

Bank Street Park
Blackwattle Bay / Tjerruing

SSD-53386706

Appendix AS

Marine Ecology Assessment (Eco Logical)



December 2023

A stylized topographic map graphic with concentric contour lines, rendered in a light grey color, positioned on the left side of the page.

Bank Street Park - Marine Ecology Assessment

Infrastructure NSW

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Abbreviations

Abbreviation	Description
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
DPI	NSW Department of Primary Industries
ELA	Eco Logical Australia Pty Ltd
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FM Act	NSW <i>Fisheries Management Act 1994</i>
KFH	Key fish habitat
MHWM	Mean high water mark
SEPP	State Environmental Planning Policy

Executive Summary

This Marine Ecology Assessment has been prepared to support a State Significant Development Application (SSDA-53386706) for a new waterfront public park within the Blackwattle Bay Precinct, to be known as Bank Street Park. Located at 1A-19 Bank Street, Pyrmont NSW, the Bank Street Park would provide new community buildings, passive watercraft facilities, open space, paths and other public domain features. Of particular relevance to this assessment are the proposed foreshore modifications and additions:

- restoration, repair and alterations to the existing seawall
- demolition and construction of a new timber boardwalk along a section of the seawall
- demolition and construction of a new timber ramp for dragon boat access
- construction of a new gangway and pontoon for kayaks
- support structure for a new sandstone block terrace that extends into the water
- demolition of existing building structures in close proximity to the seawall
- construction of three new stormwater outlets in the seawall.

The Planning Secretary's Environmental Assessments Requirements (SEARs) issued on 11 May 2023 included specific landscape and biodiversity matters to be addressed in the SSDA. SEARs relevant to marine ecology describe the need for the proponent to demonstrate how the development aligns with the Blackwattle Bay Design Guidelines and how biodiversity matters (terrestrial and aquatic ecology) would be impacted. This report addresses the aquatic ecology aspect of the biodiversity assessment. Terrestrial impacts are in a separate Biodiversity Development Assessment Report prepared for the SSDA (ELA 2023).

The primary statutory acts and policies that apply to this development and that aim to protect aquatic ecology are the *Environment Protection and Biodiversity Conservation Act 1999*, *Fisheries Management Act 1994* and *State Environmental Planning Policy (Biodiversity and Conservation SEPP) 2021*. Matters for assessment are themed around threatened species, communities and populations, and conservation of key fish habitats. The Blackwattle Bay Design Guidelines describe the preferred treatment of foreshores development, with recommendations on techniques to enhance marine habitat around the bay.

Through desktop and field assessment of the subtidal and intertidal waters in and adjacent to the site, our mapping of key fish habitat types and analysis of the proposal allowed calculation of direct and indirect impacts to marine ecology. The study area was highly modified, with an existing marina, wharf, dragon boat ramp and seawalls. The most valued habitat observed was a narrow band of macroalgae (seaweed) attached to rocky rubble in the shallow subtidal zone. Other habitats were dominated by bare unvegetated sand and artificial structures, with the latter colonised by marine organisms, such as oysters, barnacles and snails. Of these, the macroalgae is most sensitive to disturbance from foreshore development, either through physical loss, smothering by sediment or shading from overhanging structures.

The proposed piling and seawall modifications would have some temporary or minor impacts during construction, but overall improve the marine ecology in the long-term by installing a stepped sandstone block terrace into the water. Compared to the existing vertical seawall, the terrace would increase hard surface area in the intertidal zone and create complex spaces for small marine biota. Physical damage or shading from the proposed pontoon/gangway structure and replacement dragon boat ramp would

harm about 31 m² of *Sargassum linearifolium* (Brown macroalgae), which forms a narrow band around this part of the bay. Its loss could be compensated by the addition of rocky rubble where the existing ramp is to be removed. This species would likely establish itself on new rock if placed at a suitable depth.

The threatened species *Hippocampus whitei* (White's seahorse) has been recorded in Rozelle Bay nearby and could potentially use macroalgae beds in the study area. Through applying an assessment of significance, we conclude any impact to seahorses would not be significant, and we recommend a pre-clearance survey prior to piling works in this habitat to safely relocate any resident seahorses.

The proposal meets development controls for Sydney Harbour (Foreshores and Waterways Area) under the Biodiversity and Conservation SEPP and the Blackwattle Bay Design Guidelines. To protect and enhance marine habitats around the foreshore, there is opportunity to install intertidal habitat tiles/pots on seawalls, expand the rock rubble reef for macroalgae growth, use mesh material on some decks to reduce shading and add seahorse hotels. These measures would maximise habitat connectivity around the bay and at different tidal heights. Details on the exact areas and quantities to install would be developed during the detailed design stage.

With recommended measures in place, we conclude the Bank Street Park proposal would not result in a net loss of key fish habitat or have a significant effect on the marine ecology.

1. Introduction

The purpose of this report is to assess the impact on marine ecology, to support a State Significant Development Application (SSDA) for a new waterfront public park within Blackwattle Bay, to be known as Bank Street Park (SSD-53386706). Bank Street Park is located at 1A-19 Bank Street, Pyrmont on the shoreline of Tjerruing Blackwattle Bay and adjacent areas of Blackwattle Bay.

1.1. Blackwattle Bay Precinct

Bank Street Park forms part of the Blackwattle Bay Precinct, which is an area of predominantly government owned land located on the western edge of the Pyrmont Peninsula and adjoining the waters of Blackwattle Bay (Figure 1).



Figure 1: Blackwattle Bay Precinct

Source: INSW

The precinct was rezoned in December 2022 to facilitate a new mixed-use community, providing for around 2,000 new residents and 5,600 new jobs and creating a vibrant 24/7 economy. Updated planning and land use controls were incorporated into the Sydney Local Environmental Plan 2012, along with site specific design guidance in the *Blackwattle Bay Design Guidelines*.

A critical part of the Blackwattle Bay Precinct is the high quality public domain which includes a series of parks and open spaces connected by a foreshore promenade. Bank Street Park will bring new active and passive recreation uses into a unique park environment, catering for both existing and future communities in the vicinity.

1.2. Site description

Bank Street Park is located at 1A-19 Bank Street, Pyrmont NSW within the City of Sydney local government area (LGA) and includes harbour development in Blackwattle Bay. The site area is approximately 1.1 hectare. The relevant lot and deposited plans and the respective ownership for the site are detailed in Table 1 and shown in Figure 2.

Table 1: Summary of land title details of the site

Street address	Lot and Deposited Plan details	Ownership
1A Bank Street, Pyrmont NSW 2009	Lot 1 DP 85206 Lot 1 DP 188671	Transport for NSW
1-3 Bank Street, Pyrmont NSW 2009	Lots 1-2 DP 1089643 Lot 1 DP 439245	Infrastructure NSW
5 Bank Street, Pyrmont NSW 2009	Lot 20 DP 803159	Transport for NSW
7 Bank Street, Pyrmont NSW 2009	Lot 19 DP 803159	Transport for NSW
9 Bank Street, Pyrmont NSW 2009	Lot 21 DP 803159	Transport for NSW
11 Bank Street, Pyrmont NSW 2009	Lot 22 DP 803159	Transport for NSW
17-19 Bank Street, Pyrmont NSW 2009	Lots 5-6 DP 803160	Transport for NSW
Sydney Harbour	Lot 5 DP 1209992	Roads and Maritime Services (Transport for NSW)
Sydney Harbour	Lot 107 in DP 1076596	Transport for NSW
Part Bank Street road reserve	N/A	City of Sydney Council

Bank Street Park is located on Gadigal Land, one of the twenty-nine clans of the great Eora Nation. It adjoins the foreshores of Glebe to the west and Pyrmont Bridge Road and Wentworth Park to the south.



Figure 2: Site context map

The indicative site location is outlined in red. Source: SixMaps with Architectus edits (2023)



Figure 3: Bank Street Park site location within Blackwattle Bay State Significant Precinct

The indicative site location is outlined in red. Source: Blackwattle Bay Design Guidelines with Architectus edits (2023)

1.3. Proposed development

Development consent is being sought for a *recreation area* for the primary purpose of a *public park* (Figure 4), comprising:

- Site preparation works, including tree removal, earthworks and remediation to facilitate the proposed use
- Demolition of three existing buildings at 1-3 Bank Street
- New and adapted facilities for community use, including
 - New single storey building to accommodate flexible community space, café, and marina office/store facilities, with green roof and photovoltaics
 - Adaptive reuse of Building D for public amenities, bin and other storage
 - Boat launching ramp and pontoon for passive watercraft, including dragon boats and kayaks
 - Boat storage building with change facilities for dragon boat users with publicly accessible rooftop deck
- Public domain works, including
 - 'Interpretation Garden' in existing building 'ruins' at 1-3 Bank Street
 - Split level foreshore promenade
 - Multi-purpose court with edge seating and partial fence
 - Nature-based inclusive playspace for ages 2-12
 - Fitness equipment
 - Public plaza and grassed open space areas
 - New tree plantings and planter beds
 - Public art, wayfinding and interpretative signage, lighting, bike parking and seating
- Harbour works, including
 - Overwater boardwalk
 - Land/water interface works, including sandstone terracing into water and support structure, to improve marine habitat
 - Demolition and construction of a new timber launching ramp for dragon boats
 - Kayak/passive craft pontoon
 - Restoration, repair and alterations to the existing seawall for new stormwater outlets
- Works to Bank Street road reserve, including
 - Road space reallocation to provide separated cycleway
 - Cycleway transition to Bank Street to continue south as part of future works
 - Reinstatement of existing on-street parallel parking
 - Tree planting
 - Accessible parking space
 - Loading zone adjacent 1-3 Bank Street.

1.4. Works below the mean high water mark

Mean high water mark (MHWM) is the position where the plane of the mean high water level of all ordinary local high tides intersects the foreshore, which is taken for the purposes of the Sydney Harbour

Foreshores and Waterways Area Development Control Plan 2005 to be 1.48 m above zero on the Fort Denison Tide Gauge, or 0.555 m Australian Height Datum. To aid assessment of impacts to marine ecology, the following details are extracted from the design report and drawings (Figure 5 and Figure 6):

- restoration, repair and alterations to the existing seawall, potentially requiring disturbance to the seafloor and meeting the DPI Fisheries definition of 'dredging'
- demolition and construction of a new timber boardwalk along a section of the seawall, requiring about nine timber piles
- demolition and construction of a new elevated timber ramp for dragon boat access, from about 5 m depth to the top of seawall (wall to be raised to 1.9 m above MHW), requiring about 60 timber piles
- construction of a new gangway and pontoon for kayaks, from the top of seawall (wall to be raised to 1.9 m above MHW) to about 40 m offshore, with a pontoon clearance of 5 m above the substrate at lowest astronomical tide, requiring four piles, but no channel dredging is required for navigation
- support structure for a new sandstone block terrace that extends into the water, supported by about 27 piles
- replacement or modification of an existing timber decking, with 14 piles
- construction of three new stormwater outlets in the seawall, with invert levels positioned about 0.9 – 1.2 m above MHW.

