water (0 m) with the diver beginning at the river end of the transect (20 m). The transect was conducted on a bearing of 160 degrees to the river bank.

The riverbed at 20 m from the bank consisted of a sandy surface that was covered in tree branches and other debris. The riverbed changed closer to the bank, with seagrass and other vegetation growing on the silty sandy riverbed. Closer to the bank the riverbed was covered in debris and silt.

The end of a natural sandstone platform was present at a distance 15 m from the edge of the riverbank. The platform sloped slightly downwards towards the centre of the river, and extended back towards the riverbank, where it was covered by silt and vegetation debris. Another smaller section of sandstone shelving was exposed at a distance of 17 m from the riverbank. The shelving was natural and the diver noted no evidence of the shelve being worked as part of a landing. There was no evidence within the section of the sandstone platform that posts or other features had been embedded into it.

Transect 2

Recorder: Chris Lewczak

Location: 56 H N6279670 E0297940

Time in: 12:42 am *Time Out*: 12:55 *Total Time*: 13 min

Max Depth: 3 m (@ 20 m) Vis: 0.3m

This transect was located 20 m to the east of Transect 1, approximately 20 m away from the current bridge, with the transect on an angle of 160 degrees (Figure 54). The riverbed in this section was similar to that in Transect 1; sandy riverbed with tree debris. The riverbed became siltier with more tree branches and other vegetation debris.

A deposit of cobble stones was located at approximately 12 m out from the riverbank. This was a small isolated deposit of sandstone cobbled, approximately 0.15 m to 0.25 m in diameter.

No cultural material or other remains were noted during this survey.



Figure 54: Location of Transect 1 and Transect 2.

4.3.3 Summary

The maritime archaeological investigation of the seven anomies was able to identify the remains of a timber structure, potential relating to a timber structure or something that has been transported into the area during previous flood events. The timber remains were recorded between 35 and 60 m downstream from the current bridge. There is no historical evidence of a retaining wall being built in this area. An 1890 hydrographic survey of the Hawkesbury River does not show any structure being built in this area, despite the public wharf and a retaining wall on the southern side of the river on the western side of the bridge being depicted (see Figure 12). The 1980 hydrographic survey of the river does show the steep batter slope that was recorded by the divers during this survey (Figure 55). The timber remains were located within or at the base of this slope. The wharf and a retaining wall located on the southern riverbank on the western side of the current bridge were recorded, but no structures on the northern side of the river. It is possible that the remains that are present do not relate before 1890.

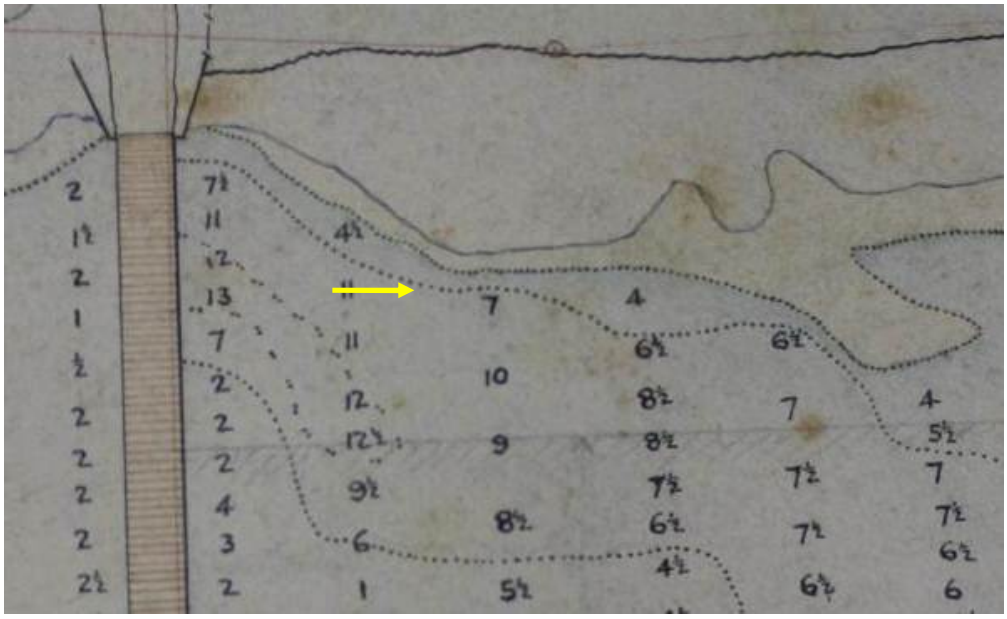


Figure 55: Section of the 1890 survey of the Hawkesbury River (as seen in Figure 12) showing the steep slope (outlined in yellow) as recorded in the 2012 maritime archaeological survey, and no indication of any structure being built in this area.

The 1955 aerial photograph shows a line of moorings, or similar structures, along the northern bank of the river in the vicinity of where the timber remains were recorded (Figure 56). No details can be seen of these possible mooring structures, whether they relate to singular mooring lines, or mooring posts in the river. It is also possible the timber remains were transported into this area from a previous flood event, and then covered with silt and other debris, creating the steep slope that was recorded by the divers in this area.

Two transects in the proposed location of the southern landing for the post 1832 punt operation located a sandstone bench where and side scan sonar anomaly was located. There was no evidence that the sandstone bench had been modified for use in the punt landing, which was most likely as the bench was located 15 m from the current riverbank. The area has silted over closer to the bank, and the sandstone bench could not be seen. No evidence was seen of any posts or other cultural remains that may have been associated with the former punt landing. This area is located close to the western side of the current bridge abutment, and is not expected to be impacted from the construction of the new bridge crossing.

The remaining anomalies identified within the side scan sonar survey were natural localised souring, modern mooring foundations or modern material (trolley).

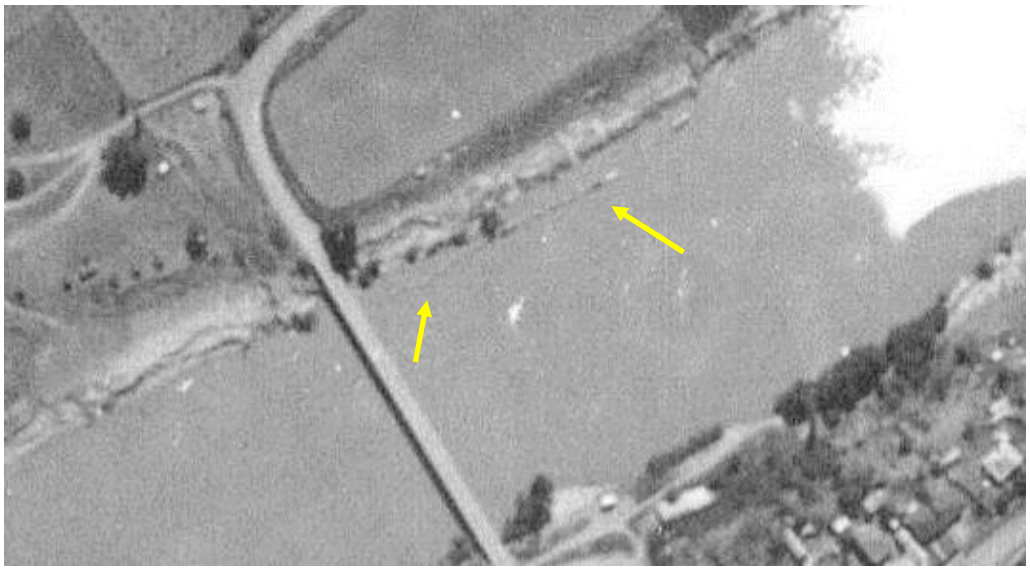


Figure 56: Section of the 1955 aerial photograph (as seen in Figure 22) showing possible moorings along the northern side of the Hawkesbury River in the vicinity.

5.0 Archaeological Potential

In an attempt to understand the archaeological potential associated with the former wharves built at Windsor and the punt crossing, an understanding of the changing formation of the river and geology is required before summarising the archaeological potential that exists for the former maritime infrastructure sites.

5.1 Historical and Present River Depths and Geology

5.1.1 River Depths

Information relating to historical depths of the river and previous dredging or sand mining has been limited and difficult to locate to date. It is known from historical documentation that the Hawkesbury River at Windsor had not been dredged before 1897, with locals in 1897 petitioning the government for dredging to occur.

A hydrographical survey of the Hawkesbury River in 1890 was the earliest known depth recordings of the river. It is likely that earlier depths were taken for the construction of the original bridge crossing in 1874; however, if undertaken, these depth measurements could not be located at the time of this assessment. In the vicinity of the new bridge crossing the depths of the river are given in feet as Spring Low Water adjusted depths. The chart shows the southern side of the river, on an alignment from the middle of the wharf present on the 1890 chart is between 4 ft and 6tf. The water depth becomes shallower in the middle of the river, between 2 ft and 4 ft, before approaching the northern side of the river where there is a deep scour and water depths of 8.5 ft and upwards (see Figure 12).

Geo-technical investigations along an early possible alignment route across the Hawkesbury River at Windsor were undertaken in 2008, 35 m downstream (east) of the current river.[41] The location of these boreholes is approximately halfway between the existing bridge and the current proposed alignment for the new bridge crossing. The seabed depths taken at the time of the geo-technical work show the riverbed being approximately 3 m deep across the river (Figure 57).

Comparing the riverbed depths between the two surveys shows there is a difference in riverbed depths of between 0.7 m and 1.6 m (see Figure 58 and (Table 1). It should be noted that there is a difference between the depths of the riverbed readings, with the1890s hydrographical survey represented as Mean Spring Low depths, and the 2008 geotechnical survey given as Australian Height Datum (AHD) figures. The height of the Mean Spring Low height is known to be 0.7 m AHD. The depths of the riverbed taken during the geo-technical investigation are given as AHD, therefore an adjusted approximate riverbed depth can be deduced by reducing the AHD levels by 0.7 m AHD. The comparison between the two depth readings will use the adjusted AHD heights to provide for an equal comparison.

The difference between the 1890s water depths and the 2008 water depths at the southern (Windsor) section of the river is 1.6 m (deeper than in 1890) in the location of borehole 3 and 1.04 m (deeper than in 1890) at Borehole 4. The difference in the depth of the riverbed at the centre of the river is between 1.54 m (deeper than in 1890) at borehole 5, 0.75 m at borehole 6 and 1.24 m (deeper than in 1890) at Borehole 7. At the northern, Wilberforce, side of the river, the difference between depths of the riverbed are closer together, 0.34 m (deeper than in 1890) at Borehole 8 and only 0. 4 m (deeper than in 1890) at Borehole 9 (see Figure 58 and Table 1).

[41] RTA April 2008, MR182. Bridge over Hawkesbury River at Windsor. Geotechnical investigation for replacement bridge (Report No. G3892).

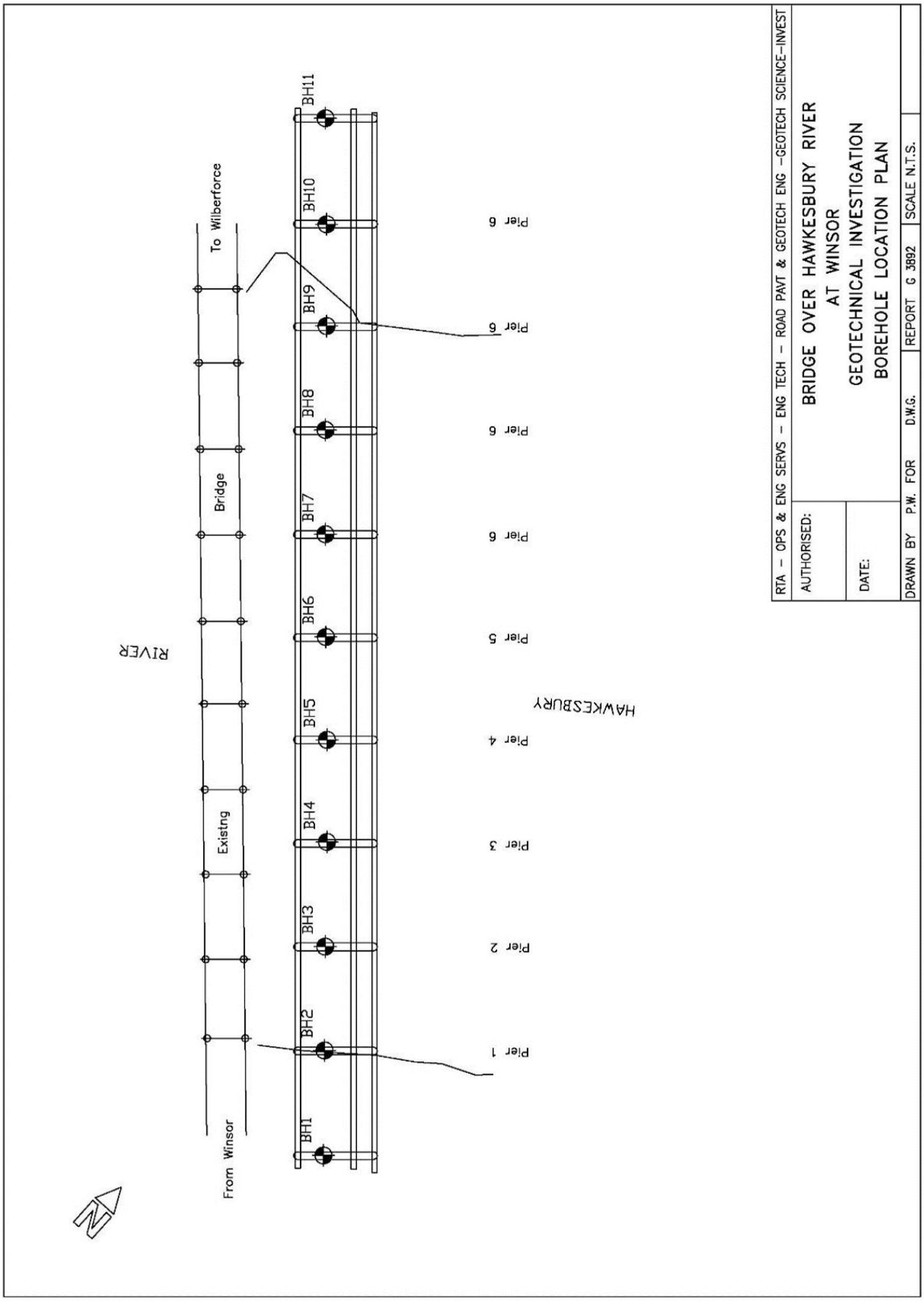


Figure 57: Location of Geotechnical boreholes investigated by RTA in 2008 (Source: RTA 2008:6).

