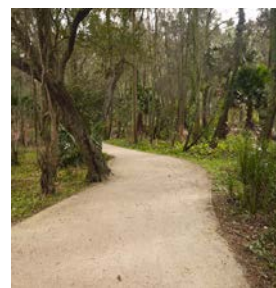


Stage 3: Feasibility Report

Narrabeen Lagoon Multi-Use Trail



Prepared for Northern Beaches Council by:
Thompson Berrill Landscape Design Pty Ltd

Revision No:	Date:	Prepared by:	Reviewed by:
V1	27 th April 2017	Andrew Zouroudis	Glenn Berrill
V2	31 st May 2017	Andrew Zouroudis	Glenn Berrill
V3	7 th June 2017	Andrew Zouroudis	Glenn Berrill

EXECUTIVE SUMMARY

Thompson Berrill Landscape Design Pty Ltd (TBLD) was engaged by Northern Beaches Council (NBC) in February 2017 to undertake a Feasibility Report to assess the feasibility of the Stage 3 Narrabeen Lagoon Multi-Use Trail (NLMUT), adjacent to the Wakehurst Parkway. TBLD prepared the recently completed concept design and detailed documentation of the nearby Narrabeen Lagoon Multi-Use Trail Stage 2A and Stage 2B trail sections which including on-ground trails, boardwalks and bridges.

The Stage 3 trail will connect from the existing trail to Billarong Reserve to the east, to the existing trail to Deep Creek to the west. The proposed Stage 3 works will remove a significant public safety hazard of the close proximity to Wakehurst Parkway for users circumnavigating Narrabeen Lagoon, and provide the only opportunity for trail users to traverse over Narrabeen Lagoon.

The primary objectives of this Feasibility Report are to:

1. Outline issues and opportunities (environment, recreational experience, public safety, materials, constructability, etc.) of the proposed Stage 3 trail.
2. Determine a feasible trail alignment, concept and construction methodology to guide Detailed Design.

The Feasibility Report investigations included consideration of alignment alternatives, background information, and information from technical consultants including terrestrial ecologists, aquatic ecologists, engineers (with experience designing similar boardwalks), and quantity surveyors.

In summary, this report confirms a 180m boardwalk over Narrabeen Lagoon (Option 2) is the most feasible and viable option for the improvement of this section of trail. Although Option 2 is a more expensive solution than Option 1 (upgrade existing trail), it is considered to be the preferred option as it provides better value for money for the community, as outlined in in section 3.2 of this report. Option 2 provides less risk (minimal impact on trail users, no potential for RMS to reject works), improved amenity (takes trail users away from the high noise levels of the path directly adjacent to Wakehurst Parkway), social benefits (immersive overwater experience for trail users), environmental benefits (no removal of mature existing trees, minimal impact on lagoon with avoidance mapped seagrass beds and revegetation of existing trail with local provenance terrestrial vegetation), and is considered to be the best solution for the proposed Narrabeen Lagoon Multi-Use Trail Stage 3 project.

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1. INTRODUCTION

1.1 Introduction

Narrabeen Lagoon is an Intermittently Closed / Open Lagoon (ICOLL) located within the Northern Beaches Council Local Government Area on the Northern Beaches of Sydney between Elanora Heights and Collaroy Plateau. It has complex ecosystems, cultural values and is the largest recreation attraction in the Northern Beaches Council local government area. The previous Warringah and Pittwater Councils recognized the importance of establishing a continuous link around Narrabeen Lagoon, and undertook significant capital works to achieve this link, which was finally connected with completion of the Narrabeen Lagoon Stage 2B works in 2015. The aim of the Northern Beaches Council is that the proposed Stage 3 trail will provide a safer route for all trail users and to improve recreational assets for the public, and protect the biodiversity within and adjacent to the lagoon.

The approximately 180m long existing section of the proposed Stage 3 trail presents an unsafe risk to users within the 8.5km Narrabeen Lagoon loop trail. Visitation and usage of the lagoon trail has increased significantly since completion of the NLMUT Stage 2B works. This section is considered unsafe as the trail unacceptably narrow (1.5m wide instead of min 2.5m required for shared trails), has no min 0.5m offset to the adjacent steel vehicle barrier (which presents a collision risk to cyclists and does not meet min 1.3m high barrier requirements), has open sections to the high speed adjacent Wakehurst Parkway, is very noisy due to the high traffic volumes on this arterial road (which presents a risk to users who cannot hear approaching bicycles or warning bells), and has a steep drop on the lagoon side of the trail with no protective barrier. Northern Beaches Council is seeking to establish a multi-use trail through this section that addresses and solves all these risks and non-conforming Australian Standards.