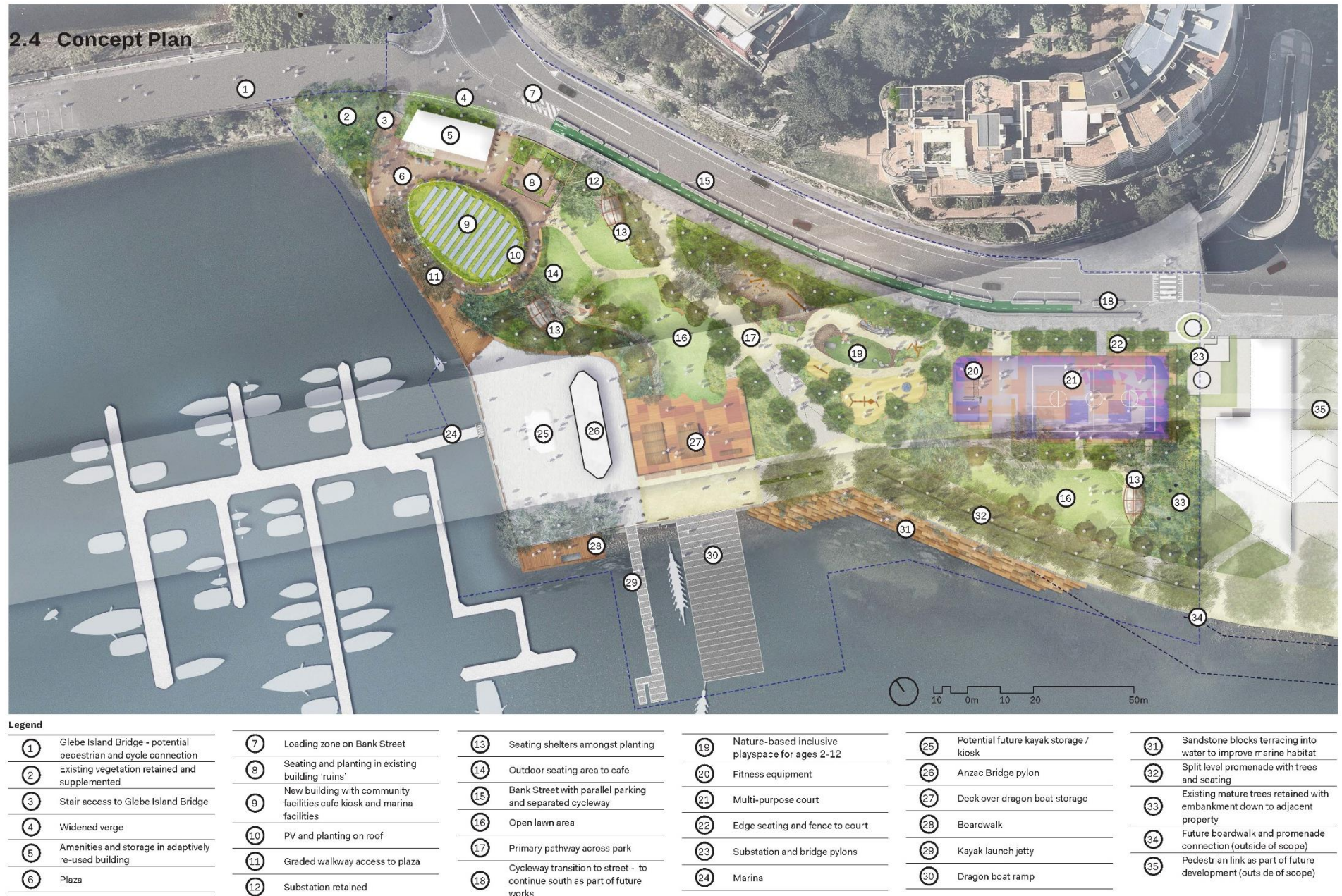


Figure 4: Preferred concept design (13 October 2023), with new or modified marine elements at No. 11, 28, 29, 30 and 31

The proposed works that form part of the project that will be undertaken within the marine environment include the following:

- + Restoration, repair and alterations to the existing sea wall.
- + Demolition and construction of a new timber boardwalk along a section of the sea wall.
- + Demolition and construction of a new timber ramp for dragon boat access.
- + Support structure for the new sandstone blocks terracing that extends into the water
- + Demolition of existing building structures in close proximity to the sea wall.
- + Construction of a new kayak jetty.

Legend

---	Over water structure
●	Indicative pile location
①	Timber decking with timber piles at 3m centres along the edge
②	Timber decking with timber piles at 3m centres
③	Floating pontoon with gangway. Concrete piles at 6m centres to pontoon.
④	Timber structure dragon boat ramp with timber piles at 3m centres
⑤	Sandstone steps on concrete slab and piled structure. Concrete piles at 6m centres

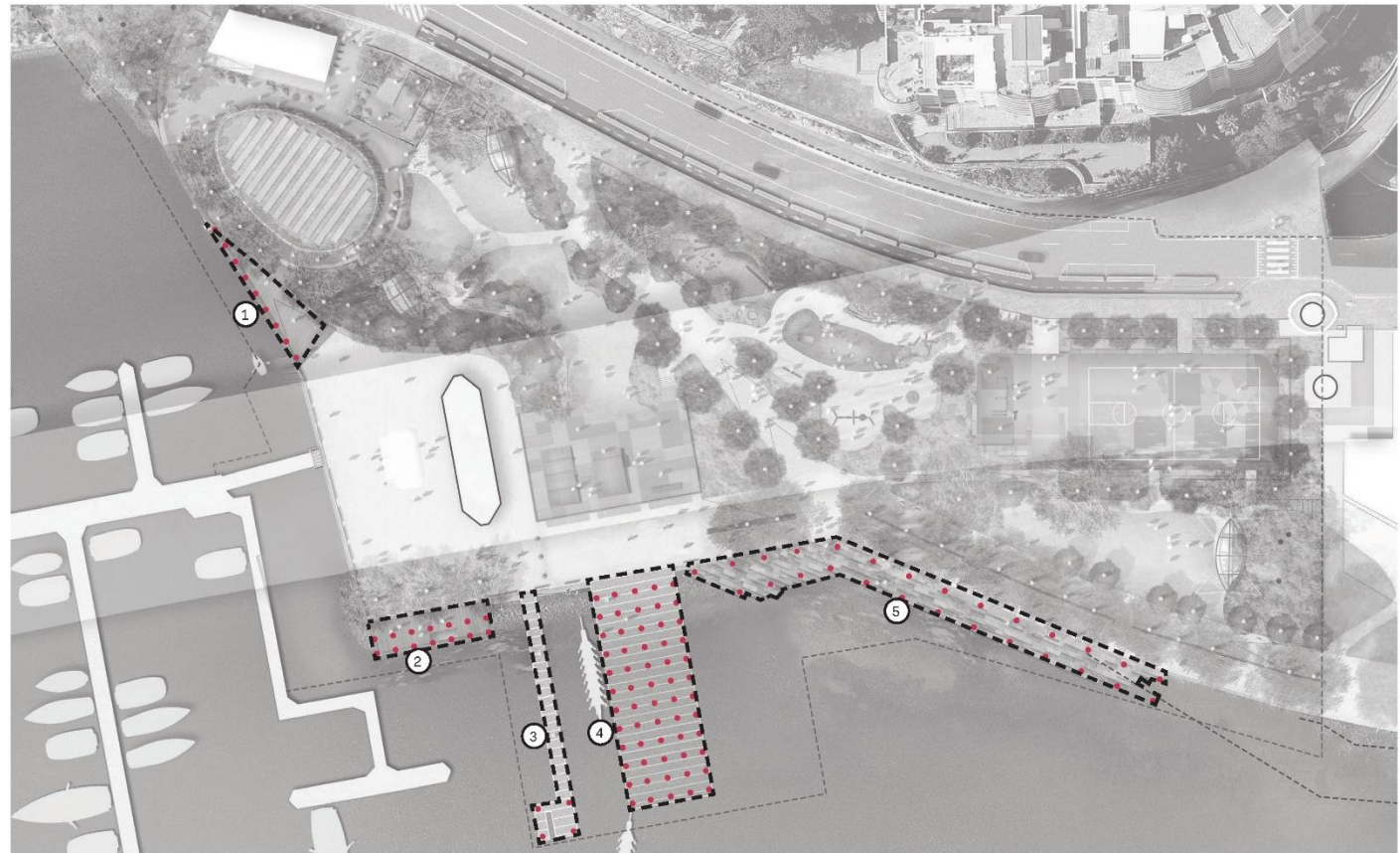


Figure 15. Over water structures and piles

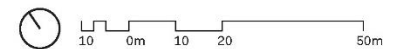


Figure 5: Overwater structures and piling plan



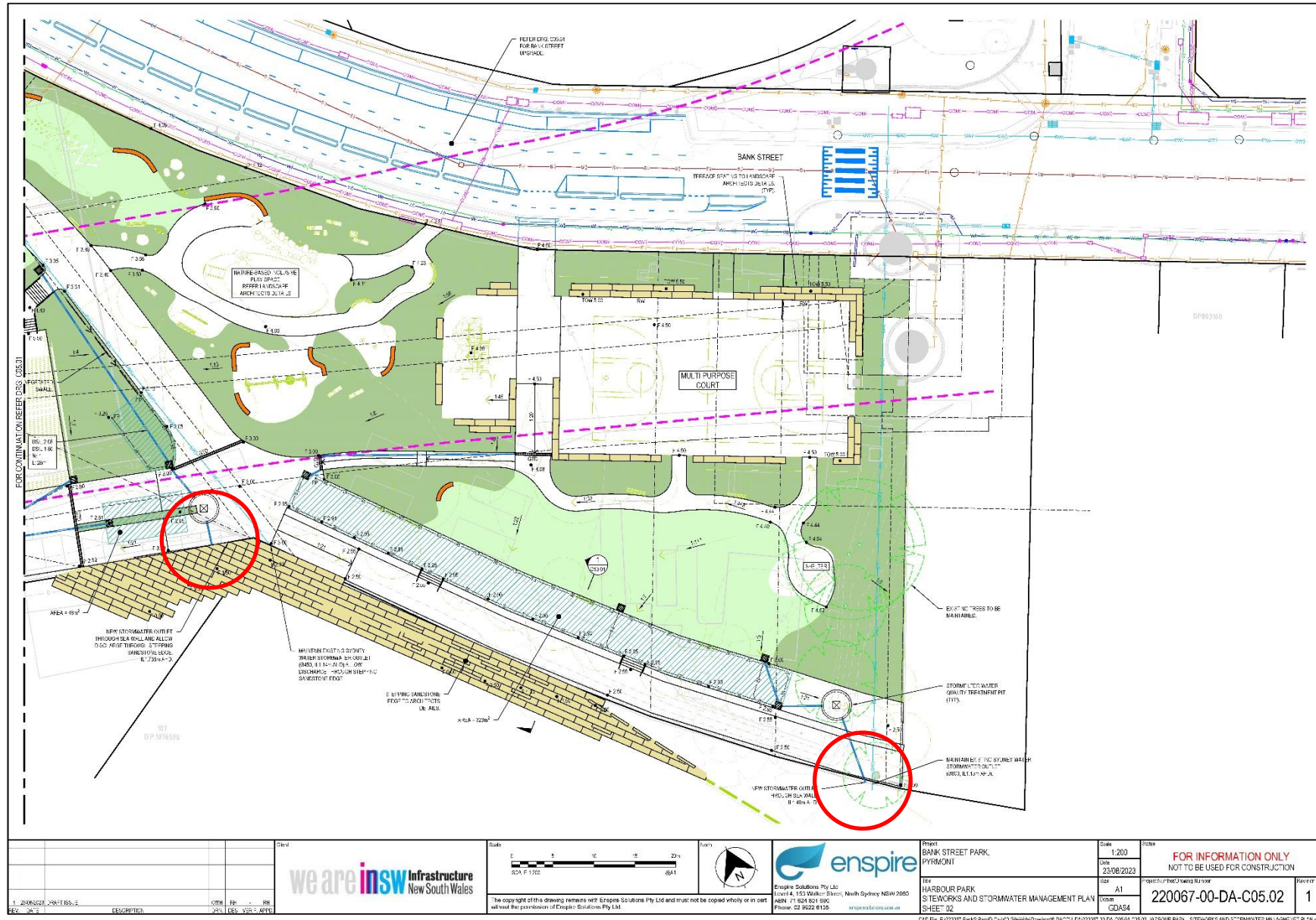


Figure 6: Stormwater management plan with proposed new outlets circled red (see civil works drawings for higher resolution)

1.5. Planning Secretary's Environmental Assessments Requirements

This report has been prepared in response to the relevant requirements outlined within the Planning Secretary's Environmental Assessments Requirements (SEARs) issued on 11 May 2023 for application SSD-53386706. Table 2 addresses the relevant SEARs requirements and provides a project response.

Table 2: Secretary's Environmental Assessments Requirements

Item	SEARs	Relevant report section(s)
4. Landscape Design and Public Domain	Demonstrate how the development aligns with the Blackwattle Bay Design Guidelines.	Design guidelines relevant to marine ecology are identified and addressed in Section 2.9 and 5.5 of this report.
12. Biodiversity	<p>Assess any biodiversity impacts associated with the development in accordance with the <i>Biodiversity Conservation Act 2016</i>, Biodiversity Assessment Regulation 2017, and the Biodiversity Assessment Method 2020, including the preparation of a Biodiversity Development Assessment Report (BDAR) unless a waiver is granted, or the site is on biodiversity certified land.</p> <p>The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method 2020.</p> <p>If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.</p> <p>The BDAR must be submitted with all spatial data associated with the survey and assessment as per the Biodiversity Assessment Method.</p> <p>The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017.</p> <p>Provide a detailed description of any works and materials to be used that will impact aquatic ecology including any dredging, piling, seawall treatments, height of the facility above the substrate and in relation to the mean high water mark, type of material/s to be used and whether any reclamation is associated with the proposal.</p>	<p>Terrestrial species and the <i>Biodiversity Conservation Act 2016</i> are addressed in the BDAR (ELA 2023). Aquatic ecology and the <i>Fisheries Management Act 1994</i> are addressed below.</p> <p>A description of works is detailed in Section 1.4.</p> <p>An assessment of impacts to aquatic ecology is provided in Section 5 below.</p>

2. Statutory context

2.1. Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Under the EPBC Act, the Commonwealth Environment Minister needs to approve any development that is likely to have a significant impact on Matters of National Environmental Significance (MNES). Should such an impact, as defined in the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (Department of the Environment 2013), be likely, the preparation and submission of a Referral is required. MNES relevant to this study includes threatened ecological communities, flora and fauna species and migratory species that are listed under the Act. The proposed work would not cause a significant impact to aquatic species, and therefore a Referral is not recommended for impacts to aquatic species. For terrestrial matters, refer to the Biodiversity Development Assessment Report (BDAR) for this project (ELA 2023).