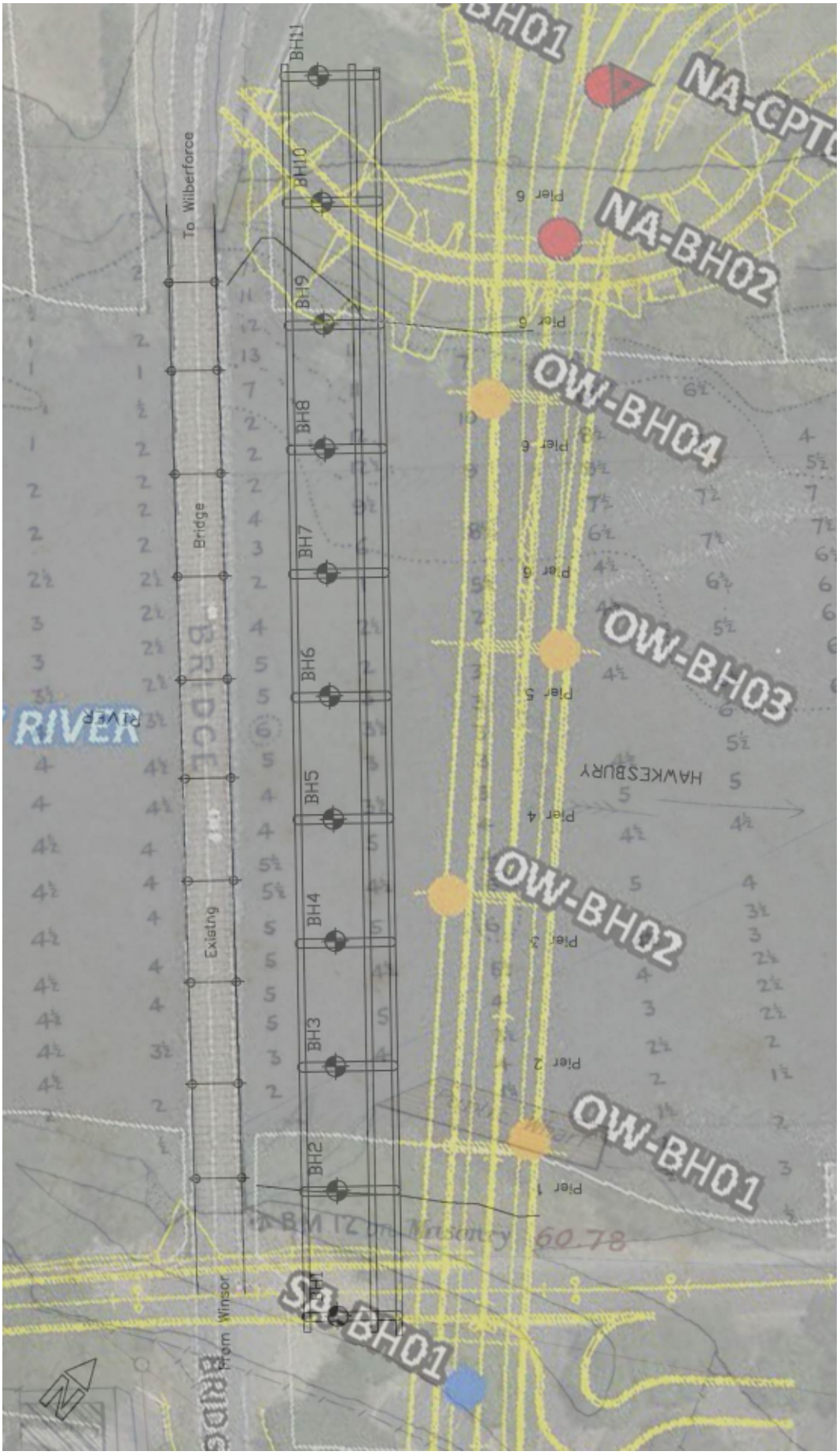


Figure 58: Location of the 2008 borehole (Black and White Boreholes) and the 2012 Boreholes (OW-BH# in colour) overlayed on the 1890 hydrographical survey plan of the Hawkesbury River at Windsor showing the location of the second wharf and 1890 riverbed depths

Geo Tech water depth	1890 water depth	Adjusted MSL difference (minus 0.7 m AHD)
Borehole 3 = 3.5 m (11.4 ft)	4 ft (1.2 m)	+1.6 m
Borehole 4 = 3.24 (10.6 ft)	5 ft (1.5 m)	+1.04 m
Borehole 5 = 3.44 (11.2 ft)	4 ft (1.2 m)	+1.54 m
Borehole 6 = 2.95 (9.6 ft)	5 ft (1.5 m)	+0.75 m
Borehole 7 = 3.14 (10.3 ft)	2 ft (0.6 m)	+1.24 m
Borehole 8 = 4.64 (15.22 ft)	12 ft (3.6 m)	+0.34 m
Borehole 9 = 2.04 (6.7 ft)	4 ft (1.2 m)	+0.14 m

Table 1: Water depth comparison table showing the depth of water during the 2008 geotechnical investigation, the recorded depth of water from the 1890 hydrographical survey, and the change in water depth between the two readings after adjusting the 2008 recording to the Mean Spring Low level (minus 0.7 m).

5.1.2 Geo-technical Data

Two sets of geo-technical borehole data has been collected for this project. The first was in 2008, with more recent borehole data collected in the location of the over water piers more recently in June 2012. The results of the geo-technical borehole data is also useful in determining the nature of the riverbed, as well as providing information on the sediments present for an understanding of the archaeological potential within the area. This analysis will only use the results of the boreholes done within the river during both geo-technical investigations, being boreholes 3 to 9 in the 2008 collected data, and the four overwater boreholes collected in June 2012.

5.1.2.1 2008 Geo-tech data

Seven boreholes were undertaken over the water approximately 35 m downstream of the current bridge, boreholes 3 to 9. The boreholes ran from south to north, from Borehole 3 taken on the southern side of the river, and Borehole 9 immediately adjacent to the northern bank of the river.

The riverbed sediments at Borehole 3 (southern side of the river) show the riverbed to be made up of coarse gravelly sand that has inclusions of fine and medium gravels to a depth of 1.1 m. Below this strata is a fine to coarse sandy gravel to a depth of 2.15 m. At the base of this strata was a 'tree root' or 'timber log'. This was followed by sandstone and siltstone that is described as bedrock.[42]

The riverbed at Borehole 4 is a coarse sand strata that continues to a depth of 2.3 m where the deposit changes to a sandy clay down to a depth of 4.0 m. At this depth coarse gravel is present that sits on top of the bedrock at a depth of 7.3 m.[43]

Boreholes 5, 6 and 7, which make up the three boreholes in the middle of the river, are similar and include pale yellow sand that continues to a depth of 4.05 m below the riverbed. Below

[42] RTA *op.cit*. Borehole Log 3.
[43] *Ibid*, Borehole Log 4.

this strata a gravel and coarse sandy gravel strata is present to a depth of 7.2 m where bedrock is present.[44]

Borehole 8, located near the northern bank of the river, revealed the presence of dark grey to grey clayey sand to a depth of 2.95 m, where a 0.15 m lens of gravel was present. Below this gravel, between 3.10 m and 3.8 m below the riverbed light grey clayey sand is present above sandy gravels to a depth of 7.0 m. At this depth the sandstone and siltstone bedrock is present. [45]

In Borehole 9, located immediately adjacent to the river bank, the riverbed consists of 2.0 m of dark grey clayey sand followed by 2.5 m of sandy gravel strata. At this depth, 4.5 m below the riverbed, a 5.2 m strata deposit of gravel and cobbles is present. This strata is immediately above the sandstone and siltstone bedrock at 9.7 m.[46]

5.1.2.2 2012 Geo-tech data

Four overwater boreholes were undertaken in early June 2012. A borehole was undertaken in the location of each of the piers associated with the new bridge crossing. The boreholes were undertaken from south to north, with overwater Borehole 1 (OW-BH01) in the location of the first in water pier on the southern side of the bridge (Figure 59).

In the location of OW-BH01 approximately 1.60 m of alluvium is present in the area. The first 0.5 m of the deposit consists of dark grey and bottled brown/black fine to coarse grain gravel with traces of organics that is considered to be very loose. This was followed by a deposit of stiff sandy clay that consisted of pale grey and bottled dark grey and orange sand with inclusions of rounded gravel with traces of organics to a depth of 1.60 m. The first bedrock layer is present at 1.60 m

Borehole OW-BH02 was located on the second in water pier from the southern bank. The deposits in this location consist of 1.80 m of very loose brown-grey sandy gravel and sand with some inclusions of gravels. This deposit was preceded by brown-grey sandy gravel that was slightly denser than the top layer. This deposit continued to a depth of 4.2 m where the same material was present only becoming more compacted at 4.2 m, and again at 5.2 m. Bedrock was present at 6.7 m below the river bed.

Borehole OW-BH03, the second of the two central river piers was similar to the deposits found in borehole OW-BH02, however, a sand and gravel deposit was present at 5.9 m extending to bedrock at a depth of 7.5 m below the riverbed.

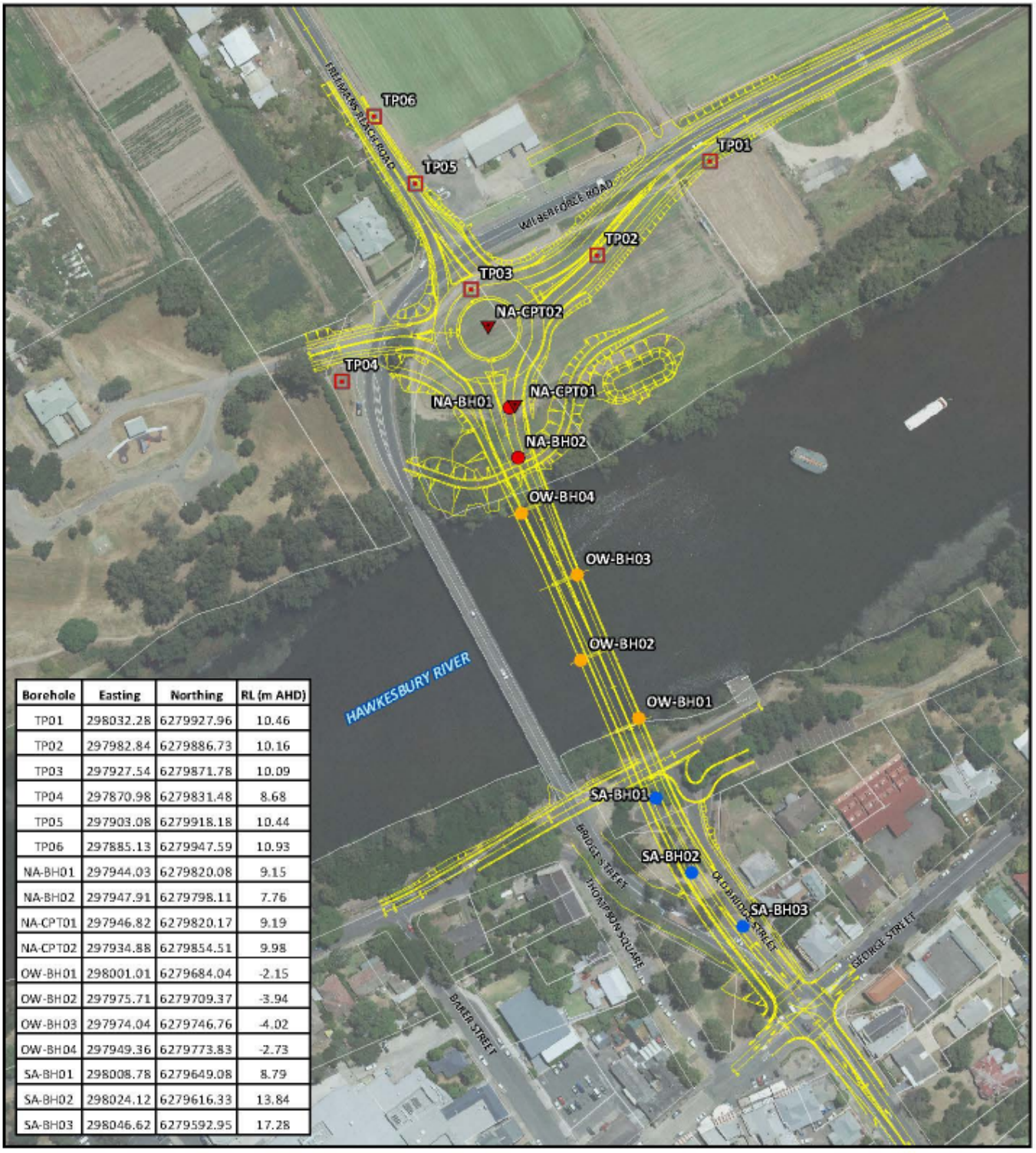
The borehole closest to the northern side of the river, OW-BH-04, consisted of 2.4 m of very loose and fine dark grey sand, followed by a dark grey and mottled brown soft clay to a depth of 3.7 m. From a depth of 3.7 m to a depth of 8.7 m the deposit consisted of dense sandy gravel with inclusions of cobbles/boulders. Bedrock was present at a depth of 8.7 m.

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[44] *Ibid*, Borehole Log 5, 6 & 7.

[45] RTA *opp*. cit, *Ibid*, Borehole Log 8

[46] RTA *opp*. cit, *Ibid*, Borehole Log 9



Borehole	Easting	Northing	RL (m AHD)
TP01	298032.28	6279927.96	10.46
TP02	297982.84	6279886.73	10.16
TP03	297927.54	6279871.78	10.09
TP04	297870.98	6279831.48	8.68
TP05	297903.08	6279918.18	10.44
TP06	297885.13	6279947.59	10.93
NA-BH01	297944.03	6279820.08	9.15
NA-BH02	297947.91	6279798.11	7.76
NA-CPT01	297946.82	6279820.17	9.19
NA-CPT02	297934.88	6279854.51	9.98
OW-BH01	298001.01	6279684.04	-2.15
OW-BH02	297975.71	6279709.37	-3.94
OW-BH03	297974.04	6279746.76	-4.02
OW-BH04	297949.36	6279773.83	-2.73
SA-BH01	298008.78	6279649.08	8.79
SA-BH02	298024.12	6279616.33	13.84
SA-BH03	298046.62	6279592.95	17.28

Figure 59: Location of the Geo-technical Boreholes undertaken in June 2012. The boreholes completed within the river are shown in orange and are numbered (OW-BH#) (Source SKM).