Landscape Architectural consultants TBLD Pty Ltd, and a team of specialist technical consultants were engaged to undertake initial site investigations, and assist council in determining a preliminary concept design for the Stage 3 trail.

1.2 Key Users

Key users of the lagoon for water and land based activities are as follows.

Key water-based user groups identified include:

- Manly Warringah Kayak Club (Established in 1987)
- Sailing Club
- Sydney Academy of Sports and Recreation
- Environment Centre

Key land-based key user groups identified include:

1. Cycling
2. Walking/strolling/jogging
3. Picnicking
4. Bushwalking/Hiking
5. Bird watching
6. Shore fishing
7. Dog training/Dog walking
8. Golf
9. NSW Academy of Sport training
10. Coastal Education Centre and Community Centre activities
11. Scout activities
12. Community Markets (on the third Sunday of every month)
13. Community Festivals.

Future increases in population growth in the Narrabeen Lagoon catchment will increase the demand for open space natural area activities, including use of its associated outdoor activities. Warringah Councils Recreation Strategy (2009) states that the vision for recreation in the Northern Beaches Council municipality is:

'A healthy and active Warringah community that has access to a wide range of appropriate, suitable, sustainable and quality recreational opportunities, both now and the future.'

Recent years have seen increased use of Narrabeen Lagoon by community users, community groups, sporting and recreational clubs and commercial operators. The construction of Stage 3 NLMUT would resolve a short unsafe section of the 8.5km walkway/cycleway around the lagoon to improve safety, and further encourage a wide range of users to safely enjoy the recreational and environmental merits of the lagoon and its surrounding areas. The design would further enhance an appreciation of the lagoon and provide significant interpretive and educational opportunities, and cater for population growth and climate change.

2. METHODOLOGY

2.1 Background Information

In 2015, council identified the requirement to upgrade the Stage 3 section of the Narrabeen Lagoon trail following numerous requests from the public, given the risk to the public from the inadequate trail width that fall short of required Australian Standards. Potential upgrade configurations were discussed internally, and in collaboration with RMS, which are detailed further in section 3 below.

2.2 Process

In late 2016, aquatic ecologists Marine Pollution Research (MPR) were engaged by council to assess and map the adjacent sea grass and provide assessment and recommendations regarding the feasibility of construction of an overwater boardwalk in this location. MPR also provided technical review and input to the Preliminary Construction Methodology, which is included as an appendix to this report.

Landscape architectural consultants (Thompson Berrill Landscape Design) were engaged in early 2017 to undertake a site investigation and feasibility report to assist council determining an appropriate design response to the site conditions. This process involved detailed site investigations and assessment of site conditions, review of background information and development of a Preliminary Concept Design in consultation with technical subconsultants and internal council departments. The outcomes of the processes contained in this Report will be used to determine the preferred Stage 3 trail alignment.

3. CONCEPT DESIGN DEVELOPMENT

3.1 Existing Site Conditions

The condition of the existing onground trail through this 180m section of the highly-used Narrabeen Lagoon trail currently present unacceptable risk to the public as the trail does not meet Australian Standards. The risks are summarised below.

3.1.1 Trail Width

The existing trail is 1.5m wide through the Stage 3 study area, which is 1m narrower than the 2.5m width provided in the newer section of the trail to meet relevant Australian Standards (refer Figure 1). The narrow trail width creates pedestrian/cyclist congestion and hazards from trail users attempting to pass in this narrow section of the trail directly adjacent to 70 km/h Wakehurst Parkway. Note the dangerous and inadequate barrier to walkway.

2.5m is the minimum width that should be provided on the Narrabeen Lagoon Trail to comply with the Austroads Guidelines (Part 6A: Pedestrian and Cyclist Paths), and follow the precedent set by the newer sections of trail recently constructed to the west. In addition, a minimum 0.5m (1m preferred) offset is required to any obstacle (where an appropriate barrier has not been installed). 1.3m is the minimum height of barrier to roadway (currently 600mm).