2.2. NSW Environmental Planning and Assessment Act 1979 (EP&A Act)

All developments in NSW are assessed in accordance with the provisions of the EP&A Act and the *Environmental Planning and Assessment Regulation 2021*. The EP&A Act provides a system for environmental planning and assessment, including approvals and environmental impact assessment requirements for proposed developments. Implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils.

2.3. NSW Biodiversity Conservation Act 2016 (BC Act)

Terrestrial biodiversity values, and flora and fauna listed under the BC Act are addressed in the BDAR for this project (ELA 2023).

2.4. NSW Fisheries Management Act 1994 (FM Act)

The FM Act is the principal piece of legislation protecting aquatic habitat in NSW. The act aims to conserve fish stocks, key fish habitat (KFH), aquatic vegetation, and threatened species, populations and communities. Threatened aquatic species, populations and communities are listed under Schedules 4, 4A and 5 of the FM Act, while key threatening processes are listed under Schedule 6. No threatened species, populations or communities listed under the FM Act would be significantly impacted by the proposal, and therefore a Species Impact Statement is not required. If works involve harm to marine vegetation (saltmarsh, mangroves, macroalgae or seagrass) or other aquatic habitat types, then the proponent is required to apply the DPI Fisheries' offset policy to ensure there is no net loss of key fish habitat, as described in Section 3.3.3 of the Policy and Guidelines for Fish Habitat Conservation and Management (Fairfull 2013). Impacts to key fish habitat are addressed in this report (Section 5).

2.5. NSW Water Management Act 2000 (WM Act)

The WM Act aims to provide for the sustainable and integrated management of water sources for NSW. The Act requires developments on waterfront land to be ecologically sustainable, and recognises the benefits of aquatic ecosystems to agriculture, fisheries and recreation. Approvals under Section 91 are required for controlled activities on waterfront land. A controlled activity includes work that builds on, removes, or deposits material or affects water flows in the channel or within 40 m from top of bank. However, the foreshore and bed of Port Jackson (Sydney Harbour) is 'exempt waterfront land', as

identified in Schedule 4 Clause 36 of the *Water Management (General) Regulation 2018*, therefore, a controlled activity approval or the application of the State riparian guidelines is not required.

2.6. NSW Coastal Management Act 2016 (CM Act) and State Environmental Planning Policy (Resilience and Hazards SEPP) 2021

The objectives of this Act are to manage the coastal environment of NSW in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State. Part 2 of the CM Act identifies objectives related to four coastal management areas of the 'coastal zone', with maps and development controls applied under the Resilience and Hazards SEPP (Table 3). Although the site lies in the 'coastal zone' under Section 6 of the CM Act, the considerations in Table 3 demonstrate that the Resilience and Hazards SEPP does not apply to this proposal.

Table 3: Coastal management areas of the 'coastal zone' and development controls under the Resilience and Hazards SEPP

Coastal management area	Considerations
Coastal wetlands and littoral rainforests (including proximity area)	Not present on site, no development controls triggered
Coastal vulnerability area	Not present on site, no development controls triggered
Coastal environment area	Present on site, however, Clause 2.10(3) of the Resilience and Hazards SEPP states that development controls for 'coastal environment area' do not apply to land within the Foreshores and Waterways Area within the meaning of the Biodiversity and Conservation SEPP 2021. Therefore, the Resilience and Hazards SEPP does not apply to this management area.
Coastal use area.	Present on site, however, Clause 2.11(2) of the Resilience and Hazards SEPP states that development controls for 'coastal use area' do not apply to land within the Foreshores and Waterways Area within the meaning of the Biodiversity and Conservation SEPP 2021. Therefore, the Resilience and Hazards SEPP does not apply to this management area.

2.7. State Environmental Planning Policy (Biodiversity and Conservation SEPP) 2021

Clause 6.1(b) identifies the Sydney Harbour Catchment as a regulated catchment. Development controls relevant to the proposal are listed under Part 6.2, Division 2 - Controls on development generally and Part 6.3, Division 3 - Development in Foreshores and Waterways Area. Clauses related to aquatic ecology are addressed in this report (Section 4.1 and 5.4). For harbour development works, these areas of the site are subject to Zone 1 Maritime Waters under Section 6.27 of the Biodiversity and Conservation SEPP.

2.8. NSW Ports and Maritime Administration Regulation 2021

Clause 100 states that a person must not use drags, grapplings, or other apparatus for lifting any object or material from the bed of a port described in Schedule 4, or otherwise disturb any such bed in any way, except with the written permission of the relevant Harbour Master and in accordance with the conditions attaching to such permission. Schedule 4 describes the port boundaries, that includes the waters of Sydney Harbour and of all tidal bays, rivers and their tributaries connected or leading to Sydney

Harbour bounded by mean high water mark together with that part of the Tasman Sea below mean high water mark enclosed by the arc of a circle of radius 4 nautical miles having as its centre the navigation light at Hornby Lighthouse. The proposal will disturb the bed during demolition and construction of seawall and piles.

2.9. Blackwattle Bay Design Guidelines

The Blackwattle Bay Design Guidelines (DPE 2022) supplements the provisions of Sydney Local Environmental Plan 2012 (SLEP 2012) by providing more detailed provisions to guide development in Blackwattle Bay. Guiding principles relevant to marine ecology are:

- Open space and amenity
 - Principle 1: Improve access to Blackwattle Bay, the foreshore and water activities for all users.
 - Principle 3: Maintain and enhance water uses and activities.
- Sustainability
 - Principle 4: Pursue leading edge sustainability outcomes including climate change resilience, improved water quality and restoration of natural ecosystems.
 - Principle 5: Deliver development that is economically, socially, culturally and environmentally viable.

Design guidelines that have an implication on foreshore structures and marine ecology are:

- Section 3 Public space
 - 3.5.1 Foreshore promenade
- Section 4 Environmental management and sustainability
 - 4.3 Urban and marine ecology.

These design guidelines are address in Section 5.5 of this report.

3. Methods

3.1. Desktop assessment

Online database searches were used to confirm the presence of recorded species in the region prior to a field survey. This was then used to infer what was likely to be present in the study area. The desktop search covered a 10 km buffer around the site, using coordinates Latitude -33.869765, Longitude 151.187187. Only aquatic species known to use estuarine/marine water or intertidal foreshores were considered in this aquatic assessment. Terrestrial species are addressed in the BDAR (ELA 2023). Databases accessed include:

- EPBC Act – Protected Matters Search Tool
- FM Act – Listed protected and threatened species and populations, including species profiles, ‘Primefact’ publications and expected distribution maps (Riches et al 2016)
- Online Zoological Collections of Australian Museums (OZCAM) and Atlas of Living Australia (ALA) – individual species searches to determine likelihood of occurrence of threatened species.

3.2. Field survey

The site was originally visited by ELA in July 2017 to map all marine habitat in Blackwattle Bay (ELA 2020), and again in November 2017 to expand the mapping into White Bay, Jones Bay and Rozelle Bay (ELA 2017). Since then, the Blackwattle Bay Marina has been constructed, along with other foreshore works in the study area. The site was visited for this report on 21 June 2023 during a medium tidal height by two ELA ecologists, including one senior aquatic ecologist. The survey included an area extending about 20 m from the edge of proposed work, unless obstructed by the marina and moored vessels. Weather conditions were calm and there was minimal swell. Underwater visibility was greater than 3 m.

The survey focused on shallow water where macroalgae was previously found. Deeper water (>3 m) is unvegetated sands around these bays and is not at risk of foreshore development. The survey was undertaken by lowering a waterproof video camera from a kayak, with the monitor visible to the ecologist. Video was recorded to allow post-field examination of high-definition footage to check habitat extent and condition. Habitat types were mapped in the field using a GPS-enabled tablet. The extent of validated aquatic flora and KFH types were merged into a final map using ArcPro.

4. Aquatic habitats and ecology

4.1. Previous aquatic habitat mapping

The Sydney Harbour Rocky Foreshores and Significant Seagrass Map Sheet RFS_001 (12 April 2022) identifies the nearest seagrass as being 600 m south-west of the site, and the nearest rocky foreshore area as being 1300 m north-east of the site (Figure 7). Macroalgae is not included in this dataset.

The State-wide mapping of estuarine macrophytes (mangroves, saltmarsh and seagrass) by DPI Fisheries (2010-2019) does not identify any mangroves, saltmarsh or seagrass in Blackwattle Bay, Rozelle Bay or Johnstons Bay (Creese et al 2009, Figure 8). It shows the nearest seagrass located in Mort Bay.

ELA staff mapped marine habitat in 2017 for all of Blackwattle Bay, Rozelle Bay, Johnstons Bay and White Bay (ELA 2017, ELA 2020) and found that a narrow band of *Sargassum linearifolium* (brown macroalgae) follows the shallow subtidal zone close to shore, where rocky rubble is present for an attachment base. Most of these bays had unvegetated subtidal sands and intertidal seawalls. No seagrass was observed in that study area. Small patches of mangroves and saltmarsh occur in Rozelle Bay, with sparse mangrove juveniles on some intertidal benches in Blackwattle Bay near the new Sydney Fish Markets.

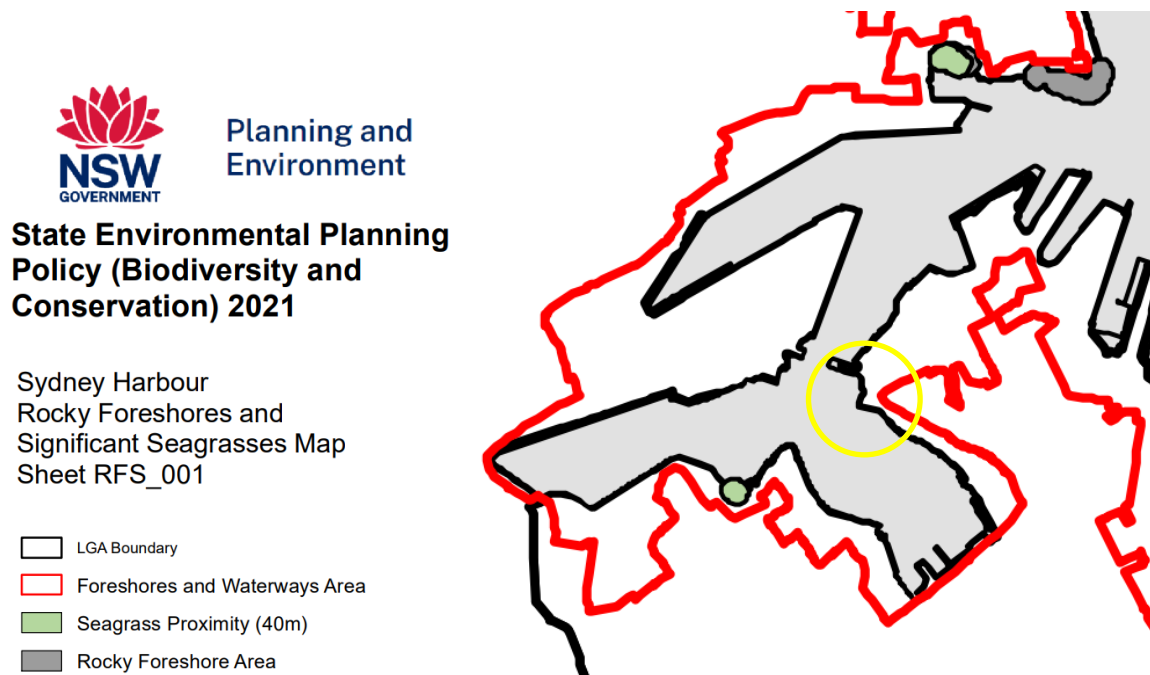


Figure 7: Sydney Harbour Rocky Foreshores and Significant Seagrass Map (14 April 2022), site circled yellow