5.2 Comparative Analysis

Cosmos Archaeology has undertaken survey and excavation works alongside wharf sites similar in design and landscape setting to the on the Hawkesbury River site at Windsor. A summary and analysis of the findings of the Bremer River (Ipswich, QLD), and Echuca Wharf (Echuca, Victoria) will be used as they are comparable to the Hawkesbury River site at Windsor. The Bremer River and Murray River sites are historically known to flood and be high current rivers at times, similar to the Hawkesbury River. The Bremer River site is also comparable as the site contained a rock rubble layer, possibly a ballast area, similar to the remains found within the current study area in 2008-9, where artefacts were recorded as being present.

5.2.1 Heart of the River, Bremer River, Ipswich Queensland (2006)[47]

Cosmos Archaeology was commissioned to undertake a maritime archaeological investigation in April 2006 for a proposed riverbank redevelopment along the Bremer River in Ipswich, Queensland. A previous cultural heritage study had identified a number of mid-19th century wharves and associated storehouses on the banks of the river within the boundary of the project area. The site was continued to be used for commercial shipping and ferry activities well into the 20th century. Three wharves were located within the study area including the J and G Harris wharf, the Australian Steam Navigation Company's wharf and the Railway wharf.[48]

A maritime archaeological survey was carried out in January 2006 by Oceania Maritime Consultants in the vicinity of the three former wharves. The results of the preliminary survey found that:

> "…*clear evidence that the Town Reach precinct is rich in archaeological evidence from the mid 19th century that will yield information that contributes to an understanding of Queensland's history, particularly the early development of Ipswich, the Darling Downs and Brisbane Valley*".[49]

Specifically the preliminary survey found:

> "…*a contiguous artefact field that extends 63.5 m along the river on the southern bank incorporating the site of the Harris and ASN wharves, and extending 12m - 17.8m into the river channel. The qualitative density assessment based on surface artefacts estimated that the zone of highest surface artefact concentration occurred within 5m of the riverbank*".[50]

The survey also identified the timber remains of the ASN and J and G Harris wharves. Figure 60shows the extent of the artefact field recorded within the river in relation to the location of the 19th century wharves within the River Terraces development area.

Based on the information obtained in the preliminary assessment, Cosmos Archaeology was engaged to undertake a maritime archaeological survey where the development was to impact on the riverbed.

The survey was undertaken in the location of piling works associated with the proposed development. The locations of the piles were marked with iron rods prior to the maritime

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[47] Cosmos Archaeology (June 2006) *River Heart Phase 1: Maritime Archaeological Investigation*. Report prepared for Ipswich City Council.
[48] *Ibid*:6-7
[49] Oceanic Maritime Consultants, January 2006 *A Preliminary Survey of Three Historic Wharf Sites at Town Reach, Bremer River, Ipswich*. Prepared for the Heritage Branch of the EPA, Queensland:16
[50] *Ibid*

survey being undertaken to concentrate the survey in the impact area. In total 11 piles were located in the river in the location of the former wharf sites. An underwater inspection was undertaken on each proposed pile location, with underwater probing and hand fanning used to identify and excavate artefacts from each pile location. A separate underwater transect was also undertaken to the east of the 11 in-water pile locations to pass through the site of the former Collins Wharf.[51]

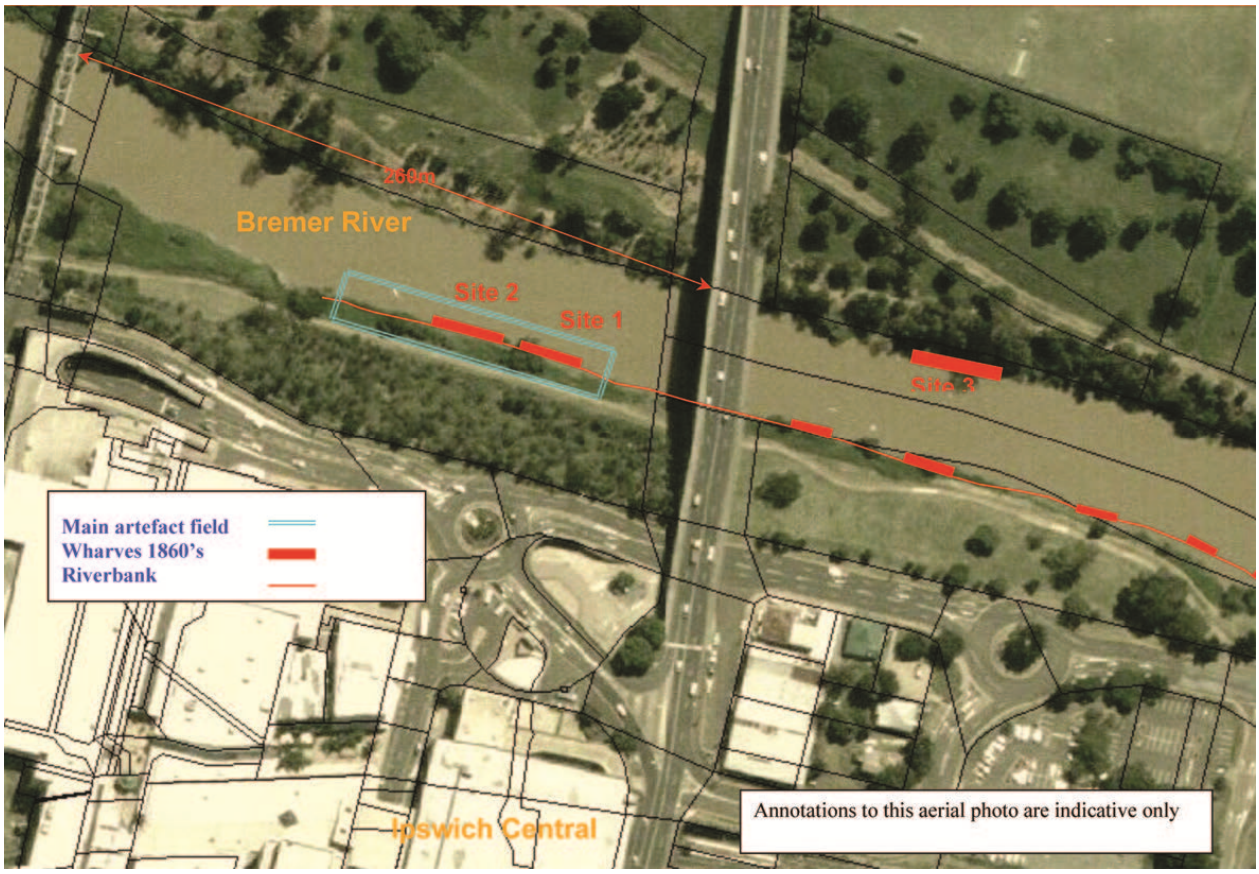


Figure 60: Artefact field from January 2006 preliminary in relation to Harris (Site 1) and ASN (Site 2) wharves (L. Rogers email: 20/3/2006).

The underwater survey in the location of the 11 piles identified rubble sandstone across the riverbed, as well as artefact remains. The rubble sandstone was located below a shallow deposit of silt across the site extending out from the base of the bank. The original function of the rock rubble on the site was unknown, however, it was speculated the source could have been from a formal retaining wall or fill material that had collapsed and deflated across the site, or deliberately in the river and used as ballast between the piles. The size of the rocks are such that they can be lifted by one or two individuals. The assessment argues the rock is likely to be associated with ballasting for the former wharves as similar material was not observed along the riverbank in the vicinity of the other former wharf sites. [52]

Artefacts recorded on the site were present at 10 of the 11 proposed pile locations. The artefacts collected ranged from copper alloy buttons to iron tie rods, and included personal and structural remains. There were a large number of smaller artefacts present within concretions within the rock ballast; including personal items such as copper alloy zipper tag, and a copper alloy broach pin. These items were found at one pile location; however, the report stipulates

[51] *Opp. Cit.,*Cosmos Archaeology (2006):14-16
[52] *Opp. Cit.,* Cosmos Archaeology (2006): 18-30

further personal material may be present in the study area if more accurate excavation techniques were employed.[53]

Heavier structural material recorded on the site included handmade and machine pressed bricks, lead flashing, roofing slate and square shanked nails. This material was attributed to either dropped cargo, remains of demolished nearby buildings or mixed fill. Two wrought iron rods, on large with an eyelet and the other smaller, were also recovered, and were believed to have been structural remains of the former wharf.

The artefacts recovered from the site were not associated with a specific date range – analysis identified a range from prior to 1850 through to the present. No stratification was found within the deposits on the site, and the investigation could not identify if deposits directly occurred onto the site or were redeposited from further upstream or from on land.[54]

The analysis of the site formation process for the study area attributed the collection of artefacts present within the study area to the presence of the rock rubble field. The Bremer River has flooded in its history and is known to be become a fast flowing river. Artefacts were able to fall between the rocks and be held in place, even during times of floods or during other strong currents. The report also assumed with the presence of artefacts on the surface between the rock rubble, there is the potential for artefacts to be present within the rock rubble matrix.[55]

The date the rock rubble was deposited on the site was also considered in the report as having bearing on the archaeological potential for the site. If deposited during the earliest wharf on the site, artefacts from that early period were considered likely to be present, and include artefacts from vessels docked at the wharf and items dropped from the wharf. If the rubble was deposited at a later date, such as from the collapse of a retaining wall, then only artefacts relating from that time, or later, would be captured by the rubble.[56]

5.2.2 Echuca Wharf Maritime Archaeological Test Excavation, Echuca Victoria (2011)[57]

Cosmos Archaeology is currently involved with the proposed redevelopment of the Echuca heritage precinct that includes dredging sections of the river in the vicinity of the current wharf and wet dock area. A maritime archaeological test excavation was required to test for potential artefact remains associated with the former working life of the wharf and or wet dock area. The sediment deposits in the river were identified as being of soft silt sitting on stiff clay. The test excavation was to determine the likelihood for archaeological remains within the softer sediments, and determine the potential for archaeological remains to be present on top of the stiff clay deposit deeper down. It was anticipated that artefacts were likely to have travelled through the softer silts to the more compact stiff clay.[58]

Three underwater trenches were excavated as part of the test excavation work, two trenches within NSW and one trench within Victoria (Figure 61). The trenches were designed to be 2 m x 2 m in size and excavated in 40 cm spits. The deposits of silts over the site were greater than anticipated, the riverbed having been surveyed and probed in late 2010. Of the three trenches,

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53 *Ibid: 31-32.*

54 *Opp. Cit.,* Cosmos Archaeology (2006): 31.

55 *Ibid: 34-37.*

56 *Ibid.*

57 Cosmos Archaeology (December 2011) Underwater Archaeological Investigations at Port of Echuca: Preliminary excavation report. Report prepare for Shire of Campaspe.

58 *Ibid:1-2.*

the two NSW trenches (NSW01 and NSW02) had 3.5 m of silt sitting over the stiff clay deposit, and not the expected 1.75 m. This was similar with the trench located within Victoria (VIC01) which had a further 1 m of silt on top of the site.[59]

Victorian trench, VIC01, was excavated to a depth of 1.44 m. The first 400 mm of the trench consisted of soft silt and other organic material. The excavation continued to a depth of 1 m where the trench was reduced in size to a 1 x 1 m trench as the silt deposit was becoming stiff, and to attempt to reach the stiff clay substrate. At a depth of 1.44 m a blue painted timber planking fastened with copper alloy boat nails was recovered. These were later identified as the remains of the wrecking of the "*Oigle*", which sank at the wharf in the early 1990s and was later damaged beyond repair during dredging. The presence of remains of this wreck were stipulated in the report that this section of the riverbed was not dredged in the mid-1990s, and therefore, it is more likely that artefacts associated with the functioning of the wharf are present below the depth of the wreck. Probing was undertaken at this depth to determine the depth of the stiff clay strata. It was found that this layer was another 2 m below the base of the excavated area, and the excavation in this trench stopped.

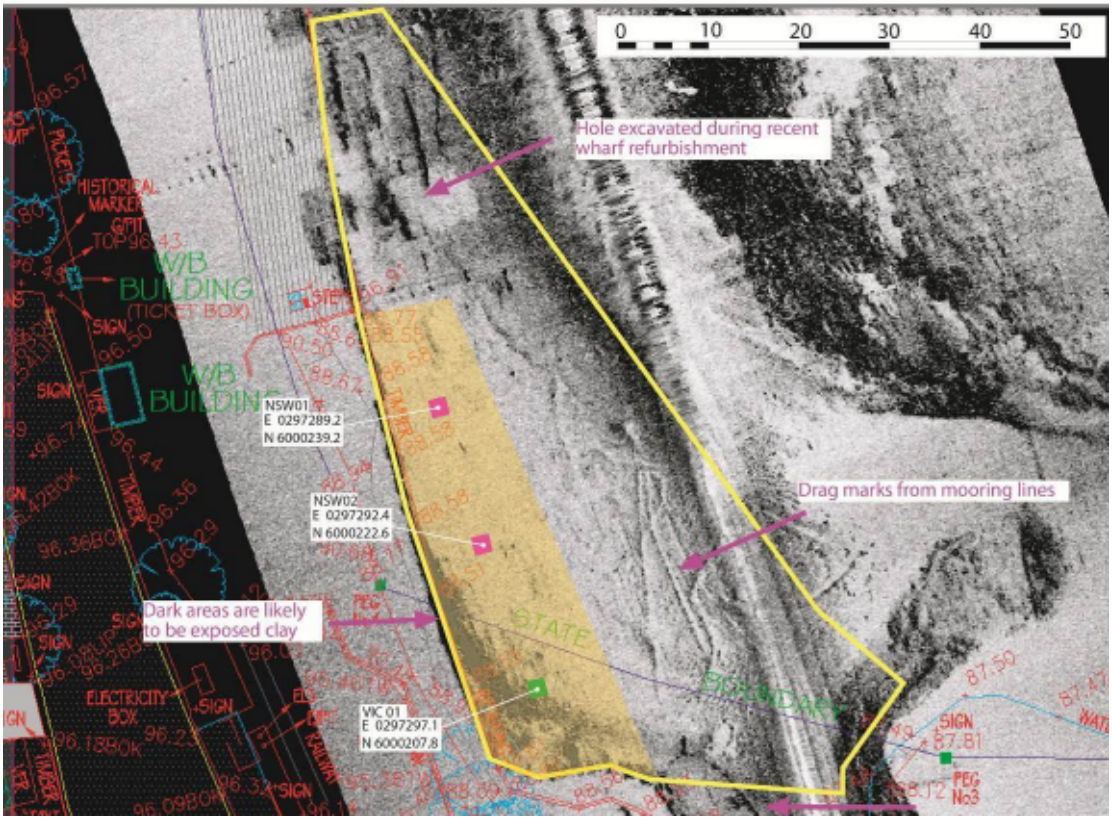


Figure 61: Location of the three test trenches excavated in the vicinity of Echuca Wharf (Source: Cosmos Archaeology).