Figure 1: 1.5m wide existing trail with hazards both sides

3.1.2 Offset of Trail to Hazards

On the north side of the existing trail, the armco steel vehicle barrier presents a significant risk to trail users. In particular, the vehicle barrier posts and exposed top steel edge present a significant risk to a cyclist in a fall. There is currently no protective barrier or the required minimum 0.5m (1m preferred) offset between the existing trail and this vehicle barrier.

On the south side of the existing trail there is a steep embankment directly adjacent to the trail containing shrubs and trees. Along this edge of the existing trail there is no protective barrier (which is required for the trail to comply with the relevant standards), and no offset between the existing trail and the adjacent embankment to protect trail users.

Adjacent to the memorial rocks there is a series of openings between the existing trail and Wakehurst Parkway. This is a significant hazard to young children with little traffic awareness (refer Figure 2).



Figure 2: Narrow exiting trail with unprotected openings to 70km/h roadway

3.1.3

Traffic Noise

The trail runs directly parallel and in close proximity to the arterial road of Wakehurst Parkway for approximately 180m through the Stage 3 study area. Vehicles (including cars, trucks and buses) travel at 70km/hr, creating high levels of tyre and wind noise which make it very difficult for shared trail users to hear each other approaching and passing, presenting an additional hazard to trail users. Warning bells on bikes cannot be heard easily, increasing risks between shared trail users.

3.2

Consideration of Options

TBLD, in conjunction with council, undertook detailed site investigations and analysis to assess the physical, functional, environmental and visual qualities of the site. Careful consideration of the ecological report by Marine Pollution Research, and the Preliminary Construction Methodology, informed the feasibility and concept design process.

3.2.1

Option 1: Upgrade existing trail

The existing on ground trail would need to be widened by approximately 2m to the south of the lagoon to comply with the relevant Australian Standards and Austroads Guidelines. To achieve the required trail width, an approximate 1.75m high retaining wall would need to be constructed along the entire south edge of the trail, which would present a substantial impact and intrusion on the natural environment (see Figure 3.)

A 1.3m high barrier to meet Australian Standards would need to be constructed along the southern edge of a widened path, and a minimum 500mm offset (1m preferred) would be required to the new 1.3m barrier along the northern side of the path.

The required trail widening would create a range of impacts on the existing vegetation and terrestrial fauna habitat including removal of number of mature existing Casuarinas and Eucalyptus, removal of ground layer vegetation and disturbance of the existing bank conditions for construction of footings and retaining walls.

Construction of a widened trail around the two 'memorial rocks' would present significant challenges. As the existing path is directly abutting to the rocks, the path would need to be widened to the north, which would require removal of the existing parking bay, which may not be accepted by RMS. Construction works in close proximity to the memorial rocks, and construction of a new path in this area, may not be acceptable to traditional owners who would require consultation.

There would be a range of environmental hazards to manage during construction of a widened trail in the existing location, including silt control and management of overland stormwater flows. Furthermore, the limited construction area would require intrusive traffic management that could present unacceptable impacts on traffic to the local community and/or significant cost implications due to the requirement for out-of-hours construction.