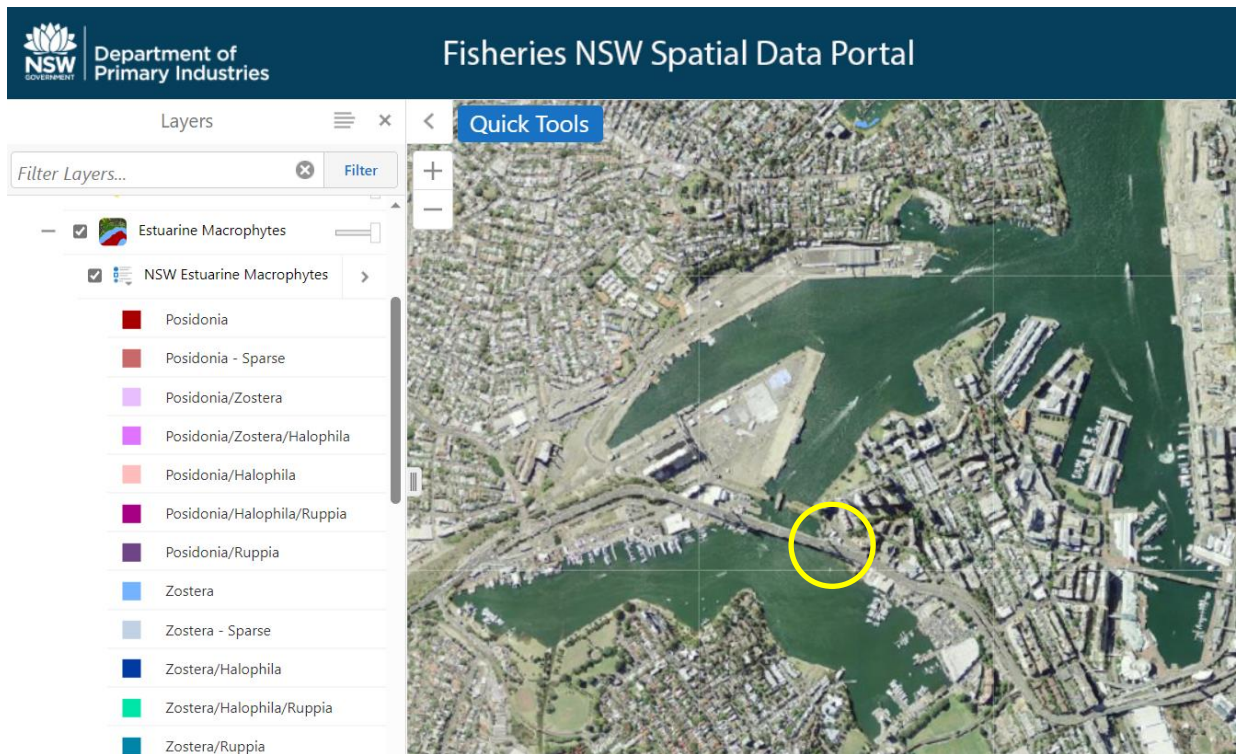


Figure 8: DPI Fisheries mapping of marine macrophytes (2010-2019), site circled yellow

4.2. Field-validated aquatic habitat mapping

The 2023 field survey confirmed that mapping from 2017 remains generally valid, with no observable change in key fish habitat types, but a small change in macroalgae extent. The Blackwattle Bay Marina built in 2020 modified a small area of seawall, shaded some macroalgae and added piles to bare sands. The upwelling of fine sediments by vessels using this facility may have exposed rock rubble in some areas, and smothered others nearby.

Distinct habitat zones were identified during the field survey, as mapped in Figure 9, with representative photographs in Figure 10:

- Subtidal sand with dense infauna, unvegetated, with either:
 - algae film
 - sparse shells
 - scattered boulders
 - fine woody debris
- Macroalgae attached to rocky rubble, dominated by *Sargassum linearifolium* (Brown macroalgae)
- Intertidal rock rubble, unvegetated, with dense cover of *Saccostrea glomerata* (Sydney rock oyster)
- Seawalls (mix of smooth concrete, vertical rough sandstone and sloping rough sandstone), often with rocky rubble near the base, with common marina fauna dominated by:
 - Barnacles: *Tessieropora rosea* (Rose-coloured barnacle)
 - Bivalve: *Saccostrea glomerata* (Sydney rock oyster)
 - Gastropod: *Bembicium auratum* (Gold-mouthed conniwink)

- Worm: *Ficopomatus enigmaticus* (Australian tubeworm)
- Man-made structures (boat ramp, wharf, marina and piles).

Fish observed around the site include: *Acanthopagrus australis* (Yellowfin bream), *Ambassis jacksoniensis* (Port Jackson glassfish), *Ambassis marianus* (Estuary glassfish), *Girella tricuspidate* (Luderick), *Gobiidae* spp. (unidentified gobies), *Monacanthus chinensis* (Fanbelly leatherjacket), *Mugil cephalus* (Sea mullet), *Tetractenos glaber* (Smooth toadfish) and unidentified crabs.

DPI Fisheries identify three types of KFH in their Policy and Guidelines for Fish Habitat Conservation and Management (Fairfull 2013, Appendix B). Type 3 (minimally sensitive) KFH dominates the study area, with Type 2 (moderately sensitive) KFH present as a narrow band of *Sargassum linearifolium* (Brown macroalgae) (Figure 9). No Type 1 (highly sensitive) KFH occurs in the study area. The noxious alga *Caulerpa taxifolia* was not observed.

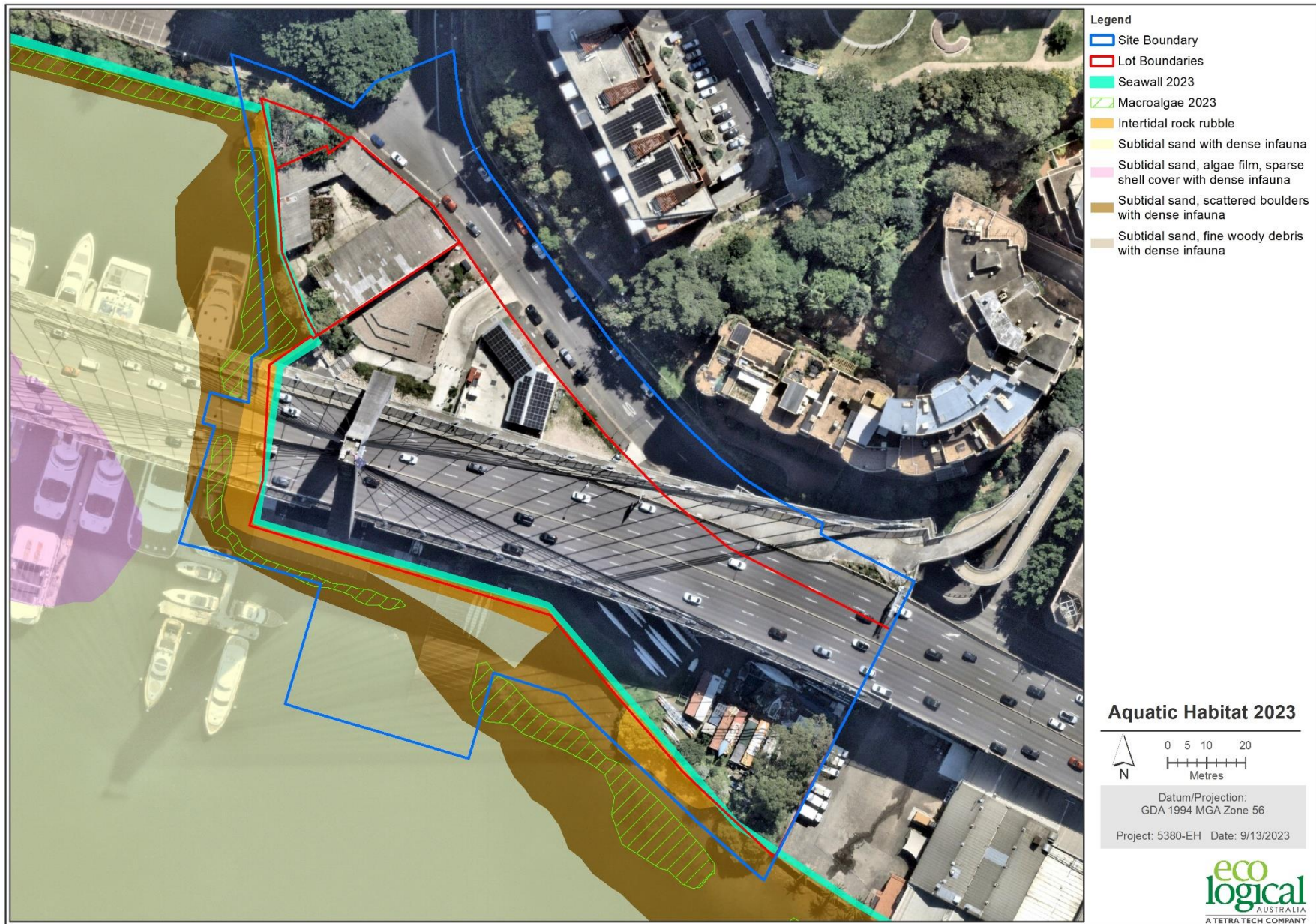
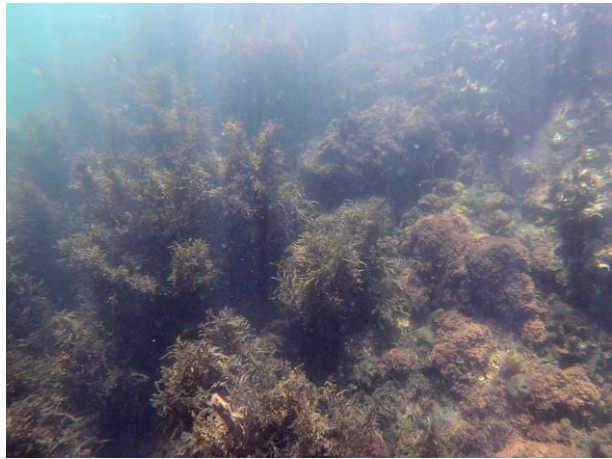


Figure 9: Field validated aquatic habitat (2023)



Dense macroalgae (*Sargassum linearifolium*) on rocky rubble fringing the study area.



Sparse macroalgae (*Sargassum linearifolium*) on rocky rubble fringing the study area.



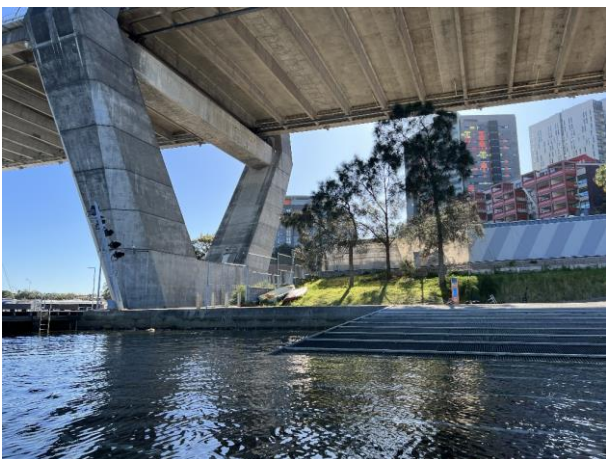
Oysters and encrusting algae on rock rubble at base of seawalls (left) and bare soft sediment with dense burrows from infauna (right).



