Review of Environmental Factors

Cuttagee Bridge Replacement

September 2021

Project Number: 21-143

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Table of contents

Figures

Tables

Appendices

Acronyms and abbreviations

AHIMS	Aboriginal Heritage Information Management System
AWS	Automatic weather station
BC Act	*Biodiversity Conservation Act 2016* (NSW)
Biosecurity Act	*Biosecurity Act 2015* (NSW)
BOM	Australian Bureau of Meteorology
BVSC	Bega Valley Shire Council
CEMP	Construction environmental management plan
Cwth	Commonwealth
DAWE	Department of Agriculture, Water and the Environment (Cwth) (formerly DoEE)
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment (NSW)
EEC	Endangered ecological community – as defined under relevant law applying to the proposal
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPL	Environmental Protection Licence
ESD	Ecologically Sustainable Development
FM Act	*Fisheries Management Act 1994* (NSW)
GDE	Groundwater Dependent Ecosystem
ha	hectares
Heritage Act	*Heritage Act 1977* (NSW)
ICOLL	Intermittent Closed and Opened lake and lagoon
ISEPP	State Environmental Planning Policy (Infrastructure) 2007 (NSW)
KFH	Key Fish Habitat
km	kilometres
LALC	Local Aboriginal Land Council
LEP	Local Environment Plan
LGA	Local Government Area
m	metres
MNES	Matters of National Environmental Significance under the EPBC Act (*c.f.*)

NML	Noise management level
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
OEH	(Former) Office of Environment and Heritage (NSW) (now EES)
PSC	Pre-cast concrete
REF	Review of Environmental Factors
SELLS	South-East Local Land Service

1. Introduction

This Review of Environmental Factors (REF) has been prepared by NGH on behalf of Bega Valley Shire Council (BVSC) to assess the potential environmental impacts of replacing Cuttagee Bridge, Cuttagee. Cuttagee Bridge is located over Cuttagee Creek, approximately 6 kilometres (km) south of Bermagui, along Tathra-Bermagui Road, in the Far South Coast of NSW.

The existing Cuttagee Bridge has come to the end of its operational life and needs to be replaced to maintain safe and reliable access to the surrounding area. BVSC propose to replace the existing timber bridge with a new two-lane concrete structure.

Funding for the proposal will be provided from various federal, state and Council Capworks sources over Financial Years 2020-2021 and 2021-2022. Construction is expected to take approximately 16 weeks and is anticipated to commence in 2022.

BVSC is both the proponent and determining authority for the works proposed. As such, the proposal would be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This REF has been prepared according to the requirements of Section 5.5 of the EP&A Act, specifying a “duty to consider environmental impact”. This REF provides a full analysis of all environmental, economic, physical and social implications of the proposal.

2. The proposal

2.1. Location of the Activity

Cuttagee Bridge is located along Tathra-Bermagui over Cuttagee Creek Road in the locality of Cuttagee, approximately 6km south of Bermagui. Cuttagee is located in south-eastern NSW, approximately 29km north-east of Bega. The proposal site is located within the Bega Valley Local Government Area (LGA) and extends across land zoned: E2 – Environmental Conservation, E3 – Environmental management and W1- Waterways under the *Bega Valley Local Environment Plan 2013 (*Bega Valley LEP*)*. Cuttagee Creek is a tributary of Cuttagee Lake, which is located approximately 1km upstream of the proposal site.

The proposal site is located in a coastal rural environment surrounded by agricultural properties, state forest, national parks and protected coastal wetlands (refer Figure 2-1).

The proposal site is shown in Figure 2-2. It includes portions of Lot 7004/DP1024289, Lot 3/DP813056, Lot 5/DP250280, Lot 2/DP813056. Lot 7004/DP1024289, which is identified as Crown land, will be the main impact area. A section of Biamanga National Park is located 200 metres (m) north-east of the existing Cuttagee bridge. The main body of Cuttagee Lake is located 1km west of the proposal site. The northern section of Cuttagee Beach is adjacent to the south-eastern boundary of the proposal site.

This REF assumes all works would occur within the proposal site footprint outlined in Figure 2-2. The footprint includes:

- The area of the existing Cuttagee bridge (4.5m by 115m).
- The area of the proposed bridge replacement, which allows for some realignment either side (approximately 115m by 11.5m).
- Up to 150m of the Tathra-Bermagui road approaches either side of the bridge.

Any works that are to occur outside this footprint would require further assessment.

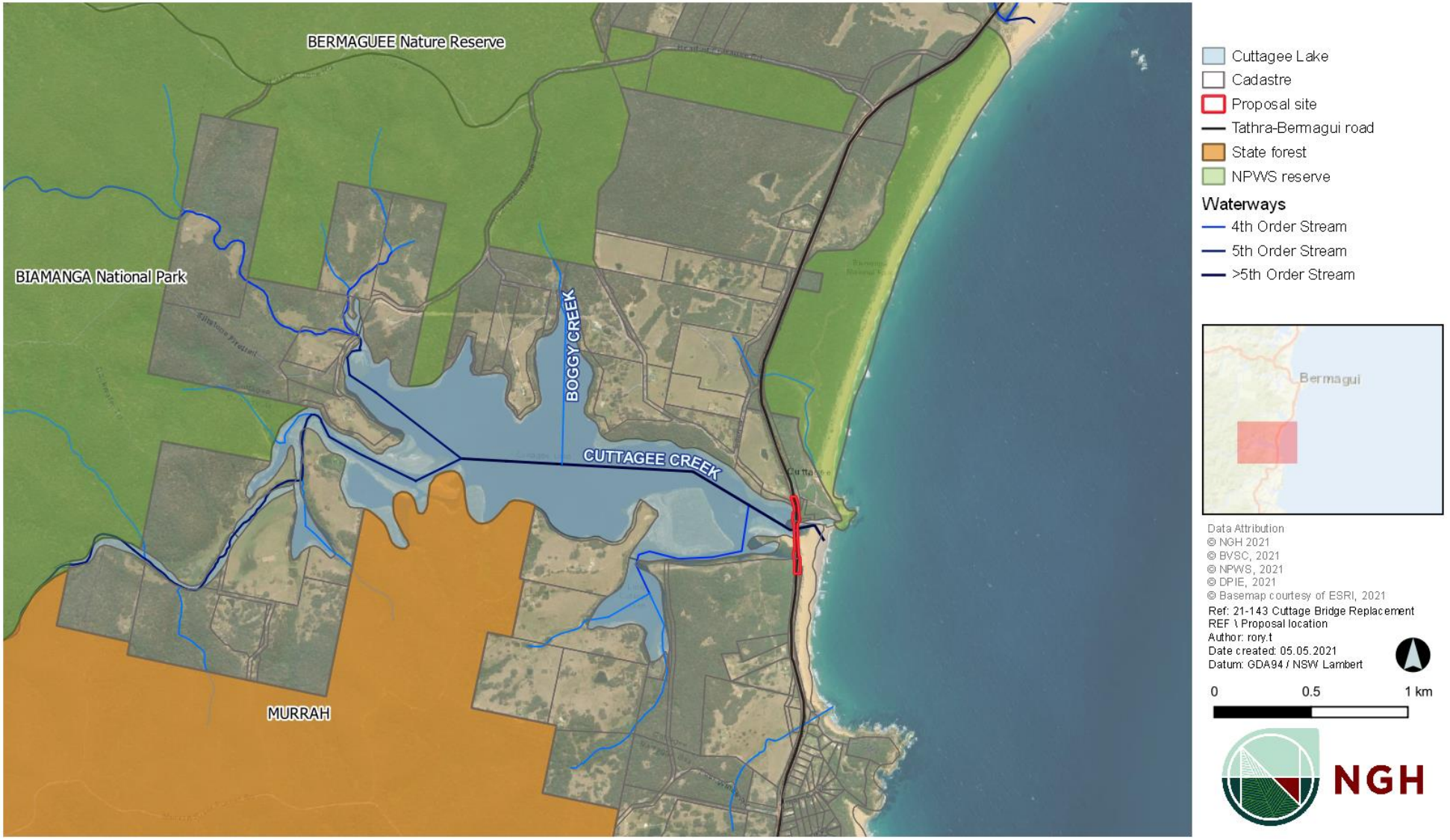

Figure 2-1 Proposal location

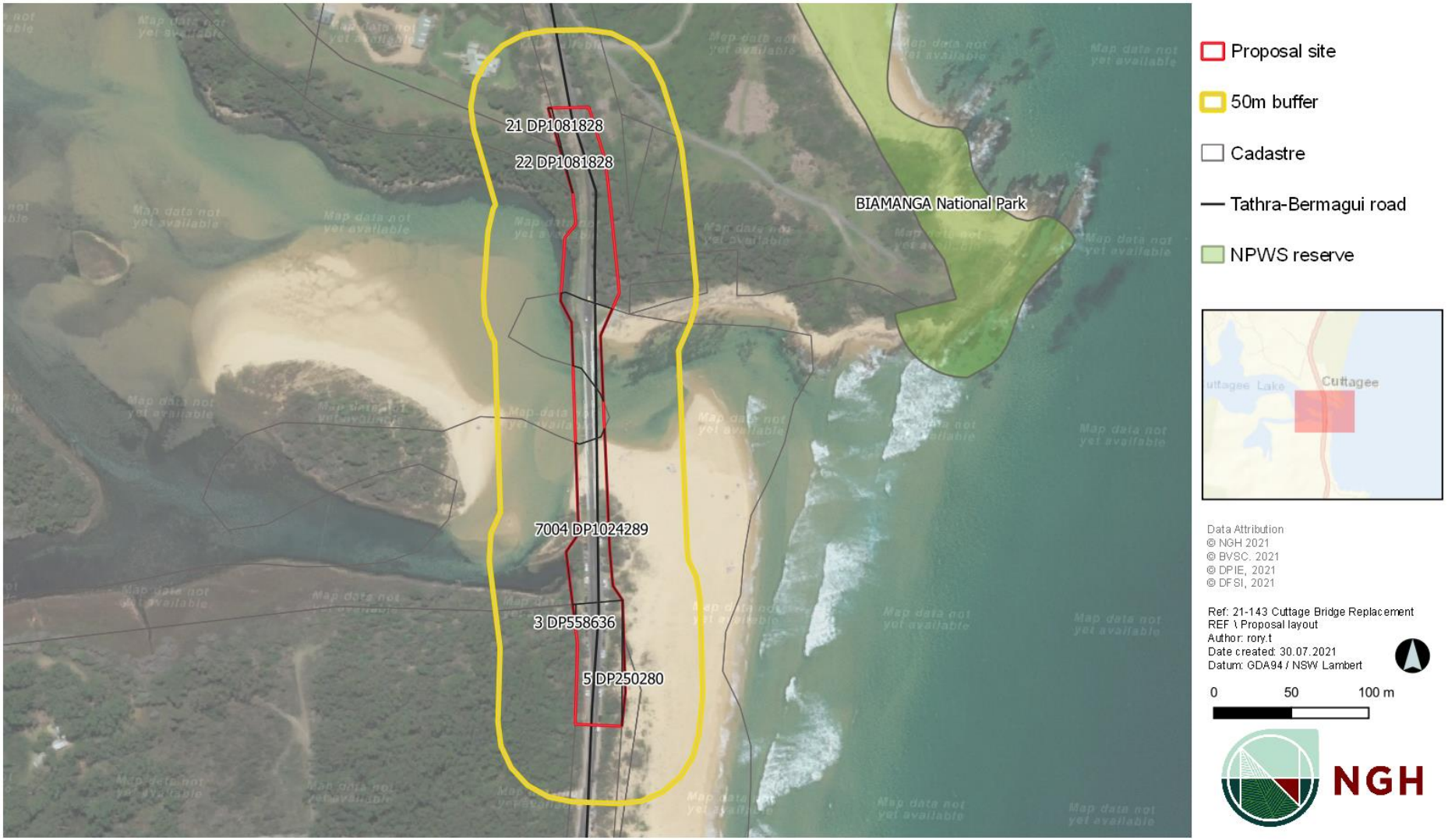

Figure 2-2 Proposal site layout, with affected lots labelled.

2.2. Background

Tathra-Bermagui Road is approximately 41.2km long. It links the townships of Bermagui and Tathra, as well as a number of scattered hamlets and localities located along the coast between these towns. It connects these communities with the local industries and services of the Bega Valley LGA, including schools, health facilities and Merimbula Airport. The Princes Highway provides an alternative though less direct route between Bermagui and Bega.

The Tathra-Bermagui road is sealed and two way (with the exception of several one lane bridges, including Cuttagee Bridge). It has a posted speed limit that varies between 80km/hr and 100km/hr depending on location and road conditions and decreasing to 40-60km/hr for one lane bridges.

Road users include local traffic and tourists travelling between Bermagui, Tathra and the localities in-between. Visitors to Cuttagee Lake and the northern end of Cuttagee beach currently utilise pull-over bays along the Tathra-Bermagui road on both ends of the bridge. Formal and informal pedestrian tracks extend from these bays to the beach and lake foreshore area. As a result, pedestrians and stationary vehicles are often present along the approaches to Cuttagee Beach, particular on weekends and during the summer tourist season.

Tathra-Bermagui Road at Cuttagee Bridge is single-lane and wooden-planked with a posted speed limit of 40km/hr. Either side of the bridge, the road is two lanes with a posted speed limit of 80km/h. Cuttagee Bridge is a ten one span timber bridge at the end of its functional life and in need of repair (refer Figure 2-3 and Figure 2-4). The bridge has a current weight restriction of 22.5T.

The bridge is heritage listed under Schedule 5 the Bega Valley LEP and has value to many members of the local community for its historic and visual character.

Figure 2-3 Cuttagee Creek Bridge (looking north)

Figure 2-4 Cuttagee Creek Bridge

2.3. Reasons for the activity and consideration of alternatives

2.3.1. Reason for the activity

The existing Cuttagee Bridge is at the end of its operational life. The bridge needs to be replaced to ensure ongoing safe and reliable movement along the Tathra-Bermagui Road, which is an important access route for local residents and tourists along the coast to key regional service centres.

The Tathra-Bermagui Road became the critical emergency route during recent bushfire and flood events when the Princes Highway was closed to traffic. Heavy vehicles as well as large numbers of evacuating caravans, campers and 4WD moving in both directions had no other option but to pass over the Cuttagee Bridge. Despite maintenance and upgrades, the current weight limitation on the existing bridge is very likely to be further reduced, which may completely eliminate the possibility of the bridge meeting the minimum requirements to function in future emergency events.

The objectives of the proposed works are to:

- Improve road safety and traffic efficiency for motorists using the bridge and the approach roads.
- Reduce ongoing maintenance costs associated with the existing timber bridge.
- Improve road connectivity between local and regional roads.
- Improve access for the local community.
- Improve freight productivity and load limit of the bridge.
- Improve accessibility for emergency response vehicles through increased load limit.
- Strengthen local economies.
- Create stronger employment opportunities.
- Minimise impact on the environment.
- Minimise impact on the community.

2.3.2. Consideration of alternatives

Four options were considered.

Do nothing

'Do nothing' would result in no improvements to the existing bridge. There would be no improvements to the aging sections of the bridge. This option does not meet the objectives of the proposal as it would not improve road connectivity and safety. It would also result in rapidly increasing ongoing repair costs to an asset approaching the end of its functional life in terms of safe traffic load capacity. This option would, however, have the least environmental impact on the surrounding area.

Alternative 1: Major repair of existing bridge

This option involves repairing the existing bridge by replacing the existing timber elements with concrete. This may extend the functional life of the existing asset. However, feasible and practicable repairs to the bridge may not guarantee the required functionality (being only one lane) and that increasingly difficult and impractical continuing maintenance activities will

no longer be required and the removal of the timber elements would reduce the historic and visual character of the bridge.

Alternative 2: Demolition of the existing timber bridge and construction of a new bridge on the existing alignment

This option involves fully demolishing the existing bridge and replacing it with a new two-lane concrete bridge. The new bridge and its approaches would be constructed in stages, with the existing bridge remaining open during construction to maintain access along Tathra-Bermagui Road.

This option would improve safety and road access. Additionally, it would reduce ongoing repair costs and traffic congestion along bridge approaches. This option would meet the proposal objectives.

Alternative 3: Demolition and construction of new bridge on a new alignment

The option to construct a new concrete bridge on a new alignment was considered, to allow the existing timber bridge to remain open until the new concrete bridge became operational. This would reduce the travel efficiency impacts on the local community and businesses during construction and provide a new bridge would with increased weight limit for heavy vehicles. However, this option is not considered feasible due to design and engineering constraints. The new bridge would also require a substantial amount of works on the approaches to align with Tathra-Bermagui Road. This alternative is not considered further.

2.3.3. Selection of the preferred option

Alternative 2 is the preferred option. This option is considered to be most appropriate in terms of improving safety and local road network efficiency and would reduce ongoing maintenance and repair costs in the long term. It would have increased environmental impacts compared to Alternative 1. These are investigated in this REF.

2.4. Description of the Activity

BVSC propose to demolish and re-construct Cuttagee Bridge in a staged approach. The works would involve three steps:

i. Firstly, construction of the eastern half of a new seven span two-land concrete bridge with 6 piers and concrete abutments, keeping the existing timber bridge open to vehicular traffic.
ii. Secondly, deconstructing the existing timber bride, with the downstream half of the new bridge open to vehicular traffic.
iii. Finally, constructing the upstream half of the new concrete bridge, with the downstream half of the new bridge open to vehicular traffic.

Other activities associated with the works would include:

- Relocation of existing services along the bridge.

- Excavation and vegetation clearing to modify the Tathra-Bermagui Road alignment along 150m of the northern approach to the new bridge.
- Resealing of approaches.
- Installation of rock lined batters.

The proposal footprint is provided in Figure 2-2. The proposed design and staged process is described and illustrated in Appendix A

A construction compound and laydown area would be required at the proposal site. The compound and laydown areas would be a combination of the road side areas within the Tathra-Bermagui Road easement to the south of the bridge as well as the BVSC depot yard at Bermagui. The area would be located at least 40m from the waterway and only on previously disturbed areas. No clearing would occur for the compound and laydown area. The compound would comprise of transportable buildings, toilets and ablution facilities, a laydown and stockpiling area. At the completion of construction, the compound site and site access would be rehabilitated as appropriate.

No property acquisition would be required for the proposal.

2.4.1. Construction methodology

Pre-construction requirements

- Consult with Crown lands and adjacent landowners.
- Obtain Fisheries Permit from Department of Primary Industries (DPI).
- Develop Environmental Management Plan and Traffic Control Plan.

Site establishment

- Implementation of traffic controls.
- Progressive installation of temporary erosion and sediment controls.
- Establishment of ancillary site and temporary stockpiles.
- Clearing and grubbing of vegetation.

Construction of new bridge and approaches

- Relocation of services.
- Establish temporary access to the creek would be required in order to undertake abutment construction works. Access would be predominantly from either side of the creek.
- The construction of the new bridge and demolition of the existing bridge would occur in the following stages:
    - Stage one: construction of the new concrete southbound lane abutments, piers, concrete decking, approaches, barriers and temporary barriers to the western side in accordance with Transport for NSW standard details. During this stage the existing timber bridge lane would remain open. Upon completion of stage one the new southbound lane would become operational.
    - Stage two: demolish the existing timber bridge. This would include the installation of devices such as boom, downstream to catch and remove particles that have potential to enter the waterway during the demolition period.

The existing bridge piers would be cut off at the creek bed. The existing bridge would be removed by crane. Crane access to the bridge would be gained from the existing road approaches. The existing bridge abutments would be demolished by removing the timber by crane and concrete by excavator, if required. The removal of the bridge abutments may require some earthworks around the abutments (profiling).

  - Stage three: Construction of the new concrete northbound abutments, piers, approaches, and barriers. During this stage the new southbound lane would be operational to maintain access. Upon completion of this stage the new bridge would become operational for two-way traffic.

- In reference to the stages above:
  - Headstock soffits and temporary falsework scaffolding would be required to be constructed around each abutment and pier to allow safe access. Pumps would be used to remove any water that seeps through the enclosures.
- Construction of 50m approach roads north and south:
  - Excavation and earthworks including engineered fill and subbase.
  - Road pavement including road base and 50mm asphalt paving.
  - Road sealing.
- Installation of railings, traffic barriers on bridge and to approach roads.

Post construction works

- Progressive stabilisation and rehabilitation of all areas disturbed during works.
- Site clean-up.
- Removal of traffic and erosion and sediment controls after stabilisation of disturbed areas.

2.4.2. Road traffic management and access

As described above, traffic access in both directions would remain open until the new bridge is commissioned. There would be some temporary and short-term impacts on traffic during the construction period of the proposed works. These impacts are assessed in Section 5.6 of this REF.

2.4.3. Proposed construction equipment

General equipment used during the work is likely to include the following:

- Work vehicles.
- Grader.
- Backhoe.
- Excavator.
- Compactors.
- Bitumen sprayer.
- Concrete trucks.
- Delivery trucks.
- Line marking vehicles.
- Dump truck.
- Concrete pump.
- Vibrating rollers.
- Water cart.
- Drills.
- Welding equipment.
- Pneumatic Jackhammer.
- Angle grinders.
- Cranes.

1.1.1 Proposed construction materials

Materials required for the work include:

- Fuels and oils required to operate plant, equipment and vehicles involved with construction.
- Concrete to be poured in situ.
- Pre-stressed concrete elements.
- Reinforcing steel and structural steel.
- Gravel and aggregate.
- Bitumen.
- Road base (DGB/DGS).
- Excavated material, including soils and fill.
- Prefabricated bridge elements (guard rails, drainage structures).
- Steel coil reinforcing tube.
- Road pavement markers/paint.
- Signage.
- Water for dust suppression.
- Geotextile fabric and other environmental control materials.

2.4.4. Timing and hours of work

Construction is estimated to begin in early 2022 and take 16 weeks to complete. The proposed works would be undertaken during standard working hours in accordance with the *Interim Construction Noise Guideline* (DECC 2009), as follows:

Standard working hours	
Monday – Friday	7:00am to 6:00pm
Saturday	8:00am to 1:00pm
Sunday and Public Holidays	No work

3. Legal and policy requirements

3.1. Legal permissibility

Table 3-1 Legal requirements for the proposal.

Legislation	Objective	Requirement for the proposal
Commonwealth		
***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)**	The Commonwealth EPBC Act's objective is to protect Matters of National Environmental Significance (MNES), including threatened and migratory species, communities and populations, and heritage places. This Act provides an assessment and approvals system for: • Actions that have a significant impact on 'Matters of National Environmental Significance'. • Actions that (indirectly or directly) have a significant environmental impact on Commonwealth land; and • Actions carried out by the Commonwealth Government.	The potential for the proposed activity to impact on MNES has been assessed in Section 5.12 of this REF. The proposal is not likely to impact on any matter of Commonwealth significance and referral to the Commonwealth Environment Minister is not required.
Native Title Act 1993	The *Native Title Act 1993* (Cwth) provides a legislative framework for the recognition and protection of common law native title rights. Native title is the recognition by Australian law that Indigenous people had a system of law and ownership of their lands before European settlement. Where that traditional connection to land and waters has been maintained and where government acts have not removed it, the law recognises the persistence of native title. A search of the National Native Title Tribunal Registers on 20th May 2021 indicated that no area within the Bega Valley LGA has been determined under native title. One (1) claim (Tribunal file no.NC2017/003) is currently in place.	Aboriginal Heritage is addressed in Section 5.4 of this REF.
NSW		

Legislation	Objective	Requirement for the proposal
***State Environmental Planning Policy (Infrastructure) 2007* (ISEPP)**	*State Environmental Planning Policy (Infrastructure) 2007* aims to facilitate the effective delivery of infrastructure across the State. Clause 94(1) of the ISEPP provides that development for the purpose of a road or road infrastructure may be carried out by or on behalf of a public authority without consent on any land. Road infrastructure includes vehicle bridges.	This proposal involves the upgrade of an existing road and construction a new bridge which would be carried out by BVSC. Pursuant to Clause 94(1) of the ISEPP, the proposal is development permitted without consent.
State Environmental Planning Policy (Coastal Management) 2018 (CSEPP)	The *State Environmental Planning Policy (Coastal Management) 2018* aims to promote an integrated and coordinated approach to land use planning in the NSW coastal zone in a manner consistent with the *Coastal Management Act 2018* by: - Managing development in the coastal one and protecting the environmental assets of the coast; - Establishing a framework for land use planning to guide decision-making in the coastal zone; and, - Mapping the four coastal management areas that comprise the NSW coastal zone for the purpose of the definitions in the *Coastal Management Act 2016*. Under Clause 11(1) of the CSEPP, development consent must not be granted to development on land identified as "proximity area for coastal wetlands" unless the consent authority is satisfied that the proposed development will not significantly impact on: a) The biophysical, hydrological or ecological integrity of the adjacent coastal wetland, or b) The quantity and quality of surface and groundwater flows to and from the adjacent coastal wetland.	The proposed works would occur in a designated "coastal wetlands proximity area". Potential impacts on the biophysical, hydrological or ecological integrity of the adjacent coastal wetland are assessed in section 5.3 of this REF. Potential impacts on water flow quality and quantity to and from the adjacent wetland are assessed in section 5.2 of this REF.
Environmental Planning and	The EP&A Act provides for a co-ordinated approach to development ensuring the proper management, development and conservation of	The proposal requires environmental assessment under Part 5 of the EP&A Act.

Legislation	Objective	Requirement for the proposal
Assessment Act 1979 **(EP& A Act)** ***& Environmental Planning and Assessment Regulation 2000*** **(EP&A Regulation)**	natural and cultural resources and promoting social and economic welfare and a better environment. Section 5.5 of the EP&A Act requires a determining authority, when considering an activity, *to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity."* Clause 228 of the EP&A Regulation lists 16 factors that must be taken into account concerning the impact of an activity on the environment.	This REF aims to address BVSC's duty as a 'determining authority' in respect to considering the environmental impact of the proposed activities under Section 5.5 of the EP&A Act and Clause 228 of the EP&A Regulation. A clause 228 checklist is included in this REF in Appendix B.
Crown Land Management Act 2016	Approval under the Act is required to reside, erect a structure or graze or drive stock on Crown land, or clear, dig up or cultivate or enclose Crown land. The Act replaces the *Crown Lands Act 1989*.	The proposal site is located in a portion of Crown Land (Lot 7004/DP1024289). BVSC will require a license from Crown Land to undertake the work in this Lot.
Biodiversity Conservation Act 2016	The BC Act establishes the new regulatory framework for assessing and offsetting the biodiversity impacts of development proposals. The purpose of the Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. The Act contains provisions relating to flora and fauna protection (repealing parts of the *National Parks and Wildlife Act 1974*), threatened species and ecological communities listing and assessment (repealing the *Threatened Species Conservation Act 1995* and section 5A of the EP&A Act), a Biodiversity Offsets Scheme (BOS), a single Biodiversity Assessment Method (BAM), calculation and retirement of biodiversity credits and biodiversity assessment and planning approvals. The Act is supported by the *Biodiversity Conservation Regulation 2017*.	An assessment of the potential impacts of the proposal on threatened species, populations, ecological communities and critical habitat listed in the BC Act and EPBC Act have been undertaken in accordance with Section 7.3 of the Act. The outcomes of the assessment are discussed in Section 5.3 of this REF. The assessments found that no significant impacts to threatened entities are likely.
Fisheries Management Act 1994 (FM Act)	The FM Act aims to protect fishery resources and marine species, and conserve habitats and diversity. Section 200(1) of the FM Act requires that a local government authority "*must not carry out dredging or reclamation work except under the authority of a permit issued by the Minister*".	The proposal would involve dredging and reclamation works in water land. A fisheries permit would be required.

Legislation	Objective	Requirement for the proposal
	In Section 198A of this Act, the definition of "dredging work" includes any work that involves excavating "water land". The definition of "reclamation work" involves filling, reclaiming or depositing of material on water land or draining water from water land for the purpose of reclamation. Where water land is defined as "*land submerged by water… whether permanently or intermittently…*". Section 205 (2) of the FM Act outlines a "*person must not harm any such marine vegetation in a protected area, except under the authority of a permit issued by the Minister under this Part".* Marine vegetation includes mangroves and seagrass. Section 219 of the FM outlines that a person must not block fish passage without a permit.	
National Parks and Wildlife Act 1974 **(NPW Act)**	The NPW Act promotes and regulates the management of national parks and historic sites or places of cultural value within the landscape and the conservation of certain fauna, native plants and Aboriginal objects and places. The NPW Act provides for a register of sites of archaeological and Aboriginal cultural significance (Schedule 14). A Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW 2010) has been released to facilitate the protection of Aboriginal heritage under the Act. An Aboriginal Heritage Impact Permit from the Office of Environment and Heritage (OEH) is required for works impacting on an Aboriginal object or place.	Section 5.4 of this REF addresses potential impacts to Aboriginal heritage.
Heritage Act 1977	Natural, cultural and built heritage is protected in NSW under the *Heritage Act 1977*. The Heritage Act provides for the listing of heritage items or places on the State Heritage Register, or for interim heritage orders to be made to protect heritage items or places. Local heritage items are also listed in Local Environmental Plans (LEP). Approval must be obtained from the Heritage Council or local council before work can be done which might damage the item or place. A person must not disturb or excavate land if they know or have reasonable cause to suspect that they might discover, expose, move or damage a relic, unless they have an excavation permit.	Section 5.4.5 of this REF addresses potential impacts on heritage items or places. The existing timber bridge is listed as a local heritage item under the *Bega Valley Local Environment Plan 2013.* A Statement of Heritage Impact will need to be completed (refer section 5.4.5).

Legislation	Objective	Requirement for the proposal
Roads Act 1993	The Roads Act regulates the carrying out of various activities in, on and over public roads. Under section 138, the consent of the appropriate road's authority is required to: (a) erect a structure or carry out a work in, on or over a public road (b) dig up or disturb the surface of a public road (c) remove or interfere with a structure, work or tree on a public road (d) pump water into a public road from any land adjoining the road (e) connect a road (whether public or private) to a classified road. Consent in relation to a classified road requires the concurrence of Transport for NSW (TfNSW). Section 138 also applies to works undertaken by roads authorities. The council is the roads authority for all public roads within an LGA, other than any freeway, Crown road, or road for which some other public authority is declared to be the roads authority. Section 71 of the Act states that a roads authority may carry out work on any public road for which it is the roads authority and on any other land under its control.	Council is the roads authority for these roads and the works are permitted under the Roads Act.
Protection of the Environment Operations Act 1997 **(POEO Act)**	The POEO Act provides an integrated system of licensing for certain polluting activities within the objective of protecting the environment: • Section 148 of this Act requires notification of pollution incidents • Section 120 of this Act provides that it an offence to pollute waters Schedule 1 of the POEO Act describes activities for which an Environmental Protection Licence (EPL) is required.	BVSC must ensure that all stages of the proposal are managed to prevent pollution, including pollution of waters. Assessment and mitigation of potential risks is included in Section 5.1.3. The contractor and BVSC are obliged to notify the relevant authorities (e.g., Environment Protection Authority (EPA)) when a 'pollution incident' occurs that causes or threatens 'material harm' to the environment. The proposal does not conform with the definition of a scheduled activity under this Act; therefore, an EPL would not be required

Legislation	Objective	Requirement for the proposal
***Water Management Act 2000 (*WM Act)**	Certain activities, in, on or under waterfront land are controlled activities under the WM Act. The NSW Office of Water administers the WM Act and is required to assess the impact of any proposed controlled activity on waterfront land. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40m of the highest bank of the river, lake or estuary. A Controlled Activity Approval must be obtained from the NSW Office of Water before commencing the controlled activity, unless an exemption applies. The *Water Management (General) Regulation 2018* (the regulation) specifies exemptions from the requirement to obtain a controlled activity approval. Pursuant to Part 3, Division 2, Clause 41 of the Regulation, local councils are exempt from the requirement to obtain a controlled activity approval in relation to all controlled activities that they carry out in, on or under waterfront land. The Act also governs the issue of new water licences and the trade of water licences and allocations for those water sources (rivers, lakes and groundwater) in NSW where water sharing plans have commenced.	As BVSC is the proponent of the proposed works, a controlled activity approval is not required for the proposed works. The works would not result in the extraction of water from a river or aquifer and therefore no water licence is required under this Act.
***Waste Avoidance and Resource Recovery Act 2001* (WARR Act)**	Waste management during the proposed works would be undertaken in accordance with the *Waste Avoidance and Resource Recovery Act 2001* (NSW) (WARR Act).	Waste minimisation and management is addressed in Section 5.9 of the REF.
Biosecurity Act 2015	The *Biosecurity Act 2015* repealed the *Noxious Weeds Act 1993* and provides a framework for the prevention, elimination and minimisation of biosecurity risks. The Act and supporting Biosecurity Regulation 2017 provide for the establishment and functions of Local Control Authorities for weeds (LGA or County Councils) and weed control obligations on public and private land.	The REF provides for the control of priority weeds occurring at the proposal site as part of the proposed works, refer Section 5.3.
Local Government		

Legislation	Objective	Requirement for the proposal
Bega Valley Local Environment Plan 2013	This plan establishes the framework for future development within the local government area of Bega Valley. The proposal site is located within the following land zones within the Bega Valley LEP: *E2 – Environmental conservation* The southern section of the proposal site is located within E2 zoned land. Within E2 – environmental conservation roads are permitted within this zoning. The objectives for development in this zone are: • To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. • To prevent development that could destroy, damage or otherwise have an adverse effect on those values. *E3 – Environmental management* The northern section of the proposal site, encompassing the northern approach to the new bridge, is located within E3 zoned land. Within E3 - environmental management, roads are permitted within this zoning. The objectives for development in this zone are: • To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values. • To provide for a limited range of development that does not have an adverse effect on those values. • To provide for low density development and land use activities relating to settlement in natural surroundings, for sustainable agriculture and for other types of land uses compatible with the primary environmental values of the zone. • To limit residential development in environmentally sensitive areas *W1 – Natural waterways* The central section of the proposal site, overlaying Cuttagee Creek, is located within W1 zoned land. Within W1 – Natural waterways, roads	The ecological, scientific, cultural and aesthetic values of the Cuttagee Bridge are described and assessed in section 5 of this REF. This section also outlines the mitigation measures and safeguards required to ensure the works' impact on these values are minimised to the extent possible. Roads are permitted with consent under both E2 and E3 land zonings but not W1. The proposed works may be in conflict with some objectives of E2 and E3 zoned land under the Bega Valley LEP as they would remove an existing bridge demonstrated to have cultural and aesthetic value (refer section 5.8). However, the ISEPP operates overriding the requirement for consent, subject to assessment and determination in accordance with the EP&A Act under Division 17 clause 94.

Legislation	Objective	Requirement for the proposal
	are ordinarily prohibited within this zoning. The objectives for development in this zone are: • To protect the ecological and scenic values of natural waterways. • To prevent development that would have an adverse effect on the natural values of waterways in this zone. • Provide for sustainable fishing industries and recreational fishing.	

4. Consultation

4.1. ISEPP Consultation

Clause 16 of the ISEPP states that a consent authority must not carry out any specific development without giving written notice to the specified authority and taken their responses into consideration. This is detailed in Table 4-1 below.

Table 4-1 ISEPP consultation checklist.