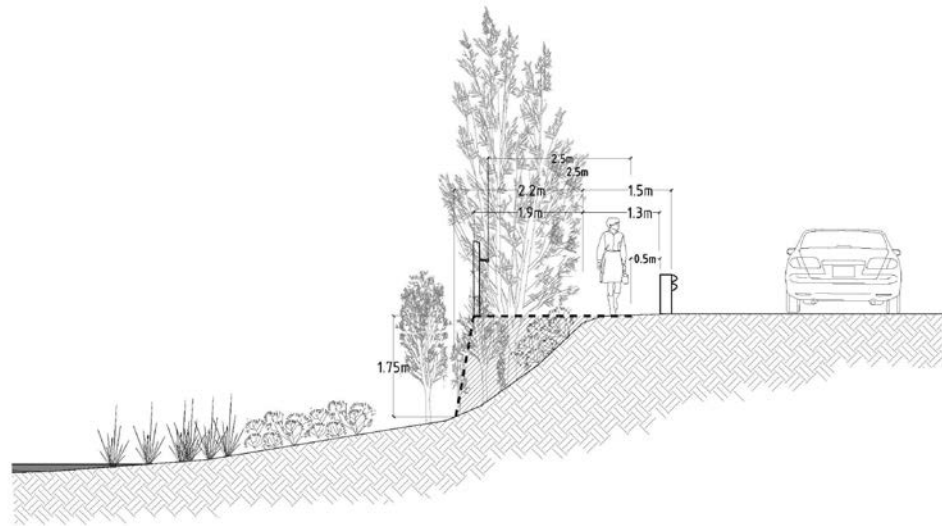


Figure 3: Typical cross section of widened existing trail (approximate)

Advantages

1. Minimal disturbance to lagoon floor and aquatic vegetation.
2. Maintains existing trail alignment.

Disadvantages

1. Shared path through this section (and therefore the Narrabeen loop trail) would be fully closed during construction, which may not be accepted by the local community.
2. Significant traffic impacts during construction may not be accepted by the local community and/or RMS.
3. Significant requirements regarding management of water and silt during construction.
4. Risk associated with openings to Wakehurst Parkway would not be improved.
5. High noise levels would not be improved.
6. RMS may not accept removal of parking bay.
7. Local aboriginal community may not accept construction in close proximity to "memorial rocks".
8. Visual impact of retaining wall on the natural environment.
9. Removal of existing terrestrial vegetation (Swamp Oak Forest EEC).

3.2.2 Option 2: Lagoon Boardwalk (preferred)

Development of the preferred concept design for an overwater boardwalk came about from consideration of a number of issues, including:

1. The requirement to create a functional and viable trail to remove the identified risks associated with retention of the existing trail alignment.
2. Consideration and protection of the existing terrestrial and aquatic ecology.
3. Suitable alignment.
4. Construction methodology.
5. Suitable materials.
6. Cost considerations.
7. Operational and safety considerations.

The proposed overwater boardwalk would be 2.5m internal width to match the existing Narrabeen Lagoon Multi-Use Trail Design (refer Appendix A & B). The boardwalk would meet all relevant Austroads Guidelines and Australian Standards in regard to barrier design and safety. The boardwalk would be aligned to avoid all mapped seagrass beds.

The approach alignment to the lagoon edge would carefully avoid surrounding vegetation. Detailed site assessment completed on site has confirmed a viable alignment for the approach sections and the over water sections (refer Figure 4). Careful consideration has been given to the construction methodology to provide a method for the construction to minimize any possible damage to seagrass beds during the works period.

The proposed boardwalk would be constructed with timber piles (driven from a low impact barge), timber subfloor, open mesh FRP deck, and painted steel barriers (refer Figure 5). The boardwalk connects with the existing trail to the west and east with raised earthen approach ramps that would be retained with sandstone retaining walls.

Advantages

1. Provides a safe boardwalk for trail users (risks associated with falls removed, and risks associated with openings to Wakehurst Parkway removed).
2. No removal of existing terrestrial vegetation (Swamp Oak Forest EEC).
3. No impact on significant lagoon seagrass beds
4. Piles can be constructed without damage to lagoon.
5. Enhancement of existing terrestrial vegetation (Swamp Oak Forest EEC) throughout revegetation of existing on ground trail.
6. Boardwalk and construction offset from memorial rocks to respect their significance to the aboriginal community.
7. Opportunity for spectacular lookout and integrated interpretive signage regarding local ecology, history, etc.
8. Provides a unique experience on the Narrabeen Lagoon loop trail for users to traverse "over" a short section of the lagoon.
9. Shared path can be maintained open throughout most (if not all) of the construction period.
10. High noise levels improved by separation from road.
11. Minimal visual impact of lightweight boardwalk construction.
12. Provide separation to historically (Aboriginal) significant memorial rocks.
13. Existing parking bays retained for maintenance and emergency parking.

Disadvantages

1. Construction within the lagoon will require strict environmental controls.
2. Some vegetation clearance is required for construction of the approach ramps.
3. Agreement required with NSW Fisheries ("in principle" support for Option 2).
4. Prevent access to plaques on north side of memorial rocks.
5. Existing parking bays provide no direct access to the NLMUT.