The first two spits in trench NSW01 contained soft silts to a depth of 800 mm. The next 400 mm spit found the silt became more compact and the size of the trench was also reduced to a 1 m x 1 m trench. Timber cut offs and a heavily corroded bolt were excavated at the base of Spit 3 (120 cm), and a nut also located in Spit 4 (depth between 1.20 and 1.60 m). The excavation continued to the base of Spit 5, at a depth of 2 m below the riverbed. Probing at the base of the trench found the stiff clay - where artefacts were predicted to move through the silts and

59 *Ibid*

rest at - was located a further 1.5 m down. This was at a depth below where the proposed dredging would occur, and as such, the predicted archaeological remains at the depth of the stiff clay would not be impacted.[60]

The third trench, NSW02, was excavated as a 2 m x 2 m trench to a depth of 800 mm (spits 1 and 2). At this stage the trench was reduced in size to a 1 x 1 m trench. The sediments were considered to be sterile until the base of Spit 5 (2 m below the riverbed), where a large cut timber block, 820 mm across and 330 mm wide, with fastenings was recovered which very likely was once part of the Wharf (Figure 62). The sediment at this point was compact sandy silt. The excavation continued to a depth of 2.69 m below the riverbed when very compact gravelly sand was reached. It was considered that no artefacts would penetrate through this strata. Resting on this substrate was a section of ferrous pipe, 30 mm in diameter. Both the timber and ferrous remains indicated the likelihood these sections of the river were not previously dredged to these depths.[61]

The results of the test excavation found there were likely to be archaeological deposits within the proposed dredge footprint of the project area at the level of the stiff clay or gravel base, and these deposits were likely associated with the functioning of the wharf.[62]



Figure 62: Timber block recovered from Spit 5 of test excavation trench NSW02 (Photograph: Cosmos Archaeology Pty. Ltd.).

5.2.3 Summary

The Bremer River maritime archaeological survey identified that archaeological remains are likely to be present between the cobbles that make up the rubble field. The artefacts that were present between them were generally small artefacts, but were protected by the rubble field during flood events or other times when strong currents were present across the site. The date range of the artefacts were from the 1850s to the present, however, the site formation

60 *Ibid:3-4.*
61 *Ibid:3-4.*
62 *Ibid:4.*

processes on the site were largely dependent on when the rock rubble was laid on the site. Artefacts deposited in the river prior to the rock rubble would have been exposed to the flood and other strong current events where artefacts could have feasibly been transported further down the river. The presence of other structural/building remains, such as bricks, roofing slate and wrought iron ties, also suggests that heavier items are less likely to have been removed from the site.

The Bremer River maritime archaeological site is similar to the maritime archaeological site recorded in the vicinity of the second Windsor Wharf. The specific environmental conditions on both rivers are similar, with high historical frequencies of flooding, with the Bremer site revealing the archaeological potential that can exist within a rubble ballast field underneath a wharf site.

The maritime archaeological test excavations at Echuca were able to show archaeological deposits at a considerable depth below the current riverbed, where the riverbed consisted of a soft silt strata. The excavation located archaeological remains 2 m below the current riverbed level, where archaeological deposits may have travelled through the softer silt deposits and settled on the stiffer clay deposits. Despite the area being previously dredged, the artefact deposits were likely to have either travelled further through the deposits, or were located lower in the river prior to the river silting up.

The river strata at Echuca, compact stiff silt underlying soft silt, is similar to that present underneath and immediately around the known location of the second wharf site at Windsor. The Echuca site shows the potential cultural material that exists in similar riverbed strata. Cultural material at this depth is also somewhat protected from the erosional conditions that may remove the soft silt from the site, as seen on the Murray River site. The presence of soft silt below the rubble ballast layer on the Windsor site may also suggest that artefacts that have penetrated the rubble ballast layer may have also worked their way down the top of the stiff silt layer.

5.3 Archaeological Potential

Based on an understanding of the historical development of Windsor, the former and current riverbed depths, geology, and archaeological surveys conducted in 2008 and 2012, an assessment on the archaeological potential present within the river can be prepared. The archaeological potential will be separated into four categories, submerged wharf remains, terrestrial wharf remains, the punt landing and crossing, and the remains identified on the northern side of the river downstream of the current bridge.

5.3.1 Wharf (Submerged)

The survival of artefacts and other archaeological deposits in a marine/riverine environment is subject to the natural and cultural processes that have occurred on the site. Natural processes, in the case of the Hawkesbury River, such as flooding and tidal movement, have the ability to cause sedimentation or erosion activity. Cultural influences can also have a dramatic effect on deposits. It is not known when or how the wharf was removed from the site; however, the activity of demolition can impact on the archaeological potential of the site.

The presence of rock ballast, very likely associated with the earliest forms of the wharf, is a positive indication of the high archaeological potential in this area despite major flooding events. This has been the case with other archaeological sites discussed in this report, such as the Bremer River project. Archaeological material would consist of structural elements and artefacts relating to the working life of the wharf. Structural remains would consist of remains associated with the construction, repair and maintenance of the wharf. This would include pile remains below the ballast layer. The potential for structural remains associated with the former

wharves built in this location is considered to be ***high***. The potential for non-structural maritime archaeological deposits to be present within this ballasted area is also considered ***high*** (see Figure 63).

The potential for archaeological deposits associated with the shipping and transportation of cargo in front of the current wharf is affected by site formation processes that have occurred during and after the lifespan of the wharf. Typically, archaeological deposits associated with vessels berthed at a wharf are located immediately between the wharf and the vessel, or on the opposite side of the vessel toward the middle of the river. The limit of these deposits is based on the width of the vessels berthed at the wharf. It is known that the wharf was built for vessels weighing up to 100 tonnes – with a width of approximately 15 ft (5 m).

Analysis of the changes in the depth of the riverbed immediately to the northwest of the ballast remains associated with the former wharf show the riverbed is approximately between 1 to 1.5 m deeper than in 1890. The geotechnical investigation found the riverbed consisted of gravel sand to a depth of 1.1 m, that was proceeded by a strata of finer sandy gravel to a depth of 2.15 m. The recent geo-technical investigations over this area found that a soft silt deposit was present to a depth of 0.5 m below the ballast layer, followed by a much stiffer and compacted silt layer.

The presence of a stiffer substrate at a depth of 0.5 m, such as sandy gravel or clay based material may indicate the depth where artefacts may penetrate softer silty strata and accumulate. It is possible this layer is compacted enough to hold artefacts on top of or immediately within this strata. Further into the midsection of the river, from borehole 4 onwards from the 2008 geo-technical investigation found the riverbed to be composed of sand. The gravelly sand observed in the mid-section of the river was not recorded closer to the riverbank. This may be due to sand extraction works undertaken in the 1970s or from the natural erosive nature of the river during flood or faster river flows that may have removed lighter sediments.

Based on this analysis, it is likely that archaeological deposits do exist within where the softer gravelly sand is present on the riverbed immediately around the known location of the current wharf. The extent of this area cannot be determined on the available information, however, a buffer area of 5 m around the ballast remains of the former wharf would be considered to contain maritime archaeological potential (see Figure 63). The archaeological potential within this area is considered to be ***moderate.***

5.3.2 Wharf (Terrestrial)

The archaeological potential of the wharf from the bank of the river back landward is difficult to determine at present. There has been vegetation cover over this area, and an uneven layer of fill up to one metre or so above the remains of the wharf is visible from the water. The deck beam protruding from the current bank of the river is close to the former round surface of the functioning wharf. It is also known from the 1814 contract for the construction of the wharf that it included land (deadman) anchors as part of the construction. This points to the possibility that other basal elements associated with the wharf, such as other timber decking, piles or other bracing components like deadman anchors, may be present. However the installation of the Gabion wall in the 1990s may have required some excavation or modification to the bank, which would have resulted in the limited truncation of the terrestrial archaeological resource associated with the wharf.

The archaeological potential for structural remains relating to the former wharves built in this area, particularly of the ca. 1816 wharf, immediately behind the current bank of the river is considered to be ***high*** (See Figure 63).

5.3.3 Punt

Infrastructure

From the historical research, the original punt landings were in the general location of the current bridge. In 1815 the punt left from the new wharf location to a riverbank landing on the northern side until ca.1835 when the location of the punt was moved. The potential for

archaeological remains prior to 1835 to be present is considered to be ***low***. The only infrastructure that is likely to be present from this time is the cutting in the riverbank on the northern side of the river that appears on the early maps.

After the relocation of the punt in 1835 a cable system was established. From the historical record, particularly from photographic evidence, it is anticipated that archaeological evidence of the punt landings still remain completely buried on the upstream side of the current bridge on both the northern and southern bank. The near-water and in-water remains of the punt would have been very limited – a ramp of hardened earth or sandstone paving with timber posts for tying or hauling up, however archaeological remains further up the bank on the northern side may have survived, such as some of the anchors or rugging lanyards that may have since been buried in reclamation. The archaeological potential within this area is considered to be ***moderate*** (See Figure 63)

Archaeological potential along the route

The archaeological potential along the route of the punt is considered to be ***low***. Archaeological potential around maritime infrastructure sites, such as punt landings, occur where most activity is carried out and where the activity is concentrated, which in this case was during loading and unloading on both sides of the river. There is a potential for cultural material to be dropped, accidently or otherwise, during the river crossing, however, the frequency would be less likely as the punt would have spent less time along the route than at the landings. This would not account for specific individual events where items may have been dropped during the route crossing, however, the frequency or opportunity for this to have occurred is far less than material being dropped or discarded in and around the land areas on both sides of the river where most of the activity occurs.

Taking into consideration the changing profile of the Hawkesbury River, the depths of the river away from either riverbank has changed from between - 0.75 m to -1.54 m deeper than recorded in 1890. The riverbed in the midsection of the river consists of sand and fine gravel sand, which has previously been discussed as likely to hold cultural material on or immediately below the riverbed level. The difference in the river profile also suggests much of the riverbed sediments have been removed. Artefacts deposited within this area are likely to have been transported further down the river during flooding or similar events where the currents in the river are at their strongest. Archaeological deposits may have also been removed via other modern processes that are likely to have occurred on the river, such as dredging and/or sand mining.

5.3.4 Northern Side of the River downstream of Bridge

The 2012 archaeological survey within this area identified structural timber remains, as well as singular timber beams. The historical record does not suggest that any retaining wall or similar structure was built in this area. The 1955 aerial does show the potential for a series of moorings in this location, however, the detail of the structures, whether they are individual moorings on anchors with rope to the surface or they are mooring posts in the riverbed. The size of the posts that were recorded, 0.2 m by 0.2 m, would not suggest that these were used as a retaining wall, or possibly even for mooring posts within the river.

It is possible that the timber remains were deposited during a flood and have since become covered with silt at within the steep batter in front of the river. If deposited in this location from previous flood events, the provenance of the material deposited is unknown and is unlikely to add any additional information to the history of the use of the Hawkesbury River and the settlement at Windsor. If the remains are associated with the ca.1950s moorings or previously unknown retaining wall, the archaeological potential in this area is likely to be ***low*** and have no archaeological research value.

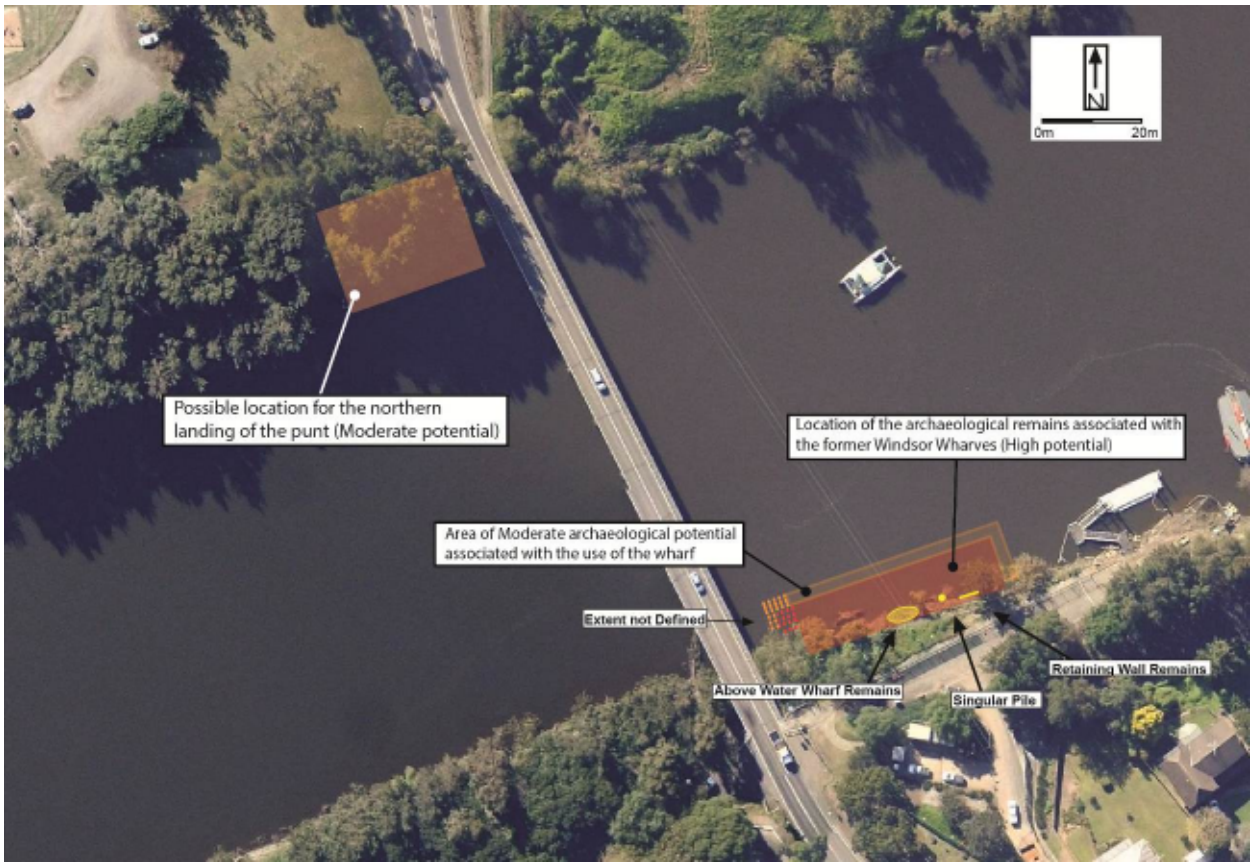


Figure 63: Areas of archaeological potential, showing the location of known remains of the former ca.1814 Windsor wharf and possible northern landing of the punt remains.