Is consultation with public authorities other than Councils required under clause 16 of the infrastructure SEPP?		
Are the works adjacent to a national park, nature reserve or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	☐ Yes	☒ No
Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	☐ Yes	☒ No
Are the works adjacent to an aquatic reserve or a marine park declared under the *Marine Estate Management Act 2014*?	☐ Yes	☒ No
Is the proposal in the Sydney Harbour Foreshore Area as defined by the *Sydney Harbour Foreshore Authority Act 1998*?	☐ Yes	☒ No
Does the development comprise of a fixed or floating structure in or over navigable waters?	☒ Yes	☐ No
Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional facility or group home in bush fire prone land?	☐ Yes	☒ No
Would the works increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark	☐ Yes	☒ No

Is consultation with public authorities other than Councils required under clause 16 of the infrastructure SEPP?		
sky region is within 200 kilometres of the Siding Spring Observatory)		
Are the works on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in clause 5.15 of Lockhart LEP 2012, Narrandera LEP 2013 and Urana LEP 2011).	☐ Yes	☒ No
Are the works on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	☐ Yes	☒ No

4.2. Agency consultation

Part of the proposal site is located on Crown Land. Consultation with DPIE - Crown Lands would be undertaken prior to commencing works.

A Fisheries Permit for dredging and reclamation works under Section 200 of the FM Act would be required for the works. Consultation with DPI would be required.

As identified in Table 4-1, the proposed development would comprise of a fixed or floating structure in or over navigable waters. Therefore, as specified in Clause 16 (2)(e) of the ISEPP, Transport for NSW need to be consulted prior to commencing works.

4.3. Community consultation

Cuttagee Bridge is valued by the local community, and the proposal to upgrade it has received strong community and media interest. Council has committed to a targeted community consultation process to:

- Explain and justify the rationale for the Proposal;
- Identify and understand key community concerns and interests; and,
- Respond to those concerns and interests.

Key activities to date include:

- A community forum, Bermagui, June 2021 (attended by Councillors and senior staff).
- Media releases outlining the facts and actions taken by Council
- Establishing a Community Advisory Group for Cuttagee Bridge
    - Participants were called for in July, 2021
    - Anticipated to commence in September, 2021.

The recommendations of the advisory group will be put to Council at key decision points as the Proposal progresses through the planning, decision-making and consent process.

4.4. Aboriginal consultation

A Due Diligence assessment for Aboriginal heritage sites was undertaken by qualified archaeologists for this proposal. It is summarised here and is provided in full in Appendix I.

The Aboriginal Due Diligence assessment was conducted in keeping with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW*. The Code of Practice provides a five-step approach to determine if an activity is likely to cause harm to an Aboriginal object, as defined by the *NSW National Parks and Wildlife Act* (1974).

Refer to Section 5.4 for details on Aboriginal heritage.

5. Environmental assessment

5.1. Topography, geology and soils

5.1.1. Existing environment

The proposal site is located in the South East Coastal Ranges IBRA sub-region within the broader IBRA South East Corner Bioregion, characterised by characterised by mountain ranges and the plateau of the Great Diving Range (NPWS, 2003). Locally, the site is flat and surrounded by undulating hills to the north and south, Cuttagee Lake to the west and coastal dune systems to the east. It is located approximately 0 to 9m above sea level (ASL).

The Narooma 1:100 000 geological sheet indicates that the local geology near and around the proposal site consists of marine quartzose sand and silt forming beaches, barriers, active dunes and tidal deltas (quaternary), and late Ordovician greywacke and pelite (Chalker & Bembrick, 1975). Ordovician metasediments underlay the majority of the broader Cuttagee Lake catchment area.

A review of eSpade indicates that the proposal site overlays portions of three soil landscapes as described in Table 5-1.

Table 5-1 Soils landscapes intersected by the proposal site (Talau, 2002).

Soil landscape	Soils	Qualities
Tanja (tj)	"50–150 cm, moderately well-drained to imperfectly drained Yellow Podzolic Soils (Yellow Kurosols) on crests and slopes. 50–150 cm, moderately well-drained to imperfectly drained Yellow Podzolic Soils (Brown Kurosols) on lower slopes and drainage depressions. 50–150 cm, well-drained black headland soils/Yellow Podzolic Soils (Melanic Mesotrophic Yellow Kurosols) on or near headlands".	• Poor drainage • Seasonal waterlogging • Gully erosion risk localised to lower slopes and drainage lines. • Topsoils and subsoils have low wet bearing strength, hard setting surfaces, acidity and localised aluminium toxicity potential.
Tathra (ta)	" >150 cm, well-drained Podzols (Aeric Podosols) and Siliceous Sands (Arenic Rudosols) on well-drained low dunes and beach ridges."	• Highly permeable. • Erodible, and subject to water erosion hazard. • Infertile soils. • Severe wind erosion hazard. • Groundwater pollution hazard.
Murrah (mu)	"50–100 cm, moderately to well-drained Red Podzolic Soils (Bleached Natric Red Kurosols and Haplic Mesotrophic Red Kurosols), Red Soloths (Bleached Natric Red Kurosols) and 50–100 cm, well-drained Yellow Podzolic Soils (Mottled Natric Yellow Kurosols) on crests to midslopes. 100–200 cm, well-drained Brown Earths (Brown	• Seasonal waterlogging. • Water erosion hazard. • High erodibility. • Acidity.

Soil landscape	Soils	Qualities
	Kandosols) and imperfectly drained Yellow Solodic Soils (Grey Dermosols/Yellow Sodosols) on lower slopes and open-depressions."	

A site inspection was undertaken on 14 May 2021 and identified the site to be slightly sloping towards Cuttagee Creek. Groundcover was extensive on the creek banks, with some exposed soils and sand on the shoulders of the approaching roadways. The creek bed beneath the bridge consists of sand. There was minimal erosion present.

Contaminated land

A search of the NSW EPA's Contaminated Land Record and List of Contaminated Sites Notified to the EPA was undertaken on 9th March 2021 of the suburbs of Cuttagee, Bermagui and Barragga Bay (EPA, Contaminated land record of notices, 2021). There are no identified contaminated lands within or adjacent to the proposed works.

No evidence of contamination was observed during the site inspection.

The new bridge abutments are likely to be built up on fill. The fill can be comprised of various materials which have the potential for contamination. Given that there are no identified contaminated lands within or adjacent to the proposed works, it is considered that there is a limited potential for contaminated fill to occur within the bridge abutments. However, caution should be taken during earthworks and appropriate mitigation measures followed if contaminated fill is suspected or encountered.

The proposal site is likely to have potential for Acid Sulfate Soils and salinity hazards, due to the close proximity to the coast:

- Acid Sulfate Probability: eSpade mapping classifies the edges of the creek at the site as 'Hm: High Probability, bottom sediments', as shown in Figure 5-1.
- Salinity: eSpade mapping classifies the parts connecting and blocking the beach to the creek as 'Moderate' as seen in Figure 5-2.

Appropriate mitigation and safeguard measures would be implemented to manage these risks as outlined in subsection 5.1.3.

An Acid Sulfate Soils Management Plan will be developed in accordance with the Acid Sulfate Soils Manual prior to construction.

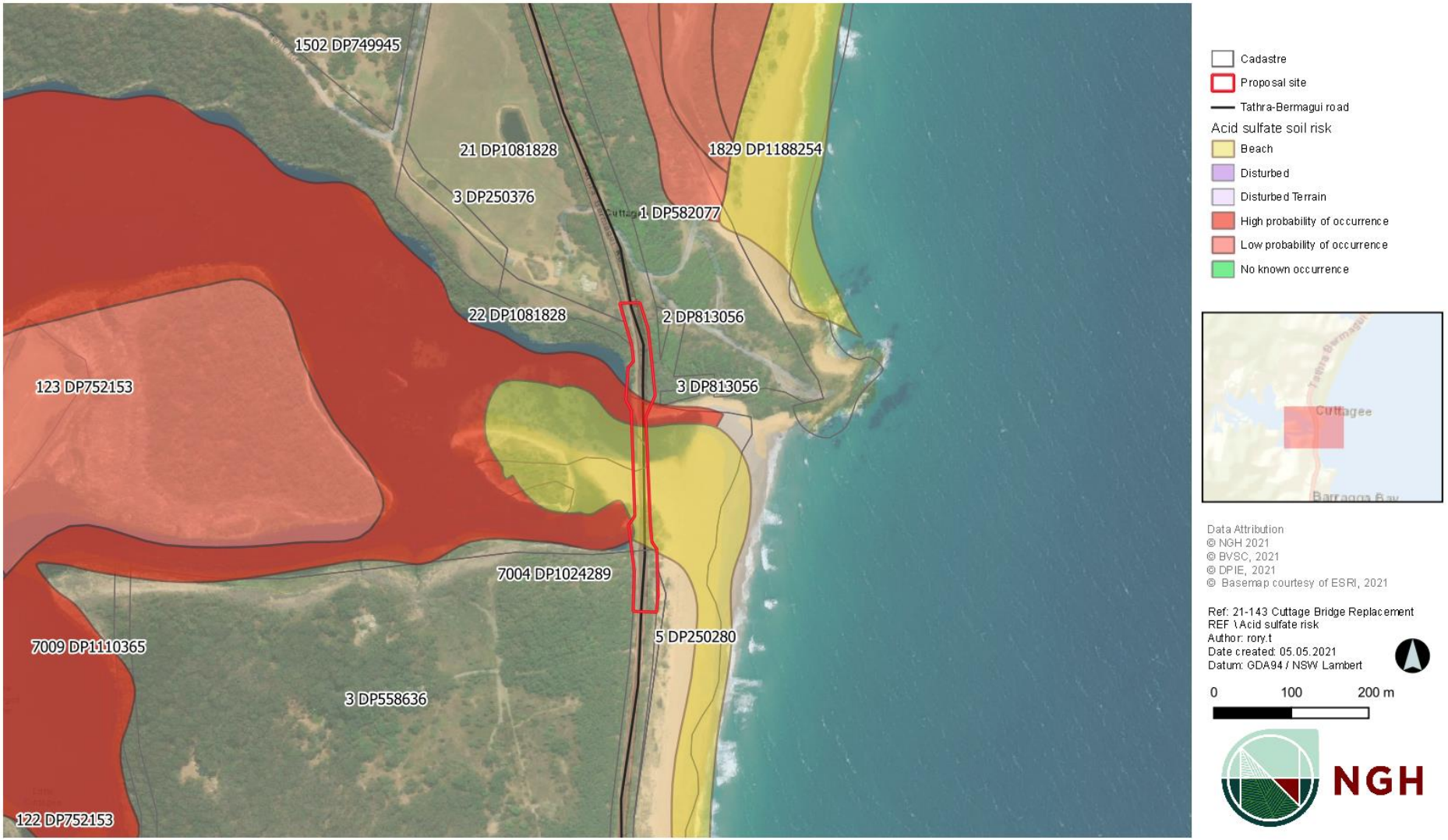

Figure 5-1 Acid sulfate probability

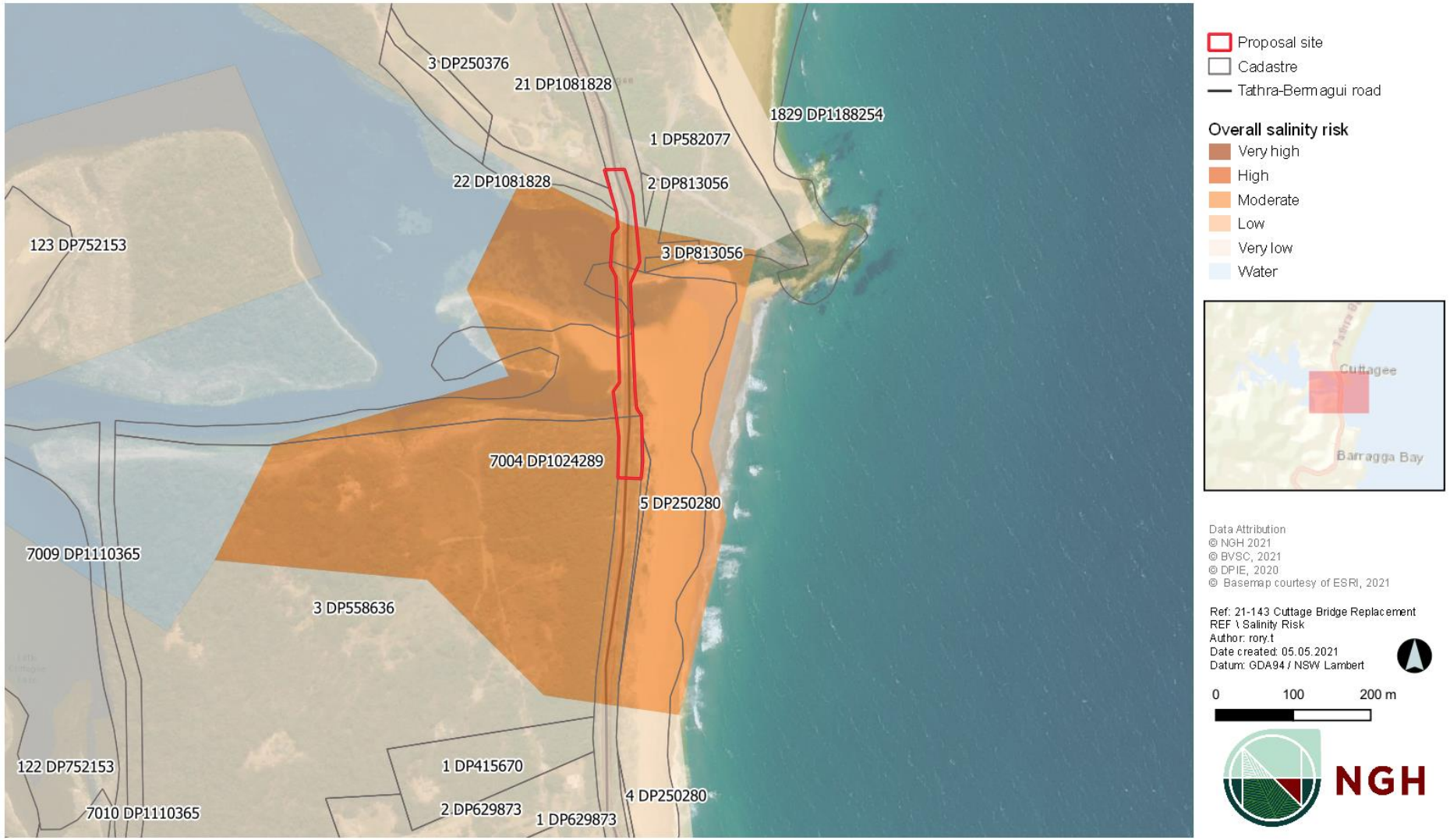

Figure 5-2 Overall salinity risk

5.1.2. Potential impacts

Construction

Generally, the potential sources of impact to soils during construction would be from:

- Excavation activities.
- Bridge construction works.
- Compaction through the use of heavy machinery.
- The use of chemicals such as fuels and hydraulic oils, which have the potential for spills.
- Risk of encountering Acid Sulfate Soils when installing new piers and abutments for bridge through earthworks and vegetation clearing.

The proposal would have a total disturbance area of approximately 1.026ha. The proposal would involve excavations for the removal of bridge components and construction of the bridge abutments and new approaches. Excavation works would involve removing vegetation that currently stabilises soils and would expose soils to weathering processes, increasing the risk of erosion and sedimentation. Removal of vegetation can expose the topsoil layer to erosive forces, including water and wind, which can induce erosion and subsequent loss of this valuable soil resource. Topsoil loss can reduce local agricultural value, slow rehabilitation and the re-establishment of native ecosystems and exacerbate nutrification of waterways as these washing into Cuttagee Creek and Cuttagee Lake. The potential soil landscapes present at the site have erosion risk hazards.

Boring/piling for construction of the bridge piers and bridge abutments would involve excavation in the bed of the Cuttagee Creek. This has the potential to disturb sediment which may become suspended and be transported up or downstream depending on tidal movements.

Demolition and removal of the existing bridge components presents a risk to soil destabilisation and subsequent erosion on the banks of Cuttagee Creek. Vehicles and machinery would be required to access the banks of the Cuttagee Creek to remove sections of the existing bridge. Movement of machinery and vehicles on the banks of the creek would be confined to stabilised approaches and old wooden bridge. Removal of instream structures including bridge piers would destabilise discrete areas of the creek bed. Areas disturbed by the bridge demolition activities would be required to be stabilised and rehabilitated as soon as practical. Erosion and sediment controls on the banks of the creek would minimise erosion from disturbed areas and prevent sediment from entering the waterway.

Compaction of soils may occur as a result of machinery movement and parking, stockpiling of materials and soil (including imported fill). Compaction of soils can retard the natural regeneration of groundcover and adversely affect soil stability.

During excavation works, there is potential to expose contaminated material which may further impede natural regeneration; roadsides have a higher risk of buried contaminants. The works also have potential to disturb acid sulfate soils, which are mapped for the area. Acid sulfate soils are naturally occurring sediments, that generate acid when exposed to oxygen. This acid generation can kill immobile organisms (such as seagrass), kill mobile organisms if acidity is broadly distributed, corrode iron, concrete and some alloys and irritate

skin and eyes of people. The proposal site does overlay a portion of high-probability soil (refer Figure 5-1), which means that acid sulfate soils are likely to occur.

Improper management of this material during the proposed works would have water quality implications for Cuttagee Lake and would create an ongoing management issues at the sites where the material was disturbed. An Acid Sulfate Soils Management Plan will be prepared to guide construction works as required.

Further, the proposed works have the potential to introduce contaminants to soils via construction machinery. These include the following:

- Hydrocarbons, lubricants, oils or other chemical pollutants, particularly at the site compound where vehicle, machinery and other equipment may be stored.
- Spillage, dust or leachate from concrete or concrete wash.
- Water containing biological contaminants such as nutrients and bacteria from site toilets and taps.

Overall, short term risks to soils would be high, but localised. Known (demonstrated to be effective on similar projects) mitigation strategies are considered highly likely to be able to adequately address these risks. Medium to long term impacts would be low provided stabilisation strategies are effectively implemented. Stabilisation and revegetation would act to resist soil erosion to the same extent that existing vegetation now functions.

Operation

Post construction impacts to soil would be largely concentrated to areas disturbed during construction. These areas have potential to continue to be susceptible to erosion until vegetation groundcover is restored. These impacts are expected to be minimal, due to the small spatial extent of works and proposed rehabilitation mitigation measures. The proposal would not result in a substantive increase of non-porous surfaces.

5.1.3. Safeguards and mitigation measures

Soil and geological impacts are considered highly manageable. The following safeguards and mitigation measures are recommended to minimise soil impacts of the proposal:

- All works will occur within the proposal footprint outlined in Figure 2-2. Any works that are to occur outside this proposal site would require further assessment.
- Design bridge, bridge abutments, and road approaches, to ensure stable landforms are achieved. Design is to include devices such as rock armouring for scour protection.
- Development of a site-specific sediment and erosion control plan, in accordance with the Blue Book (Landcom 2004), prior to the works commencing.
- Installation of erosion and sediment controls prior to commencement of construction.
- Maintenance of erosion and sediment controls throughout the duration of the works and until the site is stable.
- Works will not be undertaken in forecasted heavy rain.
- Delineation of works areas, including access and stockpile areas, and fencing of ‘no go’ zones to stop unnecessary disturbance outside the works footprint.

- Placement of compound and ancillary site as well as potential pollutants (such as soil and hazardous materials) will be located away from drainage lines (more than 40m) on relatively flat ground and already cleared of vegetation. Bridge equipment and other materials that are not a pollution risk may be stored adjacent to the bridge but outside of potential flood zones.
- Separation of topsoil and subsoil during stockpiling activities. Topsoil must be reused to assist stabilisation of disturbed areas.
- If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions have been implemented.
- An Acid Sulfate Soils Management Plan will be developed and will specifically address risks of leachate impacts on receiving waters.
- Soil sampling will be undertaken adjacent to abutments to identify and characterise specific acid-sulfate soil risk at the site.
- An Emergency Spill Management Plan will be developed for the project and would contain measures to avoid spillages of hydrocarbons onto any ground surfaces or into any waterways. The plan would include, but not be limited to:
  - Impervious bunded storage facilities for hydrocarbons, away from watercourses and areas at risk of flooding impacts.
  - Impervious bunded areas for refuelling, away from waterways and drainage lines.
  - Spill kits kept onsite and, on all machinery.
  - Training of staff in the response, notification and management of hydrocarbon spills.
  - Contingency measures for inset casting of the concrete piers within Cuttagee Creek.
- Progressive stabilisation of disturbed areas to include:
  - Respreading topsoil and mulch (thinly spread) to assist natural revegetation.
  - Maintenance of sediment and erosion controls until the surfaces are deemed to be stable.
  - Consideration of seeding and supplementary planting based on success of the former two points.
  - An Acid Sulphate Management Plan will be prepared prior to construction.

5.2. Hydrology, catchment values and water quality

5.2.1. Existing environment

Catchment values

The proposal site is located within the Bega River Catchment area, which incorporates multiple river catchments and coastal lakes and is managed by the South East Local Land Services (SELLS). The local Cuttagee Lake catchment has an area of 53.25km^2 and is bound by the Bega catchment being fed by Cuttagee creek upstream to the west, Boggy

Creek to the north and an unnamed creek to the north west. Cuttagee creek is the primary catchment stream (Elgin, 2016).

Cuttagee Lake, immediately upstream of the proposal site, is classified as a semi-mature, saline coastal estuary (Elgin, 2016). It is an *intermittently closed or open lake and lagoon (*ICOLL), influenced by the natural or artificial opening and closing of a sand bar at the ocean entrance.

ICOLLs such as Cuttagee Lake are defined by being a coastal lake or lagoon that alternates between being open or closed to the ocean. They are separated from the ocean by a sand beach barrier or berm. This entrance barrier forms and breaks down depending on the movement and redistribution of sand and sediments by waves, tides, flood flows (e.g., 50mm+) and winds. The force of the backed-up water then quickly scours an entrance channel through the beach and reopens the ICOLL to the ocean. When ICOLLs are open they become tidal with seawater moving into and out of the estuary with the daily tidal cycle (DPI, Management of coastal lakes and lagoons in NSW, 2021).

The proposal involves construction within a section the Cuttagee Creek corridor that connects Cuttagee Lake to the ocean entrance 175m to east of the proposal site. The width of Cuttagee Creek at the location of the proposal site is variable due to the nature of ICOLLs but can be up to 100m in width and was flowing during the site inspection. The creek is classified as a 6th Order Strahler watercourse at the location of the proposal site. Instream features include aquatic vegetation, minor incised channel with rock beds, riffles and pools.

Figure 5-3 Cuttagee Creek, upstream of the proposal site.

The banks of Cuttagee Creek are minor sloping with flat to gentle undulating sandbanks that change overtime occurring either side of the creek. The creek opens and closes to the ocean changing the depth and actual width of the creak depending on tidal and weather that define an ICOLL. The proposal site is located within a low point of the landscape between two crests. The creek banks are semi-stable due to the nature of sand and ICOLLs, the prominent groundcover would provide some stability, but areas of minimal ground cover would be susceptible to erosion during velocity water flows, and other extreme weather events and king tides.

There are no other waterways within the proposal site.

The proposal site is located within identified key fish habitat as shown in Figure 5-4. Key fish habitat is important for the maintenance of fish populations generally and the survival and recovery of threatened aquatic species.

The water quality would be potentially impacted by upstream land uses, including cropping and cattle grazing and recent bushfires. However, much of the catchment remains forested with little agricultural clearing (<5% of total area) (Elgin, 2016). A previous assessment of water quality over a three-year period (2010-2013) by BVSC and OEH (now DPIE) rated the

water quality as very good, and that the general condition of water quality in Cuttagee Lake had:

- High levels of dissolved oxygen.
- High to moderate water clarity (and therefore, low turbidity).
- Low levels of nutrients (mean total nitrogen and total phosphorous were below recommended limits for estuarine aquatic ecosystems.
- Low abundance of algae (Elgin, 2016).

Across the broader lake, these water quality trends are consistent regardless of whether the ocean mouth is open or closed.

Groundwater Dependent Ecosystems (GDEs)

Potential Groundwater Dependent Ecosystems (GDE) within the vicinity of the proposal site are mapped in the Groundwater Dependent Ecosystems Atlas (BOM, Groundwater Dependent Ecosystems Atlas, 2021a). Cuttagee Creek is listed as an aquatic GDE as it interacts with groundwater There is high potential for Aquatic GDEs around the proposal site. There is moderate potential for Terrestrial GDEs around the proposal site. Refer to Figure 5-5.

Flooding

There is no formal flood mapping available for the proposal site at the time of writing.

The entrance to Cuttagee Lake, within which the proposal site is location, is characterised as a flood-ebb tidal delta and is subject to tidal patterns when open to the sea. High water levels would occur during high rainfall events and king tides.

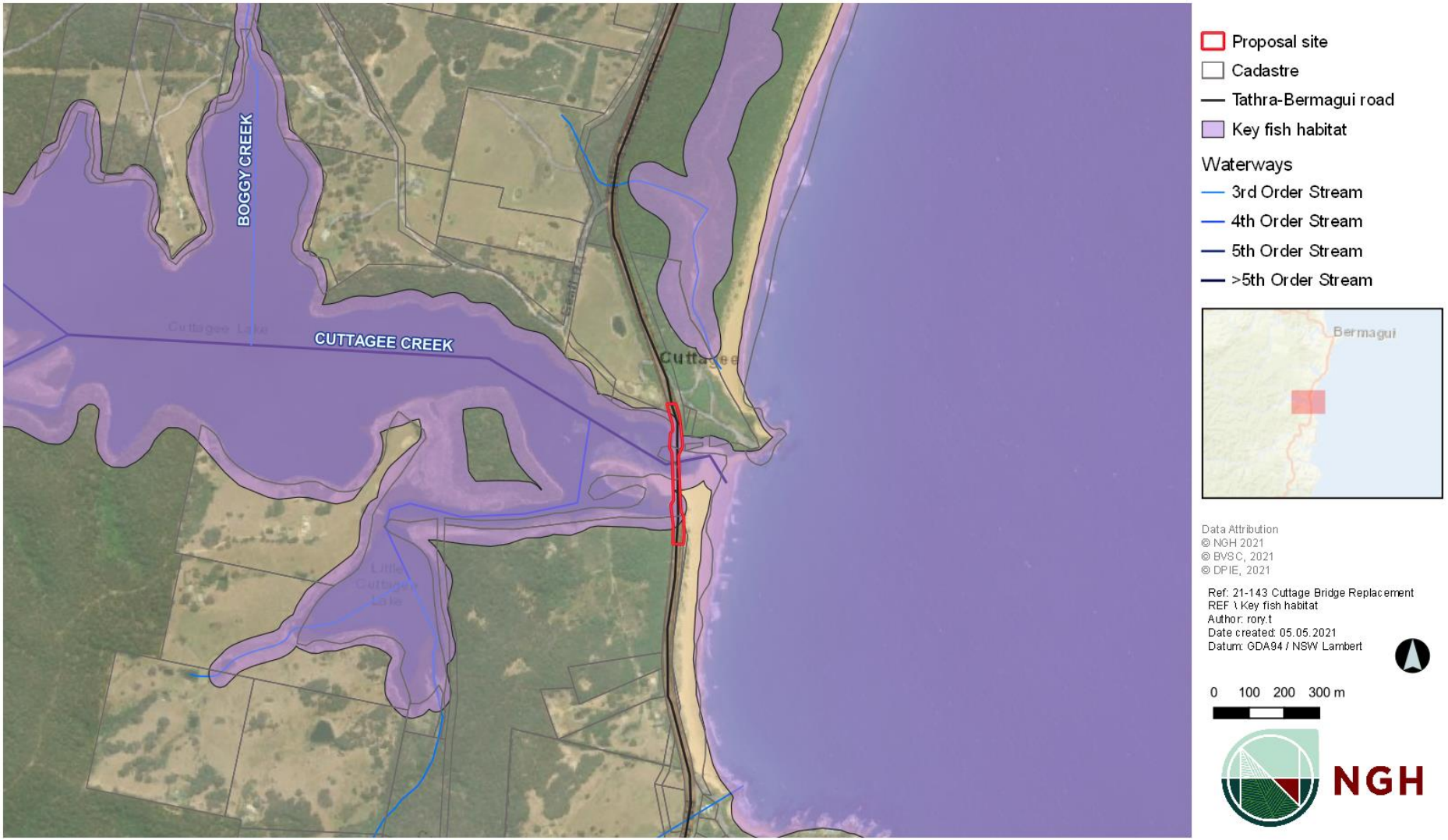

Figure 5-4 Key fish habitat.

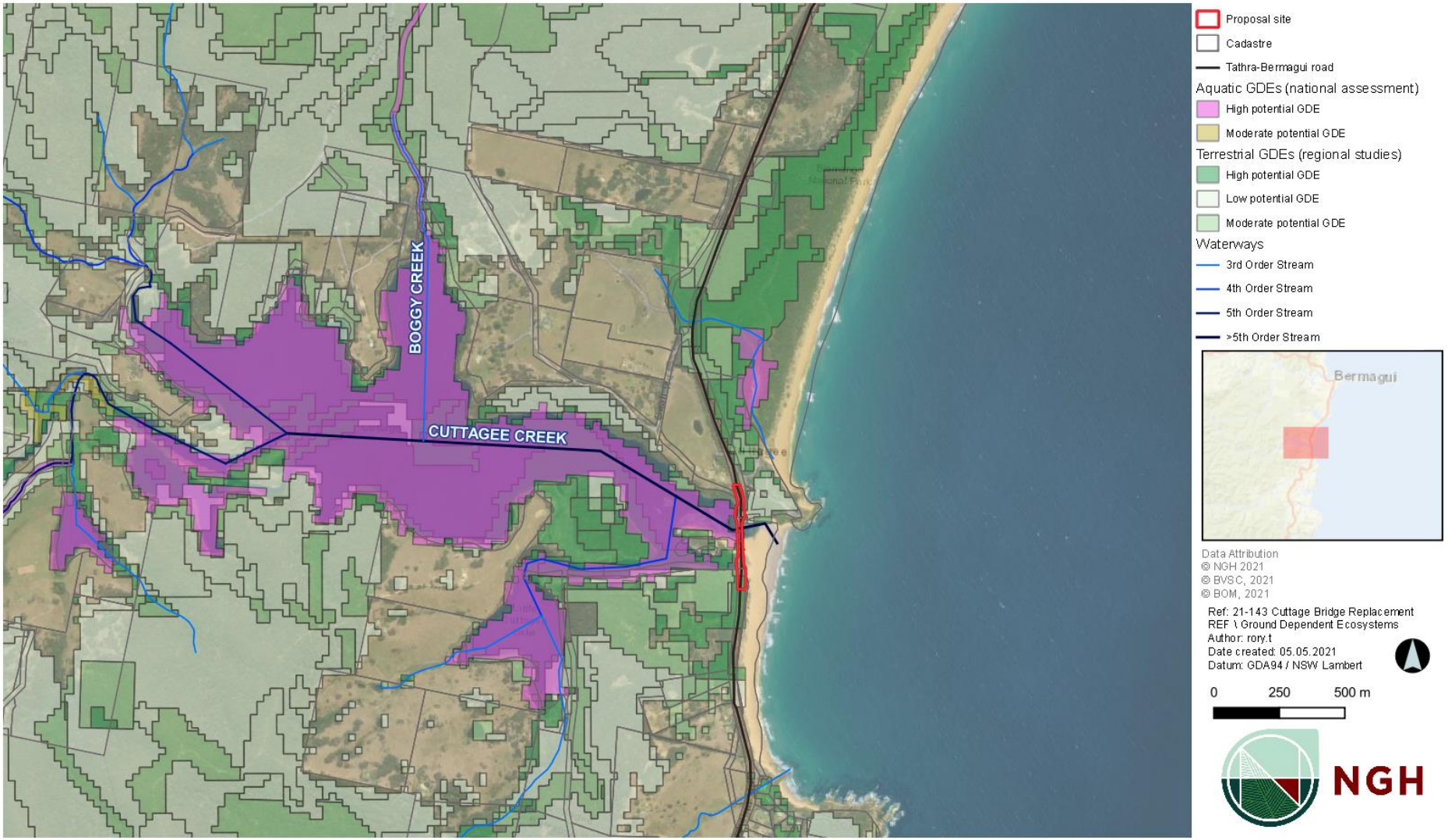

Figure 5-5 GDEs within and surrounding the proposal site.

Coastal Hazards

An overview Coastal Hazards assessment for the Cuttagee Lake entrance and Cuttagee Bridge has been prepared on behalf of BVSC by Baird Australia (Baird., 2021). This assessment is provided in full in Appendix C and summarised below. It leverages off previous coastal processes and hazards studies and modelling for the area, notably:

Bega Valley Shire Coastal Processes and Hazards Definition Study – Volume 1: Final Report (WBM , 2015).

Extreme still water levels

Elevated still water levels (SWL) offshore of Cuttagee Lake occur during storm events. Elevated water levels during a storm event may be a result of:

- Barometric pressure set up.
- Wind setup.
- Astronomical tide.

The 1 in 100-year Average Return Interval (ARI) SWL for the Cuttagee Lake region (Bermagui) is 1.32m AHD.

Sea level rise

BVSC has adopted a sea level rise (SLR) policy of an increase in mean sea level of 0.91m by 2100 above 1990 levels.

However, to adequately account for the uncertain amount of SLR in the future, a range of SLR scenarios was adopted by WBM (2015) in their study and accompanying modelling. These include Almost Certain, Unlikely and Rare scenarios, which predict rises of 0.12 m, 0.34 m and 0.5 m respectively by 2050, calculated as metres above present-day levels. For the purpose of assessment for Cuttagee Bridge, the ‘Unlikely’ SLR of 0.34m rise by 2050 is assumed.

Offshore waves

The coastline off Cuttagee Lake is periodically exposed to large waves originating from a range of weather systems. The 1-year ARI Hs is 5.4m, increasing up to 8.5 m at the 100-year ARI. The storm peak wave period (Tp) ranges between 10 – 14 seconds, with the largest waves originating from a South-Easterly direction. Cuttagee Lake entrance is relatively more exposed to the predominant South-Easterly direction offshore wave direction. Cuttagee Point provides good protection from offshore wave directions north of east.

Coastal inundation

The inundation of the lower Cuttagee Lake area can be influenced by elevated ocean levels propagating through the open entrance channel. The coastal inundation for the Immediate ‘Unlikely’ scenario to be 2.59m AHD, and the 2050 ‘Unlikely’ scenario as 2.93m AHD, with the latter incorporating a SLR of 0.34m (WBM , 2015).

Lake flood behaviour

The entrance naturally opens during periods of increased catchment inflows. Typically, the lake water level reaches greater than 2.1m AHD before this entrance opens naturally. However, at 1.8m AHD the inundation of local roads starts to occur and to avoid this, the artificial opening the lake has been enacted and is formalised through the *Cuttagee Lake Entrance Opening Policy* (BVSC, 2016).

Erosion and recession hazard

The erosion and recession hazard at Cuttagee Bridge is associated with several coastal processes, including short-term storm related erosion, long-term recession due to sea level rise and lake entrance processes. These hazards are summarised in Table 5-2 below.

Table 5-2 Erosion and recession hazards for Cuttagee Bridge

Element	Hazard
Erosion hazard extent	The immediate erosion hazard line incorporates the storm bite to the crest of the erosion scarp above 0 mAHD, and short- to medium-term variations in shoreline position due to wave climate The 2050 Planning Horizon hazard extents show that in the Unlikely scenario, the bridge and southern access road may be exposed to erosion/recession (WBM, 2015). The 2100 Planning Horizon for the Unlikely scenario is to the west of the existing bridge, and therefore the bridge may be exposed to long-term erosion and recession hazard if no protection works are undertaken.
Erosion depth	The proposed bridge at the northern abutment will be founded with concrete spread footings on bedrock, and therefore will limit erosion to bedrock depth. At the southern end, the base bedrock is covered by a deep layer of coastal sand, that is greater than 10.45 m (below the current surface). It is recommended by Marshmen O'Neill Engineers (2021) that the proposed southern abutment and intermediate piers be founded through the deep (>10.45 m) sand into the base bedrock. A lagoon entrance scour depth of -0.5m AHD was adopted for the immediate case, taken as the maximum scour depth that is likely to occur during a channel opening event. For the 2050 case, the erosion hazard line would encroach up to the bridge alignment and hence the channel scouring from flooding would have less of an influence than wave-dominated erosion.