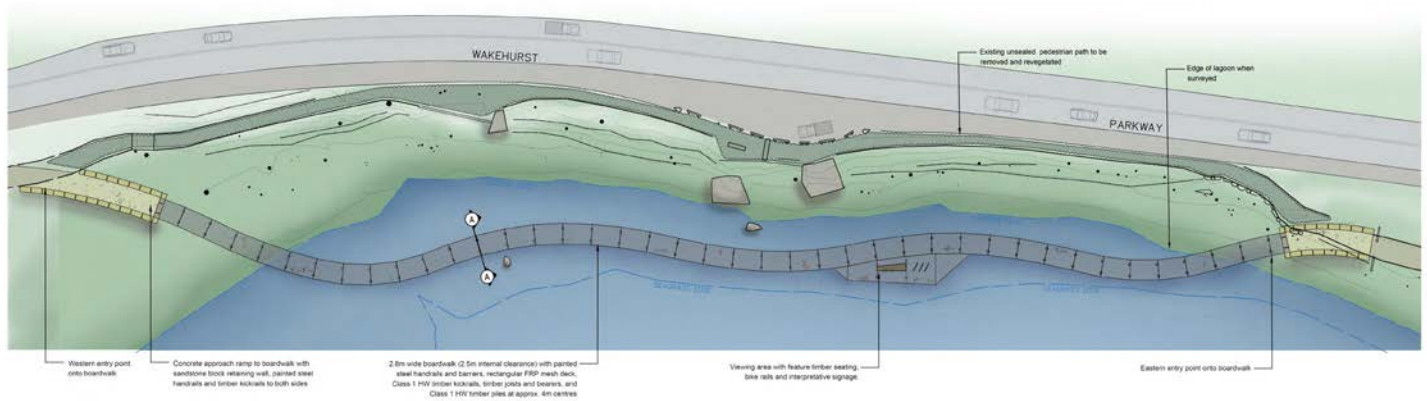
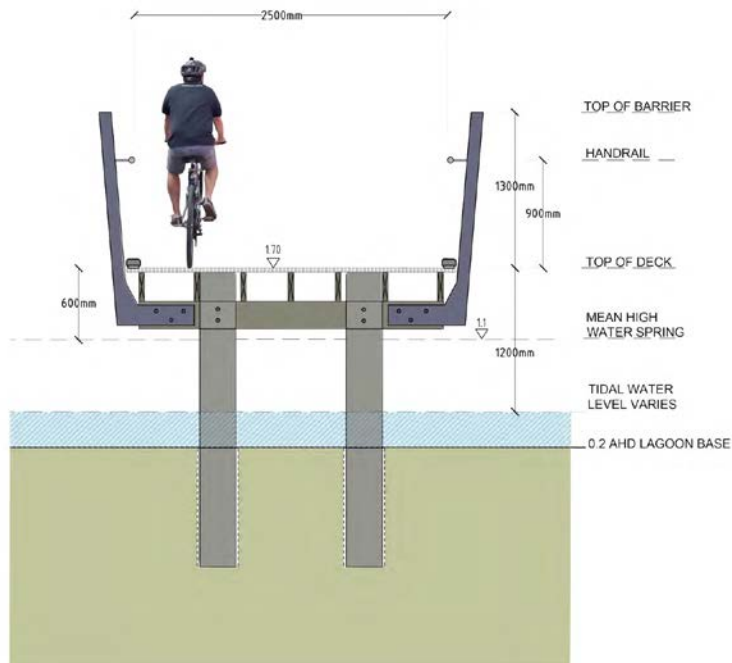


Figure 4: Concept Design



AA TYPICAL CROSS SECTION BOARDWALK
SCALE 1:25 @ A1

Figure 5: Typical cross section of proposed overwater boardwalk

4. TECHNICAL REPORTS AND RESEARCH

4.1 Ecological Background Information

4.1.1 Marine Pollution Research

Council engaged the services of Marine Pollution Research to undertake an aquatic ecology survey and report, finalised in early 2017 (Appendix D). This report included:

- Field investigations and mapping of the sea grass and wrack (dead seagrass vegetative materials) smothering extents in the Stage 3 study area;
- Impact assessment for construction of an overwalk boardwalk; and
- Recommendations for construction of an overwalk boardwalk to avoid and minimise any potential impacts.