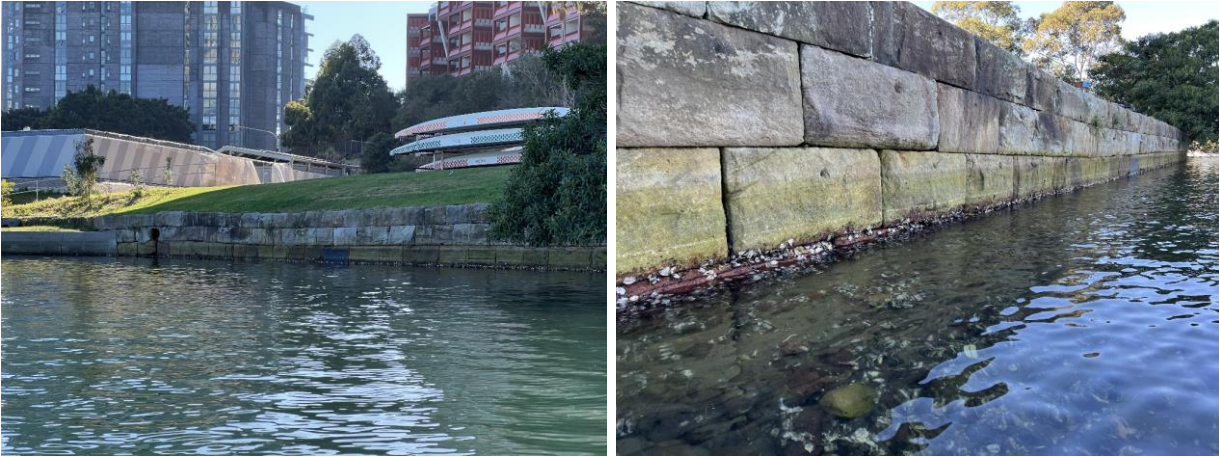
Vertical sandstone block seawall northern side of Anzac Bridge (walls to remain).



Concrete seawall and timber wharf around marina. The proposed boardwalk would overhang the water where the sandstone and concrete seawalls meet (left photos). The proposed kayak pontoon and gangway would be located near the wharf after its partial removal.



Dragon boat ramp is proposed to be relocated to the west (towards timber wharf on left).



Vertical concrete and sandstone block seawall is proposed to be removed and replaced with stepped sandstone block seawall.

Figure 10: Representative site photos (21 June 2023)

4.3. Presence or likelihood of threatened and protected species, populations and communities

Threatened species, populations or communities listed under the FM Act and EPBC Act that are known or expected to occur in the region are listed and assessed in Appendix A. For species listed under the BC Act please refer to the BDAR (ELA 2023). In the study area, there was suitable habitat for one threatened species to occur: *Hippocampus whitei* (White's seahorse). Otherwise, there was no valuable or specific habitat capable of supporting other threatened aquatic species, populations or communities. It is possible some species may opportunistically pass near or through the area given the connectivity to the broader harbour and coastal habitats, but they are unlikely to depend on habitat within the site for their survival. An overview of key species or groups is described below, including protected species (not threatened) that are typical considerations in Sydney Harbour:

- *Hippocampus whitei* (White's seahorse) and other protected syngnathids occur in Sydney Harbour. White's seahorse is known to use artificial structures such as jetty piles if there is suitable macroalgal to grasp for support. Other preferred habitat types, such as seagrass beds, soft corals, sponges and swimming nets are not present in the study area. Nearby records include:
 - 1998 – Rozelle Bay, small timber jetty on southern side, east of Glebe Point
 - 2001 – Rozelle Bay, 100 m west of Johnstons Creek on southern bank of bay (shoreline since re-engineered)
 - 2001 – White Bay, Port No. 3.

Given the proximity and modified habitat of those records, White's seahorse could use macroalgae for habitat in the study area, especially in areas away from boat activity. Therefore, we assume its presence and have prepared an assessment of significance in accordance with Section 220ZZ(2A) of the FM Act and Part 3 of the EPBC Act (Appendix C).

- *Epinephelus daemeli* (Black rockcod) is unlikely to occur. It prefers rock crevices, overhangs and caves, all of which are absent from the study area. None were observed in the underwater assessment and are considered highly unlikely to use the impact area.
- Threatened sharks and rays may opportunistically pass through the area while exploring or chasing prey. Both fauna groups are highly mobile and would likely avoid construction activity and regular boat traffic may deter large fauna from regularly using the area. Their overall habitat would remain the same during operation.
- The threatened seagrass population, *Posidonia australis*, occurs in the harbour and is known to grow on subtidal sand up to 10 m deep. No seagrass was observed in the study area.
- Marine vegetation is protected under the FM Act and includes macroalgae (seaweeds), seagrass, mangroves and saltmarsh (saltmarsh is also a threatened community under the EPBC Act):
 - Macroalgae – A narrow band of *Sargassum linearifolium* (Brown macroalgae) occurred on rocky rubble fringing the shore at depths <2 m.
 - Seagrass – None have been found in Blackwattle Bay.
 - Mangroves – None were present in the study area. Some small juveniles occur on the opposite side of Blackwattle Bay near the new Sydney Fish Markets.
 - Saltmarsh – None have been found in Blackwattle Bay.
- Aquatic mammals (whales, dolphins, dugongs and seals) are known or modelled to occur east of Millers Point where there is a greater connection to coastal waters. Large mammals are unlikely to use habitat this close to shore. Dugongs are more typical in tropical and subtropical

waters and forage on seagrass beds, which are absent at the site. There are no records of dugongs in the harbour, suggesting that if they do venture down the east coast they may prefer more expansive beds such as those in Botany Bay. Seals have been sighted around the harbour, including basking on artificial structures. It is likely that most aquatic mammals avoid human activities and would be deterred by vessels and people in this area.

- Aquatic reptiles (turtles) are more common along coastal waters than in the harbour or its estuaries. It is possible they explore the greater area but would not depend on the site for feeding habitat or nesting.
- Shore, wetland, migratory and pelagic birds may use calm intertidal zones to forage. They are unlikely to occur regularly in the study area because of the infrequent low tides that would be shallow enough for wading, plus the boat wash and splashback from seawalls. See the BDAR (ELA 2023) for further assessment.

5. Impact assessment and mitigation

This section considers the impact of construction and operation based on the work described in Section 1.3 and 1.4. Works below or crossing the mean high water mark and impacts to Type 2 (moderately sensitive) KFH are mapped below in Figure 11. The remainder of the intertidal and subtidal zone is Type 3 (minimally sensitive) KFH.

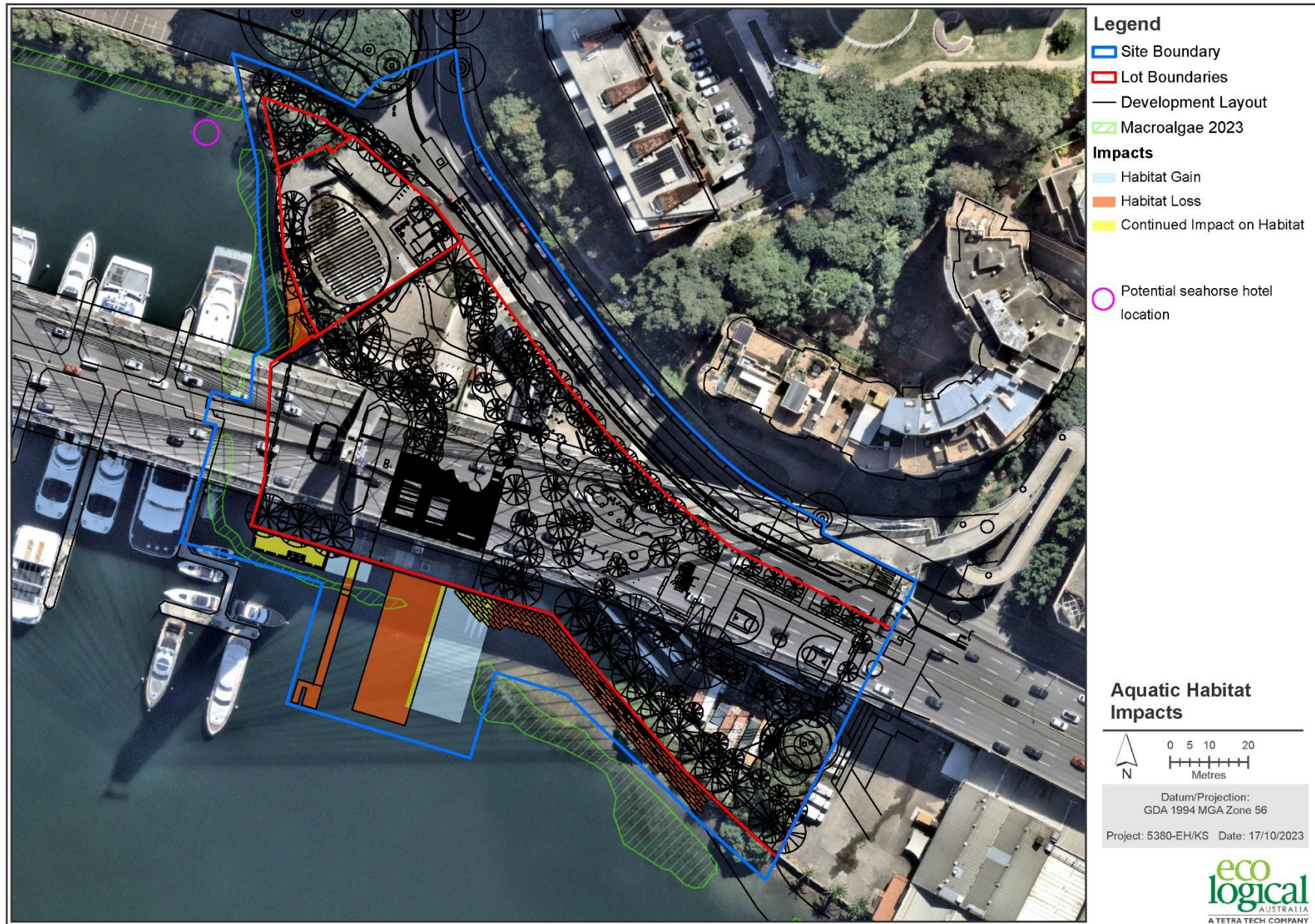


Figure 11: Proposed instream works and Type 2 (moderately sensitive) KFH - macroalgae

5.1. Construction and operational impact

The severity of impacts and recommended mitigation measures during construction and operation are below in Table 4 and Table 5. All mitigation measures are also listed in Section 5.6.

Table 4: Assessment of construction impact

Activity	Impact	Severity	Mitigation
Piling (removal and replacement).	Loss of pile habitat (removal of dragon boat ramp and part of wharf).	Low impact to Type 3 KFH, but temporary as new piles on pontoon, overwater boardwalk and replacement boat ramp will substitute habitat for species to recolonise. Similar habitat around the wharf and marina would not be affected.	None.
	Underwater noise during cutting or pulling old piles, and drilling and hammering new piles.	Moderate impact to nearby marine fauna. Fish in the vicinity would be affected by excessive underwater noise, ranging from mortality to interruption of communication, depending on species anatomy (eg fish with swim bladders closer to the ear are more sensitive to acoustic impact than species with swim bladders further from the ear). The number of fish impacted by noise is difficult to determine without modelling species abundance and distribution in the harbour. However, the impact is expected to be low when considering the small proportion of surrounding habitat compared to similar habitat in the greater harbour.	Gentle start up when hammering. Staged breaks, such as 10 mins loud, 30 min quiet.
	Sediment plumes when extracting old piles or raising drill head.	Low impact as no highly sensitive habitat occurs close to the works site. Strong winds, tidal movement or lack of sediment controls may increase this impact if plumes spread to rocky macroalgae habitat nearby. Hammering of piles is unlikely to create significant sediment plumes, with sediment being pushed downwards and outwards.	A silt curtain around the works site will contain sediment plumes in the upper 3 m, allowing sediment to fall to the seafloor consisting of mostly bare substrate.
Seawall modification.	Loss of unvegetated silty sand substrate, which is abundant in Sydney Harbour. Loss of benthic invertebrates living on or in existing wall and sediment. Gain of hard intertidal habitat through complex arrangement of stepped sandstone, giving more surface area and interstitial spaces for small marine biota.	Long-term positive impact to marine biota.	None.
Partial wharf removal, new pontoon, new boat ramp, new over water boardwalk.	Gain of habitat by removing a portion of the wharf and existing elevated boat ramp, thereby allowing light to penetrate to the seafloor. Indirect loss of 31 m ² of Sargassum macroalgae through shading from the new structures.	Neutral impact (no net loss of KFH) as loss and gain are similar, plus additional habitat would be provided.	The gangway and elevated boat ramp should be constructed from a mesh material to allow light to penetrate the water column (similar to the existing ramp). See creation of new aquatic habitat below in