Element	Hazard
	Therefore, the 2050 case has a scour depth of -1m AHD.
Historical entrance behaviour	Analysis of historical satellite imagery of the lake entrance revealed that the sand shoals are dynamic and constantly shifting; however, the channel typically runs closer to the northern abutment of the bridge. The dune at the southern extent of the bridge is consistently vegetated, in addition to the vegetated island to the west of the bridge. This suggests that these locations are rarely inundated or affected by scour and have been adopted as the southern limit of entrance erosion in this assessment.

Wave runup and propagation

The wave runup level for Cuttagee Beach was estimated as +5.5m AHD. Wave penetration through an open entrance under an elevated SWL is possible. Under this scenario, Baird (2021) calculated maximum wave crest elevations (wave crest height + coastal inundation level) at the location of the existing and proposed Cuttagee Bridge to be +5.8 mAHD and +6.6 mAHD for the Immediate and 2050 planning periods, respectively.

Wave overtopping

The overtopping rates for the existing and proposed bridge were evaluated for both the immediate and the 2050 planning periods. For the existing and proposed bridge crest elevation of +4 mAHD, the following mean overtopping rates are estimated:

- Immediate ‘Unlikely’ scenario = 7.6 litres/sec per m
- 2050 ‘Unlikely’ scenario = 8.1 litres/sec per m

5.2.2. Potential impacts

Construction

During construction, watertight enclosures would be used within Cuttagee Creek for the pouring of in situ concrete bridge piers and cutting of the existing timber piers to be removed. While relatively narrow, these watertight enclosures have the potential to disrupt water flow within Cuttagee Creek. These temporary containment measures would be used with dewatering processes during the curing of concrete and cutting of piers to minimise the risk of contaminants entering the creek.

During construction there is potential for a wide range of pollutants to enter Cuttagee Creek, particularly during instream works and high rain events. These include:

- Sediment laden water and soil nutrients (including construction wastewater).

- Construction waste during demolition works.
- Fuels spilled during refuelling of plant and equipment.
- Hydraulic and lubricating oil leaking from plant and equipment.
- Rinse water from plant washing.
- Concrete slurries or concrete wash, which could alter the pH of water if spilled into the waterway. Concrete works would be required in the construction of pier footings.
- Water containing biological contaminants such as nutrients and bacteria from site toilets and taps (compound site).

Introduction of the above pollutants from the proposal into the surrounding environment, if uncontrolled, could potentially have the following impacts on water quality of Cuttagee Creek:

- Increased sediment load and organic matter resulting in adverse impacts to aquatic fauna and flora found on the bed of rivers, creeks and other water bodies.
- Reduction in photosynthetic productivity of water bodies from increasing turbidity.
- Reduction in channel habitat from sediment deposition.
- Gross pollutants entering receiving creeks.
- Reduction in water quality due to influx in man-made substances resulting in adverse impacts to aquatic flora and fauna and potential values of key fish habitat.

Water quality risks during construction can be minimised effectively with the implementation of mitigation measures outlined in Section 5.2.3.

The removal of vegetation at the proposal site may destabilise the banks and potentially result in exposure of soils to erosion hazards, causing sedimentation of the waterway. Disturbance of the channel banks during the removal of vegetation is likely to result in temporary minor increases in turbidity.

The proposed works would occur on land that has potential to be impacted by flooding, king tides and increase currents. During construction, these have the potential to impact water quality through erosion of disturbed areas and subsequent sedimentation of Cuttagee Creek. Risks would be increased if flooding and increase currents occurred during the excavations for the bridge abutments. There is a risk that stockpiled soils and materials could potentially be transported into drainage lines and into waterways during a flood event. Some of these materials could include contaminants and excess nutrients, which would adversely impact water quality. A Flood contingency plan would be developed to manage the potential impacts of flooding on the construction site.

Operation

The proposal is for the construction of a new concrete bridge and approaches. Given the extent of the works, this would not result in a substantive increase in the area of impervious surfaces at the site. It is unlikely the proposal would increase the volume and rate of stormwater runoff entering Cuttagee Creek and Cuttagee Lake through stormwater design of the proposal.

It is unlikely that the proposal would exacerbate flooding within the creek. The works may affect creek flow due to the installation of six concrete piers and their associated footings. The works must ensure that the works do not significantly impact:

- The hydrologic integrity of the wetland or
- The quantity and quality of surface and groundwater flows to and from the adjacent coastal wetland.

The design of the structure and works methodology will need to ensure this result.

The works may result in minor dewatering processes and hydrological impacts on the creek. It is not proposed to divert the creek.

The potential for adverse water quality impacts during operation would largely be as a result of accidental spills and leaks from vehicles using the widened road and bridge, however the risk would not be any higher than the risks that currently exist. The potential impact of a spill or leakage during operation is considered to be minor as the drainage system design for the proposal includes measures to capture and treat oil or chemical spills. Risks associated with erosion and sedimentation of the waterway and subsequent reduction in water quality would not increase as a result of the completion and operation of the proposal.

Coastal hazard assessment (Baird., 2021) identified that the proposed bridge alignments are not at direct risk of erosion/recession hazards at the present day. However, the access road to the south of the bridge (Tathra-Bermagui Road) may be impacted by erosion during extreme event under the 2050 ‘Unlikely’ scenario (nominally a 100yr ARI coastal storm event that occurs in 2050).

Additionally, assessment of wave penetration and overtopping rates indicates that the proposed bridge crest elevations (+4m AHD) would allow safe access for slow moving vehicles at both the Immediate and 2050 planning periods, assuming a structurally sound bridge structure. It is noted that for vehicles driven at moderate to high speed (>40km/hr), almost any wave overtopping would be deemed hazardous. Wave overtopping depths would regularly exceed 0.5m during any extreme coastal events. To this end, for a bridge crest level of +4m AHD it would be recommended that access to the bridge be restricted to essential vehicles only during extreme coastal storm events, with road closed signage established. It is noted the wave overtopping rates significantly exceed acceptable criteria for pedestrian access for both the immediate and 2050 planning periods.

Raising the bridge to a level that minimises wave overtopping (thereby ensuring safe access for pedestrians and fast-moving vehicles) would require the bridge deck to be elevated above +7m AHD which is not considered a practical or desirable solution. This is also the case for the Tathra-Bermagui access road to the south, that has pavement level at +4mAHD, and it is noted that safe access across the bridge would be governed as much by conditions on the access road as the bridge deck elevation.

5.2.3. Safeguards and mitigation measures

In addition to soil management, set out in Section 5.1.3, the following safeguards and mitigation measures are required to minimise water quality and hydrology related impacts from the proposed works:

Construction

- Prior to works, a Fisheries Permit for dredging and reclamation works would be obtained, and works would be undertaking in accordance with the permit. This is expected to include:
    - Instream and bank work areas would be clearly delineated and other areas declared 'no go zones.
    - If dewatering is required, it would only be undertaken in accordance with a Dewatering Plan, to manage dewatering operations and discharge to receiving waters.
    - No machinery to enter the waterway unless it has been appropriately cleaned, degreased and serviced.
    - Spill kits to be available onsite at all times during instream works.
    - Only clean rock (no fines) to be used in rock armouring, if required.
    - Geotextile fabric is to be used to isolate the natural bed of the waterway from any imported clean rock fill or other material used within the bed of the waterway.
    - Surplus concrete and wash-down water would not be disposed of on site.
    - Works are to manage debris created by the demolition of the bridge components entering Cuttagee Creek using devices such as drop nets, shade clothes or instream booms.
- Hydrological assessment of the final design of bridge and road approaches to demonstrate they do not significantly impact hydrologic integrity or the quantity and quality of surface and groundwater flows to and from the adjacent coastal wetland.

Operation

- Ensure stormwater is not discharged into Cuttagee Creek unless appropriately treated.
- Access to the new bridge shall be restricted to essential vehicles only during extreme coastal storm events, with road closed signage established.
- Any pedestrian walkway shall be located on the western side of the bridge alignment, to minimise wave overtopping exposure of the walkway during moderate to severe coastal events.
- Appropriate signage shall be installed on the walkway warning of the potential dangers to pedestrians during moderate to extreme coastal storms.
- A flood contingency plan would be prepared to identify any potential flood threats and the evacuation procedure for dispersible materials, hazardous materials and equipment containing hazardous or dispersible materials. The flood contingency plan would include:
    - Detail who would be responsible for monitoring the flood threat and how is this to be done. It is expected that flood warning information would be sourced from the Bureau of Meteorology (BoM) website.
    - Regular consultation of the BoM website for weather forecasts and flood warnings.
    - A process for removing equipment and materials off site and out of flood risk areas quickly.
    - Prior to works, permission from the crown land would be acquired to work in the creek.

5.3. Biodiversity

5.3.1. Existing environment

Terminology used in this REF

For the purposes of defining areas for biodiversity assessment, the following terminology is used in accordance with the Threatened Species Test of Significance Guidelines (July 2018).

Subject Site	Means the area directly affected by the proposal (i.e., the development footprint). The subject site also includes any ancillary works, facilities and access arrangements.
Study Area	Means the proposal site as described in other parts of this report. For this project, it includes a 50m length of Cuttagee Creek and is mainly for capturing any possible impacts from disturbance to the aquatic zone.

Background searches and results

Desktop database searches were completed for records of Commonwealth and State listed threatened species, populations, and ecological communities. Searches were conducted on 9th March 2021 and are outlined in Table 5-3. NSW Bionet Atlas records and Commonwealth Protected Matters Searches are included in Appendix D and Appendix E.

At this stage, no field work or detailed biodiversity assessment has been completed. These activities will be required as identified in Section 5.3.3.

Table 5-3 Background searches and results.

Background search	Search area	Results
OEH Bionet species sightings search of flora and fauna and communities listed as threatened under the *Biodiversity Conservation Act 2016* (BC Act).	South East Corner – South East Coastal Ranges IBRA subregion within 10km of the subject site	The search results returned the following recorded threatened species within the study area: • 6 flora species • 36 birds • 10 mammals • 1 amphibian There is a recording of Matted Bush-pea (*Pultanaea pedunculata*) within the south-eastern corner of the proposal site. Pied oystercatchers have been recorded on the northern end of Cuttagee Beach <50m east of the proposal site. There are 13 Threatened Ecological Communities (TECs) with potential to occur.
Protected Matters Search Tool (PMST) for species and populations	10 km buffer of the subject site.	The search results returned the following that have the potential to occur inside the subject site.

Background search	Search area	Results
listed as threatened under the EPBC Act.		• 1 Commonwealth Marine Area • 5 Listed Threatened Ecological Communities • 66 threatened species • 55 migratory species • 84 marine species.
Department of Primary Industries WeedWise (DPI, NSW Weedwise, 2021b)	South East region of NSW Bega Valley LGA	122 priority weeds are listed for the region.
South East Local Lands Service (SELLS) Biometric Vegetation mapping	Study area	Biometric Vegetation types mapped across the proposal site include: • PCT1220: Spotted Gum - White Stringybark - Burrawang shrubby open forest on hinterland foothills, northern South East Corner. • PCT 659: Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin and South East Corner, (high potential Endangered Ecological Community (EEC): Bangalay Sand Forest of the Sydney Basin and South East Corner Bioregions). • PCT 772: Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion.
Biodiversity Values Mapping and areas of outstanding biodiversity value	Subject site	Areas of mapped biodiversity values occur to the east and west of the site. To the east, approximately 100m from the proposal site are areas of protected riparian land. To the west, approximately 90m from the proposal site are areas of protected wetlands under the *Coastal Management Act 2016*. No areas of declared outstanding biodiversity value as listed under the BC Act are present within the subject site or study area. The proposal site does not contain significant wetland communities, but does overlap with areas identified as coastal wetlands proximity area' under the CSEPP.

Background search	Search area	Results
DPI NSW Estuarine Macrophytes (Fisheries NSW Spatial Data Portal, 2021)	Study area	The proposal site does overlay mapped areas of saltmarsh. Cuttagee Lake also provides aquatic habitat for seagrass (mixed *Zostera/Ruppia*). The nearest patch is 115m to the west (upstream) of the proposal site. Refer Figure 5-7.

The results from desktop analysis indicate that the proposal site may contain EEC *Bangalay Sand Forest of the Sydney Basin and South East Corner Bioregions* as well as habitat for threatened fauna and flora. Detailed descriptions and assessment of terrestrial and aquatic fauna and flora, vegetation communities and habitat values present within or near to the proposal site would be provided following site inspection and habitat evaluation by an accredited ecologist (refer Section 5.3.3).

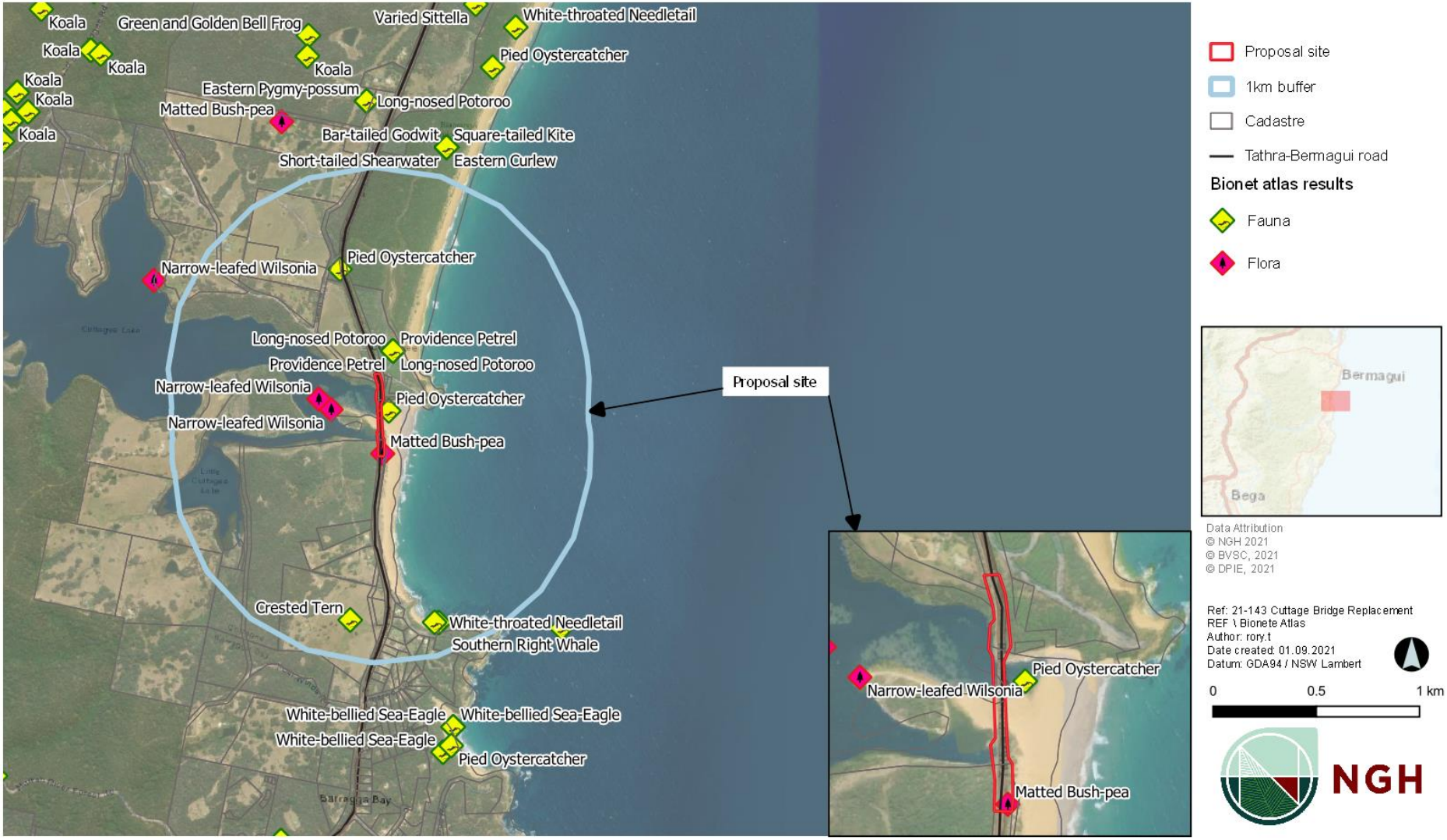

Figure 5-6 Bionet atlas results

Site inspection

A biodiversity site inspection was conducted on the 8th July 2021 by a senior NGH ecologist. The survey involved a rapid vegetation survey of the subject site including the bridge and surrounds. The inspection involved a random meander search to: i) determine flora species and ground-truth plant community types (PCTs) across the site; and, ii) conduct a basic habitat assessment to observe any fauna habitat features such as hollow bearing trees (HBTs), aquatic habitat and ground habitat resources.

Approximately three person hours were spent on site.

Vegetation and flora

Most vegetated parts of the subject site contain various compositions of coastal shrub forest, combined with some cleared and disturbed areas fringing to the road easement. Vegetation can be roughly categorised into 'north of the bridge' and 'south of the bridge'.

Northern approach

To the north of the bridge within the subject site, the vegetation onsite consisted of *Melaleuca armillaris, Westringia fruticosa, Acacia longifolia, Leucopogon sp, Myoporum batae, Pittosporum undulatum, Clematis aristata, Allocasuarina verticillate, Eucalyptus botryoides* and *Notolaea longifolia.* Groundcover was characterised by *Cenchrus clandestinus, Pteridium esculentum, Asparagus asparagoides, Smilax australis, Lomandra longifolia*, *Rytidosperma sp., Gahnia sieberiana* and *Dichondra repens.*

Here, the vegetation composition generally accords with PCT 721: *Bracelet Honey Myrtle – Coast Tea-tree tall shrubland on headlands, South East Corner Bioregion*. Refer to Figure 5-7.

Southern approach

To the south of the bridge, within the subject site, back dune vegetation consists consisting of *Leptospernum laevigstum, Spinefex sericeus, Scaevola sp., Acacia longifolia subsp. longifolia, Ficinia nodosa, Euphorbia weed, Tetradonia tetagynoides and Zoysia macrantha.* In addition, *Banksia integrifolia, Pittosporum undulatum, thst bush, Monotoca scoparia,* some *Melaleuca armillaris, Leucopogon* parviflorus, some *Eucalyptus botryoids, Leptospernum obovatum, Pittosporum revolutum* and *Breynia oblingifolia* was also present. Ground cover was characterised by *Lomandra longifolia, Rhagodia candolleana, Lepidosperma laterale, Dichondra repens, Parsonsia straminea, Poa labillarderi, Senecio linearis, Plectranthus, Pteridium esculentum, Imperata cylindrica, Carpobrotus glaucescens, Cenchrus clandestinus, Goodenia ovata* and *Stenotaphrum secundatum.*

Here, south of the bridge, the vegetation composition generally accords with PCT 772: *Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion*. Refer to Figure 5-7.

Estimated impact area

Altogether, approximately 0.743ha of native vegetation would be affected by the proposed works. Table 5-4 below summaries these areas by PCT. Table 5-5 illustrates the vegetation present. For the purpose of assessment, this REF assumes a worst-case clearing scenario in which all 0.743ha would be removed.

Table 5-4 PCTs across the subject site

Plant Community Type	Area (ha)
PCT 721: *Bracelet Honey Myrtle – Coast Tea-tree tall shrubland on headlands, South East Corner Bioregion.*	0.367
PCT 772: *Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion.*	0.367
Total	**0.743**

Table 5-5 Site imagery: Vegetation and flora along Bridge approaches

Bridge approach	
Northern approach **PCT 721: *Bracelet Honey Myrtle – Coast Tea-tree tall shrubland on headlands, South East Corner Bioregion.***	
	

Bridge approach	
Southern approach **PCT 772: *Coast Banksia - Coast Wattle dune scrub of the Sydney Basin Bioregion and South East Corner Bioregion.***	
	

Threatened flora

Bionet Atlas and Atlas of Living Australia (ALA) records indicate that Matted Pea Bush (*Pultenaea pedunculata)*, listed as endangered under the *BC Act 2016,* has been previously observed within the subject site (refer Figure 5-6). An additional 100+ individual plants have been observed 1.4km south of the Bridge on the verge of Tathra-Bermagui Road verge.

While not observed onsite during rapid vegetation surveys undertaken as part of the site inspection. However, the site inspection occurred outside the best survey period for the Matted Bush Pea (which flowers from August to December, with fruit maturing between October and January) and so the lack of detection at the time of inspection cannot be taken as lack of presence.

Additionally, while recorded on Bionet and ALA nearby, both Narrow-leafed Wilsonia (*Wilsonia backhousei)* and Square/Wingless Raspwort (*Haloragis exalata subsp. Exalata)* were not detected within the subject site during the site inspection. However, the site inspection occurred outside the best survey period for both species.

Threatened ecological communities

The species composition and distribution PCTs onsite do not correlate within any threatened ecological communities (TECs) under the NSW *BC Act* or Commonwealth *EPBC Act*.

However, the subject site does neighbour two TEC patches mapped on state databases. In addition, Cuttagee Lake is inhabited by extensive swathes of marine seagrass meadows, an important vegetation and habitat component. These are summarised in Table 5-6 and discussed below.

Table 5-6 Endangered ecological communities and marine vegetation identified near the subject site.

Vegetation community	TEC/protected marine vegetation	Status
Coastal Sand Forest	*Bangalay Sand Forest of the Sydney Basin and South East Corner Bioregions*	BC Act Endangered Ecological Community
Estuarine saltmarsh	*Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	BC Act/FM Act Endangered Ecological Community
Seagrass Meadows (primarily *Zostera*)	Protected marine vegetation	FM Act

Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions EEC

Observed during the site inspection to adjoin the western boundary of subject site to the south of Cuttagee bridge, and is located within the 50m buffer of the proposed works. The larger local patch to which this joins, as mapped within the South East Local Land Services (SELLS) Biometric Vegetation dataset (SELLS, 2014) is approximately 8.18 ha in size. This patch is largely restricted to the peninsula between Cuttagee Lake and Little Cuttagee Lake and surrounds (Elgin, 2016).

Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC

While not observed during site inspection with the subject site, coastal saltmarsh has been mapped immediately upstream of the subject site and is located within the 50m buffer of the proposed works (DPI, 2020). Previous studies have observed it at the mouth of Cuttagee Lake (Elgin, 2016). Approximately 11.24ha of coastal saltmarsh are located across Cuttagee Lake, including 0.24ha within 50m of the subject site and 0.003ha within the Project Area. Saltmarsh species dependent upon an uninterrupted tidal regime are not present in Cuttagee Lake (Elgin, 2016).

Seagrass meadows

Seagrass (primarily *Zostera muelleri, Halophila ovalis* and *Ruppia megacarpa)* has been mapped within Cuttagee Lake (DPI, 2020). The closest known patch is approximately 115m upstream of the subject site. No seagrass was observed within or adjacent to the subject site

during the site inspection. Approximately 38.44ha of seagrass meadows are located across Cuttagee Lake. There is no mapped seagrass within 50m of the subject site. Seagrass extent in Cuttagee Lake has declined continuously since the 1980s, driven by ongoing sedimentation processes (Elgin, 2016).

Weeds

Within disturbed areas in the subject site, particular along the road verge, weeds were present during the site inspection. They included *Stenotaphrum secundatum Asparagus asparagoides, Euphorbia paralias and Pennisetum clandestinum.*

Asparagus asparagoides and *Euphorbia paralias* are priority weeds for the SELLS region. Duties are summarised in Table 5-7 below.

Table 5-7 Priority weeds within the subject sit e

Weed	Duty
Asparagus asparagoides	**Prohibition on certain dealings** Must not be imported into the state, sold, bartered, exchanged or offered for sale.
Euphorbia paralias	**Regional Recommended Measure** Exclusion zone: whole region except for the core infestation area of Eurobodalla and Bega Valley councils Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant. Core area: Land managers reduce impacts from the plant on priority assets.

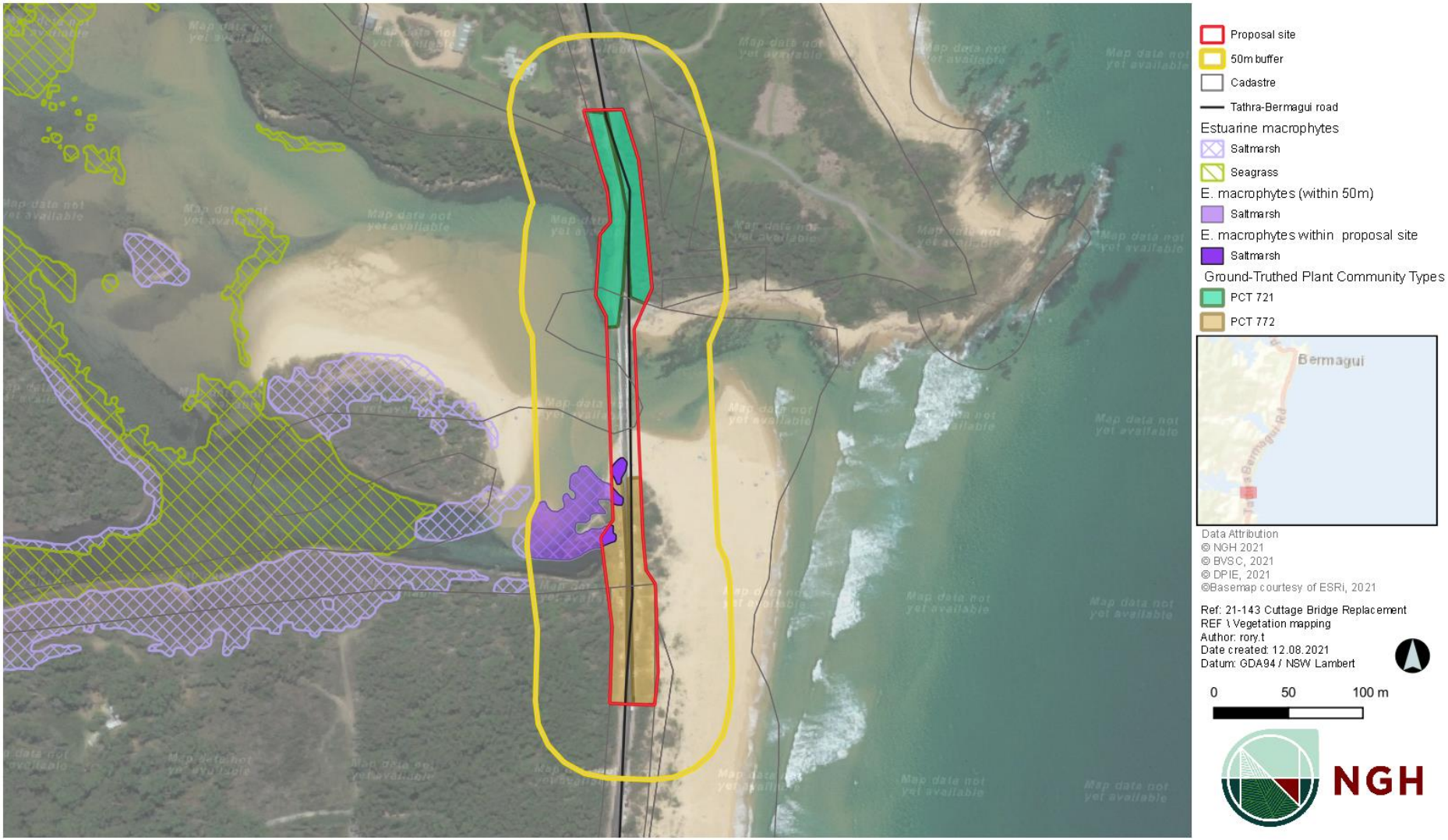

Figure 5-7 PCT and estuarine macrophyte habitat within or adjacent to the Proposal site

Terrestrial fauna habitat

The most significant fauna habitat feature with potential for impact by the proposed works would be removal of wooden bridge girders and wooden cladding, which may provide potential roosting and breeding habitat for microbats. Threatened microbats known to utilise buildings and bridge structures include Southern Myotis (*Myotis Macropus)*. Both of these have been recorded within 10km of the subject site, so should be considered possible to exist onsite. Scupper drains and large cracks in bridge girders were inspected where access could be gained, however most structures with potential habitat could not be inspected up-close. Where this was the case, binoculars were used to inspect these structures from the ground. No signs of microbat use (such as guano or staining around bridge cavities) could be detected.

The subject site contains and is contiguous with sand flats and beach that would provide potential foraging and breeding habitat for shorebirds include the Hooded Plover (*Thinornis cucullatus),* Pied Oystercatcher (*Haematopus longirostris)* and the Sooty Oystercatcher (*Haematopus fuliginosus)*. These have been recorded within 10km of the subject site, including Bionet records for Pied Oystercatcher's within 50m of the subject site, and so foraging and breeding habitat for them should be considered possible to exist onsite. No threatened shorebirds were observed at the time of the site inspection.

No hollow-bearing trees (HBTs) were observed inside the study area. The weed infested road verges may provide refuge and habitat for pest animals such rabbits, foxes and rodents, which in turn may provide foraging resources for raptors.

Aquatic fauna habitat

Both Cuttagee Lake, Cuttagee Creek and the broader marine ecosystem to which they connect are mapped as key fish habitat (refer Figure 5-4). They are very likely to support aquatic fauna. Bionet and ALA records do not identify any threatened fish species in the locality. Cuttagee Lake and Cuttagee Creek have assessed to have 'Fair' NSW Freshwater Fish Community Status as mapped on DPI's Fisheries NSW Spatial Data Portal (DPI, 2021). Murrah River (3.4km to the south-south-west) and Narira Creek (10.6km to the north-north-west) are recorded as habitat for threatened Australian Grayling (DPI, 2021).

There are multiple records for Green and Golden Bell Frog (*Litoria aurea)* within 10km, however, the area of Cuttagee Creek at the subject site is not suitable habitat for this threatened frog.

5.3.2. Potential impacts

Construction

Much of the impacts of the proposal on biodiversity values would be incurred during the construction phase.

The proposed works would require disturbance to and clearing of approximately 0.743ha of native vegetation on the northern and southern approaches to Cuttagee along Tathra-Bermagui Road to accommodate temporary Creek access and widen approaches. This would include:

- 0.367ha of PCT 721 on the northern approach; and,
- 0.376ha of PCT 772 on the southern approach.

Construction activities may incur edge effects to *Bangalay Sand Forest of the Sydney Basin and South East Corner Bioregions EEC*. These can be effectivity managed through appropriate mitigation measures, including clearly approved clearance areas (that avoid all Bangalay Sand Forest EEC). If impacts cannot be avoided, then additional specialist impact assessment on this EEC is required.

Habitat evaluation for threatened entities (refer Appendix F) identified that the Proposal would incur possible impacts on the following threatened flora, which have been previously recorded within the subject site:

- Matted Bush-Pea (*Pultenaea pedunculata*)
- Square Raspwort/Wingless Raspwort (*Haloragis exalata subsp. Exalata*)
- Narrow-leafed Wilsonia (*Wilsonia backhousei*).

Clearing of native vegetation and loss of habitat are recognised as a key threatening process to all three of these threatened flora species. Tests and Assessments of Significance under the BC Act and EPBC Act respectively for these threatened flora species have been conducted by an experienced botanist familiar with the site (refer Appendix G). The Tests/Assessments indicated that the Proposal would not incur significant impacts on these threatened species.

Minor disturbances to riparian vegetation within the subject site along the banks of Cuttagee Creek may occur. This may impact some minor habitat for amphibians, however, is not expected to have any impacts on any aquatic threatened species. Disturbance to aquatic habitat within the immediate vicinity would be temporary. Construction of the bridge would adopt minimal disturbance practices.

Construction activities would occur within the layout of the works as outlined in Figure 2-2. No hollow bearing trees or other additional fauna habitat are present in these native vegetation patches, and none would be removed under the Proposal. However, habitat evaluation (refer Appendix F) identified the potential of the Proposal to impact the following threatened fauna species:

- Microbats
    - Southern Myotis (*Myotis Macropus)*
- Threatened shoreline birds
    - Sooty Oystercatcher (*Haematopus fuliginosus)*
    - Pied Oystercatcher *(Haematopus longirostris)*
    - (Hooded Plover (eastern), Eastern Hooded Plover *(Thinornis cucullatus cucullatus)*
    - Caspian Tern (*Hydroprogne caspia)*
    - Little Tern (*Sternula albifrons*).

The existing timber bridge is proposed to be removed. This may impact roosting habitat for threatened microbats, the Southern Myotis (*Myotis Macropus)*. While no evidence of microbat use was detected during inspection of the bridge (such as guano or staining around bridge cavities), it is recommended that targeted surveys are conducted to confirm the habitat potential of the bridge for microbats and the significance of the Bridges' removal. The loss or disturbance of roosting sites are identified threats to both threatened microbat species. Adhering to the precautionary approach, the surveys should be used to inform 5 Part Tests of Significance in accordance with the *BC Act* to assess the potential impact to microbat habitat that would be incurred by the Proposal.

The sand flats within and adjacent to the subject site provide potential breeding habitat for the threatened shorebirds identified above. While individuals will most likely avoid the site during construction, targeted surveys should be conducted for prior to works commencing. Depending on the outcomes of surveys, consultation with the NPWS shorebird coordinator for the area should be conducted to prior to works commencing.

As Cuttagee Creek is subject to tidal influences at the subject site when open to the ocean, construction activities may impact water quality both upstream and downstream of the works if there are disturbances to the bed and banks of the creek. This can impose adverse indirect impacts on both coastal saltmarsh and seagrass communities that are known to occur within Cuttagee Lake, including local patches in close proximity to the proposed works. In particular, sedimentation processes negatively impact seagrass distribution and condition, with previous large sedimentation events associated with flooding in the Cuttagee Lake catchment causing considerable reductions in seagrass habitat (Elgin, 2016). Construction activities in waterways, such as dredging and reclamation, that disturb or stress local hydrological regimes are threatening processes for both Coastal saltmarsh and seagrasses.

Approximately 0.003ha of coastal saltmarsh EEC exists within the Project Area and may be directly disturbed. No seagrass would be directly disturbed by the Proposal. Taking a precautionary approach, the tests of significance considered the extent and nature of potential impacts on of the Proposal on *Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC*. This community has previously been mapped within immediate proximity to the subject site, though it was not physically observed during site inspection. The Tests determined that no significant impact on this community would be incurred by the Proposal. Considering the small scale nature of disturbance to coastal saltmarsh (0.027% of the total mapped saltmarsh extent in Cuttagee Lake and Creek), the direct impacts of the proposed works on the local community would be minor. It is, however, recommended to identify additional opportunities and design modifications to further minimise or avoid altogether direct disturbance of coastal saltmarsh

Furthermore, with the implementation of **best-practice** sediment and erosion controls, indirect impacts are expected to be minor, short term and manageable (refer to Section 5.1.3). Rehabilitation post construction (including eradication of weeds) would improve the quality of riparian vegetation and aquatic habitat in the long term. It is recommended to re-establish trees and shrubs along the creek after the new bridge is constructed to enhance fauna habitat into the future.