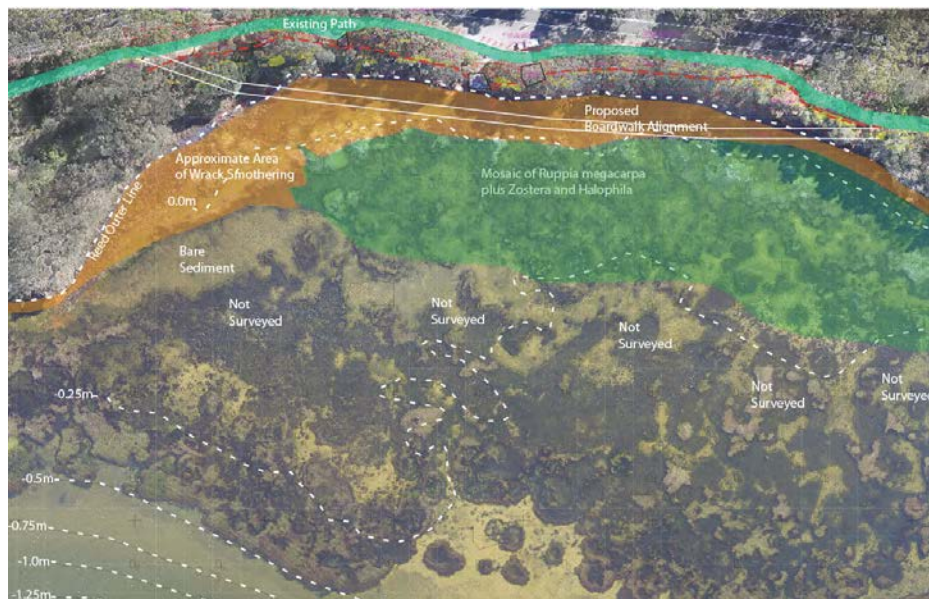


Figure 6 : Aquatic ecology mapping (refer 2017 Marine Pollution Research report)

The conclusion from this report was that the construction of an elevated boardwalk can be achieved with minimal risk to the adjacent riparian and aquatic habitats and communities provided suitable protection measures are implemented and specified in a project Construction Environmental Management Plan (CEMP) that includes the aquatic ecology management options specified in this report.

4.1.2 Council Ecologist Comments

Northern Beaches Council Staff reviewed the Stage 3 concept design and aquatic ecology report findings 23rd March, 2017. Further feedback outlined some environmental considerations for the NLMUT Stage 3 project, and included descriptions regarding:

- Conservation status;
- Habitat and distribution;
- Threats;
- Legal implications; and
- Species known in Narrabeen Lagoon.

In response to the further recommendations, council has engaged an independent professional ecologist and ornithologist to conduct an initial Fauna and Flora assessment in order to feedback into the design process.

4.2 Construction Materials Investigations

4.2.1 Trail Types

The Narrabeen Lagoon Multi-Use Stage 3 Trail consists of two trail types:

1. On ground coloured concrete trail connections; and
2. Elevated overwater boardwalk.

Based on our experience, discussions with the civil contractors who recently constructed an overwater boardwalk in similar conditions, and advice from TBLD's engineer subconsultants, it was determined that a timber substructure design would be suitable for the Stage 3 overwater boardwalk. Timber would provide improved durability and longevity in this exposed and inundated (salt water) marine environment, and improved ease of constructability within the construction envelop (4.5m wide). The boardwalk deck would be constructed from Envirowalk (or similar approved supplier) 38T rectangular mesh fibre reinforced polymer (FRP) boardwalk deck, secured to Class 1 Australian hardwood timber substructure. The overwater boardwalk deck FFL would be set at a minimum of 1.70m AHD, with 1.3m high steel barrier with vertical bar infill and handrails to Australian Standards.

All steel would be protected and painted with specialist 2 pack paint system as per Narrabeen Lagoon Stage 2 infrastructure barriers. Paint color will be selected to minimize visual intrusion on the visual landscape of the lagoon when seen from surrounding shorelines.

The on ground coloured concrete trail connections to the boardwalk would consist of a 2.5m wide coloured concrete trail for minimal maintenance requirements and consistency with other trail sections around Narrabeen Lagoon.