Figure 64: 1888 photograph of Windsor Bridge looking onto the south bank. The wharf is clearly shown on the left. To the right of the bridge a separate road can be made out immediately adjacent to it that leads to a beach area, believed to be the southern landing of the former punt (www.council.hawkesbury.nsw.gov.au/gwsSpatial/gws/gwsspatial.htm).

6.0 ASSESSMENT OF SIGNIFICANCE

6.1 Introduction

An assessment of cultural significance or heritage significance seeks to understand and establish the importance or value that a place, site or item may have to select communities and the general community at large. The Australian ICOMOS *Charter for the Conservation of Places of Cultural Significance* (the *Burra Charter 1979,* most recently revised in 1999), is the standard adopted by most heritage practitioners in Australia when assessing significance. It defines cultural significance as:

"Aesthetic, historic, scientific or social value for past, present or future generations." [63]

This value may be contained in the fabric of the item, its setting and relationship to other items, the response that the item stimulates in those who value it now, or the meaning of that item to contemporary society.

Accurate assessment of the cultural significance of sites, places and items is an essential component of the NSW heritage assessment and planning process. A clear determination of a site's significance allows informed planning decisions to be made for place, in addition to ensuring that their heritage values are maintained, enhanced, or at least minimally affected by development.

Assessments of significance are made by applying standard evaluation criteria:

European Cultural Heritage Significance Criteria (NSW Heritage Office Guidelines)

a. *An item is important in the course or pattern of NSW's cultural or natural* ***history*** *(or the cultural or natural history of the local area);*

b. *An item has strong or special* ***associations with*** *the life or works of* ***a person, or group of persons, of importance in NSW' cultural or natural history*** *(or the cultural or natural history of the local area);*

c. *An item is important in demonstrating* ***aesthetic characteristics*** *and/or a high degree of* ***creative or technical achievement*** *in NSW (or the local area);*

d. *An item has strong or special* ***associations with a particular community or cultural group*** *in NSW (or the local area)* ***for social, cultural or spiritual reasons****;*

e. *An item has* ***potential to yield information*** *that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);*

f. *An item possesses* ***uncommon, rare or endangered*** *aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);*

g. *An item is important in* ***demonstrating*** *the* ***principal characteristics of a class of NSW's cultural or natural places****; or cultural and natural environments.* [64]

6.2 Evaluation

The cultural heritage significance of the wharves built at Windsor and the punt crossing are assessed below as two separate listings. The following evaluations provide the cultural heritage significance of the wharves at Windsor and the punt using the criteria presented in Section 6.1.

[63] Australia ICOMOS Inc. (1999) *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance.* Article 1.2.
[64] NSW Heritage Office & Department of Urban Affairs & Planning [2001] *NSW Heritage Manual – Assessing Heritage Significance*

6.2.1 Windsor Wharf (1795 – ca. 1800 and ca. 1814 – ca. 1940)

Criterion a) *An item is important in the **course or pattern** of NSW's **cultural or natural history** (or the cultural or natural history of the local area)*

The construction of a wharf at Windsor was an integral part of the establishment and development of firstly dispersed frontier farming and then the township. The first wharf constructed in 1795 was used to supply the military garrison and first store built in the location of Thompson Square. By this time the surrounding area was being used for farming purposes, and the wharf was likely used to transport crops out to the settlement in Sydney. This mode of transport was likely faster than the overland route that was not formally established until 1816.

The construction of both wharves at Windsor are associated with the survival of the early colony, providing a means of transporting agricultural crops out of the greater Windsor area back to the main settlement at Port Jackson.

Both of the wharves built at Windsor (1795 and ca.1814) are considered to be ***State significant*** under this criterion on the basis they formed part of critical transport and trade infrastructure for one of the earliest European settlements in Australia, a settlement which was important for the survival of Sydney as a viable colony.

Criterion b) *An item has strong or special **associations with** the life or works of **a person, or group of persons, of importance in NSW' cultural or natural history** (or the cultural or natural history of the local area);*

The second wharf at Windsor in ca.1814 was associated with Governor Macquarie who commissioned its construction in 1814. Three years earlier Macquarie developed a plan for formation of a township at Windsor, as well as four other townships on the Hawkesbury River. While it was not in the original plan for the establishment of a formal town, the need for adequate loading facilities on the river was later identified and endorsed by Governor Macquarie. The wharf was built by John Howe and James McGrath, both early land grantees at Mulgrave (Windsor), who also improved the road from Parramatta to Windsor and searched for an overland route to the Hunter River. After the wharf was damaged in a flood in 1816, Macquarie ensured the survival of the wharf by granting further funding to complete the wharf.

The second wharf at Windsor has a strong association with Governor Macquarie, who is an important figure in the history of NSW, and as such the wharves built at Windsor are considered to be ***State significant*** under this criterion.

Criterion c) *An item is important in demonstrating aesthetic **characteristics** and / or a high degree of **creative or technical achievement** in NSW (or the local area);*

Limited archaeological remains associated with the ca.1814 wharf are visible from the current road bridge or via boat. These remains are limited to the lower support components of the wharf, such as bracing and deck beams, and are not considered to be aesthetic characteristics or show a creative or technical achievement. As much of the former wharf site is likely only to exist within the archaeological record, including on and below the riverbed, the former wharves are not considered to meet the requirements of this criterion.

Criterion d) *An item has strong or special **associations with a particular community or cultural group** in NSW (or the local area) for **social, cultural or spiritual reasons**;*

The presence of a wharf at Windsor, in 1795 and the later ca.1814 wharf was used for the supply of the early land grants and later formal settlement at Windsor, as well as to assist in transporting agricultural crops out to the settlement at Parramatta and Sydney. The evolution of the wharf from a major transportation hub for cargo and passengers continued until the early twentieth century. Although the wharf was used by the larger community for transportation needs, there were no single particular community or cultural groups who can be associated with either of the wharves built at Windsor. As such the wharves built at Windsor are not considered to meet the requirements of this criterion.

Criterion e) *An item has **potential to yield information** that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);*

Archaeological potential relating to the construction and use of both the 1795 and ca. 1814 wharf is expected to exist on site. Limited historical information exists to the construction of both wharves built at Windsor that can be answered from potential structural remains. Physical evidence that has survived in the archaeological record has the potential to provide new information relating to construction techniques and material that were used, specifically in relation to types of wood used, fastenings, bracing and pile information as well as quality of workmanship and materials. Information relating to repair work to the wharf can also be determined from the remains in the archaeological record on wharf sites, such as from the driving in of repair "sister" piles or the addition of extra bracing or fastenings.

Artefacts discarded, accidentally or deliberately, from the wharf and vessels moored alongside can contribute towards knowledge of the variety of traffic and goods that passed through this portal between Windsor and Sydney over time.

The archaeological site associated with the former wharves built at Windsor, both above and below the low water line has the potential to contribute to a greater understanding of settlement before and during the Macquarie era. As such, the archaeological site associated with both former wharves built at Windsor is considered to be ***State significant*** under this criterion.

Criterion f) *An item possesses **uncommon, rare or endangered** aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);*

The archaeological site associated with the former Windsor wharves is considered to be a rare and endangered archaeological resource. Wharf redevelopment within major ports and harbours has occurred continuously as required to maintain the function of the port area. Through this process infrastructure is updated and wharves are demolished and rebuilt. Wharf sites along major rivers and secondary ports are likely to exist, both intact and as an archaeological resource, as redevelopment of these sites is less likely to occur over the development of other transportation advances, such as rail or road infrastructure. Aspects of the wharf that are present in and behind the riverbank at Windsor are likely to be intact, and relate to design and construction techniques that relate directly to the early settlement of NSW that have since evolved.

The physical and archaeological remains of the former wharves built at Windsor are considered to be ***State significant*** under this criterion.

Criterion g) *An item is important in **demonstrating** the **principal characteristics of a class of NSW's cultural or natural** places; or cultural and natural environments.*

The site of the former wharves at Windsor are represented by fragmentary remains that can be seen from certain vantage points, such as on the river, the primary remains of the wharves likely to be present within the archaeological record. As such, the site is not considered to retain the principal characteristics of its type or design. As such, the wharves at Windsor are not considered to meet the standards of this criterion.

Statement of cultural significance

The presence of a wharf at Windsor was an important infrastructure development that was part of the early settlement and development of the township. The construction of the first wharf in 1795 allowed for supplies to be unloaded safely at the early store and military garrison, while allowing for farm crops to be exported out. The construction of a more substantial wharf in ca.1814 as part of the formalisation and development of the Macquarie town reinforced the importance of the settlement and the need for maritime infrastructure as part of that plan. The wharf was an integral part of the Windsor township until the expansion of rail to Windsor and larger maritime infrastructure at Brooklyn on the Hawkesbury River meant the use of the wharf was likely limited to public recreational uses. The archaeological resource present on the site is considered to be a rare and endangered resource that can provide new information into the design and construction types of wharves in the early settlement of NSW, and Australia.

6.2.2 Punt Crossing

Criterion a) *An item is important in the **course or pattern** of NSW's **cultural or natural history** (or the cultural or natural history of the local area);*

A crossing of the Hawkesbury River at Windsor is likely to have begun as an informal crossing before 1795 when the first Government store and military garrison were built in the area now known as Thompson Square. The construction of a wharf at this time also created a focal point where crossings from the southern side of the river could be made by boat. This allowed supplies to be taken to the agricultural farms on the northern side of the Hawkesbury River, while also sending crops to the southern side to be transported out via the wharf.

A formal punt was also established in ca.1814 with the formal laying out of the township of Windsor and the construction of a new wharf. The punt used the wharf on the southern side of the river, as well as the adjacent banks to help load supplies and unload agricultural goods to be loaded onto larger boats at the wharf. The wharf would have been the focal point for transportation in and out of Windsor, as the punt allowed for local transportation of people and goods within the greater local area. Other punts were present on the Hawkesbury River, namely at Pitt Town (1812) and North Richmond (1821); which meant the punt was used primarily by local residents.

The punt service ceased operation after the construction of the Hawkesbury River Bridge in 1874. The punt crossing of the Hawkesbury River at Windsor is considered to be of ***Local significance*** under this criterion on the basis that it serviced the local economy throughout most of the 19th century.

Criterion b) *An item has strong or special **associations with** the life or works of **a person, or group of persons, of importance in NSW' cultural or natural history** (or the cultural or natural history of the local area);*

The punt crossing at Windsor on the Hawkesbury River was established at the same time as the construction of the second wharf. Operating for the greater local patronage between Pitt Town and Richmond, the wharf was used by local farmers wanting to access the main township or the wharf. The punt crossings are not considered to have a special association with a particular person or group of persons of importance in NSW's history or the local area, and therefore are not considered to meet the requirements of this criterion.

Criterion c) *An item is important in demonstrating aesthetic **characteristics** and / or a high degree of **creative or technical achievement** in NSW (or the local area);*

The remaining elements of the operation of a punt at Windsor are restricted to the potential archaeological resource present on the northern and southern banks of the Hawkesbury River. As such, the punt is not considered to meet the requirements of this criterion.

Criterion d) *An item has strong or special **associations with a particular community or cultural group** in NSW (or the local area) for **social, cultural or spiritual reasons**;*

The presence of an operating punt at Windsor from ca.1814 to 1874 was used by the inhabitants of Windsor and the greater agricultural community between Pitt Town and Richmond. Prior to the construction of a bridge across the Hawkesbury and other than private boat landing on the banks of the river, the punt was the only formal crossing. Used to transport people, supplies and farming produce, the punt at Windsor was integral for local transport.

The punt crossing of the Hawkesbury River at Windsor is considered to be of ***Local significance*** under this criterion.

Criterion e) *An item has **potential to yield information** that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);*

Archaeological potential relating to the landing areas of the punt crossings is likely to be present on site. There is limited historical information relating to the operation of the punt that archaeological evidence may be able to supplement. The archaeological information, however, is likely to be limited to the landing features at one or both sides of the river. The exact location of the northern landing is unknown from the historical record that could be answered from the archaeological record. Infrastructure required for the punt was minimal as the punt was propelled by oars and poles not via windless cable system.

The punt crossing of the Hawkesbury River at Windsor is considered to be of ***Local significance*** under this criterion.

Criterion f) *An item possesses **uncommon, rare or endangered** aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);*

The archaeological remains associated with the former punt operation at Windsor would be considered a rare archaeological resource. The archaeological remains associated with a punt crossing, however, are considered to be limited, relating to the landings and associated infrastructure at either end. The information that would be gathered from archaeological remains of the punt would mostly relate to the cultural heritage of the local area only. As such, the archaeological remains associated with the former punts at Windsor are considered to be of ***Local significance*** under this criterion.

Criterion g) *An item is important in **demonstrating** the **principal characteristics of a class of NSW's cultural or natural** places; or cultural and natural environments.*

The sites of the former punt crossing at Windsor are likely to be represented by remains present in the archaeological record. As such, the site is not considered to retain the principal characteristics of its type or design, and the former punt at Windsor is not considered to meet the standards of this criterion.