Operation

If no bat habitat is present within the existing bridge, the operational phase of the project is unlikely to have any substantiative detrimental impacts on biodiversity value. Impacts for maintenance activities would be minimal. The monitoring of and weeds as part of construction works would have longer term and wider benefits, as many weeds are transported great distances via waterways.

5.3.3. Safeguards and mitigation measures

Assessments of significance will be required for threatened entities listed under the BC, FM and EPBC Act, where these may have potential for adverse impacts. Additional specific mitigation strategies may be required in this regard.

General safeguard and mitigation measures to be implemented will include:

- Targeted surveys for threatened microbats using heat sensing devices will be undertaken prior to any works commencing to identify any roosting colonies utilising the existing Cuttagee bridge.
- Care should be taken when removing timber bridge supports with fissures or cavities in the event of disturbing roosting microbats. An unexpected finds procedure would be implemented if species are unexpectedly encountered during demolition. This should include a pre-organised wildlife handler being readily available to rescue and relocate any displaced fauna.
- The peak construction period shall be planned for outside the breeding season of threatened shorebirds (Sooty Oystercatchers, Pied Oystercatchers and Hooded Plovers) that may utilise the sand spits either side of the bridge.
- Works should be put on hold if birds start to feed in the area, and resume when they vacate.

- Where possible to do so, avoid impacts to aquatic plants to preserve aquatic amphibian habitat and soil stability of the aquatic zone.
- Any trees cut from the site (especially eucalypts and wattles) shall be mulched onsite to assist stabilising and passively regenerating areas of disturbance. They shall be spread thinly so as not to suppress natural germination. They shall not be placed where they may be washed into the creek.
- No snags would be removed, realigned or relocated.
- A visual inspection of the waterway for dead or distressed fish will be undertaken daily during construction. Observations of dead or distressed fish will be immediately reported to DPI.
- Prior to the commencement of work, a physical vegetation clearing boundary at the approved clearing limit is to be demarcated and implemented. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar.
- Where possible, trees to be removed would be mulched on-site and re-used to stabilise disturbed areas, or for erosion and sediment control (if required).
- Where trees are to be retained, an adequate protection zone would be provided around each tree for the duration of construction. The radius of this zone is calculated by multiplying the diameter of the tree at breast height (1.4 m) by 12, and is a minimum of 2 m and a maximum of 12 m.
- Where possible, work would not encroach into dripline of trees to be retained, including those composing *Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions EEC.* This zone is define as the Tree Protection Zone (TPZ).
- The saltmarsh along the foreshore of the lake but outside the works footprint would be a designated no go area for any construction plant and construction personnel.
- Erosion controls pertaining to biodiversity protection would include:
  - Measures to ensure that the site is adequately protected when rain is forecast.
  - Erosion controls would be put in place on the upslope of works to prevent soil and debris travelling downslope, especially to prevent sedimentation of Burrill Lake.
  - Steps to prevent mixing of different soils (e.g. subsoils and topsoils) and ensure that they are replaced in their natural configuration to assist revegetation.
  - Stockpiling materials and equipment and parking vehicles would be avoided within the dripline (extent of foliage cover) of any tree.
- A Weed Management Plan would be developed for the sites to prevent/minimise the spread of weeds in and between sites.
- Any declared noxious weeds would be managed according to the requirements stipulated by the Noxious Weeds Act 1993
- Regular targeted control of noxious, priority and environmental weeds would take place during construction to manage weeds.
- All machinery and vehicles to be used during construction must be clean to minimise the potential of introducing weed seeds and Chytrid fungus. Particularly, transporting wet soil from one site to another will be avoided.
- Construction machinery (bulldozers, excavators, trucks, loaders and graders) would be cleaned using a high-pressure washer (or other suitable device) prior to entering and exiting work sites.

- All plant material containing seed heads, weeds that have allopathic properties, and weeds that are able to reproduce vegetatively, including topsoil containing weed propagules, would be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth.
- Weed-free fill would be used for on-site earthworks.
- Regular monitoring for priority weeds shall take place for at least 24 months following rehabilitation of disturbed areas.
- If straw bales are to be used during revegetation, they will come from weed-free sources if possible.
- Any pesticides would be used in accordance with the requirements on the label. Any person undertaking pesticide (including herbicide) application would be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.
- If used, silt curtains would be placed at strategic locations to prevent any sedimentation of seagrass. Care would be taken when installing the silt curtain to ensure it does not directly impact any seagrass. Silt curtains would not be installed such that they block fish passage (e.g. across the channel).
- The use of any boats and barges in seagrass beds would be minimised where possible.
- If used, boats and barges would not enter seagrass beds at low tide or when water levels are low enough that there is a risk of propellers striking seagrass (dictated by draft of the vessel). Anchoring would not occur within seagrass beds. Support vessels would be moored to the barge to prevent any damage to seagrass beds.
- To determine the degree of impact to seagrass, monitoring would be conducted twice prior construction and twice following construction and once the stabilisation of sediments has occurred. Monitoring would follow a Before After Construction Impact (BACI) design to allow impacts to be quantified and to determine any potential compensatory measures required should a net loss have occurred as a result of the proposal. Monitoring would also be used to determine if seagrass was colonising areas where old infrastructure has been removed.
- Any fallen timber, dead wood and bush rock (if present) encountered on site would be left in situ or relocated to a suitable place nearby. Rock would be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.
- Revegetation of any bare soil or cleared areas with locally-occurring native flora species typical of the original habitat types should occur.
- Stabilise and reseed disturbed areas with fast colonising species, appropriate to the area. Native dominated understorey areas should be planted with native or sterile stabilisation species. Riparian areas would require separate revegetation strategy that would be prepared before commencement by/or in consultation with a suitably qualified person and would incorporate all relevant provisions of the Fisheries Permit issued for the works.

5.4. Aboriginal heritage

5.4.1. Approach

A Due Diligence assessment for Aboriginal heritage sites was undertaken by qualified archaeologists for this proposal. It is summarised here and is provided in full in Appendix I.

The Aboriginal Due Diligence assessment was conducted in keeping with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW*. The Code of Practice provides a five-step approach to determine if an activity is likely to cause harm to an Aboriginal object, as defined by the *NSW National Parks and Wildlife Act* (1974).

The Code of Practice is aimed at providing an assessment of the potential for an activity to impact either a known Aboriginal object, or whether it is likely that unrecorded Aboriginal objects are present that may be impacted. The result of the process is aimed at providing the proponent with information about the likelihood that their activity will impact an Aboriginal object and whether an Aboriginal Heritage Impact Permit may be required.

5.4.2. Database and Desktop Assessment

An extensive search of the Aboriginal Heritage and Information Management System (AHIMS) database was undertaken over an area centred on the Proposal site on the 22nd June 2021.

No previously recorded sites are listed on the Aboriginal Heritage Information Management System (AHIMS) database within 30 km of the Proposal Area. The Proposal Area is located at the saline coastal lagoon estuary of Cuttagee Lake which has been highly disturbed by the construction and maintenance of the bridge and road, underground cables, signage, and fencing and is within a low-lying landform that is commonly inundated with water. However, there is potential for sites to occur on the sand dunes in the south-west of the Proposal Area where undisturbed sand deposits may be present.

5.4.3. Field assessment

The visual inspection identified that there are significant areas of previous land disturbance within the Proposal Area because of the initial road and bridge construction and ongoing maintenance activities, as well as infrastructure comprising beach wall and steps, underground services, fencing, signage, and erosion. The sand dunes on the south-western side appeared to have high levels of disturbance close to the road corridor, however the dune crest exhibited less evidence of ground disturbance. Exposures on the crest showed modern oyster shell and young sands, suggesting recent accretion and limited potential for *in situ* subsurface cultural deposits in the upper stratigraphic layers. However, the deeper sands within the dune landform have the potential to contain *in situ* subsurface cultural deposits, and therefore it was concluded this area has low-moderate potential to contain such deposits and is an area of archaeological sensitivity.

No Aboriginal objects or areas were identified but one area of archaeological sensitivity was recorded. Refer Figure 5-11.

5.4.4. Potential impacts

It was determined that the sand dune crest in the south-western portion of the Proposal Area is an area of archaeological sensitivity with low-moderate potential to contain *in situ* subsurface cultural deposits as depicted in Figure 5-11 The remainder of the Proposal Area outside the dune crest has low potential to contain *in situ* subsurface deposits due to the high level of disturbance.

To negate the need to conduct further archaeological assessment BVSC would need to ensure the proposed works avoid the area of archaeological sensitivity. Works within the Proposal Area, as assessed in this report, which are outside the boundary of the area of archaeological sensitivity do not require further heritage investigation and works can proceed with caution.

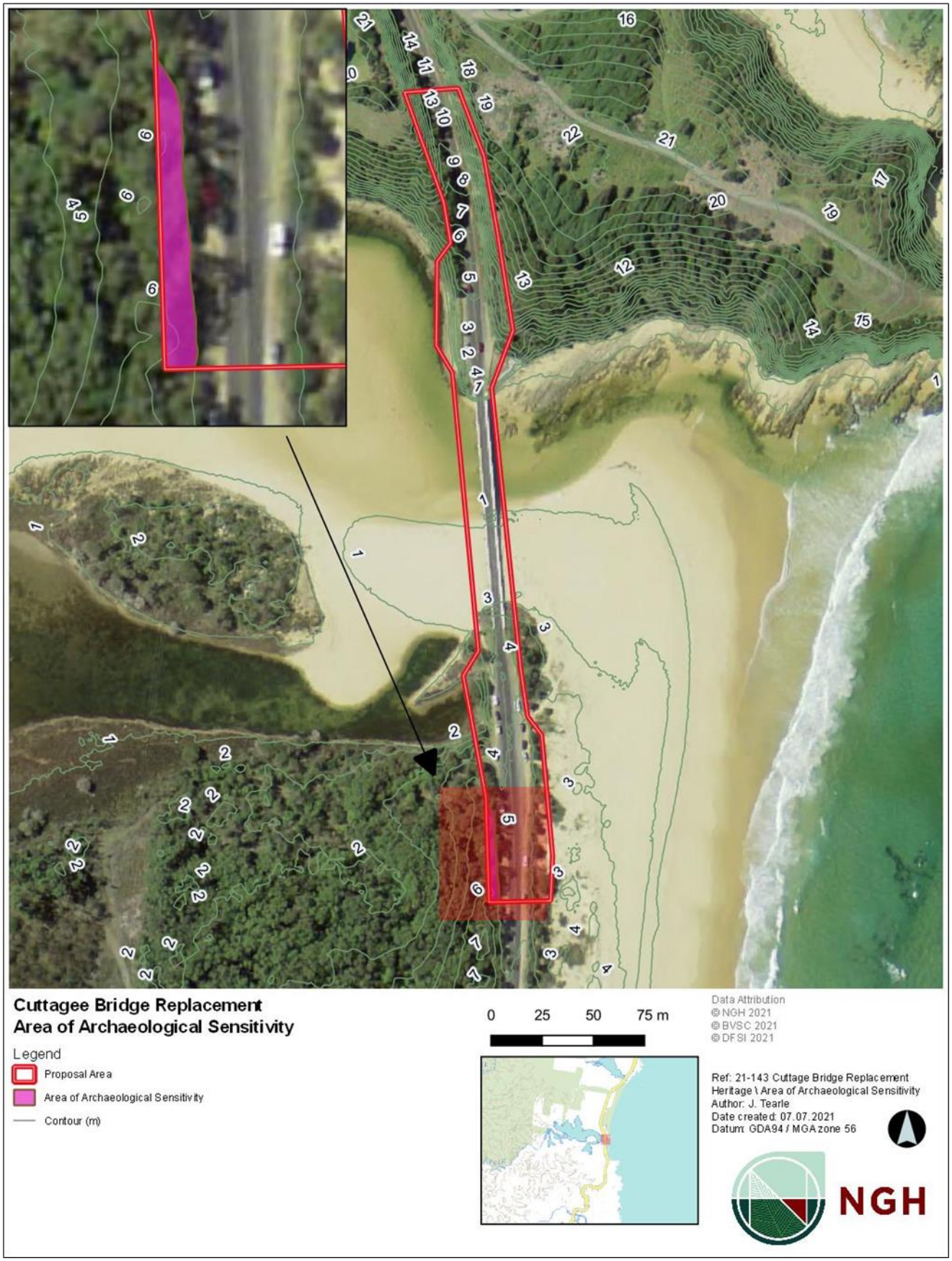

Figure 5-11 Area of Archaeological Sensitivity

5.4.5. Safeguards and mitigation measures

The proposed work can *proceed with caution*, provided the following recommendations are followed:

1. The area of archaeological sensitivity identified on the dune, as shown in Figure 5-11, must be avoided by the Proposed works. A temporary barrier fence must be placed between this area and the works area during construction.
2. Works within the Proposal Area that are not within the area of archaeological sensitivity may proceed with caution.
3. Further heritage assessment in the form of an Aboriginal Cultural Heritage Assessment (ACHA) must be completed prior to any works being undertaken within the archaeologically sensitive area, if this cannot be avoided. The ACHA can then be used in support of an Aboriginal Heritage Impact permit (AHIP) if required. To negate the need to conduct further archaeological assessment BVSC must contain their works to the previously disturbed area of the dune comprising the incised, sloped area adjacent to the road corridor.
4. Any activity proposed outside of the current assessment area should also be subject to an Aboriginal heritage assessment.
5. If any items suspected of being Aboriginal in origin are discovered during the works all work in the immediate vicinity must stop and Heritage NSW notified. The find will need to be assessed and if found to be an Aboriginal object an AHIP may be required.
6. In the unlikely event that human remains are identified during development works, all work must cease in the immediate vicinity and the area must be cordoned off. The proponent must contact the local NSW Police who will make an initial assessment as to whether the remains are part of crime scene or possible Aboriginal remains. If the remains are thought to be Aboriginal, Heritage NSW must be notified by ringing the Enviroline (131 555).

BVSC is reminded that it is an offence under the *NSW National Parks and Wildlife Act 1974* to disturb, damage or destroy and Aboriginal object without a valid AHIP.

5.5. Non-indigenous heritage

5.5.1. Approach

Cuttagee Bridge is heritage listed under Schedule 5(1) of the Bega Valley LEP. A specialist Heritage Assessment of Cuttagee Bridge was prepared on behalf of BVSC by Pop Gionvanelli, Heritage and Conservation Consultant. It involved assessing Cuttagee Bridge against NSW Heritage Criteria to produce a Statement of Significance.

The Heritage Assessment is provided in Appendix H and summarised succinctly below.

5.5.2. Existing environment

Historical context

The Cuttagee Bridge is one of a group of timber bridges in the Far South Coast constructed in the later part to the 19th century to facilitate transport between Tilba Tilba, Tanja and the port at Bermagui. Designed by the NSW Public Works Department in 1892 it was one of many that used the 'simple beam' structural system. Built from native Australian hardwoods, the bridge was extended twice in response to shifting sands and suffered major flood damage in 1934 and again in 1974.

Since 1974, Cuttagee Bridge has undergone ongoing and extensive repairs as many of its piles and headstocks reached the end of their functional life, where their deterioration has been exacerbated by fluctuating tides, severe storms and salt spray. Steel piles have been driven into the sand either side of the former timber piles. Diagonal bracing and horizontal ties have been added to the piles to provide additional strength and there is evidence of numerous repairs to the decking. The RTA Timber Bridge Management Study of 2002 makes the point that:

> *Timber degrades when left exposed to the elements, and therefore has a high maintenance demand if used for permanent outdoor structures. An unprotected timber structure will need to be continually rebuilt throughout its service life. A timber structure more than 50 years old will in all probability have had all its timber elements replaced at least once—and in the case of its decking, as many as four times.*

Current condition

A cursory site inspection reveals the bridge is in less-than-ideal condition and that many of its members are coming to the end of their functional life. Repair, replacement, and on-going change to the fabric will be necessary if it is to continue to fulfill its role. As has happened with the pier repairs and replacements since 1934, attempts to stabilise and reinstate the structural integrity of the bridge have been pragmatic, and often done at the cost of the bridge's initial design elegance.

Current integrity

Integrity refers to the degree to which the item has been altered from its initial designed and built form. Integrity can be applied to both the form of the item as well as the fabric. In some situations the fabric can be altered with relatively little impact on the integrity of the design, and is usually necessary where timber structures are exposed to the elements. Where elements are replaced in a like-for-like manner the structural integrity is retained. Where the new deviates from the old, integrity is weakened. Such is the case with the substructure at Cuttagee, which has been extensively altered over time.

On the other hand, the deck, kerbs and handrails have been repaired and replaced like-for-like and have continued to respect the visual and functional integrity of the upper part of the bridge – the part that most travellers see when driving across.

5.5.3. Assessment of Cuttagee Bridge against NSW Heritage Criteria

The NSW heritage assessment criteria encompass the four values in the Australia ICOMOS Burra Charter, which are commonly accepted as generic values by Australian heritage agencies and professional consultants:

- Historical significance
- Aesthetic significance

- Scientific significance
- Social significance.

The outcomes of Cuttagee Bridge assessment against NSW Heritage Criteria are outlined in Table 5-8 below.

Table 5-8 Assessment of Cuttagee Bridge against NSW Heritage criteria

NSW Heritage criteria	Description	Significance
Criterion a) **An item is important in the course, or pattern, of the cultural or natural history of the local area;**	The Cuttagee Bridge was one of many such bridges designed by the NSW Public Works Department and built to improve the transportation network throughout NSW in the latter part of 19th and early 20th centuries. It greatly facilitated access to ports and markets for those operators located south of Cuttagee Lake. It was effectively a link in a transport chain that included Murrah Bridge, Wapengo, Sandy Creek and various one and two span bridges over lesser creeks.	Historic significance is confined to the local area only.
Criterion (b) **An item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area);**	The bridge is one of possibly thousands designed by the Public Works Department but is not known to be associated with any significant individual, unlike for example the timber truss bridges that are named after their design engineer (Allan, McDonald, Dare and de Burgh).	The Cuttagee bridge is not significant against this criterion.
Criterion (c) **An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);**	The bridge does not demonstrate a high degree of creative or technical achievement. However, the bridge has a high degree of aesthetic value that is subtly embedded in its scale, detail and material that combine to evoke an emotive response that is held by many in the community. In this particular bridge the values are in the deck and above, not the piles and girders that have been extensively altered.	High aesthetic value.

NSW Heritage criteria	Description	Significance
Criterion (d) **An item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;**	There is a design simplicity evident in the many hundreds of timber bridges that were built like Cuttagee. They used quality Australian hardwoods, often from the local area, in a structure that was conceptually simple, and able to be built using local skills and labour. Structures that continue to demonstrate this quality sit comfortably in their landscape setting and resonate with the local community. Important values expressed recently by some community members could be summarised as the tourist, aesthetic and amenity aspects of the bridge.	The Cuttagee Bridge has strong social and associative values for members of the local community who have initiated a campaign for its retention.
Criterion (e) **An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);**	N/A	N/A
Criterion (f) **An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);**	Most of the 3000 or so timber bridges for both road and rail across NSW were constructed approximately between about 1870 and 1930. In 2009 the timber bridge study undertaken for Bega Valley Council identified 65 timber bridges in the shire. Since that time a number have been burnt in bush fires or replaced as part of the Shire's on-going bridge replacement program. Most of the bridges are coming to the end of their functional life or may not meet modern codes and standards. A bridge typology that was once common across the shire is diminishing and as a consequence surviving timber bridges will become rare.	Cuttagee Bridge possesses endangered aspects of the Bega Valley Shire's cultural heritage.

NSW Heritage criteria	Description	Significance
Criterion (g) **An item is important in demonstrating the principal characteristics of a class of the local area's cultural or natural places**	-	From the deck up, the Cuttagee bridge is a fair, if aged, example of the timber bridge type however, below the deck, it is now a poor example of the type, with multiple modifications to the piers and abutments.

Statement of significance

The Cuttagee Bridge is of historic interest as one of a group constructed in the later part to the 19th century to facilitate transport between Tilba Tilba, Tanja and the port at Bermagui. Designed by the NSW Public Works Department in 1892 it was one of many that used the 'simple beam' structural system. Built from native Australian hardwoods, the bridge was extended twice in response to shifting sands and suffered major flood damage in 1934 and again in 1974.

It was recognised as a component of a significant tourist drive as early as 1934 by the NRMA Touring Department and continues to be valued in like manner by many of the local community as well as visiting tourists. The bridge is considered to have aesthetic value for its traditional character, its setting within the immediate landscape as well as being a component of the drive between Bermagui and Tanja. It is highly valued by the local community who consider that many of the bridge's characteristics align with their own values and way of life.

Timber bridges of this type and period are coming to the end of their functional life and are being replaced with modern concrete structures. Consequently, bridges such as Cuttagee are becoming increasingly rare.

5.5.4. Potential impacts

The removal of Cuttagee Bridge would result in the loss of all heritage values identified in this section. While a Statement of Significance has been prepared, a formal Statement of Heritage Impact also needs to be completed.

It is noted in the heritage assessment that a hybrid approach may be possible that accommodates a bridge design that finds a balance between the above heritage values and a simply functional asset. The attributes can apply to either a single or a two-lane bridge. In the case of Cuttagee the substructure is not a major heritage component as for the most part the bridge is perceived from above.

5.5.5. Safeguards and mitigation measures

Safeguards to be implemented are:

- A Statement of Heritage Impact would be completed to identify and characterise the potential impacts on Cuttagee Bridge, which would occur as a result of the

proposed works. Where the Statement demonstrates that impact to the heritage value of the item is likely, approval must be obtained from the relevant authority.

5.6. Traffic and access

5.6.1. Existing environment

Tathra-Bermagui Road is approximately 41.5 km long and extends from Tathra to Bermagui. The road is sealed and two way, with a posted speed limit of 100-80km/hr with variations including along bridges where it is 40km/hr and other residential and town zones. A number of bridges along the road are single lane.

Road users may include traffic between Tathra and Bermagui, local traffic from residents of the surrounding localities and tourists. According to the most recent traffic surveys, the Tathra-Bermagui Road was used by an average of 595 vehicles per day, with 66 of those recorded as heavy vehicles (RMS, 2007). These numbers are likely to be higher now given the population growth experienced across the Bega Valley LGA since 2007. The LGA had a resident population of 31 658 persons at the time of the 2006 Census (ABS, 2008). This increased to 34 476 persons in 2019 (ABS, 2021), which equates to an 8.9% increase since 2006. Furthermore, the number of visitors to the Bega Valley (indicated by domestic and international visitor nights statistics) has increased by approximately 52% since 2010 (Tourism Research Australia, 2021); a much more significant increase. It is noted that traffic safety issues may increased for visitors not experienced with local traffic conditions.

Tathra-Bermagui Road at Cuttagee Bridge is sealed on the approaches to the Bridge. Cuttagee Bridge is a one span single lane timber bridge that is dilapidated and in need of repair. It is one lane with a speed limit of 40km/hr and experiences frequent bottle necking as cars must give way to southbound traffic, which can leading to multiple cars waiting on banks of road reserve. The bridge has a current weight restriction of 22.5 tonnes.

The closest private driveways are 128m north and 45m south of the existing bridge, therefore outside the proposal site.

The section of Cuttagee Lake and north Cuttagee beach adjacent to the proposal site are popular recreation areas. Access to them is provided by scattered formal and informal pedestrian paths between Tathra-Bermagui Road and the foreshore. These paths are accessed by vehicular pull-over bays on the south-bound lane on the northern approach as well as both lanes on the southern approach to the existing bridge. These are well-used by locals and visitors to the area, with pedestrians and parked vehicles often present, particularly on weekends and through the summer tourist season.

5.6.2. Potential impacts

Construction

There would be some temporary traffic delays during construction of the new bridge and approaches. Traffic controls and reduced speed limits would be required during the construction period, including localised and temporary road closures on the northern and

southern approaches to Cuttagee Bridge during the construction period. No road closures are proposed as part of the works.

The existing bridge would remain open during construction of the eastern half of the new concrete bridge. Once complete, this eastern half would be open for traffic during the demolition of the existing bridge and construction of the western half of the new bridge.

During construction, noise, dust and plant movements would create additional safety risks for local residents along Tathra-Bermagui Road (refer Section 5.7).

Access for the adjacent private residences would be maintained throughout construction.

Operation

The construction of the new bridge would have positive impact for motorists and local landowners. The road capability and efficiency for heavy vehicles would be improved. The proposed works are unlikely to increase traffic volumes along the road. The speed limit over the bridge would likely increase from 40km/hr to at between 60km/hr and 80km/hr, consistent with the signposted speed limit of other concrete bridges of a similar design and span along the Tathra-Bermagui Road. The current approaches to Cuttagee bridge have pull-overs, which are used to access the northern end of Cuttagee Bridge. Increased speeds may impose greater risks of collision with pedestrians in these areas. Traffic condition and safety signage would be installed to inform both pedestrians and motorists of the hazard. It's recommended that if speed limits are to increase, current pull-over areas should be formalised and more clearly separated from the road corridor.

5.6.3. Safeguards and mitigation measures

Safeguards to be implemented are:

- A Traffic Management Plan (TMP) would be prepared and include:
  - Confirmation of haulage routes.
  - Measures to maintain access to local roads and properties.
  - Site specific traffic control measures (including signage) to manage and regulate traffic movement.
  - Requirements and methods to consult and inform the local community of impacts on the local road network.
  - Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads.
  - A response plan for any construction traffic incident.
  - Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic.
  - Consideration of peak traffic volumes (school bus routes, holiday periods).
  - Monitoring, review and amendment mechanisms.
  - Operational traffic controls (expected to include signage) to warn motorists of changed traffic conditions.
- Notification to the local community of any changed traffic conditions (i.e., road closures, detours, lane closures) in advance of the works commencing and including operation. A contact number would be provided for community queries in relation to the works.

- Temporary land closures would occur for the least amount of time possible.
- Emergency services will be notified of the proposal prior to works commencing.
- Installation of road safety and traffic conditions signage
- Recommended to formalise existing pull-over areas and separate from road corridor.

5.7. Noise and vibration

5.7.1. Approach

The noise assessment has been prepared in accordance with the policies and guidance, administered by the Environment Protection Authority (EPA):

- *NSW Interim Construction Noise Guideline (ICNG) 2009* (DECC, 2009)
- *NSW Noise Policy for Industry (NPI) NSW* (EPA, NSW Noise Policy for Industry, 2017)

The *NSW Interim Construction Noise Guideline 2009 (*ICNG*)* provides guidance on the measurement and management of construction noise impacts. The guideline requires, a quantitative assessment of noise impacts when works are likely to impact an individual or sensitive land use for more than three weeks in total.

The ICNG describes likely 'noise management levels', for residences and other sensitive receivers. For works during standard working hours, residences are considered noise affected when construction noise is 10dB(A) above the rating background level (RBL) and 'highly noise affected' when construction noise is above 75dB(A). Works outside standard working hours are affected sensitive receivers when construction noise is 5dB (A) above the RBL.

5.7.2. Existing environment

The dominant sources of noise experienced in the proposal site includes:

- Local traffic noise.
- Natural sounds associated with a rural environment; farm machinery and livestock.
- Natural sounds associated with a coastal environment; wind, waves, vegetation movement.

There are approximately 23 receivers (residential dwellings) within 1km of the proposal site (Figure 5-12). The closest sensitive receiver is located 41m north west of the proposal site. In general, noise levels for this area are in keeping with a rural coastal environment. The expected background noise levels are described later in this report.

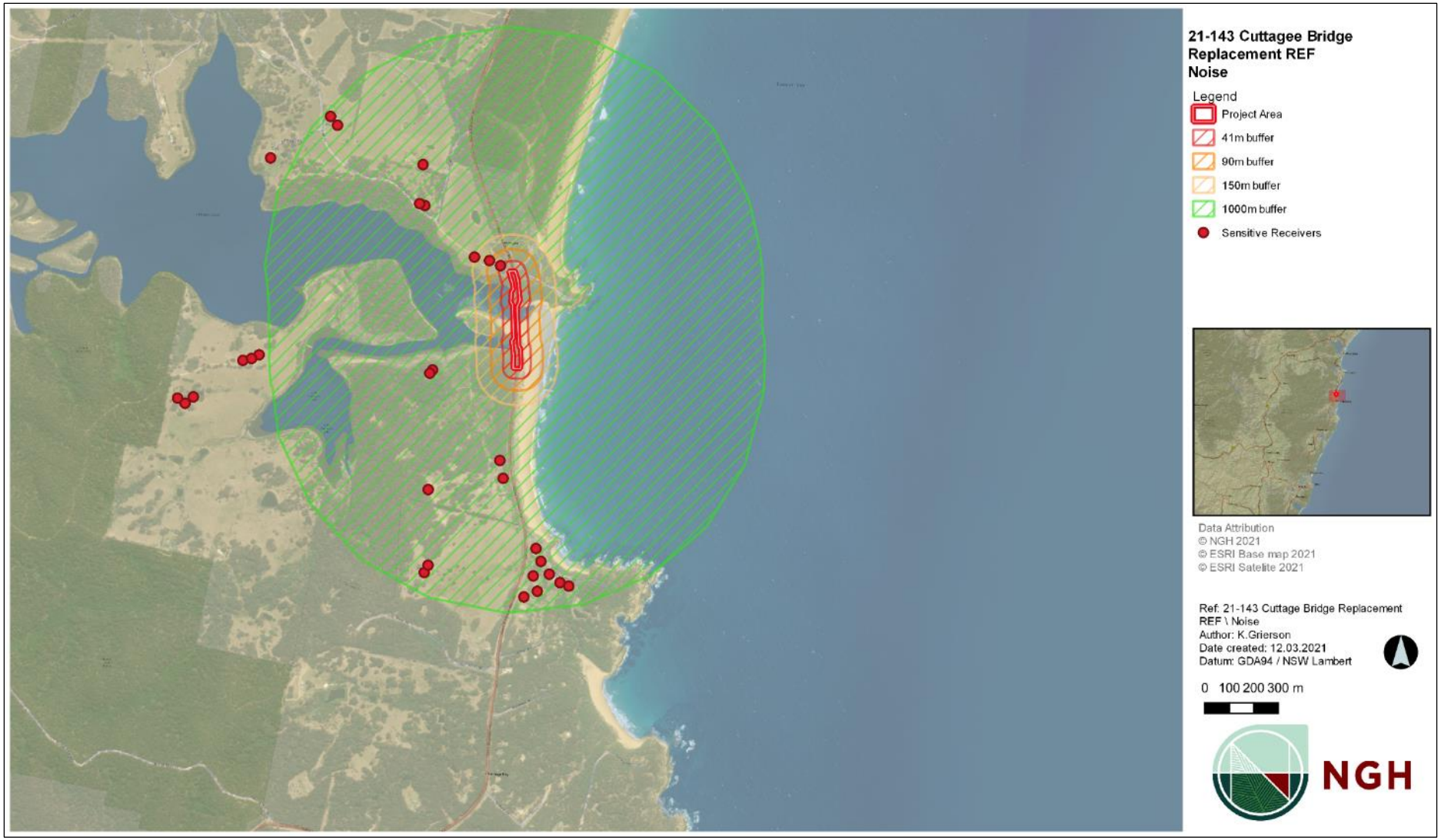

Figure 5-12 Nearest sensitive receivers

5.7.3. Background noise

Background noise levels for the study area have been described in accordance with Table 2.3 of the NSW NPI. Values for an environmental management zone with an acoustical environment that is dominated by natural sounds, low density transportation and relatively low background noise levels was selected for the study area (Table 5-9).

Table 5-9 Average Background A-weighted sound pressure level (EPA, NSW Noise Policy for Industry, 2017).

	Daytime 0700-1800	Evening 1800-2200	Night-time 2200-0700
Rural residential	40 dB(A)	35 dB(A)	30 dB(A)

Noise management levels for the proposed activity have been determined in accordance with the NSW ICNG (Table 5-10):

- Standard working hours – 10 dB(A) above rating background levels.
- Outside standard working hours – 5 dB(A) above rating background levels.
- Residences receiving noise levels over 75 dB(A) during standard working hours are considered highly noise affected irrespective of the RBL.

Table 5-10 Noise Management Levels for the proposed activity.

Daytime NML (dB(A)) (RBL +10 dB(A))	Evening NML (dB(A)) (RBL +5 dB(A))	Night NML (dB(A)) (RBL +5 dB(A))	Highly Noise Affected Level (dB(A))
50 dB(A)	**40 dB(A)**	**35 dB(A)**	**75 dB(A)**

5.7.4. Potential impacts

Construction

Noise

The equipment noise has been used to predict the likely noise associated with proposal. The equipment noise prediction has used the Roads and Maritime Services Construction Noise Estimator. The proposed works were modelled are considered 'worst case scenario' where all plant and machinery are operating continuously and concurrently (Table 5-11). This is unlikely to be the case and as such noise levels should be lower than predicted.

Table 5-11 General plant and equipment for each construction stage.

Construction equipment	Sound pressure level @ 7m ((dB(A))	No. of units
Light vehicles	78	1
Grader	85	1

Construction equipment	Sound pressure level @ 7m ((dB(A))	No. of units
Backhoe	86	1
Piling rig – drive	91	1
Concrete truck	84	1
Dump truck	83	1
Concrete pump	84	1
Tracked Excavator	85	1
Vibratory roller	84	1
Mobile crane	88	1
Small hand tools	80	2
People talking	51	5
Asphalt truck/sprayer	81	1

Distance based assessment was used to determine noise levels for the closest sensitive receiver, and receivers located within 1000 m of the proposed work. The predicted noise levels for residences within these distances for each scenario is provided in Table 5-12.

Construction of the proposed works would be Monday – Friday between the hours of 7:00 am and 6:00 pm, and on Saturdays between the hours of 8:00 am and 1:00 pm. Construction noise predictions assume the three noisiest plant items would be operating simultaneously for each construction activity. Simultaneous operation is unlikely and as a result the noise predictions are conservative. Noise levels from works at the receivers are likely to be less than that predicted.

Table 5-12 Predicted noise levels for receivers based on construction scenarios.

Receptor Distance (m)	Receiver type	Daytime NML (dB(A))	Predicted Noise Level dB(A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise effected	NMLs Exceedance (dB(A))	Description Clearly audible = < 10 dB(A) above NML Moderately intrusive = 10 – 20 dB(A) above NML Highly intrusive = > 20 dB(A) above NML
41	Rural Resident	50	77	27	Highly intrusive
90	Rural Resident	50	70	20	Highly intrusive
150	Rural Resident	50	64	14	Moderately Intrusive
330	Rural Residence	50	54	4	Minimum noise impact
380	Rural Residence	50	53	3	Minimum noise impact

Receptor Distance (m)	Receiver type	Daytime NML (dB(A))	Predicted Noise Level dB(A) Green = no exceedance Yellow = Minor exceedance Orange = Substantial exceedance Red = highly noise effected	NMLs Exceedance (dB(A))	Description Clearly audible = < 10 dB(A) above NML Moderately intrusive = 10 – 20 dB(A) above NML Highly intrusive = > 20 dB(A) above NML
450	Rural Residence	50	51	1	Minimum noise impact
600	Rural Residence	50	47	0	Not noise effected
1000	Rural Residence	50	41	0	Not noise affected

It is predicted that NML's would not be exceeded during standard construction hours for receivers located 600m or greater from the proposal site. However, it is likely the proposed works would be highly intrusive from the closest sensitive receivers located 41m north west and 330m south west of the bridge. The construction would approximately take 16 weeks to complete. The closest receiver to the proposed works is also screened by vegetation from the proposed works. Potential noise impacts are considered manageable with the short construction period, existing background noise and works to be conducted during standard working hours.