			Table 5 to ensure no net loss of KFH.
Stormwater outlets.	Concentrated freshwater discharge onto marine habitat, and/or deposition of sediment, leaves and litter.	Low, as outlets are close to other existing outlets and the catchment is minor. The low volumes would mix and disperse with the tides quickly, unlikely resulting in a change in marine communities around outlets. Sediment, leaves and litter would be trapped prior to discharge.	Install storm-filter water quality chambers as shown in the Stormwater Management Plan (Figure 6) and ensure water has free passage through the sandstone block terrace.
Construction vessels.	Disturbance from boat/propeller wash.	Low impact as large vessels/barges would need to access the foreshore during high tide when adequate clearance occurs. Propellers or boat wash from smaller vessels may disturb sediment in shallow water causing smothering of nearby habitats, however, this impact is considered low and temporary.	Avoid shallow water when turning vessels. Large vessels/barges should avoid macroalgae at low tide. Avoid anchoring on macroalgae beds.
	Compaction/scouring of benthic habitat from temporary mooring blocks/jack-ups.	Low impact as no highly sensitive benthic habitat occurs in the work area. Scouring or smothering benthic infauna burrows may impact invertebrates and patches of macroalgae, but the impact area is small in comparison to the surrounding bay and the species would recover.	Best practice is to deploy and retrieve mooring blocks or jack-ups in calm conditions, and take measures to prevent dragging chains or ropes across the seafloor. Avoid macroalgae beds as much as practical.
	Accidental spills.	Moderate impact to ecology. Chemical spills are unlikely but may occur during refuelling or if there is a hydraulic fluid leak. Spilt petrochemicals have the potential to wash up on shore or disperse in the water. This could kill or impair fish and infauna (benthic invertebrates).	Oil/fuel/chemical storage and spill management. Machinery and engine maintenance schedule to reduce oil/fuel leakage.
	Spread of marine pests.	Moderate impact to ecology. Vessels may be a vector for movement of marine pests, especially if ships are not from the local area. For example, machinery and vessels used on other sites where the noxious alga <i>Caulerpa taxifolia</i> was present could introduce the weed if hygiene procedures aren't followed. If <i>Caulerpa</i> becomes established around the structures, then other boats would potentially become vectors for the further spread of this weed.	Vessels moving from areas where <i>Caulerpa</i> is present should be cleaned and inspected before travelling to the harbour and entering the site.

Table 5: Assessment of operational impact

Activity	Impact	Severity	Mitigation
Boat traffic.	Increase in low-impact paddle craft (kayaks and dragon boats). Increase use may result in litter and scraping of shallow habitat.	Low.	Provide bins near the ramp and pontoon.
Fishing or passive foreshore use.	Increase use may result in litter.	Low.	Provide bins for fishing lines, cigarettes and waste.
Creation of new aquatic habitat.	The removal of the existing boat ramp and additional rock rubble to connect habitat could achieve 31 m ² of new	Positive.	Once the boat ramp is relocated, assess the seafloor for suitability of adding rocky rubble

	habitat suitable for establishment of Sargassum macroalgae. Addition of other benthic structures could attract fish.		around 1-2 m depth to connect nearby Sargassum habitat. Explore the suitability of adding two seahorse hotels in a quiet area, such as the corner near the submarine cable and Bank St approach to Glebe Island Bridge (see suggestion in Figure 11).
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5.2. DPI Fisheries policy and guidelines for fish habitat conservation (FM Act)

DPI Fisheries' Policy and Guidelines for Fish Habitat Conservation and Management (Fairfull 2013) outline requirements for assessing impact of waterfront development to ensure the sustainable management, and 'no net loss', of KFH in NSW (Table 6). Part 7 of the FM Act addresses the protection of aquatic habitats and works that requires a permit.

Table 6: Assessment requirements under DPI Fisheries' Policy and Guidelines for Fish Habitat Conservation

Assessment	Response	Comment
Will the proposed works directly or indirectly impact threatened species, populations or communities?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Potential <input type="checkbox"/> No	<p>Seahorses may occur on macroalgae that would be lost by the development. An assessment of significance is provided in Appendix C, which concludes there would not be a significant impact.</p> <p>Black rockcod are unlikely to occur. Posidonia seagrass does not occur in the bay. No other threatened species, populations or communities are likely to occur (see Section 4.3 and Appendix A).</p>
Will the proposed works harm protected vegetation (seagrass, macroalgae, mangroves or saltmarsh)?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<p>About 31 m² of macroalgae would be shaded by the kayak gangway, dragon boat ramp and overwater boardwalk, causing indirect harm. Three piles would also directly damage this vegetation.</p> <p>No saltmarsh, mangroves or seagrass occur in the study area.</p>
Are the proposed works in or near critical habitat for the Grey Nurse Shark (Part 7A of FM Act)?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Nearest site is Magic Point, Malabar
Will the proposed works impact aquaculture leases or commercial fisheries?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Commercial boats use Blackwattle Bay, but these works would not alter accessibility for those vessels.
Are the works categorised as a key threatening process (as per Schedule 6 of the FM Act) for example: <ul style="list-style-type: none"> • Current shark meshing program in NSW waters • Hook and line fishing in areas important for survival of threatened fish species • Human-caused climate change 	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	These works do not meet the definition of these key threatening processes.

<ul style="list-style-type: none"> • Instream structures and other mechanisms that alter the natural flow • Introduction of non-indigenous fish and marine vegetation to the coastal waters of NSW • Introduction of fish to fresh waters within a river catchment outside their natural range • Removal of large woody debris from NSW rivers and streams • Degradation of native riparian vegetation along NSW watercourses. 		
Will the works result in a 'net loss' of key fish habitat?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	As discussed in Table 4, the loss and gain are similar, plus additional habitat would be provided, therefore we expect no net loss of KFH.
Do the works require a permit or consultation under Part 7 of the FM Act? Permits relate to: <ul style="list-style-type: none"> • Harming marine vegetation • Dredging and/or reclamation of bed or bank • Obstruction of fish passage • Relocation of threatened species. 	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	The kayak gangway, replacement dragon boat ramp and overwater boardwalk would shade and likely harm marine vegetation (31 m ² of Sargassum) and a seahorse relocation plan is recommended prior to construction.

5.3. Matters of National Environmental Significance (MNES)

The following MNES (Table 7) were returned from the database search for a 10 km radius around the site. One aquatic MNES may be impacted by the proposed works (White's seahorse), and an assessment of significance is provided in Appendix C.

Table 7: Potential impacts to matters of National Environmental Significance

Matter of NES	Count	Comment	Impact Assessment
World Heritage Properties	3	Not near site - terrestrial	No impact
National Heritage Places	10	Not near site - terrestrial	No impact
Wetlands of International Importance (Ramsar Wetlands)	1	Not near site (Towra Point Nature Reserve).	No impact.
Great Barrier Reef Marine Park	None		No impact.
Commonwealth Marine Areas	None		No impact.
Listed Threatened Ecological Communities	12	None on site.	No impact (Appendix A).
Listed Threatened Species	117	Terrestrial species excluded – see BDAR (ELA 2023).	See assessment of significance in Appendix C for White's seahorse. No impact to others (Appendix A).

Listed Migratory Species	82	Terrestrial species excluded – see BDAR (ELA 2023).	No impact (Appendix A).
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5.4. State Environmental Planning Policy (Biodiversity and Conservation SEPP) 2021

An assessment under the Biodiversity and Conservation SEPP are provided below for controls on development generally (Table 8) and development in foreshores and waterways area (Table 9).

Table 8: Impact assessment for Part 6.2, Division 2 - Controls on development generally

Item	Impact assessment
Clause 6.6 Water quality and quantity	<p><i>(2) Development consent must not be granted to development on land in a regulated catchment unless the consent authority is satisfied the development ensures—</i></p> <p><i>(a) the effect on the quality of water entering a natural waterbody will be as close as possible to neutral or beneficial.</i></p> <p>As part of the proposed stormwater management strategy, Water Sensitive Urban Design measures have been introduced to improve the quality of stormwater runoff into Blackwattle Bay (Enspire 2023). The proposed water quality treatment system involves:</p> <ul style="list-style-type: none"> • Proprietary filter baskets at surface inlet pits • Vegetated swales • Bioretention tree pits • Proprietary storm filters. <p>Enspire (2023) conclude that the treatment system is required to meet the pollutant removal targets as defined in the Blackwattle Bay Design Guidelines during the operational phase of the proposed development.</p> <p><i>(b) the impact on water flow in a natural waterbody will be minimised.</i></p> <p>No flowing watercourses occur in the study area. The modification to seawalls and additional structures are unlikely to significantly affect tidal movement given the small area versus larger waterbody.</p>
Clause 6.7 Aquatic ecology	<p><i>(2) Development consent must not be granted to development on land in a regulated catchment unless the consent authority is satisfied of the following—</i></p> <p><i>(a) the direct, indirect or cumulative adverse impact on terrestrial, aquatic or migratory animals or vegetation will be kept to the minimum necessary for the carrying out of the development.</i></p> <p>Modification to the seawall would improve the intertidal habitat. Additional macroalgae habitat can be included to offset the loss of existing macroalgae, and improve connectivity around the bay.</p> <p><i>(b) the development will not have a direct, indirect or cumulative adverse impact on aquatic reserves.</i></p> <p>No aquatic reserves are nearby and would not be impacted.</p> <p><i>(c) if a controlled activity approval under the Water Management Act 2000 or a permit under the Fisheries Management Act 1994 is required in relation to the clearing of riparian vegetation—the approval or permit has been obtained.</i></p> <p>The proposal for this State significant development does not require permits under the WM Act or FM Act (Section 4.41(1) of the EP&A Act).</p>

		<p><i>(d) the erosion of land abutting a natural waterbody or the sedimentation of a natural waterbody will be minimised.</i></p> <p>The foreshore will be stabilised with new seawalls adjacent to vegetated or hardstand surfaces, thus preventing any erosion and sedimentation of the bay. A Construction Environmental Management Plan implemented during earthworks would aim at slowing surface runoff and trapping sediments.</p> <p><i>(e) the adverse impact on wetlands that are not in the coastal wetlands and littoral rainforests area will be minimised.</i></p> <p>No wetlands occur nearby and would not be impacted.</p>
Clause 6.8 Flooding		<p><i>(2) Development consent must not be granted to development on flood liable land in a regulated catchment unless the consent authority is satisfied the development will not—</i></p> <p><i>(a) if there is a flood, result in a release of pollutants that may have an adverse impact on the water quality of a natural waterbody.</i></p> <p>In assessing the overland flow and resulting flood hazard through the precinct, the small catchment contributing most to the precinct means the worst case flooding conditions are typically caused by surcharging flows or flows in excess of the pit and pipe system capacity, resulting in localised pooling (Mott MacDonald Australia 2023). Sources of contamination exist at the site as reported in JBS&G (2023a). Subject to the successful implementation of the measures described in the Remedial Action Plan, JBS&G (2023b) conclude that the site can be made suitable for the intended uses and that the risks posed by contamination can be managed in such a way as to be adequately protective of human health and the environment. Therefore, any localised flooding is unlikely to release pollutants into the bay.</p> <p><i>(b) have an adverse impact on the natural recession of floodwaters into wetlands and other riverine ecosystems.</i></p> <p>The site is not located between waterbodies and would not interfere with wetland/riverine flood processes.</p>
Clause 6.9 Recreation and public access		<p><i>(2) Development consent must not be granted to development on land in a regulated catchment unless the consent authority is satisfied of the following—</i></p> <p><i>(a) the development will maintain or improve public access to and from natural waterbodies for recreational purposes, including fishing, swimming and boating, without adverse impact on natural waterbodies, watercourses, wetlands or riparian vegetation.</i></p> <p>The proposed kayak pontoon and stepped seawall will enhance access to the harbour, whilst improving marine ecology through improved wall design and habitat connectivity (see recommendation to add rock rubble for macroalgae).</p>

Table 9: Impact assessment for Part 6.3, Division 3 - Development in Foreshores and Waterways Area

Item	Impact assessment
Clause 6.28 General	<p><i>(1) In deciding whether to grant development consent to development in the Foreshores and Waterways Area, the consent authority must consider the following—</i></p> <p><i>(f) whether the development will protect or reinstate natural intertidal foreshore areas, natural landforms and native vegetation.</i></p>

	<p>A portion of vertical seawall would be replaced with a stepped sandstone seawall, which would increase surface area, complexity and interstitial spaces for marine biota to attached, forage and shelter in at various tide heights.</p> <p><i>(g) whether the development protects or enhances terrestrial and aquatic species, populations and ecological communities, including by avoiding physical damage to or shading of aquatic vegetation (aquatic vegetation includes seagrass, saltmarsh and algal and mangrove communities).</i></p> <p>Although 31 m² of macroalgae would be shaded and piled, there are suitable areas to connect similar habitats by adding rock rubble to allow self-establishment of macroalgae and attract fish, including seahorses (see recommendations).</p> <p><i>(h) whether the development will protect, maintain or rehabilitate watercourses, wetlands, riparian lands, remnant vegetation and ecological connectivity.</i></p> <p>In accordance with the Blackwattle Bay Design Guidelines (DPE 2022), aquatic habitat enhancement opportunities will be considered during the detailed design of the public domain, such as increase rocky rubble to improve continuity and width, and construct water retaining features and increase structural complexity of intertidal or subtidal zones of seawalls (see recommendations).</p>
Clause 6.31 Dredging	<p>Not applicable, as the works do not meet the definition of dredging under the Biodiversity and Conservation SEPP: <i>“dredging means the removal of material from the sea, harbour bed or bed of a river for the purposes of constructing a new or deeper navigational area or channel or reopening a discontinued navigational area or channel, but does not include intertidal dredging or maintenance dredging”</i>.</p>
Clause 6.32 Rocky foreshores and significant seagrasses	<p><i>(1) This section applies to land identified as a rocky foreshore or significant seagrass area on the Rocky Foreshores and Significant Seagrasses Map.</i></p> <p>The site is not located on or near land identified as a rocky foreshore or significant seagrass area on the Rocky Foreshores and Significant Seagrasses Map.</p>

5.5. Blackwattle Bay Design Guidelines

An assessment of the proposal against the Blackwattle Bay Design Guidelines (DPE 2022) relative to marine ecology is provided below in Table 10. Where criteria aren't currently met, but could be met during the detailed design phase (ie post approval) it is assumed a commitment will be made to ensure the recommendations in Section 5.6 are conditioned or implemented, or an alternative but equally valuable measure is applied if unforeseen constraints prevent its application (eg seawall tiles could be swapped for seahorse hotels, or vice versa).