Statement of cultural significance

The former punt crossing at Windsor on the Hawkesbury River was established in 1816 at the same time as the second wharf. The punt operated in an area opened up for agricultural settlement in 1795 and a formal township in 1812. The punt serviced an area between the Pitt Town punt (1812) and the North Richmond punt (1821) and allowed for residents on the northern side of the Hawkesbury River to access the township, the road to Parramatta, as well as the wharf for bringing our exporting agricultural materials to and from Sydney. Replaced by the bridge built across the river at Windsor in 1874, the punt was a vital piece of maritime transport infrastructure for the greater local area.

7.0 IMPACT ASSESSMENT

The following section identifies the impact of the project on the cultural heritage significance of the archaeological remains within the study area.

In particular the assessment focused on the impact the project would have on the known and potential archaeological remains associated with the former wharves, punt crossing and other associated cultural material.

Specifically the proposed works would involve (see Figure 65 to Figure 68):

- Construction of a replacement bridge over the Hawkesbury River at Windsor, around 35 metres downstream of the existing Windsor bridge.
- Reconstruction and upgrading of existing intersections and bridge approach roads to accommodate the replacement bridge, including:
  - Removal of the existing roundabout and installation of traffic signals at the intersection of George and Bridge Streets.
  - Construction of a new dual lane roundabout at the intersection of Freemans Reach Road, Wilberforce Road, northern bridge approach road and the access road to Macquarie Park. All roads serviced by the new roundabout would require minor realignments.
  - Realignment of the southern and northern bridge approach roads. The new southern bridge approach road would generally follow the alignment of Old Bridge Street along the eastern side of Thompson Square. The northern bridge approach road would be a new road connecting the bridge to the new dual lane roundabout.
- Construction of a shared pedestrian/cycle pathway for access to and across the replacement bridge.
- Removal of the existing bridge approach roads and then backfilling, rehabilitating and landscaping these areas.
- Demolition of the existing Windsor Bridge including piers and abutments.
- Landscaping works within Thompson Square parkland and adjacent to the northern intersection of Bridge Street, Wilberforce Road, Freemans Reach Road and the access road to Macquarie Park.
- Redevelopment of part of The Terrace to provide continuous access along the southern bank of the river and under the replacement bridge to Windsor Wharf.
- Construction of scour protection works on the southern and northern banks and around three bridge piers.
- Construction of a permanent water quality basin to capture and treat stormwater runoff from the bridge and northern intersection prior to stormwater being discharged to the Hawkesbury River.
- Architectural treatments for noise mitigation, as required, where feasible and reasonable and in agreement with affected property owners.
- Ancillary works including:

- Adjustment, relocation and/or protection of utilities and services, as required.
- Construction and operation of temporary construction, stockpiling and compound sites.

In addition to the above-listed work elements, early works for further identification, salvage, recording and protection of Aboriginal and non-Aboriginal heritage, would be carried out as part of impact mitigation for the project. These early works would include:

- Salvage excavation at identified Aboriginal heritage sites on the southern bank of the river in accordance with the procedures identified in the Aboriginal heritage chapter of the Environmental Impact Statement for the project.
- Recording and protection of historic heritage in accordance with the procedures identified in the historic heritage chapter of the Environmental Impact Statement for the project.

The replacement bridge and intersections

The replacement bridge would be located around 35 metres downstream of the existing Windsor Bridge. The southern bridge approach road would be via a new realigned section of Bridge Street, which would start at the existing intersection of George Street and Bridge Street and head generally north-west along the alignment of Old Bridge Street on the eastern side of the Thompson Square parkland. The existing roundabout at the George Street and Bridge Street intersection would be replaced by traffic signals. The replacement bridge would connect with the junction of Wilberforce Road, Freemans Reach Road and the Macquarie Park access road at a new dual lane roundabout intersection.

The replacement bridge would be an incrementally launched bridge constructed of reinforced concrete and comprising five spans. The bridge deck would be about 15.5 metres wide and be supported on up to four piers in the river. It would have an overall length of about 160 metres, spanning both the river and The Terrace. This would enable The Terrace to be reconnected to provide vehicular, pedestrian and cyclist access to Windsor Wharf. The clearance under the bridge where it spans The Terrace would be about 3.6 metres, which would allow a range of service and emergency vehicles to pass under the bridge and access Windsor Wharf.

The replacement bridge would initially comprise two traffic lanes (one in each direction), each about 3.5 metres wide and with an adjacent two metre wide shoulder. There would also be a three metre wide shared pedestrian/cycle path on the western side of the bridge. The two metre wide road shoulders of the replacement bridge would allow the bridge to be re-configured to a three lane bridge in the future, when required. The introduction of the three lane configuration would occur when additional traffic capacity is required. The three traffic lanes would consist of two southbound lanes and one northbound lane.

The low point of the replacement bridge would be around 9.8 metres Australian Height Datum (AHD), making it around 2.8 metres higher than the lowest point of the existing bridge. The height of the replacement bridge may change slightly during the detailed design phase. This would give the replacement bridge a slightly higher level of flood immunity than the existing bridge. While the existing bridge is overtopped in a one in two year flood, the replacement bridge is predicted to remain above water for the one in two year flood but be overtopped in an event just smaller than the one in three year flood. This level of flood immunity is consistent with that of the northern approach roads (Wilberforce Road and Freemans Reach Road), which have a flood immunity that lies about midway between the one in two year and one in three year flood levels.

Demolition of the existing bridge

The existing Windsor bridge would be removed following commissioning of the replacement bridge and associated bridge approach roads. The existing bridge superstructure and substructure would be removed in sections, with temporary bracing installed, as required, to maintain the stability of remaining sections during the demolition process. Where possible the process of demolition would involve cutting or dismantling the superstructure and substructure into sections, with each section transported off-site for further demolition at an appropriately approved and licensed facility. Where possible the dismantled bridge elements would be reused or recycled, however some components of the bridge would require disposal at a landfill. Lead based paint has also been found on the bridge, so demolition activities would need to comply with relevant standards for managing lead based paint. Disruption of waterway traffic would be limited to the greatest extent practicable, with alternative navigation channels provided while the existing navigation span is closed for the demolition works.

Pedestrian and cyclist facilities

The project would incorporate facilities for pedestrians and cyclists and include a shared pedestrian/cycle pathway that would be constructed from Wilberforce Road and Macquarie Park, across the western side of the replacement bridge and southern approach road to the corner of George and Bridge Streets. Pedestrian and cyclist access along the southern bank of the river would also be improved with the connection and redevelopment of The Terrace. In addition, the following general works would be undertaken to improve pedestrian safety and access:

- Provision of a new 1.2 metre wide footpath adjacent to properties fronting Old Bridge Street.
- Provision of a new signalised pedestrian crossing on all four approaches to the intersection of Bridge Street and George Street.
- Provision of new pedestrian footpaths for safe access around and across the proposed dual lane roundabout at the junction of Freemans Reach Road, Wilberforce Road and the Macquarie Park access road including a path under the northern bridge abutment.

Water quality basin

The project would include construction of a permanent water quality basin to capture and treat stormwater runoff from the bridge and northern intersection prior to stormwater being discharged to the Hawkesbury River. The water quality basin would be located on the eastern side of the proposed roundabout at the junction of Freemans Reach Road, Wilberforce Road and the Macquarie Park access road.

For the southern approach road a trash net to collect litter and a shut-off-valve to contain any spills in the stormwater system would be installed at the discharge point of the drainage system near Windsor Wharf.

Scour protection

Scour protection would be provided to protect the bridge abutments and piers from the erosive impacts of high river flows. On the southern bank, the scour protection would consist of a concrete panel retaining wall between Windsor Wharf and the existing bridge. Large diameter

rocks (900 millimetres) and/or sandstone blocks would also be used to provide scour protection in some locations on the southern bank.

On the northern bank extensive rock and sandstone block scour protection would be required extending up the bank to about five meters above the usual water level. Other forms of scour protection such as a concrete grid planted with grass would be installed in areas above this where scour protection is required.

Scour protection using large rocks would be provided around three of the four bridge piers. Scour protection for each pier would cover an eight metre radius and would be to a depth of 4.5 metres. Dredging around the piers would be required to place the rocks below the river bed level. For the southernmost pier little or no scour protection would be required as bedrock is close to the surface in this location.

During the detailed design phase further work would be undertaken to minimise the visual impact of all visible scour protection.

Public utility works

The existing bridge supports a number of public utilities which would be replicated on the replacement bridge including:

- A 450 millimetre water main (cement lined steel pipe).
- A 50 millimetre sewer rising main (galvanised iron pipe).
- A 100 millimetre electrical conduit.
- Telecommunications conduits (3 x 80 millimetre galvanised iron conduits).

Other public utilities that may need to be adjusted as part of the project include:

- High voltage overhead power lines from Macquarie Street to Wilberforce Road which cross the river on a similar alignment to the replacement bridge. These power lines would need to be relocated prior to bridge construction.
- Power lines near the corner of Wilberforce Road and Freemans Reach Road.
- Local stormwater drainage infrastructure.
- A rising main from Windsor Wharf to the local sewer system, which is used to pump out boat sewage holding tanks.
- A gravity sewer main, which runs beneath Old Bridge and Bridge Streets.
- A number of water mains on both the northern and southern river banks.
- Street lighting on both the northern and southern river banks.
- Telstra assets located on both sides of the river. In particular, Telstra assets located near the proposed southern bridge abutment would need to be relocated prior to construction of the bridge abutment.
- A new recycled water main for future use if required.
- Traffic signal cables along Bridge Street between George Street and Macquarie Street.

Urban and landscape concept design

The urban design and landscape concept design associated with the project was developed by applying project specific urban design principles and treatments. Works associated with the current concept design are described below.

Southern bank and Thompson Square area
At this stage of project development, the scope of works in Thompson Square parkland has yet to be fully defined and would be subject to further consultation with the community, government stakeholders and most importantly Hawkesbury City Council – who would be responsible for managing Thompson Square parkland in the longer term. For the purposes of assessment in the EIS, preliminary urban design and landscaping works for Thompson Square have been identified. These works have been developed with the objectives of providing pedestrian and cyclist access from the replacement bridge to various areas in Thompson Square and providing a base for additional urban design and landscaping works arising from the consultation process. The consultation process for the additional urban design and landscaping works for Thompson Square is ongoing and if possible the full scope of works would be presented and assessed in the Submissions Report. However, it is recognised that the full scope of works may not have been agreed before the completion of the Submissions Report and a post-approval Urban Design and Landscaping Plan for Thompson Square parkland maybe be required.

The scope of works assessed in the EIS include:

- Infilling the southern approach road to the existing bridge.
- Removal of some trees which are either in poor condition or would be impacted by the project.
- Minor earthworks in the Thompson Square lower parkland area to improve the connection of the parkland to the river.
- Construction of stairs from the bridge pedestrian/cyclist path to The Terrace and from Thompson Square road to The Terrace to provide pedestrian access.
- Reinstatement of the section of The Terrace and river bank currently bisected by the existing bridge and approach roads.
- Planting of trees and other vegetation in Thompson Square parkland.
- Landscaping in the road reserve between the three properties on Old Bridge Street and the southern approach road.

Bridge
The project specific urban design principles have been used to refine the visual appearance of the replacement bridge. This includes refinements to the pier shape, bridge superstructure and abutments to minimise its visual impact and provide context to the heritage values of Windsor.

Northern bank

- Infilling the northern approach road to the existing bridge.
- Minor earthworks to improve the visual appearance of the bank.
- Construction of pedestrian/cyclist paths to Wilberforce Road and Macquarie Park.
- Planting of trees and other vegetation.

Construction works

Temporary construction and compound sites

There would be two main construction and compound sites required for the duration of the project (about 18 months, excluding pre-construction and early works). One of these sites

would be located within the turf farm between the Hawkesbury River and Wilberforce Road (Lot 2 DP 1096472 and Lot 2 DP65136); while the other would be sited on land between Old Bridge Street and Windsor Wharf (refer to Figure 1-1). The majority of the construction activity would be concentrated on the northern bank as this would be the location of casting yard for the incrementally launched bridge and would be the location where access to the river would predominately occur.

The construction compound on the southern bank would be located in the car parks and grassed areas and would support the construction of the southern approach road and other minor works.

Offices may be leased near Thompson Square for construction personnel.

Order of Construction Works

The order of construction works would be implemented to minimise environmental and traffic impacts as far as practical. The likely order of construction works would consist of the following:

- Pre-construction activities and early works – including construction compound and casting bed establishment, installation of environmental controls, public utility relocations or adjustments and additional investigations and heritage salvage.
- Construction of the bridge - including construction of the piers in the river, two bridge abutments and construction and launching of the bridge superstructure.
- Installation of scour protection on the banks and in the river.
- Construction of the northern roundabout and approach road and most of the southern approach road.
- Construction of temporary pavement both at Wilberforce Road and near the corner of George and Bridge Streets to provide additional road width to enable construction of the subsequent stages.
- Construction of the remainder of the southern approach road and the new sections of Freemans Reach Road, Wilberforce Road and Macquarie Park access road.
- Commissioning and opening of the replacement bridge to traffic.
- Demolition of the existing bridge and urban design works in Thompson Square, on the southern bank, northern bank and other adjacent areas.
- Removal of temporary structures and demobilisation of the construction facilities.

This proposed order of construction works is indicative and may change once detailed construction planning is completed. It is likely that some aspects of construction may overlap.

Construction period

It is anticipated that a construction period of around 18 months (excluding pre-construction and early works) would be required to complete the proposed works including demolition of the existing bridge.

Work hours

The majority of the construction works would be carried out during standard working hours, as detailed in Table 2. Some construction activities, in particular those requiring road closures, would need to be undertaken outside of standard working hours to prevent major disruptions to

traffic and access. Other construction activities such as service relocations and cutovers may also need to undertaken outside normal working hours. Low noise activities may also be undertaken outside of normal working hours to optimise construction efficiency.