Noise calculations are provided in greater detail in Appendix J.

Vibration

Vibration impacts during construction work are likely to be intermittent with two potential outcomes:

- Disturbance at receivers
- Potential architectural/structural damage to buildings.

Human exposure vibration impacts are likely to be intermittent during construction work. Intermittent vibration is assessed using the vibration dose value (VDV), acceptable values of vibration are listed in Table 5-13.

Table 5-13 Acceptable vibration dose values for intermittent vibration (m/s$^{1.75}$).

Location	Daytime[1]		Night time[1]	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Critical Areas[2]	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

The closest identified non-involved receiver is approximately 41m from the proposal site. Due to the nature of the works the vibration risk is low as, unlike noise travelling through air, vibration levels diminish quickly over distance and an adverse impact from vibration on the broader community is not expected. Although impacts to residential receiver are expected to comply with acceptable intermittent vibration standards outlined in *Assessing Vibration: a technical* guideline (DEC, 2006), which is based on guidelines contained in British Standard (BS) 6472–1992*, Evaluation of human exposure to vibration in buildings* (1–80 Hz), complaints handling mitigation measures have been recommended for potential human exposure impacts. Assessment for vibration impact on human comfort would be undertaken in the event complaints were received during the construction phase. Generally, if disturbance issues are controlled, there is limited potential for structural damage to buildings.

Operational

Noise

Operational noise would slightly reduce as a result of the proposal. The bridge would be utilised in the same manner post-construction as it would pre-construction. However, vehicles would no longer produce the noise generated from crossing the existing timber bridge as well as breaking to give way to on-coming traffic.

No increased traffic is anticipated as a result of the works.

Vibration

Vibration generating activities are expected to occur only during the construction phase. There are no vibration generating activities during the operational phase.

5.7.5. Safeguards and mitigation measures

Safeguards to be implemented are:

[1] Daytime is 7.00 am to 10.00 pm and night-time is 10.00 pm to 7.00 am.

- A specialist noise assessment of the Proposal be conducted prior to any works commencing, in particular for the three nearby receivers where the Daytime NML (dB(A)) exceeds 50.
- A Noise and Vibration Management Plan (NVMP) would be prepared prior to the commencement of works and implemented through all phases of the proposed construction works. It would be prepared in consultation with all highly affected receivers. The NVMP would provide the framework for the monitoring of noise levels and management of all potential noise impacts resulting from the construction works and would detail the environmental mitigation measures to be implemented throughout the construction works.
- Affected neighbours to Affected neighbours to the construction works would be advised in advance of the proposed construction period at least two weeks prior to the commencement of works.
- All site workers (including subcontractors and temporary workforce) should be familiar with the potential for noise impacts upon residents and encouraged to take all practical and reasonable measures to minimise noise during their activities.
- The contractor or site supervisor (as appropriate) would hold details for a liaison officer including phone number so that the noise and vibration related complaints, if any, would be received and addressed in a timely manner.
- Construction works should adopt Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as addressed in the ICNG. BMP includes factors discussed within this report and encouragement of a project objective to reduce noise emissions. BATEA practices involve incorporating the most advanced and affordable technology to minimise noise emissions.
- Ensure that all construction works scheduled for standard construction hours comply with the start and finish time.
- Where practical, simultaneous operation of dominant noise generating plant should be managed to reduce noise impacts, such as operating at contrasting times or increase the distance between plant and the nearest identified receiver.
- Where possible, reversing beepers on mobile equipment would be replaced with low pitch tonal beepers (quackers). Alternatives to reversing beepers include the use of spotters and designing the site to reduce the need for reversing may assist in minimising the use of reversing beepers.
- Unnecessary noise emissions would be avoided by turning equipment off when it is unused for an extended period.
- Equipment would be maintained in good condition so that excessive noise is not emitted. Noise attenuation methods may be used on particularly noisy equipment if required.
- All noise complaints should be reported to BVSC, recorded in a register and appropriately investigated promptly.
- Assessment for vibration impact on human comfort would be undertaken in the event complaints were received during the construction phase.

5.8. Community and socio-economic

5.8.1. Existing environment

The Proposal site is located in the locality of Cuttagee, approximately 6km south of Bermagui long the Tathra-Bermagui Road. The Study Area is characterised by a rural-coastal setting, Cuttagee Lake (including coastal and estuarine wetland systems), open native woodland, southern coastal dune systems and northern coastal rock formations. Tathra-Bermagui Road is used by local residents and tourist through traffic with moderate traffic volumes. The area upstream of the Proposal Site is used for agriculture, tourist accommodation, minimal residential use and environmental conservation. Built infrastructure is restricted to property boundary fences, the Tathra-Bermagui road and its associated road infrastructure facilities (bridges, signage, cross roads).

The closest sensitive receiver is approximately 41m north west of the proposal site. The existing bridge is located within an ICOLL at the bottom of two crests and is well vegetated from most sensitive receivers (Figure 5-12). This screening would not be disturbed by the proposed works. However, there is one (1) sensitive visual receiver approximately 1km to the west with a direct, though narrow, line of sight to the existing bridge (visible in Figure 5-3). Other receivers to the proposed works would include motorists along Tathra-Bermagui Road and tourists and locals using Cuttagee Beach (northern end) and Baragoot Beach (southern end).

A preliminary desktop review of was undertaken to determine the community and socio-economic impacts of the proposed works as described below. Sources included a Change.org petition (Change.org, 2021) as well as media articles in the local Bega District News (Dion, 2021), Canberra Times (Tim the Yowie Man, 2021) and Sydney Morning Herald (Farrelly, 2021).

The review indicates that Cuttagee Bridge is widely valued and that there is significant community opposition to the proposed demolition and replacement of the Bridge (as of 1 June 2021, the Change.org petition has been signed by 12, 100 signatories). In terms of values, current community and socio-economic values of the existing Cuttagee Bridge can be broadly organised into five themes as follows:

1. Historic – the heritage value of the existing timber bridge, which reflects the high historical significance attributed to it in the *Bega Valley LEP 2013*.
2. Identity – the value and contribution the Bridge makes to community members' sense of place and connection to the Far South Coast (as residents or as tourists).
3. Amenity – the high visual aesthetic value of the Bridge, both as a standalone structure and in its relation to the local natural and built landscape.
4. Safety – as one-way only and with speed restrictions in place, the Bridge is valued for appropriately slowing down passing traffic at this location.
5. Recreation – pull-over areas on both the southern and northern approach to the bridge are used and valued by recreational day visitors (both locals and tourists). Formalised and informalised paths provide access from these pull over bays to Cuttagee Lake and Cuttagee Beach.

5.8.2. Potential impacts

Construction

During construction, the Proposal would be likely to generate the following impacts:

- Changes to the local visual amenity of the Proposal site, due to the localised removal of native vegetation, excavation works and the presence machinery and materials on site, restricting of the bridge, and the temporary interruption of views of Cuttagee Lake, Cuttagee Beach and the ocean beyond. There is also potential for immediate visual amenity to be impacted through construction litter and untidy construction site.
- Residents, motorists and businesses within proximity to the works may experience temporary traffic, noise, and air emissions impacts during construction, which may disrupt the normal rural-coastal land- and soundscape of the locality.
- Most potential sensitive receivers also have screening limiting their view of the proposal site. There is one sensitive receiver 1km to the west of the proposal site that would have direct, though narrow, line of sight to the southern section of bridge construction works. Their view of Cuttagee Lake, Cuttagee Creek and the ocean beyond would be interrupted for the duration of construction.
- The proposed compound sites would occupy the existing pull-over areas on the southern approach to the bridge currently used by recreational visitors to Cuttagee Lake and Cuttagee beach. Access to the beach and lake along the existing access tracks may be restricted for the length of the construction period.
- The constructions works may lower visitor numbers to Cuttagee Lake and Cuttagee Beach for the duration of the construction period due to lower visual amenity and restricted access, which may incur indirect impacts on visitation to local businesses.
- Relocation of services would be required, which may cause water, sewerage and power disruptions for local residents.
- Positively, during the construction period the proposal has potential to generate local employment opportunities, business for local construction and building suppliers, as well as increased trade for accommodation, food outlets and other businesses.

Operation

Once operational, the Proposal would be likely to generate the following impacts:

- Permanent removal of the existing Cuttagee Bridge and the historic, identity and amenity values attributed to it by the local community. Heritage impacts are discussed further in section 5.4.5. The process and outcomes of community consultation are described further in section 4.3.
- Rehabilitation works would extend post-construction. All disturbed areas would be rehabilitated, however visual amenity impacts would continue until vegetation re-establishes. This impact is considered short term to medium term.
- The Proposal would improve vehicle efficiency at the along Tathra-Bermagui Road. This increased efficiency is expected to contribute to the economic development of the region.

- The Proposal would improve freight connectivity between commercial centres and contribute to the local economy.
- The Proposal would improve emergency logistics and vehicular access along the Tathra-Bermagui road, particularly during large-scale natural disasters such as bushfires.
- The speed limit along the bridge would increase from 40km per hour to between 60km/hr and 80km/hr. This could increase the risk of pedestrian-strike in the area given the popularity of the area, and intensity of use, by recreational visitors.

5.8.3. Safeguards and mitigation measures

General safeguard and mitigation measures recommended to minimise impacts from the proposed works include the following:

- Working areas and compound site are to be maintained, kept free of rubbish and cleaned up at the end of each working day.
- Rehabilitation works would take place as soon as possible following the completion of construction.
- Remove temporary erosion and sediment controls from the site once landforms have been assessed as stable.
- Signage and barriers would be implemented at the works site to prevent public access to areas deemed unsafe.
- Visual surveillance for dust generation would occur at all times. Work would cease when high levels of airborne dust cannot be controlled.
- Sensitive receivers in the near vicinity and/or visually impacted would be notified and consulted with prior to works commencing.

Additionally, to enable informed characterisation and assessment of the possible community and socio-economic impacts of the Proposal, it is recommended that targeted and ongoing community consultation continue to occur. Council has already committed to establishing and supporting a Community Advisory Group for Cuttagee Bridge. The recommendations of this group shall be provided to Council and considered in the Proposal's planning and decision-making process.

5.9. Climate and air quality

5.9.1. Existing environment

The South East Coast Bioregion is characterised by a temperate climate with warm summers and cool, wet winters. The temperature records available from the nearest automated weather station at Bega AWS (BOM station no. 069139) which is 28.7km away indicate a mean summer maximum of 27.3 °C (January) and a mean winter minimum of 16.6°C (July) (Figure 5-14).The rain records available from the nearest climate station at Wapengo Lake Road (BOM station no. 069032) indicate a mean maximum of 103.0mm(March), a mean minimum of 52.0mm (July), and an annual mean of 941.9mm (Figure 5-13).

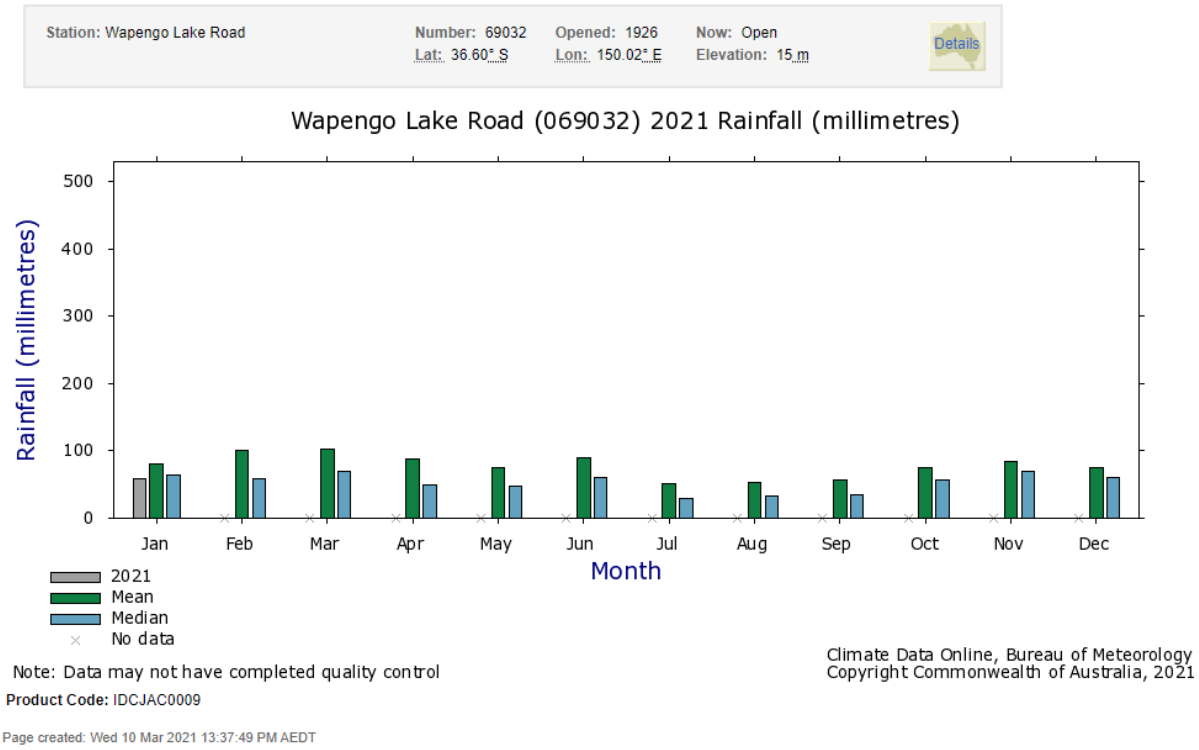

Figure 5-13 Rain statistics for Wapengo Lake Road (BOM, 2021b).

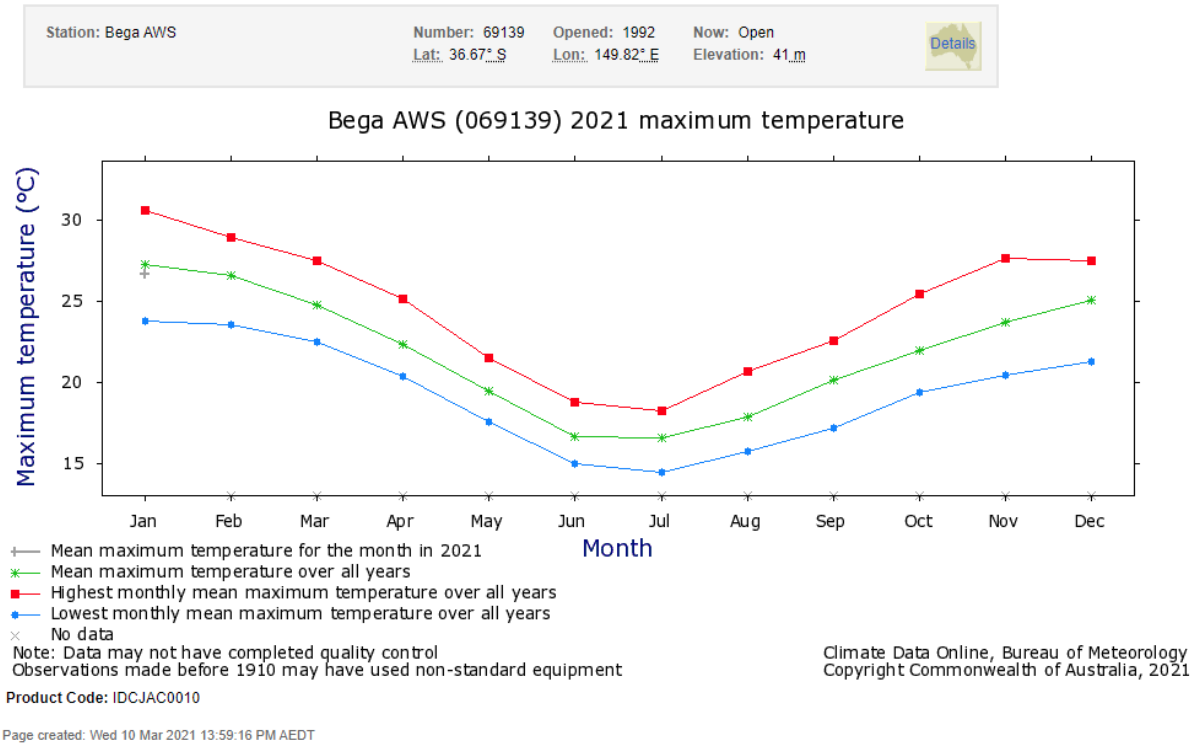

Figure 5-14 Temperature statistics for Bega AWS (BOM, 2021b).

According to the State of the Environment Report, 2016 (SoE), the Bega Valley is considered to have very good air quality. The primary sources of air contaminants are likely to be smoke from bushfires and motor vehicles.

A search of the Australian Government's National Pollutant Inventory in 2020 data within Bega Valley LGA was undertaken 12 March 2021. According to the data 'Dairy Product Manufacturing', 'Water Supply, Sewerage and Drainage Services' and 'Mineral, Metal and Chemical Wholesaling' are the main source of air emissions in the LGA (DAWE, 2021). There are nine sources in the LGA, the closest is the Bermagui Sewage Treatment Plant, approximately 5.5km north of the proposed works area.

Considering the low density of settlement and lack of polluting industries in the general locality of the proposed works, the existing air quality is likely to be high quality.

5.9.2. Potential impacts

Construction

During construction the following activities would potentially result in air quality impacts:

- Stripping and stockpiling topsoil.
- Earthworks.
- Transport and handling of soils and other materials.
- Dust from bridge removal.
- Dust from bridge construction.
- Use of construction vehicles and equipment, generating exhaust fumes.

Air quality impacts to sensitive receivers are considered unlikely given the distance and vegetation between the proposal site and the closest sensitive receiver. With the implementation of mitigation measures such as watering for compaction and dust suppression, impacts from dust generation as a result of the works is considered minor.

Operation

During operation, the proposed works are unlikely to incur additional impacts on local air quality. Traffic numbers are not anticipated to increase as a result of the works.

5.9.3. Safeguards and mitigation measures

Safeguards and mitigation measures recommended to minimise impacts from the proposed works include the following:

- Visual surveillance for dust generation would occur at all times. Work would cease when high levels of airborne dust cannot be controlled.
- Water carts should be used as required (using non-potable water where available) to suppress dust during road construction.
- Ensure all plant and equipment complies with part 4 of the *Protection of the Environment Operations (Clean Air) Regulation 2002*.
- Smoky emissions would be kept within the standards and regulations under the *Protection of the Environment Operations Act 1997* that no vehicle shall have continuous smoky emissions for more than 10 seconds.
- Stockpiles would be managed to suppress dust emissions, such as covering them in windy conditions.

- Delivery vehicles must be covered during transportation.

5.10. Waste minimisation and management

5.10.1. Policy

Waste management would occur in accordance with the *Waste Avoidance and Resource Recovery Act 2001*. The objectives of this Act are:

- To encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecologically sustainable development.
- To ensure that resource management options are considered against a hierarchy of the following order:
    - Avoidance of unnecessary resource consumption.
    - Resource recovery (including reuse, reprocessing, recycling, and energy recovery).
    - Disposal.
- To provide for the continual reduction in waste generation.
- To minimise the consumption of natural resources and the final disposal of waste by encouraging the avoidance of waste and the reuse and recycling of waste.
- To ensure that industry shares with the community the responsibility for reducing and dealing with waste.
- To ensure the efficient funding of waste and resource management planning, programs, and service delivery.
- To achieve integrated waste and resource management planning, programs, and service delivery on a State-wide basis.
- To assist in the achievement of the objectives of the POEO Act.

5.10.2. Potential impacts

The main waste streams likely from construction of the proposal include:

- General construction waste.
- Material from the removal of the old bridge.
- Excavated material.
- Cleared vegetation, including weeds.
- General waste from staff.
- Concrete washout.

There are not expected to be either significant quantities of waste, or any problems with its storage, transport or disposal. All excavated material would be reused on site where practicable.

Waste that is not adequately managed can have a range of potential impacts, including:

- Loss of potentially recoverable resources.
- Contamination of the site and surrounding environment (including potential visual and ecological impacts).

- Offsite contamination due to inappropriate disposal or handling by unlicensed operators.

Impacts from waste would only occur during the construction phase.

The materials required during the proposed construction works are not currently restricted resources however, materials such as metals and fuels are considered non-renewable and should be used conservatively.

Where possible, all of the new and purchased materials to be used would be sourced within the Bega Valley region, as close to the work site as practical to reduce transport costs, including fuel usage.

5.10.3. Safeguards and mitigation measures

Safeguards to be implemented are:

- Waste shall be managed in accordance with the *Protection of the Environment Operations Act 1997*. A Waste Management Plan shall be prepared for construction which includes the following:
    - Identify all potential waste streams associated with the works.
    - Identify opportunities to minimise the use of resources, and to reuse and recycle materials.
    - Outline methods of disposal of waste that cannot be reused or recycled at appropriately licensed facilities. Waste must be disposed of at a facility able to accept the waste.
- Resource management hierarchy principles are to be followed:
    - Avoid unnecessary resource consumption as a priority.
    - Avoidance is followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery).
    - Disposal is undertaken as a last resort (in accordance with the *Waste Avoidance & Resource Recovery Act 2001*).
- All waste generated on site is to be transported off site and disposed of at landfill site approved to accept General Solid Waste (non-putrescible).
- Toilets (e.g., portable toilets) will be provided for construction workers.
- Cleared vegetation shall not be burnt at the site.
- Once the works have been completed, all waste material is to be removed from site and disposed of at a licenced facility. Waste is not to be buried on site.

5.11. Cumulative impacts

5.11.1. Policy setting

There is a requirement under Clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* to take into account any cumulative environmental impacts with other existing or likely future activities. Cumulative impacts of the proposed works include the combined effect of individual impacts associated with the proposal in addition to the impacts of other activities in the area. These may include current and future road works and local

land development that could result in ongoing biodiversity, noise, air quality, visual, waste generation and traffic impacts.

5.11.2. Potential impacts

Key adverse cumulative impacts for the proposed works relate to the combined impact from proposed construction activities on the local environment. This is namely potential loss of a small area of vegetation and potential water quality risks to Cuttagee Creek and loss of topsoil through excavation activities. Additionally, there may be cumulative social impacts, related to traffic delays, noise and dusts, for users of Tathra-Bermagui Road.

The positive cumulative impacts associated with the proposal would result in improved access for motorists and local residents and reduced traffic jams due to bottle necking that may create more air pollution by having the car on longer. These benefits offset to some degree the environmental impacts of the works and therefore the cumulative impacts of this proposal on balance, are considered to be acceptable.

5.11.3. Safeguards and mitigation measures

Adverse cumulative impacts relate to the construction phase of the proposed works. Cumulative impacts are considered to be best managed by dealing with each component individually. No additional safeguards are proposed.

5.12. Matters of national environmental significance

An EPBC Act Protected Matters Report was generated on 9 March 2021 for a 10km radius around the proposal site to identify Matters of National Environmental Significance (MNES) that may be impacted by the proposed works (refer Table 5-14).

Table 5-14 Matters of National Environmental Significance

MNES searches	Items within 10km of site	Potential for impact?
World Heritage Places	None	Nil
National Heritage Places	None	Nil
Wetlands of International Importance	None	Nil
Great barrier Reef Marine Park	None	Nil
Commonwealth Marine Areas	1	Nil
Listed Threatened Ecological Communities	5	Refer Section 5.3.
Listed Threatened Species	66	Refer Section 5.3.
Listed Migratory Species	55	Refer Section 5.3.

5.12.1. Potential impacts

Based on the results of the Protected Matters Search, the only MNES that may occur within proximity to the works are listed Threatened Ecological Communities and listed threatened and migratory species. The potential for the proposed works to impact on these species has been assessed in Section 5.3 of this report. Further biodiversity assessment, including field

inspection, would be required to characterise and assess the impacts of the proposal on threatened or migratory species are considered likely.

5.12.2. Safeguards and mitigation measures

Safeguards and mitigation measures are outlined in section 5.3.3.

5.13. Principles of ecologically sustainable development

The *Protection of the Environment Administration Act 1991* outlines a number of principles of ecologically sustainable development (ESD). These are presented below and discussed in relation to the proposal.

5.13.1. The precautionary principle

According to the precautionary principle, if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be seen as a reason not to protect the environment. The use of the precautionary principle implies that proposals should be carefully evaluated to identify possible impacts and assess the risk of potential consequences.

The precautionary principle has been applied in assessing conservation values and environmental threats and impacts associated with works proposed throughout this REF. Assessments have been precautionary with respect to threatened entities and impacts to Aboriginal heritage. The development of mitigation measures and safeguards to manage impacts aims to reduce the risk of serious and irreversible impacts on the environment.

Desktop assessment has revealed that there are biodiversity and heritage values within or near to the proposal site. Further targeted assessment, including site inspection by qualified ecologists and archaeologists, are required to characterise and assess the specific impacts of the proposal on biodiversity and heritage values. These must occur prior to any works commencing.

5.13.2. Inter-generational equity

The principle of inter-generational equity requires the present generation to ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

The direct construction and operational impacts of the proposal are likely to be localised and temporary and would not significantly diminish resources and nature conservation values available for use by future generations.

However, the proposal itself involves the permanent removal of a local heritage-listed bridge with high amenity value to the local community. Under the proposal future generations would not be able to enjoy the high amenity and heritage values of the current Cuttagee Bridge.

5.13.3. Conservation of biological diversity and ecological integrity

Conservation of biological diversity and ecological integrity are a fundamental consideration of ESD.

An assessment of the existing local environment has been undertaken in order to identify and manage any potential impacts of the proposal on local biodiversity. The impacts of the proposal on local populations of threatened species, threatened communities and their habitats would be characterised and assessed following targeted site inspection and reporting by a qualified ecologist.

5.13.4. Appropriate valuation of environmental factors

This principle requires that “costs to the environment should be factored into the economic costs of a project”.

This REF has examined the environmental consequences of the proposal and identified mitigation measures for factors which have the potential to experience adverse impacts. Requirements imposed in terms of implementation of these mitigation measures would increase both the capital and operating costs of the proposal. This signifies that environmental resources have been given appropriate valuation.

6. Summary of licences, approvals and safeguards

Aspect	Safeguard and mitigation measures
Approvals	• Consultation with Crown Lands would be undertaken prior to commencing works, if required. • Prior to works, a Fisheries Permit for dredging and reclamation works would be obtained, and works would be undertaking in accordance with the permit. • Consultation will be required to Maritime as per Clause 16 of the ISEPP for the construction of a fixed structure in or over navigable waters.
Topography geology and soils	• All works will occur within the proposal footprint outlined in Figure 2-2. Any works that are to occur outside this proposal site would require further assessment. • Design bridge, bridge abutments, and road approaches, to ensure stable landforms are achieved. Design is to include devices such as rock armouring for scour protection. • Development of a site-specific sediment and erosion control plan, in accordance with the Blue Book (Landcom 2004), prior to the works commencing. • Installation of erosion and sediment controls prior to commencement of construction. • Maintenance of erosion and sediment controls throughout the duration of the works and until the site is stable. • Works will not be undertaken in forecasted heavy rain. • Delineation of works areas, including access and stockpile areas, and fencing of 'no go' zones to stop unnecessary disturbance outside the works footprint. • Placement of compound and ancillary site as well as potential pollutants (such as soil and hazardous materials) will be located away from drainage lines (more than 40m) on relatively flat ground and already cleared of vegetation. Bridge equipment and other materials that are not a pollution risk may be stored adjacent to the bridge but outside of potential flood zones. • Separation of topsoil and subsoil during stockpiling activities. Topsoil must be reused to assist stabilisation of disturbed areas. • If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been

Aspect	Safeguard and mitigation measures
	confirmed and any necessary site-specific controls or further actions have been implemented. • An Acid Sulfate Soils Management Plan will be developed and will specifically address risks of leachate impacts on receiving waters. • Soil sampling will be undertaken adjacent to abutments to identify and characterise specific acid-sulfate soil risk at the site. • An Emergency Spill Management Plan will be developed for the project and would contain measures to avoid spillages of hydrocarbons onto any ground surfaces or into any waterways. The plan would include, but not be limited to: ○ Impervious bunded storage facilities for hydrocarbons, away from watercourses and areas at risk of flooding impacts. ○ Impervious bunded areas for refuelling, away from waterways and drainage lines. ○ Spill kits kept onsite and, on all machinery. ○ Training of staff in the response, notification and management of hydrocarbon spills. ○ Contingency measures for inset casting of the concrete piers within Cuttagee Creek. • Progressive stabilisation of disturbed areas to include: ○ Respreading topsoil and mulch (thinly spread) to assist natural revegetation. ○ Maintenance of sediment and erosion controls until the surfaces are deemed to be stable. ○ Consideration of seeding and supplementary planting based on success of the former two points. ○ An Acid Sulphate Management Plan will be prepared prior to construction.
Hydrology, catchment values and water quality	• Prior to works, a Fisheries Permit for dredging and reclamation works would be obtained, and works would be undertaking in accordance with the permit. This is expected to include: ○ Instream and bank work areas would be clearly delineated and other areas declared ‘no go zones. ○ If dewatering is required, it would only be undertaken in accordance with a Dewatering Plan, to manage dewatering operations and discharge to receiving waters. ○ No machinery to enter the waterway unless it has been appropriately cleaned, degreased and serviced. ○ Spill kits to be available onsite at all times during instream works. ○ Only clean rock (no fines) to be used in rock armouring, if required.

Aspect	Safeguard and mitigation measures
	○ Geotextile fabric is to be used to isolate the natural bed of the waterway from any imported clean rock fill or other material used within the bed of the waterway. ○ Surplus concrete and wash-down water would not be disposed of on site. ○ Works are to manage debris created by the demolition of the bridge components entering Cuttagee Creek using devices such as drop nets, shade clothes or instream booms. • Hydrological assessment of the final design of bridge and road approaches to demonstrate they do not significantly impact hydrologic integrity or the quantity and quality of surface and groundwater flows to and from the adjacent coastal wetland. • Ensure stormwater is not discharged into Cuttagee Creek unless appropriately treated. • Access to the new bridge shall be restricted to essential vehicles only during extreme coastal storm events, with road closed signage established. • Any pedestrian walkway shall be located on the western side of the bridge alignment, to minimise wave overtopping exposure of the walkway during moderate to severe coastal events. • Appropriate signage shall be installed on the walkway warning of the potential dangers to pedestrians during moderate to extreme coastal storms. • A flood contingency plan would be prepared to identify any potential flood threats and the evacuation procedure for dispersible materials, hazardous materials and equipment containing hazardous or dispersible materials. The flood contingency plan would include: ○ Detail who would be responsible for monitoring the flood threat and how is this to be done. It is expected that flood warning information would be sourced from the Bureau of Meteorology (BoM) website. ○ Regular consultation of the BoM website for weather forecasts and flood warnings. ○ A process for removing equipment and materials off site and out of flood risk areas quickly. ○ Prior to works, permission from the crown land would be acquired to work in the creek.
Biodiversity	• Targeted surveys for threatened microbats using heat sensing devices will be undertaken prior to any works commencing to identify any roosting colonies utilising the existing Cuttagee bridge. • Care should be taken when removing timber bridge supports with fissures or cavities in the event of disturbing roosting microbats.

Aspect	Safeguard and mitigation measures
	An unexpected finds procedure would be implemented if species are unexpectedly encountered during demolition. This should include a pre-organised wildlife handler being readily available to rescue and relocate any displaced fauna. • The peak construction period shall be planned for outside the breeding season of threatened shorebirds (Sooty Oystercatchers, Pied Oystercatchers and Hooded Plovers) that may utilise the sand spits either side of the bridge. • Works should be put on hold if birds start to feed in the area, and resume when they vacate. • Where possible to do so, avoid impacts to aquatic plants to preserve aquatic amphibian habitat and soil stability of the aquatic zone. • Any trees cut from the site (especially eucalypts and wattles) shall be mulched onsite to assist stabilising and passively regenerating areas of disturbance. They shall be spread thinly so as not to suppress natural germination. They shall not be placed where they may be washed into the creek. • No snags would be removed, realigned or relocated. • A visual inspection of the waterway for dead or distressed fish will be undertaken daily during construction. Observations of dead or distressed fish will be immediately reported to DPI. • Prior to the commencement of work, a physical vegetation clearing boundary at the approved clearing limit is to be demarcated and implemented. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar. • Where possible, trees to be removed would be mulched on-site and re-used to stabilise disturbed areas, or for erosion and sediment control (if required). • Where trees are to be retained, an adequate protection zone would be provided around each tree for the duration of construction. The radius of this zone is calculated by multiplying the diameter of the tree at breast height (1.4 m) by 12, and is a minimum of 2 m and a maximum of 12 m. • Where possible, work would not encroach into dripline of trees to be retained, including those composing *Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions EEC.* This zone is define as the Tree Protection Zone (TPZ). • The saltmarsh along the foreshore of the lake but outside the works footprint would be a designated no go area for any construction plant and construction personnel. • Erosion controls pertaining to biodiversity protection would include: o Measures to ensure that the site is adequately protected when rain is forecast. o Erosion controls would be put in place on the upslope of works to prevent soil and debris travelling downslope, especially to prevent sedimentation of Burrill Lake.

Aspect	Safeguard and mitigation measures
	○ Steps to prevent mixing of different soils (e.g. subsoils and topsoils) and ensure that they are replaced in their natural configuration to assist revegetation. ○ Stockpiling materials and equipment and parking vehicles would be avoided within the dripline (extent of foliage cover) of any tree. • A Weed Management Plan would be developed for the sites to prevent/minimise the spread of weeds in and between sites. • Any declared noxious weeds would be managed according to the requirements stipulated by the Noxious Weeds Act 1993 • Regular targeted control of noxious, priority and environmental weeds would take place during construction to manage weeds. • All machinery and vehicles to be used during construction must be clean to minimise the potential of introducing weed seeds and Chytrid fungus. Particularly, transporting wet soil from one site to another will be avoided. • Construction machinery (bulldozers, excavators, trucks, loaders and graders) would be cleaned using a high-pressure washer (or other suitable device) prior to entering and exiting work sites. • All plant material containing seed heads, weeds that have allopathic properties, and weeds that are able to reproduce vegetatively, including topsoil containing weed propagules, would be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth. • Weed-free fill would be used for on-site earthworks. • Regular monitoring for priority weeds shall take place for at least 24 months following rehabilitation of disturbed areas. • If straw bales are to be used during revegetation, they will come from weed-free sources if possible. • Any pesticides would be used in accordance with the requirements on the label. Any person undertaking pesticide (including herbicide) application would be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation. • If used, silt curtains would be placed at strategic locations to prevent any sedimentation of seagrass. Care would be taken when installing the silt curtain to ensure it does not directly impact any seagrass. Silt curtains would not be installed such that they block fish passage (e.g. across the channel). • The use of any boats and barges in seagrass beds would be minimised where possible. • If used, boats and barges would not enter seagrass beds at low tide or when water levels are low enough that there is a risk of propellers striking seagrass (dictated by draft of the vessel). Anchoring would not occur within seagrass beds. Support vessels would be moored to the barge to prevent any damage to seagrass beds.