Path finished surface level to be minimum 1.3m AHD. This may require minor fill, batters and drainage culverts to allow for transference of overland stormwater and flood flows.

4.2.2 Recreation Infrastructure

Seating for the rest point will be of bespoke steel and timber construction for comfort and connectivity with the surrounding deck, and not pose a safety risk to trail users.

4.2.3 Signage Options

Wayfinding, regulatory and/or interpretive signage distribution and type to be determined by NBC.

4.2.4 Planting

All plant species will be indigenous and local provenance where available. Detailed revegetation planting plans will be prepared for the final documentation in collaboration with council, to specifically cater for the microclimate, soils, surrounding vegetation and the function of the planting (screening, supplementary planting or revegetation/habitat creation planting).

4.3 Construction Methodology for the Preferred Option

The preliminary construction methodology (refer Appendix F) is preliminary only. The concept design for the proposed Narrabeen Lagoon Multi-Use Trail Stage 3 boardwalk has taken into account the site environmental conditions, access, nearby infrastructure, minimal impact design, preferred materials, low key environmentally sympathetic aesthetics, hydraulic conditions and construction methodology (refer Figure 7).

The alignment and design of the boardwalk has been carefully assessed and positioned to minimise potential impact on the adjacent shore, and to minimise potential impact on the adjacent seagrass beds in the lagoon. Materials and colours have been selected to ensure the boardwalk has a low visual impact on the surrounding environment. Innovative and best practice construction methodologies have been selected to minimise any environmental impact.

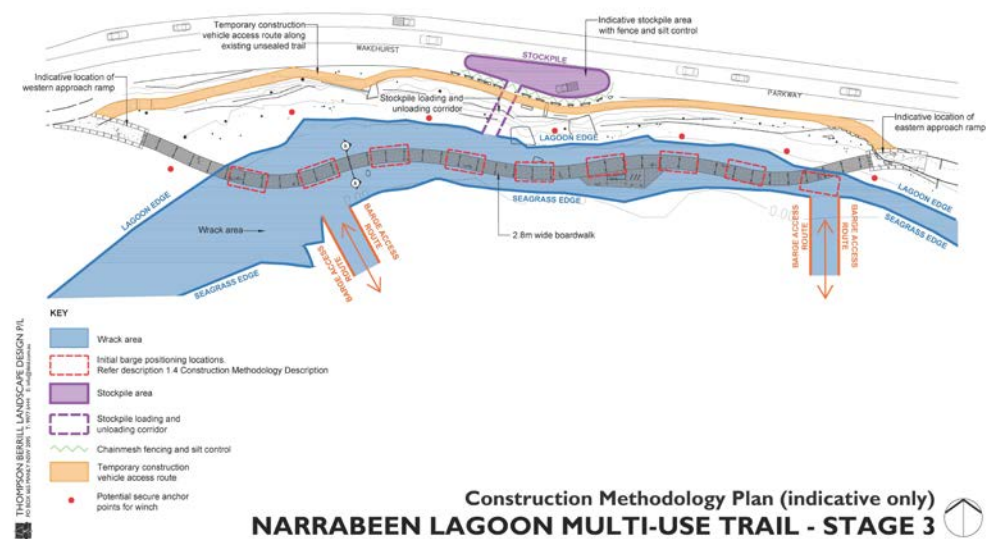


Figure 7: Preliminary Construction Methodology Plan (TBLD)

5. CONCLUSION

The preferred proposal for an overwater boardwalk through the Narrabeen Lagoon Multi-Use Trail Stage 3 study area was derived from outcomes gained from detailed review of background information extensive site assessments, council and stakeholder consultation, technical subconsultant input and project objectives informed by council.

There are a range of additional works and studies required to guide the preferred option development including:

- Additional ecological investigations and reporting;
- Stakeholder (RMS and NSW Fisheries) consultation;
- Detailed Documentation;
- Engineering design and certification;
- Geotechnical investigations and reporting;
- Preparation of Construction Environmental Management Plan (CEMP);
- Preparation of Anchor Management Plan;
- Community consultation;
- Revised cost estimate to meet business case;
- Any other studies necessary; and
- Tendering and selection of suitable Contractor.

Subject to satisfactory completion of the above tasks, the preferred concept design (Option 2) presented within this report is deemed to be practical, and the most feasible option for the improvement of this section of trail.