Table 2 Standard working hours

Day	Start time	Finish time
Monday to Friday	7am	6pm
Saturday	8am	1pm
Sunday and public holidays	No work	

Construction equipment

The types of construction equipment likely to be used for the project would include (but would not necessarily be limited to) the following:

- Excavation plant, such as excavators, back hoes and front end loaders for pavement cutting, removal and general earthworks.
- Bobcats and sweepers.
- Compaction plant, including rollers, vibrating rollers, concrete vibrators and trench plate compactors.
- Pneumatic jack hammers.
- Profiling, milling and road paving plant.
- Jet-blasting and shot-blasting machines.
- Miscellaneous vehicles, including utilities, trucks, bogies and semi-trailers.
- Miscellaneous hand tools and equipment.
- Generators, lighting towers, signage and variable message boards.
- Various barges, workboats and pontoons.
- Piling rigs and various mobile and fixed cranes.
- Concrete and grouting pumps and transport vehicles.
- Support trusses, stress jacks and scaffold systems.

The equipment chosen would be the current best-practice technology for the construction industry.

7.1 Potential Impact

The project would impact on known and potential archaeological remains within the project area.

Construction of the replacement bridge would directly impact on known and potential archaeological remains associated with the former wharf on the southern side of the river, specifically from the installation of the first in-water pier on the southern side of the river; retaining wall associated with the scour protection; immediately in front of the southern bank of the river and associated rock armor for scour protection.

Proposed filling, landscaping and installation of rock armor on the upstream and northern side of the existing bridge may expose and impact cuttings made into the natural sandstone for the approach to the northern punt landing.

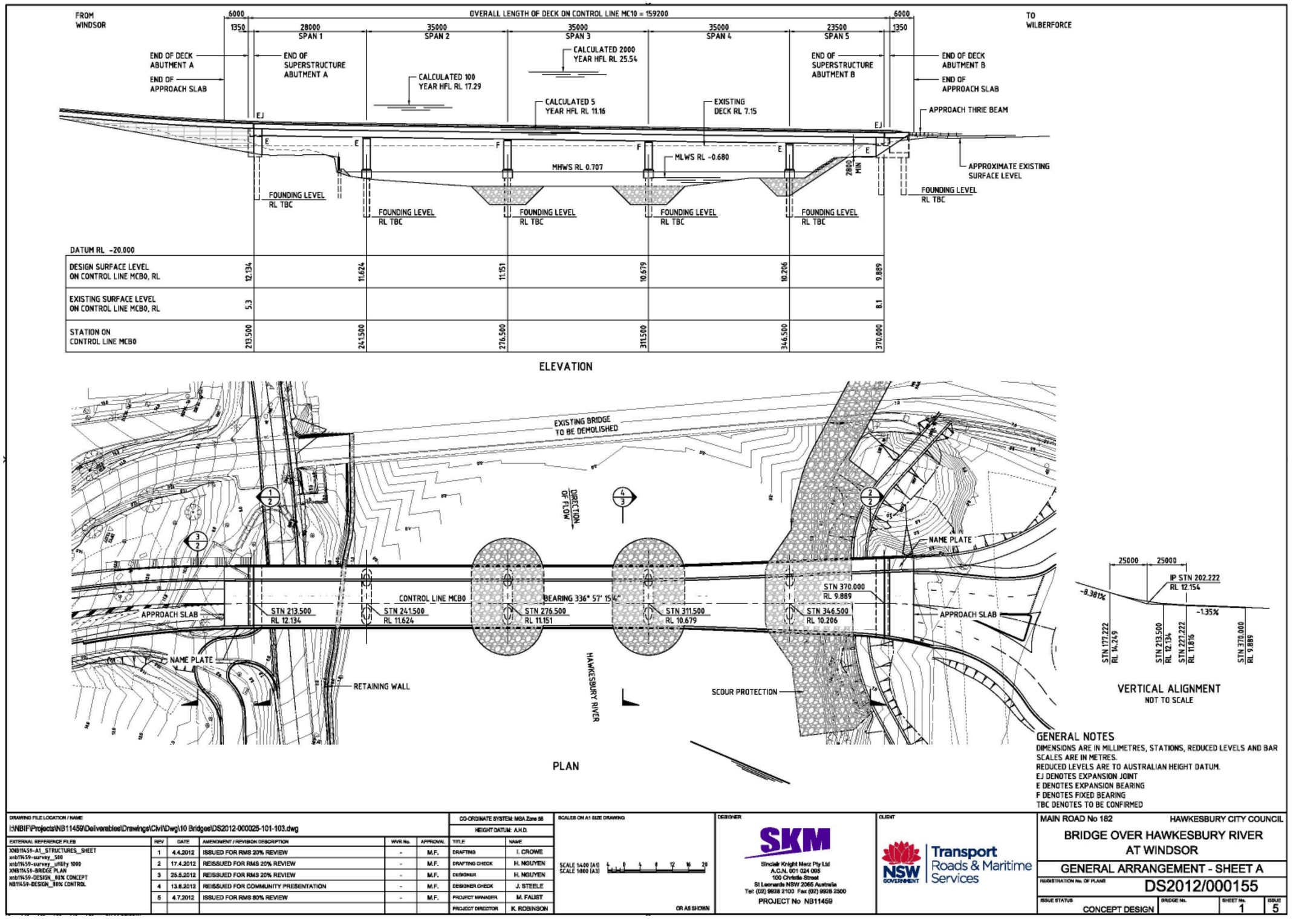


Figure 65: General Design layout of the Bridge crossing across the Hawkesbury River at Windsor (Source SKM).

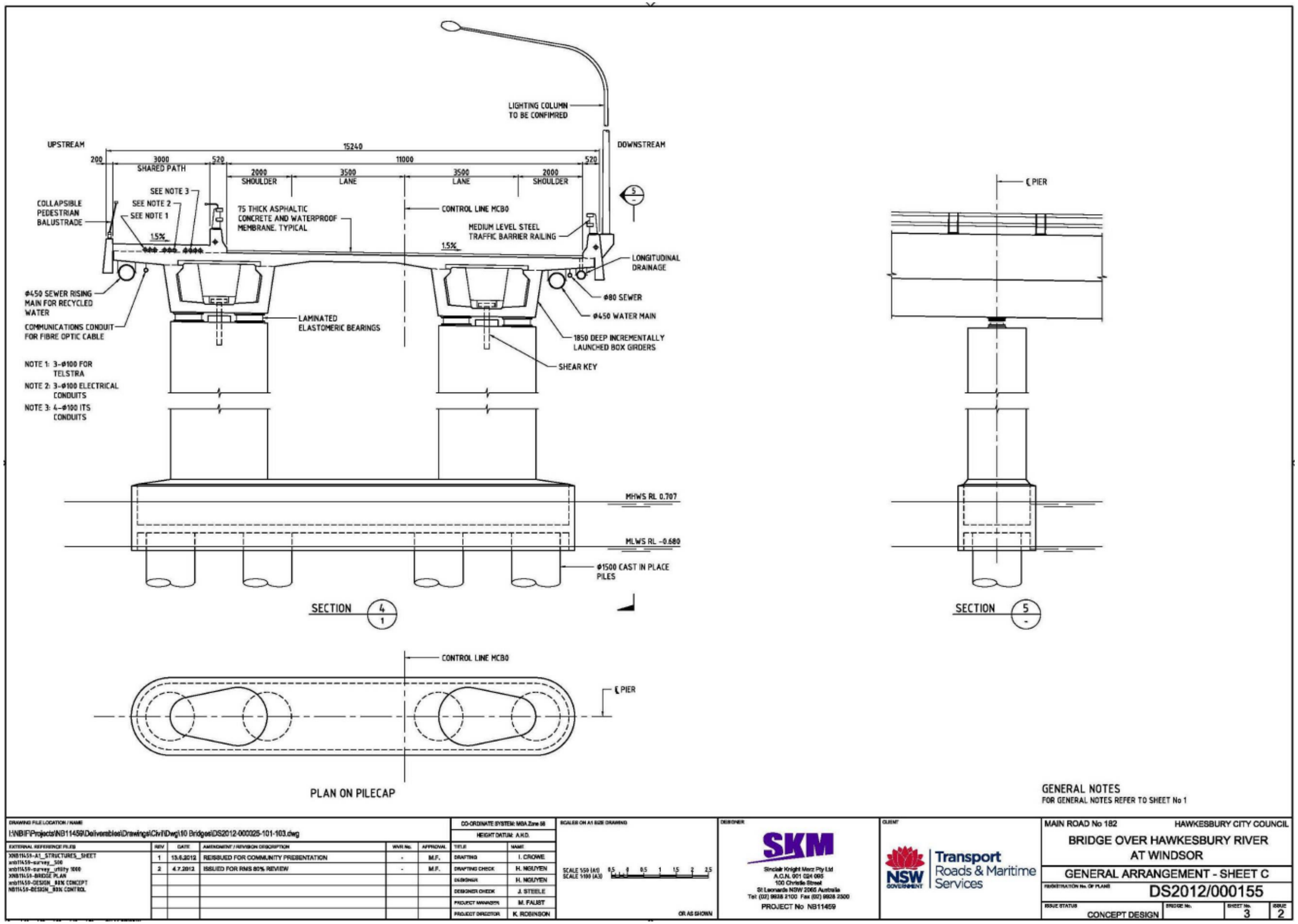
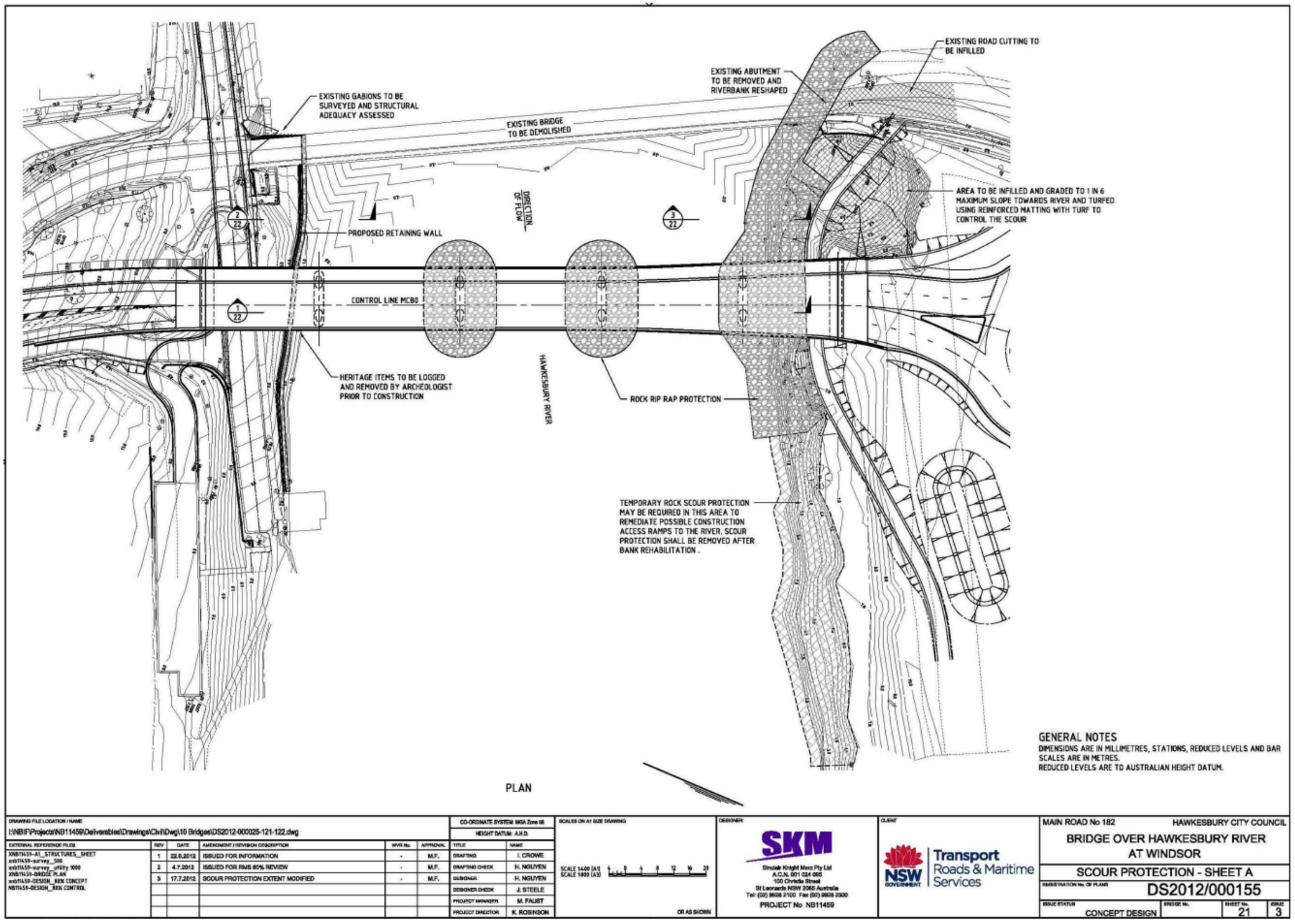


Figure 66: Pier design for the new Hawkesbury River Bridge crossing at Windsor, NSW (Source SKM).



EXTERNAL REFERENCE FILES	REV	DATE	AMENDMENT / REVISION DESCRIPTION	WVR No.	APPROVAL
XNB11459-A1_STRUCTURES_SHEET xnb11459-survey_500 xnb11459-survey_utility 1000 XNB11459-BRIDGE PLAN xnb11459-DESIGN_80% CONCEPT NB11459-DESIGN_80% CONTROL	1	22.6.2012	ISSUED FOR INFORMATION	-	M.F.
	2	4.7.2012	ISSUED FOR RMS 80% REVIEW	-	M.F.
	3	17.7.2012	SCOUR PROTECTION EXTENT MODIFIED	-	M.F.

TITLE	NAME
DRAFTING	I. CROWE
DRAFTING CHECK	H. NGUYEN
DESIGNER	H. NGUYEN
DESIGNER CHECK	J. STEELE
PROJECT MANAGER	M. FAUST
PROJECT DIRECTOR	K. ROBINSON

Figure 67: Design of the new Bridge crossing across the Hawkesbury River at Windsor showing the rock armour and protection (Source SKM).