Aspect	Safeguard and mitigation measures
	• To determine the degree of impact to seagrass, monitoring would be conducted twice prior construction and twice following construction and once the stabilisation of sediments has occurred. Monitoring would follow a Before After Construction Impact (BACI) design to allow impacts to be quantified and to determine any potential compensatory measures required should a net loss have occurred as a result of the proposal. Monitoring would also be used to determine if seagrass was colonising areas where old infrastructure has been removed. • Any fallen timber, dead wood and bush rock (if present) encountered on site would be left in situ or relocated to a suitable place nearby. Rock would be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance. • Revegetation of any bare soil or cleared areas with locally-occurring native flora species typical of the original habitat types should occur. • Stabilise and reseed disturbed areas with fast colonising species, appropriate to the area. Native dominated understorey areas should be planted with native or sterile stabilisation species. Riparian areas would require separate revegetation strategy that would be prepared before commencement by/or in consultation with a suitably qualified person and would incorporate all relevant provisions of the Fisheries Permit issued for the works.
Aboriginal heritage	The proposed work can *proceed with caution*, provided the following recommendations are followed: 7. The area of archaeological sensitivity identified on the dune, as shown in Figure 5-11, must be avoided by the Proposed works. A temporary barrier fence must be placed between this area and the works area during construction. 8. Works within the Proposal Area that are not within the area of archaeological sensitivity may proceed with caution. 9. Further heritage assessment in the form of an Aboriginal Cultural Heritage Assessment (ACHA) must be completed prior to any works being undertaken within the archaeologically sensitive area, if this cannot be avoided. The ACHA can then be used in support of an Aboriginal Heritage Impact permit (AHIP) if required. To negate the need to conduct further archaeological assessment BVSC must contain their works to the previously disturbed area of the dune comprising the incised, sloped area adjacent to the road corridor. 10. Any activity proposed outside of the current assessment area should also be subject to an Aboriginal heritage assessment. 11. If any items suspected of being Aboriginal in origin are discovered during the works all work in the immediate vicinity must

Aspect	Safeguard and mitigation measures
	stop and Heritage NSW notified. The find will need to be assessed and if found to be an Aboriginal object an AHIP may be required. 12. In the unlikely event that human remains are identified during development works, all work must cease in the immediate vicinity and the area must be cordoned off. The proponent must contact the local NSW Police who will make an initial assessment as to whether the remains are part of crime scene or possible Aboriginal remains. If the remains are thought to be Aboriginal, Heritage NSW must be notified by ringing the Enviroline (131 555). BVSC is reminded that it is an offence under the *NSW National Parks and Wildlife Act 1974* to disturb, damage or destroy and Aboriginal object without a valid AHIP.
Non -Indigenous heritage	A Statement of Heritage Impact will be completed to address the potential impacts on Cuttagee Bridge, which would occur as a result of the proposed works. Where the Statement demonstrates that impact to the heritage value of the item is likely, approval must be obtained from the relevant authority.
Traffic and access	• A Traffic Management Plan (TMP) would be prepared and include: • Confirmation of haulage routes. • Measures to maintain access to local roads and properties. • Site specific traffic control measures (including signage) to manage and regulate traffic movement. • Requirements and methods to consult and inform the local community of impacts on the local road network. • Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads. • A response plan for any construction traffic incident. • Consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic. • Consideration of peak traffic volumes (school bus routes, holiday periods). • Monitoring, review and amendment mechanisms. • Operational traffic controls (expected to include signage) to warn motorists of changed traffic conditions. • Notification to the local community of any changed traffic conditions (i.e. road closures, detours, lane closures) in advance of the works commencing. A contact number would be provided for community queries in relation to the works and including operation.

Aspect	Safeguard and mitigation measures
	• Temporary land closures would occur for the least amount of time possible. • Emergency services will be notified of the proposal prior to works commencing. • Installation of road safety and traffic conditions signage • Recommended to formalise existing pull-over areas and separate from road corridor.
Noise and vibration	• A specialist noise assessment of the Proposal be conducted prior to any works commencing. • A Noise and Vibration Management Plan (NVMP) would be prepared prior to the commencement of works and implemented through all phases of the proposed construction works. It would be prepared in consultation with all highly affected receivers. The NVMP would provide the framework for the monitoring of noise levels and management of all potential noise impacts resulting from the construction works and would detail the environmental mitigation measures to be implemented throughout the construction works. • Affected neighbours to the construction works would be advised in advance of the proposed construction period at least two weeks prior to the commencement of works. • All site workers (including subcontractors and temporary workforce) should be familiar with the potential for noise impacts upon residents and encouraged to take all practical and reasonable measures to minimise noise during their activities. • The contractor or site supervisor (as appropriate) would hold details for a liaison officer including phone number so that the noise and vibration related complaints, if any, would be received and addressed in a timely manner. • Construction works should adopt Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as addressed in the ICNG. BMP includes factors discussed within this report and encouragement of a project objective to reduce noise emissions. BATEA practices involve incorporating the most advanced and affordable technology to minimise noise emissions. • Ensure that all construction works scheduled for standard construction hours comply with the start and finish time. • Where practical, simultaneous operation of dominant noise generating plant should be managed to reduce noise impacts, such as operating at contrasting times or increase

Aspect	Safeguard and mitigation measures
	the distance between plant and the nearest identified receiver. • Where possible, reversing beepers on mobile equipment would be replaced with low pitch tonal beepers (quackers). Alternatives to reversing beepers include the use of spotters and designing the site to reduce the need for reversing may assist in minimising the use of reversing beepers. • Unnecessary noise emissions would be avoided by turning equipment off when it is unused for an extended period. • Equipment would be maintained in good condition so that excessive noise is not emitted. Noise attenuation methods may be used on particularly noisy equipment if required. • All noise complaints should be reported to BVSC, recorded in a register and appropriately investigated promptly. • Assessment for vibration impact on human comfort would be undertaken in the event complaints were received during the construction phase.
Community and socio-economic	General safeguards and mitigation measures will include: • Working areas and compound site are to be maintained, kept free of rubbish and cleaned up at the end of each working day. • Rehabilitation works would take place as soon as possible following the completion of construction. • Remove temporary erosion and sediment controls from the site once landforms have been assessed as stable. • Signage and barriers would be implemented at the works site to prevent public access to areas deemed unsafe. Additionally, to enable informed characterisation and assessment of the possible community and socio-economic impacts of the Proposal, it is recommended that targeted and ongoing community consultation continue to occur. Council has already committed to establishing and supporting a Community Advisory Group for Cuttagee Bridge. The recommendations of this group shall be provided to Council and considered in the Proposal's planning and decision-making process.
Climate and air quality	• Visual surveillance for dust generation would occur at all times. Work would cease when high levels of airborne dust cannot be controlled. • Water carts should be used as required (using non-potable water where available) to suppress dust during road construction. • Ensure all plant and equipment complies with part 4 of the *Protection of the Environment Operations (Clean Air) Regulation 2002*. • Smoky emissions would be kept within the standards and regulations under the *Protection of the Environment Operations Act 1997* that no vehicle shall have continuous smoky emissions for more than 10 seconds.

Aspect	Safeguard and mitigation measures
	• Stockpiles would be managed to suppress dust emissions, such as covering them in windy conditions. • Delivery vehicles must be covered during transportation.

Waste minimisation and management	• Waste shall be managed in accordance with the *Protection of the Environment Operations Act 1997*. A Waste Management Plan shall be prepared for construction which includes the following:
	  ○ Identify all potential waste streams associated with the works.
	  ○ Identify opportunities to minimise the use of resources, and to reuse and recycle materials.
	  ○ Outline methods of disposal of waste that cannot be reused or recycled at appropriately licensed facilities. Waste must be disposed of at a facility able to accept the waste.
	• Resource management hierarchy principles are to be followed:
	  ○ Avoid unnecessary resource consumption as a priority.
	  ○ Avoidance is followed by resource recovery (including reuse of materials, reprocessing, and recycling and energy recovery).
	  ○ Disposal is undertaken as a last resort (in accordance with the *Waste Avoidance & Resource Recovery Act 2001*).
	• All waste generated on site is to be transported off site and disposed of at landfill site approved to accept General Solid Waste (non-putrescible).
	• Toilets (e.g. portable toilets) will be provided for construction workers.
	• Cleared vegetation shall not be burnt at the site.
	• Once the works have been completed, all waste material is to be removed from site and disposed of at a licenced facility. Waste is not to be buried on site.

7. Conclusion

This REF has been prepared for BVSC. It assesses the construction and operational environmental impacts of a proposal to replace the existing timber bridge over Cuttagee Creek along Bermagui-Tathra Road with a new two-lane concrete bridge.

This REF has been prepared according to the requirements of part 5.5 of the EP&A Act, specifying a "duty to consider environmental impact". It provides a preliminary analysis of all environmental, economic, physical and social implications of the proposal.

The proposed works would improve safety and traffic efficiency for all motorists using the bridge and Bermagui-Tathra Road. It would also reduce ongoing maintenance costs for BVSC associated with the degrading existing timber bridge.

The key environmental risks of the works have been identified as soil and water, heritage, biodiversity and community impacts. A range of safeguards have been developed for the potential impacts identified. These would ensure that the negative impacts of the proposal are prevented, mitigated or limited as far as practical. Additional input is required for soil and water management with a Fisheries Permit required for instream works, as well as biodiversity surveys and historic heritage assessment, and community consultation as noted previously. Of benefit, the new bridge would potentially reduce current noise, soil and water impacts in the long term.

With the exception of historic heritage and community, the potential impacts of the proposal are considered acceptable and justified at this stage of assessment. They are unlikely to generate a significant adverse impact if the safeguards listed in this REF are implemented effectively. Further assessment and consultation, however, is required to adequately assess historic heritage and community as follows:

- A Statement of Heritage Impact (SOHI) on the local heritage listed Cuttagee Bridge.
- To enable informed characterisation and assessment of the possible community and socio-economic impacts of the Proposal, it is recommended that specific community consultation occur regarding this proposal. The results of this should be used to inform the proposal description and scope of works.

The results of these studies should be included in future planning and approvals activities prior to works commencing to fully address the proponent's obligations under Part 5 of the EP&A Act.

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9. Appendices

Appendix A Concept Design

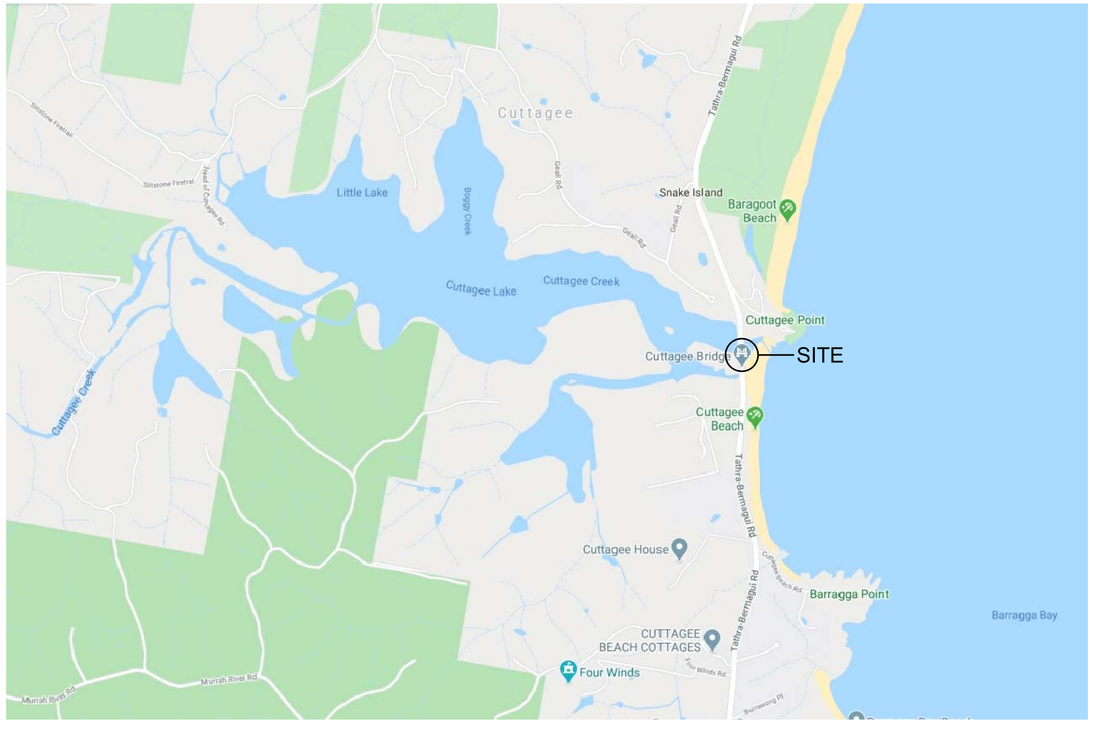
CUTTAGEE LAKE BRIDGE REPLACEMENT

TATHRA - BERMAGUI ROAD, CUTTAGEE, NSW

for BEGA VALLEY SHIRE COUNCIL

SAFETY IN DESIGN STATEMENT & ENGINEERING DESIGN CERTIFICATION

THIS DESIGN FOR THE
CUTTAGEE LAKE BRIDGE REPLACEMENT
AS PREPARED BY ANDREW MARSHMAN AND ASSOCIATES PTY LTD REPRESENTS THE CONSTRUCTION METHODS AND MATERIALS AS PRESCRIBED BY THE BRIDGE OWNER AND PRINCIPAL ENGINEERING AUTHORITY (BEGA VALLEY SHIRE COUNCIL (BVSC)) AND COMPLIES WITH THE REQUIREMENTS OF AS5100-2004 FOR AN SM1600 LOAD RATING. ANY VARIATIONS TO THOSE ELEMENTS SHOWN ON THESE PLANS (INCLUDING NATURALLY OCCURRING FOUNDATION TYPES/LEVELS AND EXISTING BRIDGE CONSTRUCTION) DISCOVERED PRIOR TO AND/OR DURING CONSTRUCTION ARE TO BE REFERRED IMMEDIATELY TO THIS OFFICE AND THE PRINCIPAL ENGINEERING AUTHORITY (BVSC) FOR DESIGN COMPLIANCE APPRAISAL AND CONSTRUCTION IMPLICATIONS, TO MAINTAIN THE CURRENT VALIDITY OF THIS STATEMENT AND CERTIFICATION. ALL ASPECTS OF THE DESIGN IMPLEMENTATION AND CONSTRUCTION INCLUDING CONTRACT, SPECIFICATION, CONSTRUCTION SUPERVISION/CERTIFICATION AND STATUTE AUTHORITY OCCUPATIONAL HEALTH AND SAFETY REQUIREMENTS ARE TO BE IN ACCORDANCE WITH FORMAL DETAILED AND SUPERVISED APPROVAL OF THE PRINCIPAL ENGINEERING AUTHORITY (BVSC).



LOCALITY PLAN

DRAWING SCHEDULE

Sheet No.	TITLE	Revision
C1.1	COVER SHEET	P2
C1.2	NOTES	P2
C1.3	NOTES	P2
C2.1	SITE PLAN	P2
C3.1	GENERAL ARRANGEMENT PLAN	P2
C3.2	GENERAL ARRANGEMENT CENTRELINE LONGITUDINAL SECTION / ELEVATION	P2
C3.3	GENERAL ARRANGEMENT TYPICAL SECTION THROUGH BRIDGE DECK	P2

SHEETS IN SET: 7

PRELIMINARY
NOT FOR CONSTRUCTION

Rev.	Description	Eng.	Date	Rev.	Description	Eng.	Date
P1	PRELIMINARY DESIGN ISSUE	A.M.	07.08.20				
P2	PRELIMINARY DESIGN ISSUE	A.M.	12.08.20				

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PROJECT
CUTTAGEE LAKE BRIDGE REPLACEMENT
TATHRA - BERMAGUI ROAD, CUTTAGEE, NSW for BEGA VALLEY SHIRE COUNCIL

TITLE
COVER SHEET

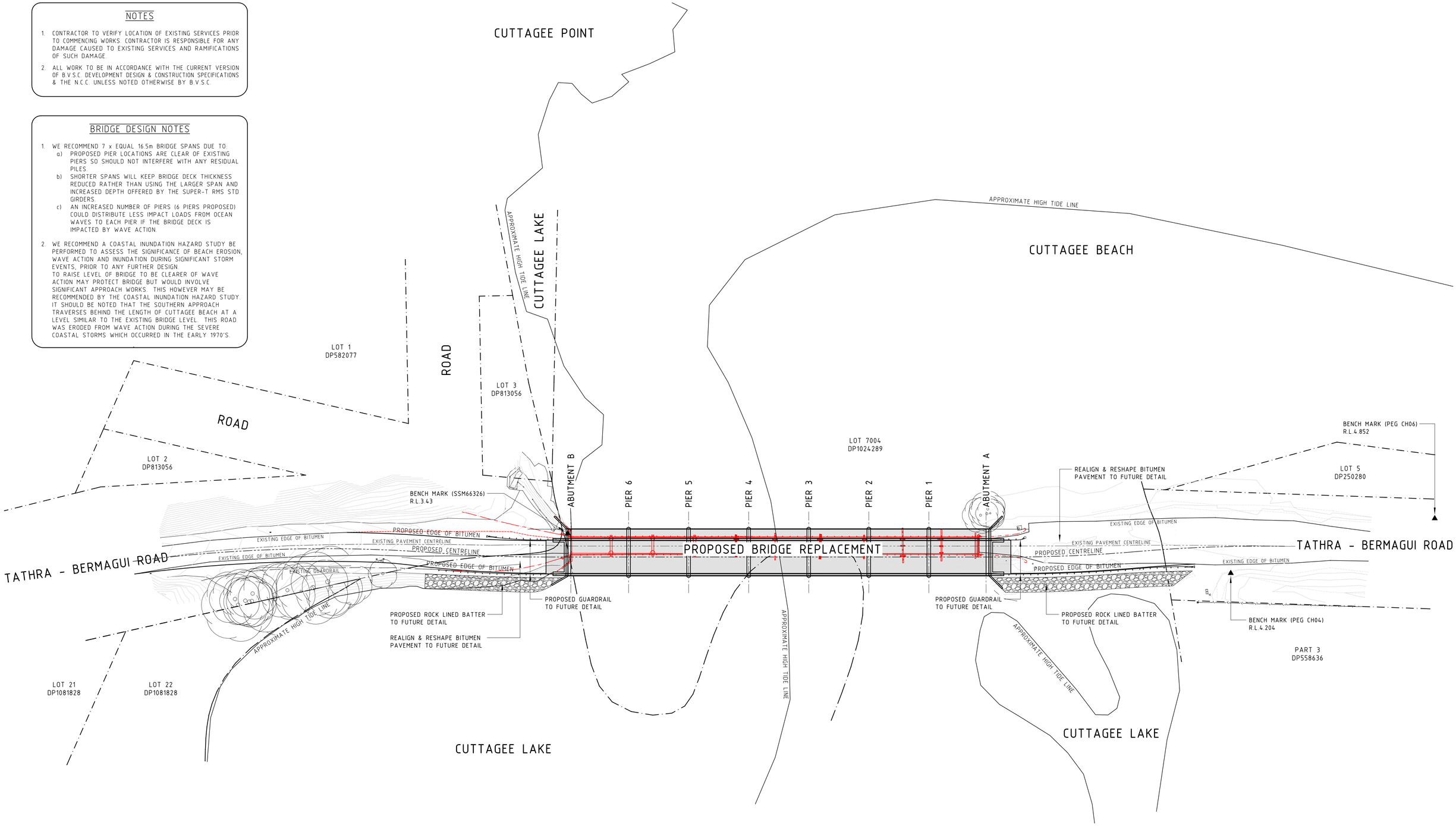
Design	Drawn	Approved		
A. MARSHMAN	D. ELCOAT	ANDREW MARSHMAN BE (HONSIII) MIE Aust (388076) CPEng NER Chartered Engineer		
Scale	**Date**	**Job. No.**	**Sheet**	**Rev.**
N.T.S. (A1)	AUGUST 2020	AC20022.06	C1.1	P2

NOTES

1. CONTRACTOR TO VERIFY LOCATION OF EXISTING SERVICES PRIOR TO COMMENCING WORKS. CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE CAUSED TO EXISTING SERVICES AND RAMIFICATIONS OF SUCH DAMAGE.
2. ALL WORK TO BE IN ACCORDANCE WITH THE CURRENT VERSION OF B.V.S.C. DEVELOPMENT DESIGN & CONSTRUCTION SPECIFICATIONS & THE N.C.C. UNLESS NOTED OTHERWISE BY B.V.S.C.

BRIDGE DESIGN NOTES

1. WE RECOMMEND 7 x EQUAL 16.5m BRIDGE SPANS DUE TO:
   a) PROPOSED PIER LOCATIONS ARE CLEAR OF EXISTING PIERS SO SHOULD NOT INTERFERE WITH ANY RESIDUAL PILES.
   b) SHORTER SPANS WILL KEEP BRIDGE DECK THICKNESS REDUCED RATHER THAN USING THE LARGER SPAN AND INCREASED DEPTH OFFERED BY THE SUPER-T RMS STD GIRDERS.
   c) AN INCREASED NUMBER OF PIERS (6 PIERS PROPOSED) COULD DISTRIBUTE LESS IMPACT LOADS FROM OCEAN WAVES TO EACH PIER IF THE BRIDGE DECK IS IMPACTED BY WAVE ACTION.
2. WE RECOMMEND A COASTAL INUNDATION HAZARD STUDY BE PERFORMED TO ASSESS THE SIGNIFICANCE OF BEACH EROSION, WAVE ACTION AND INUNDATION DURING SIGNIFICANT STORM EVENTS, PRIOR TO ANY FURTHER DESIGN.
   TO RAISE LEVEL OF BRIDGE TO BE CLEARER OF WAVE ACTION MAY PROTECT BRIDGE BUT WOULD INVOLVE SIGNIFICANT APPROACH WORKS. THIS HOWEVER MAY BE RECOMMENDED BY THE COASTAL INUNDATION HAZARD STUDY. IT SHOULD BE NOTED THAT THE SOUTHERN APPROACH TRAVERSES BEHIND THE LENGTH OF CUTTAGEE BEACH AT A LEVEL SIMILAR TO THE EXISTING BRIDGE LEVEL. THIS ROAD WAS ERODED FROM WAVE ACTION DURING THE SEVERE COASTAL STORMS WHICH OCCURRED IN THE EARLY 1970'S.



SITE PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

Rev.	Description	Eng.	Date	Rev.	Description	Eng.	Date
P1	PRELIMINARY DESIGN ISSUE	A.M.	07.08.20				
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PROJECT
CUTTAGEE LAKE BRIDGE REPLACEMENT
TATHRA - BERMAGUI ROAD, CUTTAGEE, NSW for BEGA VALLEY SHIRE COUNCIL

TITLE
SITE PLAN

Design	Drawn	Approved		
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Scale	**Date**	**Job. No.**	**Sheet**	**Rev.**
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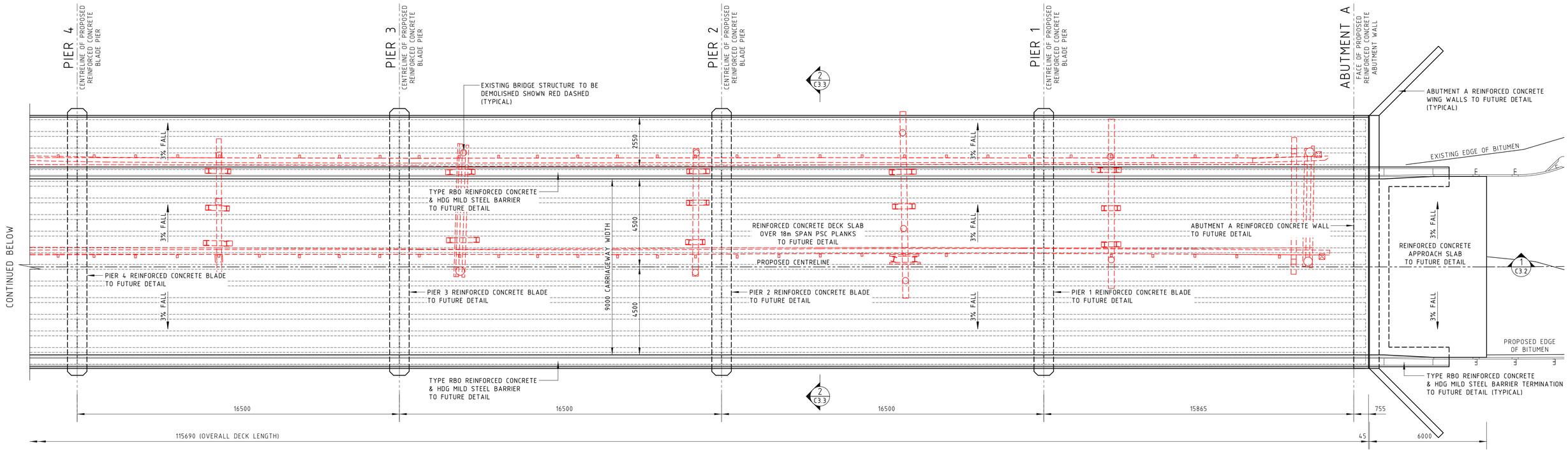

GENERAL ARRANGEMENT PLAN

PRELIMINARY
NOT FOR CONSTRUCTION

Rev.	Description	Eng.	Date	Rev.	Description	Eng.	Date
P1	PRELIMINARY DESIGN ISSUE	A.M.	07.08.20				
P2	PRELIMINARY DESIGN ISSUE	A.M.	12.08.20				

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TITLE
GENERAL ARRANGEMENT PLAN

Design	Drawn	Approved		
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Scale	**Date**	**Job. No.**	**Sheet**	**Rev.**
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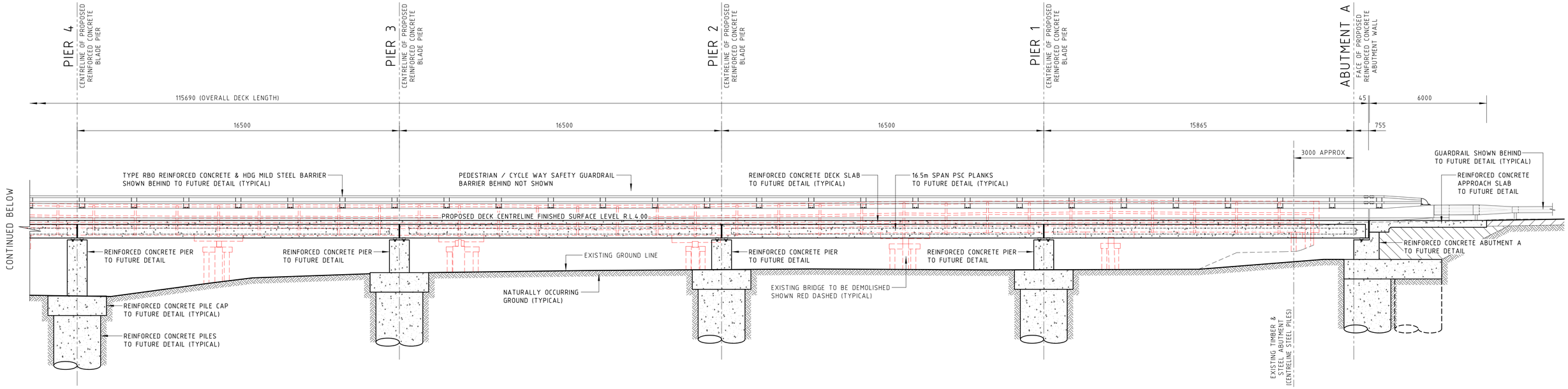

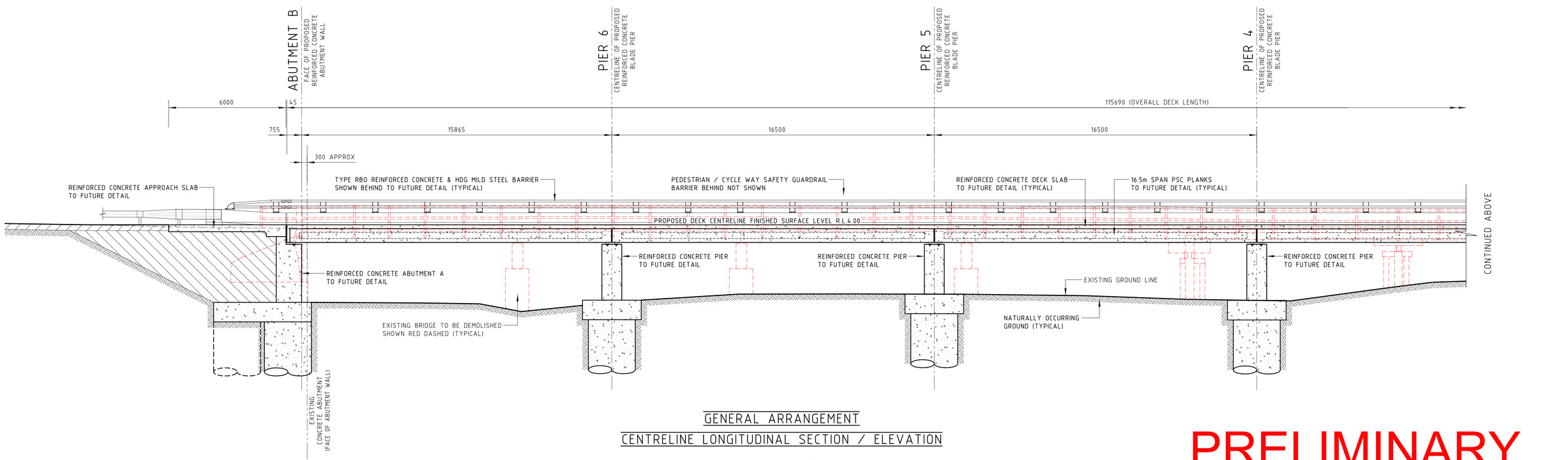

GENERAL ARRANGEMENT
CENTRELINE LONGITUDINAL SECTION / ELEVATION

SECTION 1 / C3.1

PRELIMINARY
NOT FOR CONSTRUCTION

Rev.	Description	Eng.	Date	Rev.	Description	Eng.	Date
P1	PRELIMINARY DESIGN ISSUE	A.M.	07.08.20				
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TITLE
GENERAL ARRANGEMENT
CENTRELINE LONGITUDINAL SECTION / ELEVATION

Design	Drawn	Approved		
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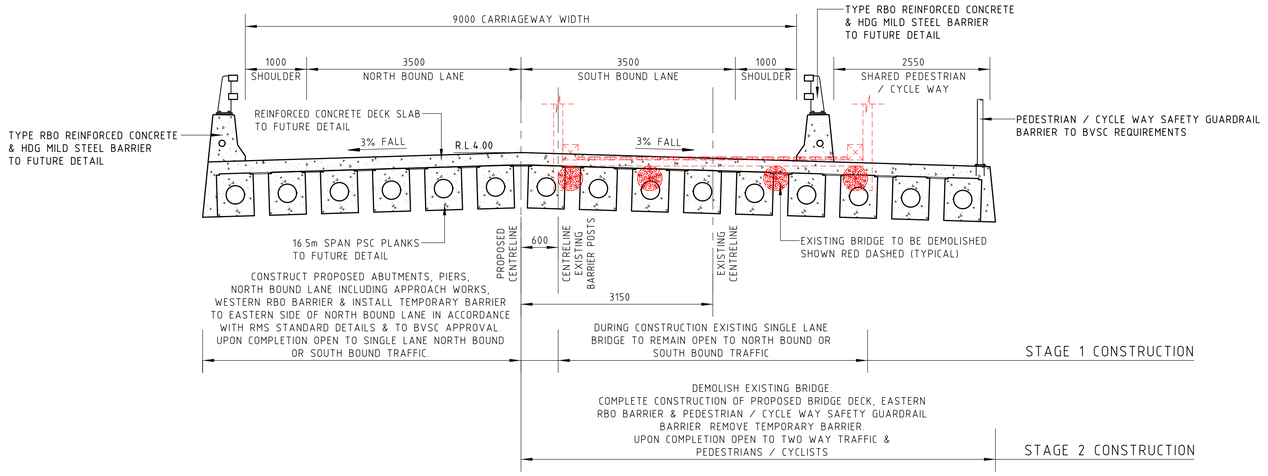

GENERAL ARRANGEMENT

TYPICAL SECTION THROUGH BRIDGE DECK

SECTION 2 / C3.1

PRELIMINARY
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TITLE
GENERAL ARRANGEMENT
TYPICAL SECTION THROUGH BRIDGE DECK

Design	Drawn	Approved		
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Appendix B Clause 228 Checklist

A checklist of factors that should be considered in the assessment of impacts prior to its determination is included within Clause 228 of the *Environmental Planning and Assessment Regulation 2000*. This clause identifies sixteen issues that need to be addressed. The following text provides summary details of each of the issues, the majority of which have been addressed within the body of this document.

Factor
a. Any environmental impact on a community? The proposal would have impacts on the community during construction, including temporary traffic delays, visual, noise and air quality issues. This impact is considered manageable with the recommended safeguards and management measures recommended in Section 6.
b. Any transformation of a locality? The proposal would transform the locality as it is replacing an existing Bridge with considerable heritage, identity and visual amenity values. The new bridge would replace the existing bridge along the existing alignment. Further assessment of community values is required to confirm the extent to which the works are perceived to transform the locality.
c. Any environmental impact on the ecosystems of the locality? Further biodiversity assessment is required to confirm ecosystem impacts.
d. Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? The removal of a heritage listed structure and replacement with a more modern concrete design will impact these values.
e. Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? The removal of a heritage listed structure and replacement with a more modern concrete design will impact these values. ACHAR and SHI are required to confirm impacts.
f. Any impact on the habitat of protected fauna (within the meaning of the National Parks and Wildlife Act 1974)? Further biodiversity assessment is required to confirm ecosystem impacts.
g. Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? Further biodiversity assessment is required to confirm ecosystem impacts.
h. Any long-term effects on the environment? No adverse long-term effects on the environment are predicted to occur as an impact of the proposed work.
i. Any degradation of the quality of the environment? No likely degradation of the quality of the environment is predicted to occur as an impact from the proposed work with the implementation of mitigation measures outlined in this REF.

Factor
j. Any risk to the safety of the environment? No likely additional risk to the safety of the environment is predicted to occur as an impact of the proposed work with the implementation of mitigation measures outlined in this REF, including measures to mitigate risks to pedestrians from increased speed limits.
k. Any reduction in the range of beneficial uses of the environment? No likely reduction in the range of beneficial uses of the environment is likely to occur as an impact of the proposed work with the implementation of the mitigation measures outlined in this REF.
l. Any pollution of the environment? Pollution of the environment is likely to be restricted to noise, dust and plant exhaust, and erosion during construction. This is likely to be minor with implementation of identified mitigation measures.
m. Any environmental problems associated with the disposal of waste? There are no foreseeable problems with the disposal of waste generated by the proposal.
n. Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? No likely increase of demand on resources (natural or otherwise) that are, or are likely to become, in short supply.
o. Any cumulative environmental effect with other existing or likely future activities? No significant cumulative impacts are likely from the proposed work.
p. Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? Hydrological assessment required to confirm the design of the bridge will not impact hydrological integrity, in consideration of the coastal context of the site.

Appendix C Cuttagee Lake and Bridge Replacement – Coastal Hazards Assessment (Baird., 2021)

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Status: Final
02/08/2021

Dear Daniel,

Reference # 13610.101.L1.Rev0

RE: CUTTAGEE LAKE BRIDGE REPLACEMENT - COASTAL HAZARDS ASSESSMENT

This letter provides a coastal hazard assessment for Cuttagee Lake entrance, particularly focussed on the proposed replacement of Cuttagee Bridge. The existing bridge crosses Cuttagee Lake entrance area at the northern end of Cuttagee Beach and is a crucial linkage between Barragga and Bermagui providing access to the Sapphire Coast. Cuttagee Lake is a shallow saline coastal lagoon with an intermittently closed entrance. The existing bridge spans across the lake close to the intermittent entrance to the Tasman Sea, in an area that can be considered the active lake entrance region. It is noted that a section of the existing bridge was washed away during coastal storm events in the 1970s, with the northern spans having to be rebuilt. However, more recently significant structural concerns have prompted the proposal of a new bridge, which will be constructed along the same alignment as the existing bridge.