Table 10: Blackwattle Bay Design Guidelines assessment for marine ecology

Blackwattle Bay Design Guidelines provision	Assessment
3.5 Open Space 3.5.1 Foreshore promenade	
5. The foreshore promenade at the water's edge should include naturalised edges to support marine ecology, manage stormwater and flooding and respond to sea level rise.	A new stepped sandstone block seawall and other recommended retrofits (eg seawall tiles) would provide intertidal habitat for a range of marine species.
6. The Environmentally Friendly Seawalls guide prepared by Department of Environment and Climate Change and the Sydney Metropolitan Catchment Management Authority is	A new stepped sandstone block seawall is proposed for part of the foreshore, which meets the Design Principles for New Seawalls (Section 3.2 of OEH 2012), by:

Blackwattle Bay Design Guidelines provision	Assessment
to be considered in the design of any new and reconstruction of any existing seawalls.	<ul style="list-style-type: none"> 3.2.3 - Maximising habitat diversity and complexity 3.2.4 - Creating low-sloping seawalls or incorporating changes of slope
7. Existing seawalls should be retro-fitted with appropriate environmentally friendly features.	Although not detailed in the current plans, there is space along the seawalls to attach marine habitat features, such as seawall tiles or other water retention pots. Priority areas are smooth concrete, followed by vertical stone walls.
8. Where possible, artificial reef or underwater statues should be fitted to the base of seawalls to improve fish habitat quality.	<p>The base of seawalls would benefit from additional rock rubble laid on the seafloor to promote colonisation of invertebrates and macroalgae, plus stabilise fine sediments typically suspended from boat wash or stormwater discharge that cause turbulence around the wall. Installation of a shallow reef to connect the existing macroalgae strip would enhance connectivity of fish habitat. Underwater statues are not suited at this site because the depth required clashes with boat/watercraft traffic around the marina and pontoon/ramp. Alternatively, lower profile seahorse hotels could be installed near macroalgae between the submarine cable and approach road to Glebe Island Bridge, which is secluded and away from vessel movement.</p> <p>The proposal can meet this design provision.</p>
9. Any over-water structures should be designed with light penetration features to allow light to start food-chain ecology under hard structures.	<p>Four overwater structures are proposed to be added or modified:</p> <ol style="list-style-type: none"> 1) The existing dragon boat ramp is currently made of mesh, and a similar product is proposed for its replacement/relocation. 2) The proposed gangway extends over a macroalgae bed, so a mesh deck is proposed to reduce shading of this marine vegetation. As the pontoon requires supporting floats that block light, a mesh deck on a pontoon is less effective, but may still be appropriate for grip and drainage. 3) The existing wharf would be reduced in size, which is a timber deck built under approval for the Blackwattle Bay Marina. 4) A small promenade deck is proposed to cut the corner of a sharp seawall turn. The shading created would be minor given its elevation, length and orientation to the sun, so this design provision is a low priority in regard to selection of material. <p>The proposal can meet this design provision.</p>
4 Environmental Management and Sustainability	
Ecology and landscape	
p. Enhance terrestrial and marine ecology within the Precinct	<p>Marine ecology would be enhanced by the replacement seawall (stepped sandstone blocks) and other intertidal and subtidal features recommend for installation.</p> <p>The proposal can meet this design provision.</p>
4.3 Urban and marine ecology	

Blackwattle Bay Design Guidelines provision	Assessment
2. Aquatic habitat enhancement opportunities, summarised below as location/environment and opportunity, should be considered during the detailed design of the public domain.	
Subtidal sand (>2 m depth): Install 'oyster reefs' to provide colonisation and refuge for marine fauna.	The site does not expand into an appropriate depth for this feature, therefore, this design provision is not applicable.
Subtidal sand (1-2 m depth): Subject to boat safety considerations, install scattered rubble to connect macroalgae habitat.	There is potential to connect patches of existing macroalgae habitat at this depth by placement of rock rubble. Specifics should be determined once the dragon boat ramp has been removed, as there is an opportunity to fill that void. The proposal can meet this design provision.
Macroalgae (dense <i>Sargassum linearifolium</i>): Plant/transplant native macroalgae and/or increase rocky rubble to improve continuity and width.	<i>Sargassum linearifolium</i> is common in this area as it grows on hard substrate. This demonstrates that planting or transplanting is not required as it can self-establish if rocky rubble is available. An increase of hard substrate at an appropriate depth would help connect existing macroalgae patches, especially once the dragon boat ramp is relocated. The proposal can meet this design provision.
Intertidal rocky rubble seawalls: Construct water retaining features and increase structural complexity of intertidal or subtidal zones of seawalls.	This style of wall does not occur on site, except a small portion of concrete around the submarine cable (near the road to Glebe Island Bridge). This area has dense oyster growth and does not require manipulation to improve its habitat value. Therefore, this design provision does not apply.
Vertical and sloped smooth seawalls: Replace with gentle grade wall and/or retrofit with horizontal features like flowerpots, water retaining features and complex hard surfaces.	A sloped smooth concrete seawall is located beneath the Anzac Bridge at the marina. This surface presents a large area to retrofit with an improved surface, such as habitat tiles or other complex surfaces and water retaining features. The proposal can meet this design provision.
Vertical rough seawalls: Retrofit with horizontal features like flowerpots.	This style of wall occurs between Anzac Bridge and Glebe Island Bridge, and could benefit from water retention features (eg flower pots and/or habitat tiles or similar). The other location of this style of wall is proposed for replacement as a stepped sandstone block wall, and therefore does not need additional features. The proposal can meet this design provision.
Sloped stepped seawalls: Increase macroalgae habitat at base through planting and/or additional rubble.	This style of wall does not occur on site, but the proposed stepped sandstone block wall would replace and vastly improve the existing vertical wall. The proposal can meet this design provision.
Future boardwalks, wharves and jetties: Design to allow light penetration to water and suspend fish aggregation devices.	As discussed above, a mesh decking is appropriate for the gangway. However, due to the shallow depth beneath overwater structures, suspended devices are not suitable in this location.
Future floating boardwalks (temporary): Add benthic habitat features to improve fish shelter and connectivity.	No floating boardwalks are proposed. This design provision is not applicable.
Piles: Select products with rough surface and/or attach rough material for macroalgae attachment.	About 100 piles are required for the overwater structures. Rough timber piles, like at Pirrama Park, are preferred if structurally suitable. The pontoon's piles would provide less

Blackwattle Bay Design Guidelines provision	Assessment
	habitat as the structure slides up and down with the tide, therefore, other materials are appropriate.

5.6. Recommendations and mitigation measures

Table 10 above discusses the feasibility of the Blackwattle Bay Design Guidelines and provides a rationale for items not suggested below. The following recommendations and mitigation measures apply to the detailed design phase of the proposal:

- The gangway and elevated boat ramp would be constructed from a mesh material to allow light to penetrate the water column. Other materials are suitable for the pontoon deck and overhanging promenade.
- Except for the pontoon, rough timber piles are preferred over smooth steel piles (cased in plastic). Roughness would improve colonisation of marine biota, but consideration of maintenance and longevity is required before committing to a material.
- Provide adequate bins near the foreshore, to receive fishing lines, cigarettes and general waste.
- Once the boat ramp is relocated, assess the seafloor for suitability of adding rocky rubble (shallow reef) around 1-2 m depth to connect nearby Sargassum habitat and improve the overall continuity of fish habitat.
- The base of seawalls would benefit from additional rock rubble laid on the seafloor to promote colonisation of invertebrates and macroalgae, plus stabilise fine sediments typically suspended from boat wash or stormwater discharge that cause turbulence around the wall.
- Explore the suitability of adding two seahorse hotels in a quiet area, such as the corner near the submarine cable and Bank Street approach to Glebe Island Bridge (see suggestion in Figure 8).
- Explore the suitability of attaching marine habitat features to portions of the existing seawalls, such as seawall tiles or other water retention pots. Priority areas are smooth concrete, followed by vertical stone walls.

Addition of all marine habitat structures should come with a caveat that features may be customised or interchanged to suit constructability and effectiveness at a particular location. The project ecologist should work with project engineers/designers to ensure an overall positive outcome is achieved if alterations are required.

The following mitigation measures are recommended to minimise the risk of impact during construction and operation. These are adapted from DPI Fisheries document Policy and Guidelines for Fish Habitat Conservation and Management. At a minimum, the construction contractor or representative should:

- Implement the Construction Environmental Management Plan (JBS&G 2023c) to address pollution, contamination and unnecessary disturbance which could arise during construction, such as:
 - sediment and debris control
 - oil/fuel/chemical storage and spill management
 - machinery and engine maintenance schedule to reduce oil/fuel leakage
 - low impact barge positioning to prevent propeller scouring and thrust wash onto benthic habitats (along the foreshore)

- minimise footprint and establish no-go zones in shallow habitats, especially on macroalgae beds
- accidental waste/material overboard response (eg construction materials dropped into the bay)
- biological hygiene (eg prevent spread of noxious species on and off the site)
- other measures listed below.
- Positioning of barges, drilling and pile driving should occur during calm conditions.
- Avoid shallow water when turning vessels. Large vessels/barges should avoid macroalgae at low tide.
- All mooring lines should be suspended off the seafloor to minimise drag across benthic habitat.
- Use of a floating boom with silt curtain encompassing full works area. The curtain is to remain in place until all suspended material has settled (no visible plumes).
- All waste material should be disposed of on land and not reused in the construction or left on the seafloor.
- Care should be taken not to introduce *Caulerpa taxifolia*. For example, a drill head or anchor used at another site with *Caulerpa* should be thoroughly cleaned of plant propagules and sediment before being used at another location. Fragments of *Caulerpa* can remain viable for up to three days out of the water. Best hygiene practices are outlined in the NSW Control Plan for the Noxious Marine Alga *Caulerpa taxifolia* (NSW I&I 2009).
- Gentle start-up hammering is recommended to allow undetected aquatic fauna to leave the area and avoid hearing damage. Include staged breaks, such as 10 mins loud, 30 min quiet. Work should be stopped if large fauna is observed nearby.
- An inspection for seahorses should occur two weeks prior to demolition of submerged piles/supports or where works will remove or directly damage macroalgae, or at a time recommended by the diver. The diver must operate under a s.37 licence (FM Act) and Seahorse Relocation Plan approved by DPI Fisheries. The relocation site should be selected by the diver in a nearby area (<200 m) with similar habitat that would not be impacted by known future work.