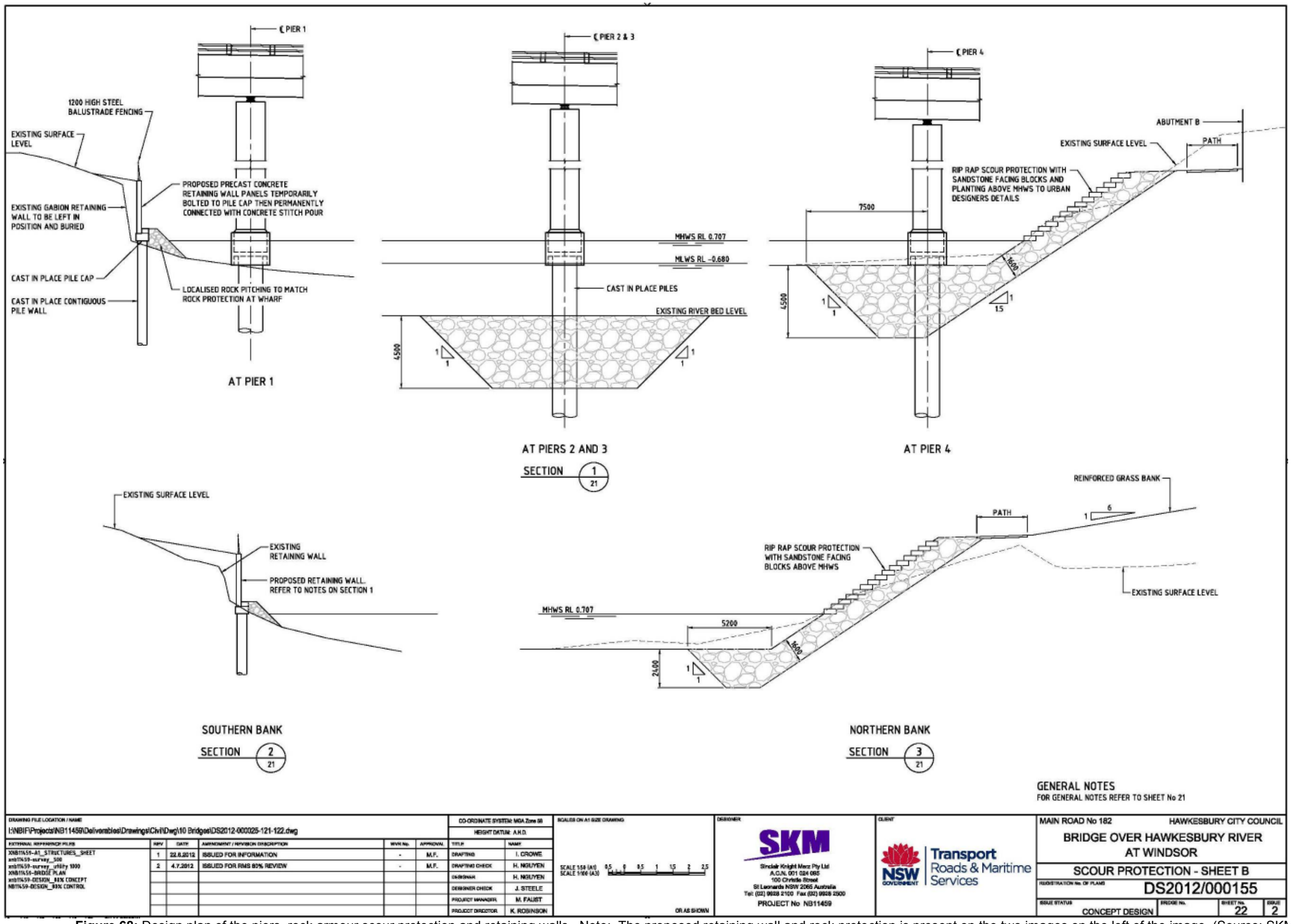


Figure 68: Design plan of the piers, rock armour scour protection and retaining walls. Note: The proposed retaining wall and rock protection is present on the two images on the left of the image. (Source: SKM).

Based on the NSW Heritage Office and Department of Urban Affairs & Planning publication for *Statements of Heritage Impact,* a Statement of Heritage Impact must address a number of questions relevant to the proposed works with regards to items of cultural significance identified to be within the study area. These questions help to ascertain whether all options have been explored prior to the proposed works or actions taking place, and to determine how the heritage value of an item can be conserved, or preferably enhanced, by the proposed development. The types of questions that are relevant to the project include:

- Have all options for retention and adaptive re-use been explored?
- Can all of the significant elements of the heritage item be kept and any new development be located elsewhere on the site?
- Is demolition essential at this time or can it be postponed in case future circumstances make its retention and conservation more feasible?
- Have the consultant's recommendations been implemented? If not, why not?

Below is a statement answering the relevant questions required for this statement of heritage impact statement for the proposed bridge crossing.

7.2 New Bridge Crossing

Options for retention and adaptive re-use

The design of the project has been undertaken in consultation with the maritime archaeological consultants (Cosmos Archaeology). There are no options that will allow for retention of the maritime archaeological remains present within the study area, particularly within the vicinity of the ca.1814 wharf remains. This is due to engineering design requirements for the bridge and the site. A bridge designed with piers immediately behind the southern bank of the river behind the known and potential archaeological remains would require scour stabilisation work along the front of the southern bank of the river. A pier placed further out into the river in front of the known and potential archaeological remains would not have a direct impact to the known archaeological remains, however, the pier and riverbank would create a funnel that would result in an increase in water velocity and create localised scouring in the vicinity of the archaeological remains. As a result this area would also require scour protection through the installation of rock armour.

The creation of a protective barrier over the top of the known and potential archaeological remains associated with the ca.1814 second wharf is also not possible. A protective rock armour layer, as required for the scour protection works, over the top of the site, comprising of large sandstone boulders, would likely damage or destroy the site as soft silts are present below the rubble ballast remains associated with the former ca.1814 wharf.

Retention of significant elements through relocation of new bridge[65]

The current alignment for the new bridge crossing was chosen from 10 options that included the 'do nothing' option, refurbishment of the existing bridge, bypass of Windsor and replacement of the existing bridge. Ten alternate options were proposed and a feasibility study was undertaken in July 2009. Project objectives were developed that allowed for the assessment of each option. This included location, performance,

[65] Cosmos Archaeology was not directly involved with the selection process or final design decision, however, the results of the maritime archaeological survey completed in 2008-9 were used in the reporting process.

potential environment impacts and cost/benefit analysis of each option. Based on preliminary assessments and feedback from the consultation process on each option, RMS shortlisted three options for further assessment, these were:

1. Option 1 - Replacement high-level bridge via Old Bridge Street, Windsor.
2. Option 2 - Replacement low-level bridge via Old Bridge Street, Windsor.
3. Option 6 - Bypass of Windsor via a new bridge parallel to Palmer Street, Windsor and new bridge over South Creek.

The selection of the preferred option by RMS was based on consideration of transport needs, heritage impacts, environmental impacts, safety and engineering and cost constraints. Each of the 10 options was identified to have varying levels of impact to known and potential heritage and archaeological items. The decision on the preferred option was made by considering:

- The performance of each option against the project objectives.
- The relative advantages and disadvantages of each option.
- Information on the potential impact of each option, including biophysical, heritage, community and socio-economic impacts.
- Community and government agency issues, as identified in community and agency consultation.

RMS identified Option 1 (new high-level downstream bridge) as the preferred option for the project. This option was found to perform best in terms of value for money and would perform well in relation to most of the project objectives.

Once this decision was made, RMS engaged consultants to prepare specialist studies required for this stage of the project. The potential to relocate the bridge after completing the earlier investigation is now not an option.

Is demolition essential or can it be postponed?

Impact to the archaeological remains cannot be avoided. The alternate designs for the bridge along the current alignment has attempted to relocate piers, both in-water and immediately behind the southern bank of the river, in an attempt not to impact known and potential archaeological remains. Choosing the option with the least impact to the known archaeological remains associated with the former wharf would still have a substantial impact on archaeological remains. As such, the significance and archaeological research potential for the site would likely be removed from the remainder of the site.

Have the consultant's recommendations been implemented?

Consultation regarding the maritime archaeological potential on the site began in February 2012 and has been included in all design meetings and strategies since. This consultation included discussing options and constraints for the location of piers and associated infrastructure for the new bridge. These meetings have been based on the desire to preserve the known archaeological remains present within the maritime study area as the first priority, which lead to looking at possible design modifications. At the final stage, when it was clear that impacts could not be entirely

avoided, it was recommended that an archaeological salvage excavation of the site would be required as the only alternative to a complete engineered redesign that ensured the archaeological site would not be impacted. Archaeological Recording and salvage of the maritime archaeological sites is considered the only appropriate mitigation measure for the level of impact the project will have to the former wharf remains within the study area.

The recommendations presented in this report have been formulated over the course of this project, including the consultation process with RMS, and have been agreed on by RMS.

7.3 Punt Crossing

Options for retention?

The impacts to potential archaeological remains associated with the former punt crossing are confined to the post ca.1835 crossing of the river when the punt crossing was relocated upstream and a cable system was installed. Photographic evidence suggests there is potential for infrastructural remains associated with the cable system to be present in the vicinity of the northern landing. Also present is a cutting or former road surface associated with the former approach to the northern landing.

It is unclear if any structural or artefact remains are still present in this area as previous flood events have scoured and eroded this area; however cuttings made into the sandstone in this area are likely to have survived.

The proposed works in this area would include the filling of the area for landscaping purposes, but also may require the excavation of areas where rock armour would be placed. This work is likely to expose any cuttings made for the approaches for the road. As such, the works are not likely to remove this feature, but expose and then cover over as required for the filling and subsequent landscaping of the area.

Retention of significant elements through relocation of works?

Any archaeological remains, such as relics associated with the former cabling system are not expected to be present as the area has previously been exposed during flood events and none were observed. The nature of the works, including the removal of current vegetation, infilling the area and landscaping is not likely to remove any significance intact elements.

Is demolition essential or can it be postponed?

It is not expected that archaeological remains are present associated with the former punt crossing. Landscape features, such as the cuttings and approaches to the punt crossing are expected to be present. These items are not expected to be demolished or removed as part of the fill and landscape works.

Have the consultant's recommendations been implemented?	Consultation regarding the maritime archaeological potential on the site began in February 2012 and included potential archaeological remains associated with the former punt crossing. The archaeological remains that are expected to be present are limited to the northern landing, and features made into the sandstone present on the northern bank. Relics are not expected to be present; however, archaeological work in this area has been discussed and agreed to by RMS.

8.0 Summary and Recommendations

8.1 Summary

The key findings of this assessment are:

Historical findings

- A wharf was first constructed at the initial settlement at Windsor in 1795.
- The wharf supplied the early store and military garrison and also provided transportation for crops from the surrounding farms.
- A second wharf was built at Windsor in ca.1814 and repaired in 1820 under the direction of Governor Macquarie.
- A private punt service also started in 1815 using the wharf as the southern landing.
- In 1832 the punt was taken over and operated by the Government.
- In c.1835 the location of the punt moved upstream and a cabling system was installed for the crossing.
- The bridge across the Hawkesbury River was built in 1874 with the punt service ceasing soon after.
- A temporary bridge was constructed in 1896 for the raising of the main bridge across the Hawkesbury River.
- The temporary bridge was built in six weeks, although, no other details relating to the location of the bridge is known. It is believed to be located on the upstream side of the current bridge.
- The second wharf was present on the site until the late 1930s or early 1940s.

Archaeological Investigations and archaeological potential

- A maritime archaeological survey on the site of the former wharf in 2008 identified above and below water structural remains present on the site *in situ*.
- The archaeological potential at the wharf site is considered to be high in the location of the rock ballast, and moderate for an area up to 5 m around the boundary of the ballast.
- There is likely to be structural remains associated with the wharf and artefact deposits associated with the functioning of the structure, located behind the southern riverbank.
- There is considered to be moderate potential for archaeological remains associated with the punt landing on the northern side of the river on the upstream side of the current bridge associated with the relocation of the punt service in ca.1835; but a low archaeological potential along the route of the punt across the river.
- A second maritime archaeological survey was conducted in 2012 on seven anomalies identified from a side scan sonar survey of the project area and the post 1835 southern punt landing;
- The survey located timber structural remains located on the northern side of the river, close to the bank on the eastern (downstream) side of the current bridge location, possibly relating ca.1950 mooring posts or a retaining wall built in the area;
- The timber remains are not considered to have archaeological or research value;

- Four other anomalies within the river were surveyed and were either found to be sterile or continuing modern material;
- A natural sandstone rock shelf was located in the location of the southern punt landing location. This shelf was located 15 m into the river and was not considered to be part of the landing area.

Heritage significance

- The archaeological remains associated with the former ca.1814 wharf have been assessed as being of State significance.
- The significance of the archaeological remains associated with the former punt has been assessed as being of local significance.

Impact Assessment

- The project would have both a direct and indirect impact on known and potential archaeological remains associated with the former wharves and punt crossing from the placement of in-water piers and retaining walls.
- Redesigning elements of the bridge that would allow for the retention and protection of the known and potential archaeological remains has been investigated; however, impacts cannot be avoided.

8.2 Recommendations

Based on an understanding of the development history of Windsor, the stratigraphy of the river sediment and previous maritime archaeological survey completed in the vicinity of the former wharf site, the following actions are recommended to progress the maritime archaeological cultural heritage component of the project.

Recommendation 1

An above and below water maritime archaeological salvage excavation should be undertaken within the area assessed to have high archaeological potential relating to the remains associated with the former ca.1814 wharf. This includes the area immediately behind the southern bank of the river that may contain land ties (also known as deadman anchors) and other structural remains.

As the project is being assessed under Section 5.1 of the EP&A Act, no permits under the NSW Heritage Act (1979) are required for the project. The excavation should, however, be conducted by a qualified maritime archaeologist after the preparation of a research design. The research design should include, as a minimum, an excavation methodology, research questions and provisions for an artefact analysis at the conclusion of the excavation phase of the project.

Excavation and other on-site investigation should be coordinated with the Aboriginal and non-Aboriginal archaeological investigations as part of a single coordinated process of examining the human history of Windsor.

An archaeological excavation report should be prepared at the conclusion of the excavation, and the report submitted to the Office of Environment and Heritage for their records.

The results of the excavation and artefact analysis should be used in on-site interpretation of the maritime history and heritage of the Windsor area, where appropriate.

Recommendation 2

Archaeological monitoring works should be undertaken as part of the early site works on the northern side of the existing bridge in the general location of the northern punt landing. This archaeological monitoring should occur during early site preparation works to record any remaining archaeological remains, relics or landscape features that remain of the former crossing.

This work should be done by a qualified archaeologist and an archaeological monitoring report should be prepared at the end of the monitoring works and submitted to the Office of Environment and Heritage for their records.

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