This coastal hazard assessment has reviewed and utilised numerous relevant studies to provide a summary of coastal hazards and associated exposure for both the existing and proposed bridges. This has been performed for both present day and at the 2050 planning level.

Coastal Hazards

The existing and proposed Cuttagee Lake bridges are exposed to several coastal hazards, that can occur individually or together to impact upon the bridge. This section outlines the coastal hazards through the entrance area of Cuttagee Lake, and predominantly leverages off the Bega Valley Shire Coastal Processes and Hazards Definition Study (WBM, 2015) that defines coastal hazards along Cuttagee Beach. WBM (2015) defines a series of likelihood scenarios for use in coastal hazard classifications, based on a standard risk assessment framework (ISO 31000). This assessment utilises the 'Immediate Unlikely' and '2050 Unlikely' planning scenarios. The Unlikely scenario is defined as having "*a low possibility that the event (or chain of events) will occur, however, there may be a history of infrequent or isolated occurrences at some locations.*" and could be considered analogous to the 100-years Average Return Interval (ARI) condition. In fact, the adopted storm demand values for the unlikely scenario are equivalent to the commonly referenced 100-years ARI storm demand values on the NSW coast (e.g. from Gordon, 1987). The 100-years ARI storm condition is considered a suitable probability for consideration of coastal hazard exposure at Cuttagee Bridge, noting that design criteria for critical infrastructure would typically adopt a

probability level of 500-years or higher. The Tathra-Bermagui Road may be considered critical infrastructure for its use as part of evacuation routes during natural disasters.

Extreme Still Water Levels

Elevated still water levels (SWL) offshore of Cuttagee Lake occur during storm events. Elevated water levels during a storm event may be a result of:

- Barometric pressure set up.
- Wind setup.
- Astronomical tide.

The extreme SWL for the Cuttagee Lake region (Bermagui) has been calculated by MHL (2013), excluding wave setup and wave run up. The 1 in 100-year ARI SWL is 1.32 mAHD.

Sea Level Rise

The Bega Valley Shire Council has adopted a sea level rise (SLR) policy of an increase in mean sea level of 0.91m by 2100 above 1990 levels (WBM, 2015). However, to adequately account for the uncertain amount of SLR in the future, a range of SLR scenarios was adopted in WBM (2015) for the Almost Certain, Unlikely and Rare scenarios, as 0.12 m, 0.34 m and 0.5 m respectively by 2050, calculated as metres above present-day levels. This coastal hazard assessment has adopted a SLR of 0.34 m for the 2050 calculation (in keeping with the 'Unlikely' scenario).

Offshore Waves

The coastline off Cuttagee Lake is periodically exposed to large waves originating from a range of weather systems. The ARI of significant wave height (H_s) has been calculated from historical measured records at the Eden offshore buoy (Shand et al. 2011), using the one-hour exceedance value. The 1-year ARI H_s is 5.4m, increasing up to 8.5 m at the 100-year ARI. The storm peak wave period (T_p) ranges between 10 – 14 seconds, with the largest waves originating from a South-Easterly direction. The wave direction is an important consideration for Cuttagee Lake, as the entrance is afforded protection from offshore wave directions north of east due to the presence of Cuttagee Point. For example, the June 2016 east coast low event that cause widespread erosion in the Shoalhaven region did not significantly affect the existing Cuttagee Bridge, as the peak wave conditions arrived from the East-Northeast direction. The entrance is relatively more exposed to the predominant South-Easterly direction offshore wave direction.

Coastal Inundation Level

The inundation of the lower Cuttagee Lake area can be influenced by elevated ocean levels propagating through the open entrance channel. WBM (2015) calculated the coastal inundation for the Immediate 'Unlikely' scenario to be 2.59 mAHD, and the 2050 'Unlikely' scenario as 2.93 mAHD, with the latter incorporating a SLR of 0.34m. The inundation levels take account of wave setup (the super elevation of the water surface due to the release of energy from the breaking waves) at the shoreline, which can be more than 1m in magnitude for extreme conditions.

Lake Flood Behaviour

Cuttagee Lake is a shallow Intermittent Closed and Open Lake/Lagoon (ICOLL) which is periodically open to the ocean. However, the entrance is predominantly closed, as the influences of oceanic processes (primarily waves) are dominant compared with catchment inputs. The catchments of these systems are relatively small and therefore catchment flows are insufficient to keep the entrances permanently open (WBM, 2015). The entrance naturally opens during periods of increased catchment inflows. Typically, the lake water level reaches greater than 2.1 mAHD before this entrance opens naturally (BVSC, 2016). However, at 1.8 mAHD the inundation of roads starts to occur and to avoid this, the artificial opening the

lake has been enacted and is formalised through the Cuttagee Lake Entrance Opening Policy (BVSC, 2016). The policy sets out that the entrance channel is opened when water level in the lake is greater than 1.8 mAHD, with the artificial entrance created east of the bridge, towards the northern end of the beach. Despite choosing the initial opening location when artificially managing the lake, the natural variability of the channel could mean that a wide area of the entrance will scour, where it is not limited by bedrock. The area of potential entrance scour has not previously been defined.

The joint occurrence of catchment flows and offshore storm conditions has not been explicitly assessed, as it has been assumed that a natural or artificial breakout of the lake entrance would occur ahead of the peak of the coastal storm event.

Erosion and Recession Hazard

The erosion and recession hazard at Cuttagee Bridge is associated with several coastal processes, including short-term storm related erosion, long-term recession due to sea level rise and lake entrance processes. The following provides a summary of the erosion hazard at the site.

- **Erosion Hazard Extents**
  - WBM (2015) determined erosion and recession hazard extent lines based on wave climate, wave exposure, beach storm bite extent and capacity, extreme still water level, natural short to medium term shoreline variability and long-term recession, and SLR projections. A 100-year ARI storm demand of approximately 200 m^3/m at Cuttagee Beach was adopted (WBM, 2015).
  - The immediate erosion hazard line incorporates the storm bite to the crest of the erosion scarp above 0 mAHD, and short- to medium-term variations in shoreline position due to wave climate.
  - The 2050 and 2100 erosion hazard lines were determined by projecting the 'immediate' erosion extents and by incorporating shoreline recession trends and shoreline recession due to future SLR.
  - The 2050 Planning Horizon hazard extents show that in the Unlikely scenario, the bridge and southern access road may be exposed to erosion/recession (WBM, 2015). The 2100 Planning Horizon for the Unlikely scenario is to the west of the existing bridge, and therefore the bridge may be exposed to long-term erosion and recession hazard if no protection works are undertaken.
- **Erosion depth**
  - The impact of erosion on the bridge location is also bounded by the erosion depth through the entrance areas.
  - The northern extent of the existing bridge is founded on Palaeozoic age Adaminaby group bedrock, with Cainozoic age Quarternary coastal marine deposits. The proposed bridge at the northern abutment will be founded with concrete spread footings on the bedrock, and therefore will limit erosion to bedrock depth (Marshmen O'Neill Engineers, 2021).
  - At the southern end, the base bedrock is covered by a deep layer of coastal sand, that is greater than 10.45 m (below the current surface). The existing bridge pylons are supported through the dune system with driven fiction steel and timber piles. It is recommended by Marshmen O'Neill Engineers (2021) that the proposed southern abutment and intermediate piers be founded through the deep (>10.45 m) sand into the base bedrock.
  - A lagoon entrance scour depth of -0.5 mAHD was adopted for the immediate case, taken as the maximum scour depth that is likely to occur during a channel opening event, based on experience of flooding behaviour at other small ICOLLs in NSW. For the 2050 case, the erosion hazard line would encroach up to the bridge alignment and hence the channel scouring from flooding would have less of an influence than wave-dominated erosion. Therefore, the 2050 case has a scour depth of -1 mAHD (based on Neilson et al, 1992).
- **Historical Entrance Behaviour**
  - Baird performed an analysis of historical satellite images to determine the typical entrance channel location and behaviour, enabling a greater understanding and assessment of the likely entrance

position during an extreme event. This analysis applied the InletTracker Python toolkit to satellite images from 1987 - 2021, using a novel least cost pathfinding method to determine the channel position, and a machine learning algorithm to ascertain if the lake was open or closed (Heimhuber et al, 2021). This analysis revealed that the sand shoals are dynamic and constantly shifting; however, the channel typically runs closer to the northern abutment of the bridge, as seen in Figure 1. The imagery also revealed that the dune at the southern extent of the bridge is consistently vegetated, in addition to the vegetated island to the west of the bridge. This suggests that these locations are rarely inundated or affected by scour and have been adopted as the southern limit of entrance erosion in this assessment.

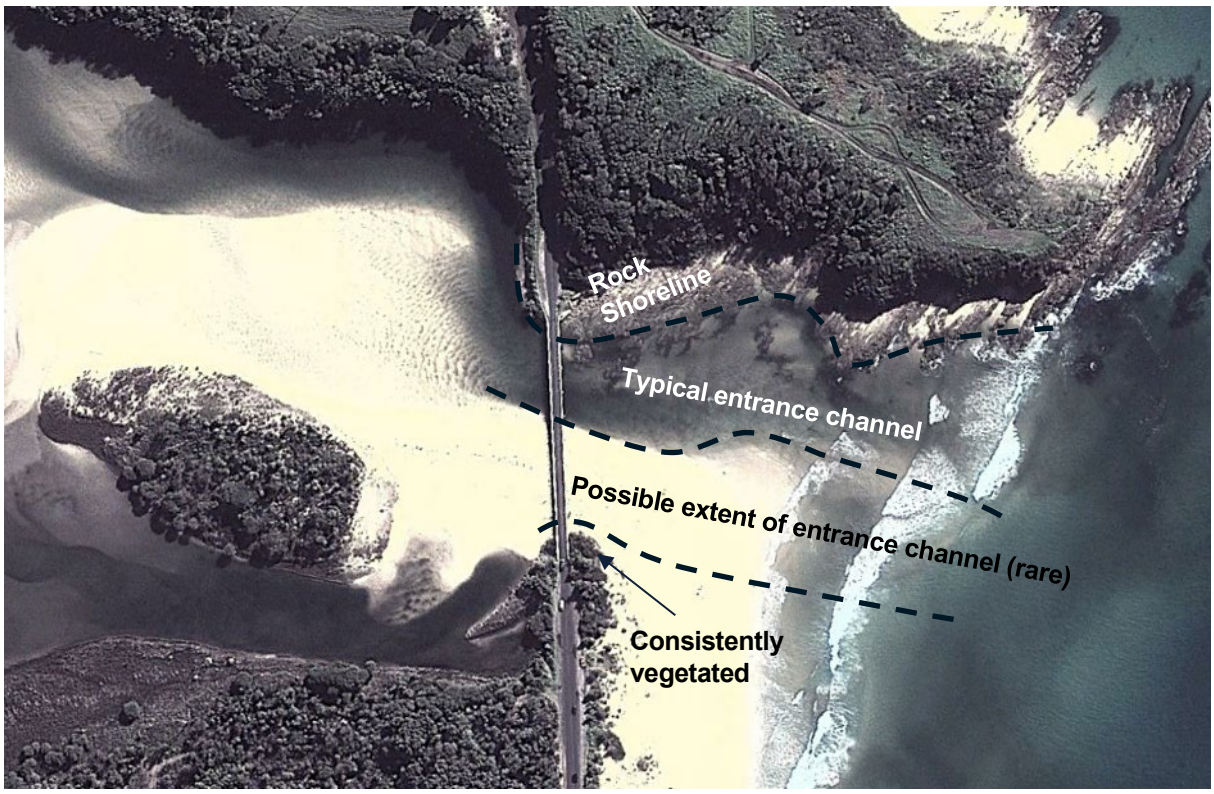

Figure 1: Summary of Cuttagee Lake Entrance Conditions

Through a detailed review of the WBM (2015) erosion/recession hazard lines, satellite imagery and analysis and assessment of the entrance channel behaviour, we have revised the Immediate 'Unlikely' hazard lines to extend through the entrance area. The 2050 'Unlikely' hazard line on the open coast has remained the same. Figure 2 depicts the revised erosion/recession hazard lines using the 'Unlikely' scenario.

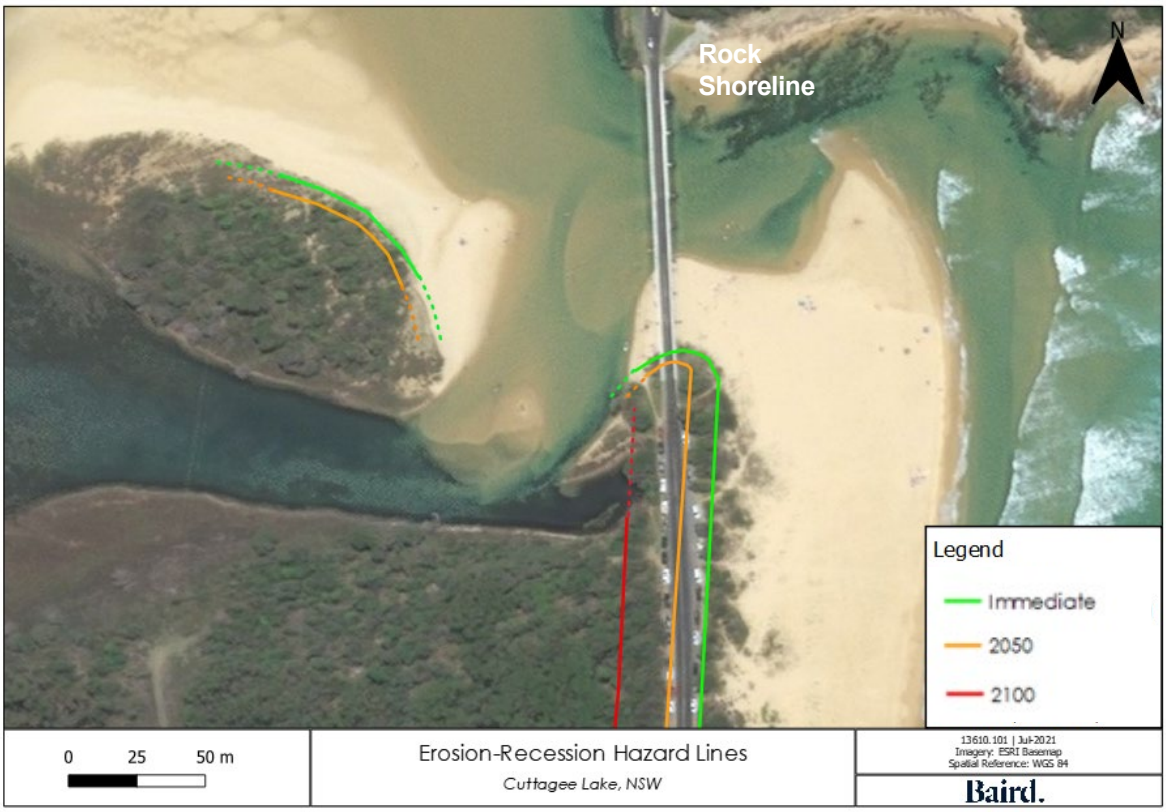

Figure 2: Extended Erosion/Recession Hazard Lines at Cuttagee Lake Entrance

Wave Runup and Propagation

The wave runup level for Cuttagee Beach was estimated as +5.5 mAHD (WBM, 2015). This wave runup level will not be achieved through an open entrance, however, wave penetration through an open entrance under an elevated SWL is possible. Therefore, Baird has calculated the maximum wave conditions that could impact the existing and proposed bridges. The nearshore significant wave height for the overtopping calculation was determined by applying the breaking wave equation of Goda (2010) to the offshore significant wave height of 8.5 m (WBM, 2015), with a period of 14 s (the 100-year ARI condition). This resulted in a nearshore depth limited significant wave height of 2.6 m in a water depth of 3.1 m for the immediate planning period, and a nearshore significant wave height of 3.0 m in a water depth of 3.9 m for the 2050 planning period. From this, the maximum wave crest elevations (wave crest height + coastal inundation level) were calculated to be +5.8 mAHD and +6.6 mAHD for the Immediate and 2050 planning periods, respectively.

Wave Overtopping

The overtopping rates for the existing and proposed bridge were evaluated for both the immediate and the 2050 planning periods, using the empirical EurOtop method for wave overtopping of plain vertical walls (EurOtop, 2018). Wave overtopping was calculated to estimate whether the rate of overtopping of the bridge surface remained within tolerable limits and hence considered safe for both cars and pedestrians. EurOtop (2018) provides guidance for acceptable mean overtopping rates based on the incident wave height. For the wave conditions described above, the following thresholds are interpreted (from EurOtop, 2018, Table 3.3):

- < 0.8 litres/sec per m for pedestrians
- < 7 litres/sec per m for vehicles

Determination of the overtopping rate requires the definition of the bridge design crest elevation as well as hydraulic input parameters including the water elevation, the significant wave height (H_s) and the mean wave period (for the calculation of wavelength, to define the occurrence of impulsive wave conditions). Wave overtopping equations for a vertical wall under impulsive wave conditions were applied (Equation 7.9 from EurOtop, 2018) which is considered a conservative estimate for the bridge structure. In reality, the open spans of the bridge would likely reduce the overtopping rate of the bridge deck compared to an impermeable vertical wall, however no readily applicable relationship exists for such structures.

The crest freeboard of the bridge was calculated as the bridge crest elevation minus the still water level. The existing and proposed bridge crest level is +4 mAHD, and the water level taken as the coastal inundation level, using the WBM (2015) 'Unlikely' values for the Immediate and 2050 cases, as outlined above.

For the existing and proposed bridge crest elevation of +4 mAHD, the following mean overtopping rates are estimated:

- Immediate 'Unlikely' scenario = 7.6 litres/sec per m
- 2050 'Unlikely' scenario = 8.1 litres/sec per m

Under both planning period scenarios, a bridge crest elevation of +4 mAHD is marginally above the acceptable overtopping rates for vehicles and significantly exceeds acceptable criteria for pedestrian access. Table 1 provides a summary of the bridge crest levels that would achieve the allowable overtopping thresholds.

Table 1: Bridge Crest Levels for Acceptable Overtopping Rates

Planning Period	Acceptable for Cars	Acceptable for Pedestrians
Immediate	+4.3 mAHD	+ 6.8 mAHD
2050	+4.5 mAHD	+ 7.6 mAHD

Note that the overtopping calculations apply an empirical relationship for solid vertical walls, and as such represent an upper estimate of mean overtopping rates of an open bridge span. To this end, a bridge crest level of +4 mAHD is considered to meet the allowable overtopping rate threshold for slow moving vehicles (defined as vehicles travelling <10km/hr). However, based on the wave crest elevation estimates there will be periods of time during an extreme event where overtopping depths are greater than 0.5m. At these depths cars and vans are unstable (HR Wallingford, 2006) hence it is recommended that for bridge crest levels lower than +5.5mAHD the bridge is closed to normal traffic during extreme coastal storm conditions.

To achieve safe access for pedestrians during extreme events, the bridge crest level would need to be raised. The required crest levels summarised in Table 2 have adopted a bridge crest level that elevates the bridge deck soffit to the maximum wave crest elevation for each planning period. This assumes a bridge deck thickness (soffit depth) of 1m based on the preliminary bridge design (Marshman O'Neill Engineers, 2020). This would minimise the amount of wave overtopping during extreme wave events thereby improving pedestrian access under such conditions, if required.

Summary

Baird have completed a coastal hazard assessment for Cuttagee Lake entrance in relation to the existing and proposed bridges that span the active lake entrance region. The coastal hazard assessment has considered available studies and data to define the offshore extreme wave and water level conditions, wave runup, and erosion and recession hazards. An assessment of channel entrance conditions, wave penetration and wave overtopping at the bridge location has then been made to determine the exposure of the bridge located to coastal hazards.

The assessment identifies that the existing and proposed bridge alignments are not at direct risk of erosion/recession hazards at the present day. However, the access road to the south of the bridge (Tathra-Bermagui Road) may be impacted by erosion during extreme event under the 2050 'Unlikely' scenario (nominally a 100yrARI coastal storm event that occurs in 2050) as shown in Figure 2.

An assessment of wave penetration and overtopping rates indicates that both the existing and proposed bridge crest elevations (+4 mAHD) would allow safe access for slow moving vehicles at both the Immediate and 2050 planning periods, assuming a structurally sound bridge structure. It is noted that for vehicles driven at moderate to high speed (>40km/hr), almost any wave overtopping would be deemed hazardous (EurOtop, 2018). Further, the calculated wave overtopping rates are very close to the acceptable thresholds for slow moving vehicles and wave overtopping depths would regularly exceed 0.5m during an extreme coastal event (a flood depth threshold for light vehicle stability; HR Wallingford, 2006). To this end, for a bridge crest level of +4 mAHD it would be recommended that access to the bridge be restricted to essential vehicles only during extreme coastal storm events, with road closed signage established. It is noted the wave overtopping rates significantly exceed acceptable criteria for pedestrian access for both the immediate and 2050 planning periods.

Raising the bridge to a level that minimises wave overtopping (thereby ensuring safe access for pedestrians and fast-moving vehicles) would require the bridge deck to be elevated above +7 mAHD which is not considered a practical or desirable solution. This is also the case for the Tathra-Bermagui access road to the south, that has pavement level at +4mAHD, and it is noted that safe access across the bridge would be governed as much by conditions on the access road as the bridge deck elevation.

It is understood that a dedicated pedestrian walkway is to be included in the bridge design. It would be recommended that the pedestrian walkway be located on the western side of the bridge alignment, to minimise wave overtopping exposure of the walkway during moderate to severe coastal events. Council may also consider the use of appropriate signage on the walkway waning of the potential dangers to pedestrians during extreme coastal storms.

It is noted that no assessment of the structural integrity (including potential wave loads and local scour around bridge piles) has been made for either the existing or proposed bridge structures.

With thanks,

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Document Approval and Revision History

Revision	Status	Comments	Prepared	Reviewed	Approved
A	Draft	Issued for Client Review	CS/SG	JC	SG
0	Final	Issued to Client	SG	JC	SG

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Appendix D NSW Threatened entities

D.1 Bionet Atlas: Threatened species

Scientific Name	Common Name	NSW status	Comm. status
^^Mixophyes balbus	Stuttering Frog	E1,P,2	V
Litoria aurea	Green and Golden Bell Frog	E1,P	V
Heleioporus australiacus	Giant Burrowing Frog	V,P	V
Eretmochelys imbricata	Hawksbill Turtle	P	V
Apus pacificus	Fork-tailed Swift	P	C,J,K
Hirundapus caudacutus	White-throated Needletail	P	V,C,J,K
Diomedea exulans	Wandering Albatross	E1,P	E
Diomedea gibsoni	Gibson's Albatross	V,P	V
Thalassarche cauta	Shy Albatross	V,P	V
Ardenna pacifica	Wedge-tailed Shearwater	P	J
Ardenna tenuirostris	Short-tailed Shearwater	P	C,J,K
Macronectes halli	Northern Giant-Petrel	V,P	V
Pterodroma solandri	Providence Petrel	V,P	
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	

Scientific Name	Common Name	NSW status	Comm. status
Hieraaetus morphnoides	Little Eagle	V,P	
Lophoictinia isura	Square-tailed Kite	V,P,3	
Burhinus grallarius	Bush Stone-curlew	E1,P	
Haematopus fuliginosus	Sooty Oystercatcher	V,P	
Haematopus longirostris	Pied Oystercatcher	E1,P	
Thinornis cucullatus cucullatus	Eastern Hooded Dotterel	E4A	V
Irediparra gallinacea	Comb-crested Jacana	V,P	
Arenaria interpres	Ruddy Turnstone	P	C,J,K
Calidris canutus	Red Knot	P	E,C,J,K
Limosa lapponica	Bar-tailed Godwit	P	C,J,K
Limosa limosa	Black-tailed Godwit	V,P	C,J,K
Numenius madagascariensis	Eastern Curlew	P	CE,C,J,K
Numenius minutus	Little Curlew	P	C,J,K
Numenius phaeopus	Whimbrel	P	C,J,K
Hydroprogne caspia	Caspian Tern	P	J
Sterna hirundo	Common Tern	P	C,J,K
Sternula albifrons	Little Tern	E1,P	C,J,K
Thalasseus bergii	Crested Tern	P	J
Callocephalon fimbriatum	Gang-gang Cockatoo	V,P,3	

Scientific Name	Common Name	NSW status	Comm. status
^^***Calyptorhynchus lathami***	Glossy Black-Cockatoo	V,P,2	
Glossopsitta pusilla	Little Lorikeet	V,P	
Lathamus discolor	Swift Parrot	E1,P,3	CE
Ninox connivens	Barking Owl	V,P,3	
Ninox strenua	Powerful Owl	V,P,3	
Tyto novaehollandiae	Masked Owl	V,P,3	
Tyto tenebricosa	Sooty Owl	V,P,3	
Anthochaera phrygia	Regent Honeyeater	E4A,P	CE
Epthianura albifrons	White-fronted Chat	V,P	
Daphoenositta chrysoptera	Varied Sittella	V,P	
Pachycephala olivacea	Olive Whistler	V,P	
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V,P	
Petroica boodang	Scarlet Robin	V,P	
Petroica phoenicea	Flame Robin	V,P	
Petroica rodinogaster	Pink Robin	V,P	
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E
Phascogale tapoatafa	Brush-tailed Phascogale	V,P	
Sminthopsis leucopus	White-footed Dunnart	V,P	

Scientific Name	Common Name	NSW status	Comm. status
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E1,P	E
Phascolarctos cinereus	Koala	V,P	V
Cercartetus nanus	Eastern Pygmy-possum	V,P	
Petaurus australis	Yellow-bellied Glider	V,P	
Petauroides volans	Greater Glider	P	V
Potorous tridactylus	Long-nosed Potoroo	V,P	V
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V,P	
Myotis macropus	Southern Myotis	V,P	
Phoniscus papuensis	Golden-tipped Bat	V,P	
Scoteanax rueppellii	Greater Broad-nosed Bat	V,P	
Miniopterus orianae oceanensis	Large Bent-winged Bat	V,P	
Eubalaena australis	Southern Right Whale	E1,P	E
Megaptera novaeangliae	Humpback Whale	V,P	V
Wilsonia backhousei	Narrow-leafed Wilsonia	V	
Pultenaea pedunculata	Matted Bush-pea	E1	

Scientific Name	Common Name	NSW status	Comm. status
Distichlis distichophylla	Australian Saltgrass	E1	
Persicaria elatior	Tall Knotweed	V	V
Pomaderris bodalla	Bodalla Pomaderris	V	
Correa baeuerlenii	Chef's Cap Correa	V	V

D.2 Bionet Atlas: Threatened ecological communities

Common Name	NSW status	Comm. status
Araluen Scarp Grassy Forest in the South East Corner Bioregion	E3	
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	E3	
Brogo Wet Vine Forest in the South East Corner Bioregion	E3	
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V
Dry Rainforest of the South East Forests in the South East Corner Bioregion	E3	
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	

Common Name	NSW status	Comm. status
Lowland Grassy Woodland in the South East Corner Bioregion	E3	CE
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	E3	E
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	E
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3	
Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions	E4B	
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands,	E4B	CE

Common Name	NSW status	Comm. status
NSW South Western Slopes, South East Corner and		

Appendix E Matters of National Environmental Significance

Australian Government

Department of Agriculture, Water and the Environment

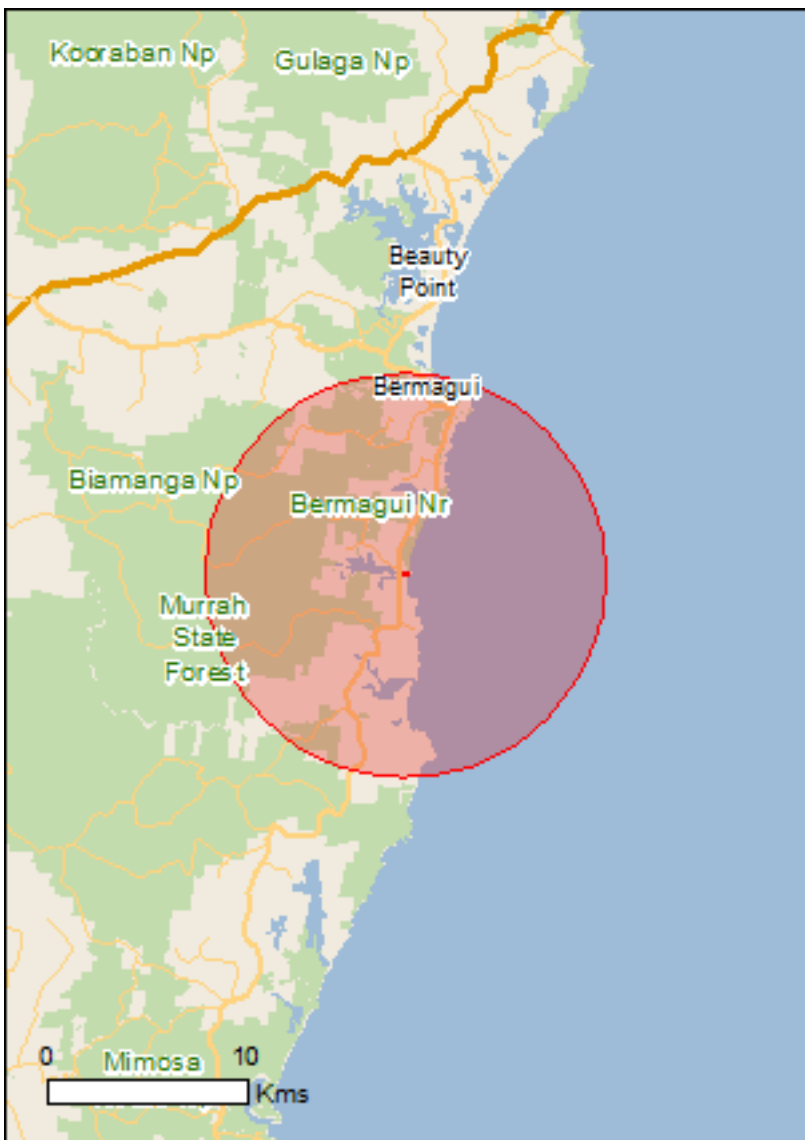
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

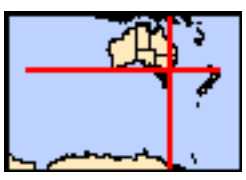
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 09/03/21 15:14:52



Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	66
Listed Migratory Species:	55

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	84
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	6
Regional Forest Agreements:	1
Invasive Species:	35
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-east
Temperate East

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Grassy Woodland in the South East Corner Bioregion	Critically Endangered	Community likely to occur within area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
[Diomedea antipodensis](#) Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Diomedea antipodensis gibsoni](#) Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Diomedea epomophora](#) Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Diomedea exulans](#) Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Diomedea sanfordi](#) Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
[Falco hypoleucos](#) Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
[Fregetta grallaria grallaria](#) White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
[Grantiella picta](#) Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
[Lathamus discolor](#) Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
[Limosa lapponica baueri](#) Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
[Macronectes giganteus](#) Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
[Macronectes halli](#) Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
[Neophema chrysogaster](#) Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
[Pachyptila turtur subantarctica](#) Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
[Phoebetria fusca](#) Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
[Pterodroma leucoptera leucoptera](#) Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis cucullatus cucullatus Hooded Plover (eastern), Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat may occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat known to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus		
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Caladenia tessellata		
Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Correa baeuerlenii		
Chef's Cap [17007]	Vulnerable	Species or species habitat known to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Haloragis exalata subsp. exalata		
Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat known to occur within area
Persicaria elatior		
Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat known to occur within area
Rhodamnia rubescens		
Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat may occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Sharks		
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area

Name	Threatened	Type of Presence
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Gallinago megala		
Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura		
Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus		
Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Cosmocampus howensis Lord Howe Pipefish [66208]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
[Arctocephalus pusillus](#) Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
[Eretmochelys imbricata](#) Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
[Balaenoptera acutorostrata](#) Minke Whale [33]		Species or species habitat may occur within area
[Balaenoptera borealis](#) Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Balaenoptera edeni](#) Bryde's Whale [35]		Species or species habitat may occur within area
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat may occur within area
[Balaenoptera physalus](#) Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
[Berardius arnuxii](#) Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
[Caperea marginata](#) Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
[Delphinus delphis](#) Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
[Eubalaena australis](#) Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
[Globicephala macrorhynchus](#) Short-finned Pilot Whale [62]		Species or species habitat may occur within area
[Globicephala melas](#) Long-finned Pilot Whale [59282]		Species or species habitat may occur within area

Name	Status	Type of Presence
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Bermaguee	NSW
Bermagui	NSW
Biamanga	NSW
Mimosa Rocks	NSW
Mumbulla	NSW
Murrah	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
Eden RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat may occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Upwelling East of Eden	South-east

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-36.487319 150.053792,-36.488388 150.053857,-36.488354 150.053857

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix F Threatened Species Habitat Evaluation

The table in this appendix present the habitat evaluation for threatened species, ecological communities and endangered populations listed in a 10km radius from the proposal area in the Atlas of NSW Wildlife[1] and those identified as potentially occurring in the area according to the Commonwealth EPBC Protected Matters Search Tool[2].

The likelihood of occurrence is based on presence of habitat, proximity of nearest records and mobility of the species (where relevant). The assessment of potential impact is based on the nature of the proposal, the ecology of the species and its likelihood of occurrence. The following classifications are used:

Presence of habitat:

Present: Potential or known habitat is present within the study area

Absent: No potential or known habitat is present within the study area

Likelihood of occurrence:

Unlikely: Species known or predicted within the locality but unlikely to occur in the study area

Possible: Species could occur in the study area

Present: Species was recorded during the field investigations

Possible to be impacted:

No: The proposal would not impact this species or its habitats. No Assessment of Significance (AoS) is necessary for this species

Yes: The proposal could impact this species or its habitats. An AOS has been applied to these entities.

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[1] The Atlas of NSW Wildlife is administered by the NSW Department of Environment& Heritage (OEH) and is an online database of fauna and flora records that contains over four million recorded sightings.

[2] This online tool is designed for the public to search for matters protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). It is managed by the Commonwealth Department of the Environment and Energy.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Flora				
Caladenia tessellata Thick Lip Spider Orchid, Daddy Long-legs *BC-E* *EPBC-V* *PMST*	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).	Present. Associated with PCT 721.	Unlikely. No records within 10 km of Development Site.	No.
Correa baeuerlenii Chef's Cap Correa *BC-V* *EPBC-V* *PMST*	Occurs in riparian sites within forests of various eucalypts, including Silvertop Ash (*Eucalyptus sieberi*), Yellow Stringybark (*E. muelleriana*), Blue-leafed Stringybark (*E. agglomerata*) and Spotted Gum (*Corymbia maculata*), or she-oak woodland. It may also be found in near-coastal rocky sites. Has been recorded between Nelligen (on Nelligen Creek and the Buckenbowra River) and Mimosa Rocks National Park.	Absent.	Although there are records throughout Murrah State Forest, west of Cuttagee Lake, and Mimosa Rocks NP, south of Development Site (albeit > 10km from site). PCT is not a correct match.	No.