6. Conclusion

This aquatic ecology assessment concludes that the proposed stepped sandstone seawall, stormwater outlets, dragon boat ramp relocation, kayak pontoon, partial wharf removal and overwater boardwalk would:

- not have a significant impact on any aquatic threatened species, population or community
- not trigger the need for a Species Impact Statement, nor referral to a Commonwealth body for aquatic species
- not require a permit under Part 7 of the FM Act as the type of work and impact is exempt under Section 4.41(1)(b) of EP&A Act
- require fauna management in regard to survey and relocation of seahorses, if any, prior to construction
- have a neutral impact on Type 2 (moderately sensitive) KFH and Type 3 (minimally sensitive) KFH, meeting DPI Fisheries' policy of 'no net loss' of KFH
- have a long-term benefit to marine ecology due to an improved seawall and habitat connectivity if additional rocky rubble is included, plus other benefits if seahorse hotels or other fish habitat are installed
- meet the development controls for Water Catchments (Part 6.3, Division 3 - Development in Foreshores and Waterways Area) under the Biodiversity and Conservation SEPP
- meet the marine habitat controls in the Blackwattle Bay Design Guidelines.

7. References

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Appendix A – Threatened species likelihood of occurrence and impact

If a species has suitable habitat present on site AND is likely to use this habitat AND the species or its habitat would be directly or indirect impacted, THEN an Assessment of Significance is required. Such species, if any, are highlighted in the table below. This list excludes freshwater and terrestrial species and those only listed under the BC Act.

Class	Scientific Name	Common Name	FM Act Status	EPBC Status	Use of site	Is an impact assessment required?
Fish	<i>Epinephelus daemeli</i>	Black Rockcod	V	V	No suitable habitat present, eg rock overhangs, crevices or caves	No
Fish	<i>Hippocampus whitei</i>	White's Seahorse	E1	E	Potentially uses macroalgae in sheltered areas	Yes
Fish	<i>Prototroctes maraena</i>	Australian Grayling	E1	V	No records in catchment	No
Shark	<i>Carcharhinus longimanus</i>	Oceanic Whitetip Shark		M	No suitable habitat	No
Shark	<i>Carcharias taurus</i>	Grey Nurse Shark	E4A	CE	No suitable habitat	No
Shark	<i>Carcharodon carcharias</i>	White Shark	V	V, M	No suitable habitat	No
Shark	<i>Lamna nasus</i>	Porbeagle		M	No suitable habitat	No
Shark	<i>Mobula alfredi</i>	Reef Manta Ray		M	No recent records in harbour, unlikely to regularly visit area	No
Shark	<i>Mobula birostris</i>	Giant Manta Ray		M	No recent records in harbour, unlikely to regularly visit area	No
Shark	<i>Rhincodon typus</i>	Whale Shark		V, M	No suitable habitat	No
Reptile	<i>Caretta caretta</i>	Loggerhead Turtle		E, M	Typically coastal, unlikely to use site	No
Reptile	<i>Chelonia mydas</i>	Green Turtle		V, M	Typically coastal, unlikely to use site	No
Reptile	<i>Dermochelys coriacea</i>	Leatherback Turtle		E, M	Typically coastal, unlikely to use site	No
Reptile	<i>Eretmochelys imbricata</i>	Hawksbill Turtle		V, M	Typically coastal, unlikely to use site	No
Reptile	<i>Natator depressus</i>	Flatback Turtle		V, M	Typically coastal, unlikely to use site	No
Mammal	<i>Balaenoptera edeni</i>	Bryde's Whale		M	Unlikely close to shore	No
Mammal	<i>Balaenoptera musculus</i>	Blue Whale		E, M	Unlikely close to shore	No
Mammal	<i>Caperea marginata</i>	Pygmy Right Whale		M	Unlikely close to shore	No

Mammal	<i>Dugong dugon</i>	Dugong		M	Unlikely close to shore	No
Mammal	<i>Eubalaena australis</i>	Southern Right Whale		E, M	Unlikely close to shore	No
Mammal	<i>Lagenorhynchus obscurus</i>	Dusky Dolphin		M	Unlikely close to shore	No
Mammal	<i>Megaptera novaeangliae</i>	Humpback Whale		M	Unlikely close to shore	No
Mammal	<i>Orcinus orca</i>	Killer Whale		M	Unlikely close to shore	No
Other	<i>Dendronephthya australis</i>	Cauliflower Soft Coral	E1	E	None observed	No
Population	<i>Posidonia australis</i> - Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie populations	Posidonia	E2		None observed	No
Community	<i>Posidonia australis</i> seagrass meadows of the Manning-Hawkesbury ecoregion	Posidonia		E	None observed	No

FM Act: E1 = Endangered, E2 = Endangered Population, E4 = Extinct, E4A = Critically Endangered, V = Vulnerable

EPBC Act: M = Migratory, CE = Critically Endangered, E = Endangered, V = Vulnerable, X = Extinct

Appendix B – Key fish habitat types

NSW key fish habitat types and associated sensitivity classification (from Fairfull 2013)

Key fish habitat and associated sensitivity classification scheme (for assessing potential impacts of certain activities and developments on key fish habitat types)
TYPE 1 – Highly sensitive key fish habitat:
<i>Posidonia australis</i> (strapweed)
<i>Zostera</i> , <i>Heterozostera</i> , <i>Halophila</i> and <i>Ruppia</i> species of seagrass beds >5 m ² in area
Coastal saltmarsh >5 m ² in area
Coral communities
Coastal lakes and lagoons that have a natural opening and closing regime (i.e. are not permanently open or artificially opened or are subject to one off unauthorised openings)
Marine park, an aquatic reserve or intertidal protected area
SEPP 14 coastal wetlands, wetlands recognised under international agreements (e.g. Ramsar, JAMBA, CAMBA, ROKAMBA wetlands), wetlands listed in the Directory of Important Wetlands of Australia
Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants
Any known or expected protected or threatened species habitat or area of declared 'critical habitat' under the FM Act
Mound springs
TYPE 2 – Moderately sensitive key fish habitat:
<i>Zostera</i> , <i>Heterozostera</i> , <i>Halophila</i> and <i>Ruppia</i> species of seagrass beds <5 m ² in area
Mangroves
Coastal saltmarsh <5 m ² in area
Marine macroalgae such as <i>Ecklonia</i> and <i>Sargassum</i> species
Estuarine and marine rocky reefs
Coastal lakes and lagoons that are permanently open or subject to artificial opening via agreed management arrangements (e.g. managed in line with an entrance management program)
Aquatic habitat within 100 m of a marine park, an aquatic reserve or intertidal protected area
Stable intertidal sand/mud flats, coastal and estuarine sandy beaches with large populations of in-fauna
Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in TYPE 1
Weir pools and dams up to full supply level where the weir or dam is across a natural waterway
TYPE 3 – Minimally sensitive key fish habitat may include:
Unstable or unvegetated sand or mud substrate, coastal and estuarine sandy beaches with minimal or no in-fauna
Coastal and freshwater habitats not included in TYPES 1 or 2
Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation

Appendix C – Assessment of significance

An Assessment of Significance for *Hippocampus whitei* (White's seahorse) has been conducted below against criteria listed in Section 221ZV of the FM Act (C1) and MNES Significant Impact Guidelines 1.1, EPBC Act (C2).

Hippocampus whitei (White's seahorse)

August 2019, Primefact 1702, First edition, DPI Fisheries – Threatened Species Unit

The White's seahorse is a medium-sized seahorse that grows to a maximum length of 16 cm (from the tip of the tail to the top of the seahorse crown). Favouring shallow-water (1-18 m) estuarine habitats, it is currently known to occur in eight estuaries on the NSW Coast, but is most abundant in Port Stephens, Sydney Harbour and Port Hacking. Habitats that are considered important habitat for the White's Seahorse include natural habitats such as sponge gardens, seagrass meadows and soft corals. It is also known to use artificial habitats such as protective swimming net enclosures and jetty pylons. Within Sydney Harbour, population pressure has caused their natural habitats to decline and, as a result the species is now predominantly found on man-made swimming nets within the harbour. In the wild they are known to live for up to six years and the breeding season is from September to around February. They display long-term monogamy to their partners and the pregnancy period is about three weeks. The male seahorse gives birth to 100 – 250 babies and can reproduce up to 8 times during the breeding season.

C1 - FM Act Assessment of Significance

Hippocampus whitei (White's seahorse) – Endangered (FM Act)

FM Act	Question	Response
221ZV a)	In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	About 31 m ² of potential habitat would be harmed where shading or piling occurs over rocky rubble with macroalgae. We recommend a pre-clearance survey for seahorses is conducted prior to removal of habitat or piling/disturbance within macroalgae beds. Any seahorses found can be relocated to adjacent protected habitat along the macroalgae bed running parallel to the Bank Street approach to Glebe Island Bridge. Survey and relocation must be undertaken by a diver holding a Scientific Licence under s.37 of the FM Act, and operated under a Seahorse Relocation Plan endorsed by DPI Fisheries. With relocation of seahorses, there would be no adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
221ZV b)	In the case of an endangered population, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of	Not applicable to an endangered species.

FM Act	Question	Response
	the species is likely to be placed at risk of extinction.	
221ZV c)	<p>In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	Not applicable to an endangered species.
221ZV d)	<p>In relation to the habitat of a threatened species, population or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the threatened species, population or ecological community in the locality.</p>	<p>The extent of habitat loss from shading is approximately 31 m² of rocky rubble with macroalgae plus physical damage to the substrate from the 3 piles supporting the boardwalk.</p> <p>Although these areas will be removed or disturbed, a similar amount of habitat would be added with the replacement boat ramp, kayak pontoon and other minor piling beneath the boardwalk. We recommend additional rock rubble is added where the existing boat ramp is removed and elsewhere to maximise connectivity of habitat along the site.</p> <p>The importance of the habitat impacted is relatively low considering the amount of adjacent similar habitat that would not be disturbed.</p>
221ZV e)	Whether the proposed development or activity is likely to have an adverse effect on any critical habitat (either directly or indirectly).	The site is not declared critical habitat.
221ZV f)	Whether the proposed development or activity is consistent with a Priorities Action Statement.	<p>Our report allows the consent authority to consider impacts to seahorses. Stakeholder consultation is consistent with the High Priority action for DPI to:</p> <p><i>Provide information on the distribution of White's seahorse to coastal councils, consent authorities and determining authorities to ensure appropriate consideration during development assessment processes or approval of other activities which may impact this species (eg cleaning of swimming nets in key areas).</i></p>
221ZV g)	Whether the proposed development constitutes or is part of a key threatening process or is likely to	The proposal does not meet the definition of any of the eight key threatening processes:

FM Act	Question	Response
	result in the operation of, or increase the impact of, a key threatening process.	https://www.dpi.nsw.gov.au/fishing/threatened-species/what-current/key-threatening-processes
Conclusion	Is there likely to be a significant impact?	No

C2 - EPBC Act Assessment of Significance

Hippocampus whitei (White's seahorse) – Endangered (EPBC Act)

Criterion	Question	Response
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility of the following:		
1)	Will the action lead to a long-term decrease in the size of a population	As discussed above in C1, a pre-clearance survey and relocation of seahorses would prevent impacts to this species and local population.
2)	Will the action reduce the area of occupancy of the species	Lost habitat would be replaced by similar structures and additional rock rubble positioned at an appropriate depth to support macroalgae and provide habitat for seahorses.
3)	Will the action fragment an existing population into two or more populations	Connectivity of habitat would be improved by the addition of rocky rubble, and seahorses would not have their movement restricted between any local population.
4)	Will the action adversely affect habitat critical to the survival of a species	The habitat to be disturbed is a small area and is not critical given the amount of adjacent similar habitat that would be protected.
5)	Will the action disrupt the breeding cycle of a population	Seahorses would be relocated prior to disturbance of habitat. Under a s.37 licence (FM Act) and approved Seahorse Relocation Plan, seahorses couples would be collected and relocated together, thereby not disrupting the breeding cycle.
6) i	Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The work would remove and add like-for-like habitat plus provide additional connectivity of rocky rubble (at a depth suited to macroalgae). This would be a positive outcome for the species' habitat extent and survivorship.
6) ii	Will the action result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	Any invasive species colonising the site post-construction (eg on the underside of the pontoon) would not be predatory on the seahorse or change the habitat to an extent that is unsuitable to the seahorse.
7)	Will the action introduce disease that may cause the species to decline	No, diseases harmful to this species are known or expected from this type of work.

Criterion	Question	Response
8)	Will the action interfere with the recovery of the species	Seahorses would not be harmed as they would be relocated prior to disturbance, and additional habitat provided to improve connectivity. This would aid recovery of the species in Sydney Harbour.
Conclusion	Is there likely to be a significant impact?	No