[3] Information sourced from species profiles on NSW OEH's threatened species database or the Australian Government's Species Profiles and Threats database (SPRAT) unless otherwise stated.
BCD threatened species database: http://www.threatenedspecies.environment.nsw.gov.au/index.aspx
SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Cryptostylis hunteriana Leafless Tongue Orchid *EPBC-V* *PMST*	The species occurs mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. It prefers open areas in the understorey of forested communities. The soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi),* Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*).	Absent. Not associated with PCTs onsite	Unlikely. No records within 10 km of Development Site.	No. Not associated with PCTs onsite and no nearby records.
Distichlis distichophylla Australian Saltgrass *BC-E* *BioNet*	Australian Salt-grass is a spreading perennial grass, in the form of a loose, somewhat prickly clump of spreading underground stems (rhizomes). A coloniser of damp saline soils; found at the edges of salt marshes and on low dunes. The foliage is distinctive, with a row of thin stiff leaves to 50 mm on each side of the stem. It often grows with a similar-looking grass *Sporobolus virginicus*, and is best-distinguished in summer when in flower or fruit. This grass is common in Victoria and Tasmania, and extends to South Australia and Western Australia. In Victoria it is found inland as well, but in its limited NSW range it grows only in coastal situations, except for one existing population at Lake Cargelligo in south western NSW. Scattered records are from the areas of Jervis Bay, Bermagui, Wonboyn, Narooma, Bodalla and Nadgee Nature Reserve (at Womboyn).	Present. Occurring at estuary 4km south.	Unlikely, not seen during survey.	No.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Haloragis exalata subsp. exalata Square Raspwort, Wingless Raspwort *BC-V* *EPBC-V* *PMST*	Appears to require protected and shaded damp situations in riparian habitats. It is disjunct distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Species is known from a range of vegetation types, all with a history of recurrent disturbance – appears to be a post-disturbance coloniser.	Present about 400m west of the north end of bridge.	Possible. ALA shows several records around the edges of Cuttagee Lake. This population is considered an 'important population'.	Yes. Survey required.
Persicaria elatior Knotweed, Tall Knotweed *BC-V* *EPBC-V* *PMST*	**General habitat** Knotweed normally grows in damp places, including: • coastal with swampy areas (Quinn et al. 1995) • along watercourses, streams and lakes (NSW DECCW 2005ov) • swamp forest (NSW DECCW 2005ov) • disturbed areas (NSW DECCW 2005ov). Associated species include. *Melaleuca linearifolia*, *M. quinquenervia*, *Lophostemon suaveolens*, *Casuarina glauca*, *Corymbia maculata*, *Pseudognaphalium luteoalbum* and *Polygonum hydropiper* (NSW undated; Quinn et al. 1995). **Specific habitat** On South Stradbroke Island, Knotweed is found in waterholes under *Livistona australis* (Queensland Herbarium 1999). At Cornubia Wetland, where 12 specimens have been recorded, there are three different vegetation communities in the area (Leiper 2008). Leiper (2008) is not specific about whether a particular community is preferred. These vegetation communities are (Leiper 2008):	Absent. No associated PCT's in the Development Site.	Possible, BioNet record within 3km. Recorded where Cuttagee Creek opens into lagoon.	No. Not associated with PCTs onsite and no nearby records.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	• Regional Ecosystem 12.9.1; tall open forest on sedimentary derived soils with a mixture of gum species. Species include *Eucalyptus crebra*, *Angophora leiocarpa*, *Corymbia intermedia* and *L. confertus*. • Regional Ecosystem 12.3.8; swamps with *Cyperys* spp., *Schoenoplectus* spp. and *Eleocharis* spp. • Regional Ecosystem 12.3.5; *M. quinquenervia* open forest on coastal alluvium.			
Pomaderris Bodalla Bodalla Pomaderiris *BC-V* *BioNet*	On the south coast Bodalla Pomaderris occurs in moist open forest along sheltered gullies or along stream banks. In the upper Hunter valley, it occurs in open forest or woodland on open slopes.	Absent. Not associated with this site habitat.	Unlikely. Recorded growing on lower slopes running into a small rocky gully near Cuttagee Creek in 2004 and 2019 (ALA 2021)	No.
Pultenaea pedunculata Matted Bush-Pea *BC-E* *BioNet*	The Matted Bush-pea occurs in a range of habitats. NSW populations are generally among woodland vegetation, but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area.	Present. Associated with PCT 721. One record within development site.	Present. Historical (2000) and recent (2019) confirmed record along roadside at southern end of Development Site. Not	Yes. Targeted survey should be undertaken for any other individuals on-site. Confirmation and protection of the individual bush on-site should also occur. *Environmental Impact Assessment Guidelines state,* "Any

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
			targeted or seen during NGH survey (wrong time of year to survey for the species).	development or activities that result in loss of individuals or reduce recruitment to populations may have serious impacts" (NPWS 2002). Surveys should be conducted from September – November (NPWS 2002). There is also a likely a dormant seedbank around the recorded plant.
Wilsonia backhousei Narrow-leafed Wilsonia *BC-V BioNet*	Narrow-leafed Wilsonia is a perennial, sprawling, matted shrub less than 15 cm tall. The narrow, pointed, dark green, stalkless leaves are succulent and less than 20 mm long. The single white flowers are also stalkless. They have a 10 mm long slender tube with curled-back tips, from which purple-tipped stamens and style protrude. In NSW Narrow-leaf Wilsonia is found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney (Nelson's Lake, Potato Point, Sussex Inlet, Wowly Gully, Parramatta River at Ermington, Clovelly, Voyager Point, Wollongong and Royal National Park). It grows in all southern states.	Present just out of development site on sandy site.	Several records on the southern side of Cuttagee Lake, near the mouth, including one near the road – may be in the Development Site. Not seen directly within the development footprint.	Yes. The development site borders on habitat for this species. Care should be taken with any laydown areas near sandy section (signs effected for the species as part of the CEPM). If the development footprint changes at all, further surveys are advised. Within current design it is.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood *BC-CE* *EPBC-CE* *PMST*	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of R. rubescens typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. • Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. • This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	Absent.	Unlikely. Outside of species known distribution.	No. Outside of species known distribution.
Thesium australe Austral Toadflax *BC-V* *EPBC-V* *PMST*	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast, in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda triandra*).	Present.	Unlikely. No BioNet records within 10km buffer of site. Not seen during survey.	No.
Zieria tuberculata Warty Zieria *BC-V* *EPBC-V* *PMST*	Grows in heath amongst rocky outcrops on rain forest edges and in tall forest and shrubland. Occurs in the Mt Dromedary and Tilba Tilba area.	Absent. No Associated PCT's Present	Unlikely. No BioNet records within 10km buffer of site	No. Not associated with PCTs onsite and no nearby records.
Ecological Communities				

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Araluen Scarp Grassy Forest in the South East Corner Bioregion *BC-E*	Open forest or grassy woodland dominated by Maiden's Gum (Eucalyptus maidenii), Yellow Box (E. melliodora) and Forest Red Gum (E. tereticornis) in the canopy. Rough-barked Apple (Angophora floribunda), White Stringybark (E. globoidea) and Black Wattle (Acacia mearnsii) are common associated overstorey species. An open shrub layer may contain Tree Violet (Hymenanthera dentata), Sweet Pittosporum (Pittosporum undulatum) and various vines and climbers. The grassy groundlayer is generally sparse, and may contain Weeping Grass (Microlaena stipoides), Common Tick-trefoil (Desmodium varians), Creeping Beard Grass (Oplismenus imbecillis), Sickle Fern (Pellaea falcata) and Prickly Starwort (Stellaria pungens). The structure of the community varies depending on past and current disturbances, particularly clearing, selective firewood harvesting and grazing.	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions *BC-E*	Dense to open tree canopy, 5 – 20 m tall. Common tree species include Bangalay (Eucalyptus botryoides) and Coast Banksia (Banksia integrifolia subsp. integrifolia). Blackbutt (Eucalyptus pilularis) and Lilly Pilly (Acmena smithii) may occur in more sheltered situations. Swamp Oak (Casuarina glauca) may occur on dunes. Shrub stratum may be dominated by sclerophyllous species and/or mesophyllous, species. Groundcover species include Flax-lilies (Dianella spp.), Lepidosperma concavum, Spiny-headed Mat-rush (Lomandra longifolia), Bracken (Pteridium esculentum), and grasses including Blady Grass (Imperata cylindrica), Weeping Grass (Microlaena stipoides var. stipoides) and Kangaroo Grass (Themeda australis)	Present in the Southwest corner of the site.	Present	As outlined in the REF mitigation measures will be put in place to avoid any impact on vegetation within this PCT. Clear demarcation of this community from the works site, through fencing and signage for example, will be required.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Brogo Wet Vine Forest in the South East Corner Bioregion *BC-E*	Brogo Wet Vine Forest is a tall forest with a sparse small tree layer, open shrub layer and grassy ground layer. Forest Red Gum (Eucalyptus tereticornis) and Rough-barked Apple (Angophora floribunda) are the dominant tree species. The small tree layer is made up of one or more of Kurrajong (Brachychiton populneus), Sweet Pittosporum (Pittosporum undulatum), Hickory Wattle (Acacia implexa) and occasionally Port Jackson Fig (Ficus rubiginosa). The shrub layer is diverse and may include Cassinia trinerva, Tree Violet (Hymenanthera dentata), Coffee Bush (Breynia oblongifolia) and Blackthorn (Bursaria spinosa). The groundlayer is dominated by the grasses Weeping Grass (Microlaena stipoides), Creeping Beard Grass (Oplismenus imbecillis) and Forest Hedgehog Grass (Echinopogon ovatus), the herbs Kidney Weed (Dichondra repens), Stinking Pennywort (Hydrocotyle laxiflora), Large Tick-trefoil (Desmodium brachypodum), Stellaria flaccida and Glycine clandestina, and the ferns, Cheilanthes sieberi and Sickle Fern (Pellaea falcata). The grass species Hillside Burrgrass (Cenchrus caliculatus) is almost exclusively associated with this community in the Bega Valley region and is moderately common. This community is distinguished from other communities in the south east forests of NSW by the dominance of Forest Red Gum and the abundance of shrubs and vines.	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and	Occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. Frequently found as a zone on the landward side of mangrove stands. Plants include Baumea juncea, Sea Rush (Juncus krausii subsp. australiensis), Samphire	Marginal.	Present 200m upstream (SELLS mapping).	Unlikely temporary impact. Risk considered manageable through CEMP.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
South East Corner Bioregions *BC-E*	(Sarcocornia quinqueflora subsp. quinqueflora), Marine Couch (Sporobolus virginicus), Streaked Arrowgrass (Triglochin striata), Knobby Club-rush (Ficinia nodosa), Creeping Brookweed (Samolus repens), Swamp Weed (Selliera radicans), Seablite (Suaeda australis) and Prickly Couch (Zoysia macrantha). Occasionally mangroves are scattered through the saltmarsh. Tall reeds may also occur, as well as salt pans.			
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological Community *BC - E* *EPBC - E*	This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which Casuarina glauca (swamp oak) is the dominant species northwards from Bermagui. Other trees including Acmena smithii (lilly pilly), Glochidion spp. (cheese trees) and Melaleuca spp. (paperbarks) may be present as subordinate species and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and Melaleuca ericifolia is the only abundant tree in this community south of Bermagui. The understorey is characterised by frequent occurrences of vines, Parsonsia straminea, Geitonoplesium cymosum and Stephania japonica var. discolor, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter. The composition of the ground stratum varies depending on levels of salinity in the groundwater. Under less saline conditions prominent ground layer plants include forbs such Centella asiatica, Commelina cyanea, Persicaria decipiens and Viola banksii; graminoids such as Carex	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	appressa, Gahnia clarkei, Lomandra longifolia, Oplismenus imbecillis; and the fern Hypolepis muelleri. On the fringes of coastal estuaries, where soils are more saline, the ground layer may include the threatened grass species, Alexfloydia repens, as well as Baumea juncea, Juncus kraussii, Phragmites australis, Selliera radicans and other saltmarsh species. For a comprehensive list of species that characterize the community open the Scientific Determination link in the top right box.			
Dry Rainforest of the South East Forests in the South East Corner Bioregion *BC-E*	Dry Rainforest of the South East Forests is dominated by Port Jackson Fig Ficus rubiginosa which forms a dense canopy to about 10 m tall. Sweet Pittosporum Pittosporum unudulatum, Kurrajong Brachychiton populneus and a scattered emergent tree layer of Coast Grey Box Eucalyptus bosistoana and Forest Red Gum E. tereticornis also occur occasionally. Less common tree species are Native Rambutan Alectryon subcinereus and Giant Stinging Tree Dendrocnide excelsa. A sparse shrub layer may include Tree Violet Hymenanthera dentatum and Mock Olive Notelea venosa. The groundlayer is also sparse and includes Plectranthus graveolans, Sigesbeckia orientalis, Pellaea falcata, and the grass, Oplismenus imbecillis.	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.
Freshwater Wetlands on Coastal Floodplains of the	Found in coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams. Dominated by herbaceous plants and have	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
New South Wales North Coast, Sydney Basin and South East Corner Bioregions *BC-E*	very few woody species. Those that usually lack standing water dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5m tall and dominated by amphibious plants. If subject to regular inundation and drying, vegetation may include large emergent sedges over 1m tall. As standing water becomes deeper or more permanent, amphibious and emergent plants become less abundant, while floating and submerged aquatic herbs become more abundant.			
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia *BC - E* *EPBC-CE*	Littoral Rainforest is generally a closed forest, the structure and composition of which is strongly influenced by its proximity to the ocean. The plant species of this community are predominantly rainforest species. Several species have compound leaves, and vines may be a major component of the canopy. These features differentiate littoral rainforest from forest or scrub, but while the canopy is dominated by rainforest species, scattered emergent individuals of sclerophyll species, such as Angophora costata, Banksia integrifolia, Eucalyptus botryoides and Eucalyptus tereticornis occur in many stands. There is considerable floristic variation between stands and in particular areas, localised variants may be recognised. The Sutherland Shire Littoral Rainforest Endangered Ecological Community which was listed previously as an endangered ecological community is included within this community. Characteristic species of this community are cited in the NSW Scientific Committee Final Determination on the DEC website.	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Lowland Grassy Woodland in the South East Corner Bioregion *BC - E* *EPBC-CE*	Lowland Grassy Woodland in the South East Corner bioregion is the name given to the ecological community associated with rainshadow areas of the south coast and hinterland of New South Wales. Typically, the community comprises an open tree canopy, a near-continuous groundcover dominated by grasses and herbs, sometimes with layers of shrubs and/or small trees. Undisturbed stands of the community may have a woodland or forest structure. Small trees or saplings may dominate the community in relatively high densities after partial or total clearing. The community also includes 'derived' native grasslands which result from removal of the woody strata from the woodlands and forests.	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions *BC-E* *EPBC-E*	Dense, open or sparse layer of shrubs with soft-leaved sedges, grasses and forbs. May contain more than trace amounts of Sphagnum spp., the hummock peat-forming mosses. Small trees may be present as scattered emergents or absent. Has an open to very sparse layer of shrubs, 1-5m tall, though this layer may be very sparse or absent. Have dense groundcover of sedges, grasses and forbs, except where a dense cover of tall shrubs casts deep shade. Forbs growing amongst the sedges include Drosera spp., Geranium neglectum, Gratiola spp., Mitrasacme serpyllifolia, Ranunculus spp. and Viola spp. Hummocks of Sphagnum moss may occur amongst other components of the ground layer.	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales	Comprises river flats of the coastal floodplains. Has a tall open tree layer of eucalypts, which may exceed 40m in height. While the composition of the tree stratum varies considerably, the most widespread and abundant	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
North Coast, Sydney Basin and South East Corner Bioregions	dominant trees include Eucalyptus tereticornis (forest red gum), E. amplifolia (cabbage gum), Angophora floribunda (rough-barked apple) and A. subvelutina (broad-leaved apple). A layer of small trees may be present, along with scattered shrubs and groundcover composed of abundant forbs, scramblers and grasses.			
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria *BC - E* *EPBC-CE*	As the name suggests, this EEC is found on the river flats of the coastal floodplains. It has a tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include Eucalyptus tereticornis (forest red gum), E. amplifolia (cabbage gum), Angophora floribunda (rough-barked apple) and A. subvelutina (broad-leaved apple). Eucalyptus baueriana (blue box), E. botryoides (bangalay) and E. elata (river peppermint) may be common south from Sydney, E. ovata (swamp gum) occurs on the far south coast, E. saligna (Sydney blue gum) and E. grandis (flooded gum) may occur north of Sydney, while E. benthamii is restricted to the Hawkesbury floodplain. A layer of small trees may be present, including Melaleuca decora, M. styphelioides (prickly-leaved teatree), Backhousia myrtifolia (grey myrtle), Melia azaderach (white cedar), Casuarina cunninghamiana (river oak) and C. glauca (swamp oak). Scattered shrubs include Bursaria spinosa, Solanum prinophyllum, Rubus parvifolius, Breynia oblongifolia,	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	Ozothamnus diosmifolius, Hymenanthera dentata, Acacia floribunda and Phyllanthus gunnii. The groundcover is composed of abundant forbs, scramblers and grasses including Microlaena stipoides, Dichondra repens, Glycine clandestina, Oplismenus aemulus, Desmodium gunnii, Pratia purpurascens, Entolasia marginata, Oxalis perennans and Veronica plebeia . The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic shrubs, grasses, vines and forbs. For a comprehensive list of species that characterize the community open the Scientific Determination - http://www.environment.nsw.gov.au/determinations/riverflat36a.htm. This community also has a listing advice provided by the Commonwealth following its gazettal to the EPBC (http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=154&status=Critically Endangered). The combination of features that distinguish River-Flat Eucalypt Forest on Coastal Floodplains from other endangered communities on the coastal floodplains include: its dominance by either a mixed eucalypt canopy or by a single species of eucalypt belonging to either the genus Angophora or the sections Exsertaria or Transversaria of the genus Eucalyptus; the relatively low abundance or sub-dominance of Casuarina and Melaleuca species; the relatively low abundance of Eucalyptus			

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	robusta; and the prominent groundcover of soft-leaved forbs and grasses. River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions includes and replaces Sydney Coastal River-Flat Forest Endangered Ecological Community.			
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions *BC - E* *EPBC-E*	This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which Casuarina glauca (swamp oak) is the dominant species northwards from Bermagui. Other trees including Acmena smithii (lilly pilly), Glochidion spp. (cheese trees) and Melaleuca spp. (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and Melaleuca ericifolia is the only abundant tree in this community south of Bermagui.	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.
Subtropical and Temperate Coastal Saltmarsh *EPBC-V*	Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Characteristic plants include Baumea juncea, Sea Rush (Juncus krausii subsp. australiensis), Samphire (Sarcocornia quinqueflora subsp. quinqueflora), Marine Couch (Sporobolus virginicus), Streaked Arrowgrass (Triglochin striata), Knobby Club-rush (Ficinia nodosa), Creeping Brookweed (Samolus repens), Swamp Weed (Selliera radicans), Seablite (Suaeda australis) and Prickly Couch (Zoysia macrantha). Occasionally mangroves are	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	scattered through the saltmarsh. Tall reeds may also occur, as well as salt pans.			
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions *BC - E*	Themeda australis is the dominant species, and it may have a distinctive appearance. Banksia integrifolia subsp. integrifolia, Westringia fruticosa and Acacia sophorae occurs as an emergent shrub or as a dense cover. Smaller shrubs occur often as prostrate to dwarf forms. Woody species are usually sparsely distributed and may be absent from some stands. Poa poiformis-dominated tussock grassland is generally found lower on cliffs and on steeper slopes. Other grasses include Zoysia macarantha and Cynodon dactylon. A number of threatened species occur in some stands of the community, including Diuris sp. aff. chrysantha, Pultenaea maritima, Rutidosus heterogama, Thesium australe and Zieria prostrata.	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.
Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions *BC - E*	Werriwa Tablelands Cool Temperate Grassy Woodland ranges in structure from woodland to low open woodland. It is characterised by a sparse to very sparse (woodland to open woodland) tree layer dominated by Eucalyptus pauciflora (snowgum) either in single species stands or with E. rubida (candlebark) as a co-dominant. Other tree species have been recorded within the community, although very infrequently and always as canopy sub-dominants.	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and	Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum and a generally grassy understorey. The trees may occur as pure stands, mixtures of the three species or in mixtures	Absent.	Unlikely. All PCTs and TEC identified within site.	No. Not identified within site.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and *BC - E* *EPBC-CE*	with other trees, including wattles. Commonly co-occurring eucalypts include Apple Box (E. bridgesiana), Red Box (E. polyanthemos), E. macrorhyncha), Coastal Grey Box (E. moluccana), Candlebark (E. rubida), Bundy (E. goniocalyx), Broad-leaved Stringybark (E. goniocalyx), Youman's Stringybark (E. youmanii) and others.			
Birds				
Anthochaera phrygia Regent Honeyeater *BC-CE* *EPBC-CE* *BioNet, PMST*	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak, that inhabit woodlands that support a significantly high abundance and species richness of bird species, and have large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Recently recorded in urban areas around Albury where woodlands tree species such as Mugga Ironbark and	Yes. Associated PCT 722	Possible . Not within 'important areas of map'. BioNet record within 10km buffer. Only foraging habitat present.	No. 2 records within 10 km buffer. Though they may frequent the area, individuals will not likely be impacted by the works (small and manageable temporary impact to foraging habitat only).

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	Yellow Box were planted 20 years ago. A generalist forager, although mainly feeds on the nectar from a relatively small number of eucalypts that produce high volumes of nectar e.g. Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important e.g. Lower Hunter Spotted Gum forests support regular breeding events. Flowering of associated species such as *Eucalyptus eugenioides* and other Stringybark species, and *E. fibrosa* can also contribute important nectar flows at times. Nectar and fruit from *Amyema miquelii, A. pendula* and *A. cambagei* are also utilised. When nectar is scarce, lerp and honeydew can comprise a large proportion of the diet. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Nests in horizontal branches or forks in tall mature eucalypts, mistletoes and Sheoaks. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands.			
Artamus cyanopterus cyanopterus Dusky Woodswallow *BC-V*	Inhabits dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. Shrublands, heathlands, occasionally in moist forest or rainforest. Farmland, usually at the edges of forest or woodland. Nest sites generally occur in shrubs or low trees, living or dead, horizontal or upright forks in branches, spouts, hollow stumps or logs, behind loose bark or in a hollow in the top of a wooden fence post.	Present. Associated with PCT 721 in the project area.	Possible. Record within the 10km buffer of BioNet search.	No. Though they may frequent the area, individuals will not likely be impacted by the works (small and manageable temporary impact to foraging habitat only).

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Botaurus poiciloptilus Australasian Bittern *EPBC-E* *PMST*	Favours permanent freshwater wetlands with tall, dense vegetation, particularly *Typha* spp. and *Eleocharis.* Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely vegetated wetlands on a platform of reeds; there are usually six olive-brown eggs to a clutch. Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges.	Absent. No Associated PCTs in the project area.	Unlikely. Not record within the 10km buffer of BioNet search	No. No Associated PCTs or sighting in the area. Though they may frequent the area, individuals will not likely be impacted by the works (small and manageable temporary impact to foraging habitat only).
Burhinus grallarius Bush Stone-Curlew *BC-E* *BioNet*	Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer.	Present. Though not associates with PCT immediately on-site. The Bangalay PCT has could provide habitat and foraging may occur around bridge.	Possible. Record within the 10km buffer of BioNet search.	No. Though they may frequent the area, individuals will not likely be impacted by the works (small and manageable temporary impact to foraging habitat only).
Callocephalon fimbriatum Gang-gang Cockatoo *BC-V* *BioNet*	In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. In spring and summer,	Present. Associate with PCT 722 in area. Foraging habitat contiguous with site.	Possible. 16 BioNet records within 10 km.	No. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. May also occur in sub-alpine Snow Gum (Eucalyptus pauciflora) woodland and occasionally in temperate rainforests. The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August. Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (Allocasuarina littoralis), Forest She-oak (A. torulosa) or Drooping She-oak (A. verticillata) occur. In the Riverina area, inhabits open woodlands dominated by Belah (Casuarina cristata). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill.			impact to foraging habitat only).
Calyptorhynchus lathami Glossy Black-cockatoo *BC-V*	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western	Present. Associate with PCT 721 in area. Foraging habitat	Possible. Many BioNet records within 10 km.	No. Though they may frequent the area, individuals will not likely be directly impacted by

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
BioNet	plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August. Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (Allocasuarina littoralis), Forest She-oak (A. torulosa) or Drooping She-oak (A. verticillata) occur. In the Riverina area, inhabits open woodlands dominated by Belah (Casuarina cristata). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill.	contiguous with site.		the works (small and manageable temporary impact to foraging habitat only).
Dasyornis brachypterus Eastern Bristlebird *BC-E* *EPBC-E* *PMST*	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone. Age of habitat since fires (fire-age) is of paramount importance to this species. The Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, habitat in northern NSW requires frequent fires to maintain habitat condition and suitability. The northern fire regimes are between 3-6 years and of variable intensity depending on the habitat condition.	Absent.	No BioNet records within 10 km	No.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Daphoenositta chrysoptera Varied Sittella *BC-V*	In NSW most individuals have a grey head and are streaked with dark brown, but in the extreme north-east they have a white head, and in the extreme south-west a black cap. The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades	Marginal. Associated with PCT 722.	One BioNet records within 10 km	No. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Diomedea antipodensis gibsoni Gibson's Albatross *BC-V* *EPBC-V* *BioNet* *PMST* *(name change from: Diomedea gibsoni)*	Gibson's Albatross is marine, pelagic and aerial. In the Antarctic, it occurs in open water, and rarely enters the belt of icebergs region (Falla 1937a; Hicks 1973). In late summer, it may approach the edge of the pack-ice (Darby 1970). Gibson's Albatross flies within 15 m of the sea surface, using the updraft from wave fronts for lift. It circles over breeding islands to heights of at least 1500 m (Marchant & Higgins 1990). On breeding islands, the Gibson's Albatross nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground (Falla 1937a; Warham & Bell 1979). Nests of the Gibson's Albatross are sited on moss terraces, in dense tussocks, and often in loose aggregations on the west (windward) side of islands. It prefers open or patchy vegetation (tussocks, ferns or shrubs), and it requires nesting areas that are near exposed ridges or hillocks so that it can take off (Warham & Bell 1979).	Absent. No Associated PCT nor good habitat to land at.	Unlikely	Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Epthianura albifrons White-fronted Chat *BC-V* *BioNet*	The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas.	Marginal. No Associated PCT nor good habitat to land at.	Possible. There are salt marshes very close to site.	No. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Falco hypoleucos Grey Falcon *BC-E* *EPBV-V* *PMST*	Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast, and near wetlands where surface water attracts prey. Preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring. Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Believed to be extinct in areas with more than 500mm rainfall in NSW.	Absent. No associated PCTs present.	Unlikely. No BioNet records within 10km buffer.	No. There is no associated PCTs or records of the species in the area.
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), Whitebellied	The White-bellied Storm-Petrel occurs across sub-tropical and tropical waters in the Tasman Sea, Coral Sea and, possibly, the central Pacific Ocean (Harrison 1983; Hutton 1991; Marchant & Higgins 1990). In the non-breeding season, it reaches and forages over near-shore waters	Absent. No associated PCTs present as a Marine species.	Unlikely. No BioNet records within 10km buffer.	No. individuals are unlikely to frequent the area, furthermore individuals will not likely be directly impacted by

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Storm-Petrel (Australasian) *EPBC-V* *PMST*	along the continental shelf of mainland Australia (Holmes 1977; Priddel 1996). It breeds, in Australian territory, on offshore islets and rocks in the Lord Howe Island group (Hutton 1991). It nests in crevices between large volcanic rocks (Fullagar et al. 1974; Hutton 1991), and in burrows excavated in banks (Hindwood 1940; McAllan et al. 2004). Breeding colonies are often situated along dykes (Fullagar 2002, pers. comm.). The White-bellied Storm-Petrel (Tasman Sea) does not occur in any of the ecological communities that are listed as threatened under the EPBC Act 1999. It is not known to associate with any other species or subspecies that is listed as threatened under the EPBC Act 1999.			the works (small and manageable temporary impact to foraging habitat only).
Glossopsitta pusilla Little Lorikeet *BC-V* *BioNet*	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Occupies isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.	Marginal. Associated with PCT 722. No breeding habitat (hollow-bearing trees) evident.	Possible. Many BioNet records within 10 km. However, construction noise will likely keep them away.	No. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Grantiella picta Painted Honeyeater	Nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing	Marginal. Associated with PCT 722.	Unlikely. No BioNet records	No.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
BC-V *EPBC-V* *PMST*	Range in NSW, Victoria and southern Queensland. Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema.* Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.	Distributed inland of Great Dividing Range.	within 10km buffer.	
Haematopus fuliginosus Sooty Oystercatcher *BC-V* *BioNet*	Sooty Oystercatchers are found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Small numbers of the species are evenly distributed along the NSW coast. The availability of suitable nesting sites may limit populations. The species favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries.	Present. Sand flats and beach contiguous with site. Foraging habitat.	Possible.	Yes. Potential breeding habitat around bridge, targeted survey needed before works. Individuals will most likely avoid the site during works. Works should be put on hold if birds start to feed in the area, and resume when they vacate.
Haematopus longirostris Pied Oystercatcher *BC-E* *BioNet*	The species is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria, such as Corner Inlet. In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State. 'Pied' Oystercatchers are occasionally recorded on Lord Howe island but it is uncertain which species is involved. The species favours intertidal flats of inlets and bays, open beaches and sandbanks..	Present. Sand flats and beach contiguous with site. Foraging habitat.	Possible.	Yes. Potential breeding habitat around bridge, targeted survey needed before works. Individuals will most likely avoid the site during works. Works should be put on hold if birds start to feed in the

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
				area, and resume when they vacate.
Haliaeetus leucogaster White-bellied Sea Eagle *BC-V* *BioNet*	The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. The species also occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).	Present. Foraging habitat. No nesting sites observed during site visit.	Possible flying overhead. And foraging around bridge.	No. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Hieraaetus morphnoides Little Eagle *BC-V* *BioNet*	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. The species often occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Marginal. Foraging habitat.	Possible flying overhead.	No. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Irediparra gallinacean Comb-crested Jacana *BC-V* *BioNet*	Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation. Forage on floating vegetation, walking with a characteristic bob and flick. They feed primarily on insects and other invertebrates, as well as some seeds and other vegetation.	Absent. No associated PCTs present.	Unlikely. Needs permanent freshwater wetland.	No.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	Breed mainly in spring and summer in NSW, with clutches recorded from September to April. The nest is a platform or shallow cup of vegetable material, though eggs sometimes laid directly onto a large leaf with no nest built. The male builds the nest, incubates the eggs and broods the young. Eggs that roll into the water from a nest are usually retrieved. The young are precocial, but the adult male can carry one or two under each wing if they are threatened and drop them in separate places. Young birds will dive and stay submerged with just their nostrils exposed for a very long time. Adults will also dive for safety on occasion. Comb-crested Jacanas are dispersive, moving about in response to the condition of wetlands, and occasionally turn up well beyond normal range.			
Lathamus discolor Swift Parrot *BC-E* *EPBC-CE* *BioNet, PMST*	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Migrates to the Australian south-east mainland between March and October. No breeding in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*.	Marginal. Not associated with any PCTs on site. Foraging habitat only.	Possible.	No. not associated with PCTs. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Lophoictinia isura Square-tailed Kite *BC-V*	"The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered	Present. Foraging habitat.	Possible flying overhead.	No. Though they may frequent the area, individuals will not likely

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
BioNet	records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.			be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Neophema chrysogaster Orange-bellied Parrot *BC-CE* *EPBC-CE* *PMST*	Breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia, southern Victoria, and occasional reports from NSW. Winter habitat is saltmarsh and strandline/foredune vegetation communities either on coastlines or coastal lagoons. Spits and islands are favoured but they will turn up anywhere within these coastal regions. Forages in weedy areas associated with these coastal habitats or even in totally modified landscapes such as pastures, seed crops and golf courses.	Marginal. No Associated PCTs.	Unlikely. No record within BioNet 10km Buffer.	No. No habitat or record or species present. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Ninox connivens Barking Owl *BC-V* *BioNet*	Although common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Many populations crashed as woodland on fertile soils was cleared over the past century, leaving linear riparian strips of remnant trees as the last inhabitable areas. Surveys in 2001 demonstrated that the Pilliga Forest supported the largest population in southern Australia. The owls sometimes extend their home range into urban areas, hunting birds in garden trees and insects attracted to streetlights.	Absent. No Associated PCTs. Too close to the coast minimal open vegetation for hunting.	Unlikely.	No.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Ninox strenua Powerful Owl *BC-V* *BioNet*	In NSW the Powerful Owl lives in forests and woodlands occurring in the coastal, escarpment, tablelands and western slopes environments. Specific habitat requirements include eucalypt forests and woodlands on productive sites on gentle terrain; a mosaic of moist and dry types, with mesic gullies and permanent streams; presence of leafy sub-canopy trees or tall shrubs for roosting; presence of large old trees to provide nest hollows. Optimal habitat includes a tall shrub layer and abundant hollows supporting high densities of arboreal marsupials. Roosts in groves of dense mid-canopy trees or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines, but also adjacent to cliff faces and below dry waterfalls. Species commonly used for roosting include the She-oaks Allocasuarina spp., rainforest species such as Coachwood Ceratopetalum apetalum, Lilly Pilly Acmena smithii and Sassafras Doryphora sassafras, Black Wattle Acacia melanoxylon, Turpentine Syncarpia glomulifera and eucalypts. In NSW the species occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. It generally occupies coastal lakes, inlets, bays and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets.	Present. Foraging habitat.	Unlikely.	No. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Pachycephala olivacea Olive Whistler *BC-V* *BioNet*	The Olive Whistler is a small, stocky bird with a large head and strong sharp bill. It grows up to 22 cm long, including the 10 cm tail. It has a dark grey head, olive-brown upperparts, a grey throat and buff-brown underparts. The female is duller in colour than the male. The Olive Whistler has perhaps the most rich and melodious array of calls of any of the whistlers. The Olive Whistler inhabits the wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range.	Marginal. Associated with PCT 721.	Possible. Record within BioNet 10km Buffer.	No. Recorded in 10km range, no suitable known habitat on site.. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Petroica boodang Scarlet Robin *BC-V* *BioNet*	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. The Scarlet Robin is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.	Marginal. Associated with PCT 722.	Possible. Record within BioNet 10km Buffer.	No. Recorded in 10km range, no suitable known habitat on site. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Petroica phoenicea Flame Robin *BC-V* *BioNet*	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. In winter, migrate to drier more open habitats in the lowlands, in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. Occasionally seen in heathland or other shrublands in coastal areas.	Marginal. Associated with PCT 722 and 721.	Possible. Record within BioNet 10km Buffer.	No. Recorded in 10km range, no suitable known habitat on site. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Petroica rodinogaster Pink Robin *BC-V* *BioNet*	Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW.	Marginal. Not associated with PCTs on site.	Possible. Record within BioNet 10km Buffer.	No. Though recorded in 10km range no habitat present. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Pterodroma solandri Providence Petrel *BC-V* *BioNet*	Marine. Nest on the tops of Mount Gower and Mount Lidgbird and to a less extent, on the lower slopes of the mountains. The nest is a grass lined chamber at the end of a burrow, 1 - 2 metres in length.	Absent. No Associated PCTs Present	Unlikely.	No. individuals are unlikely to frequent the area, furthermore individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Pachyptila turtur subantarctica Fairy Prion (southern) *EPBC-V* *PMST*	Marine; found mostly in temperate and subantarctic seas. The species as a whole is abundant in south-east Australia, New Zealand and Indian Ocean waters but its oceanic distribution is poorly known. Sometimes forages over the continental shelves and continental slopes but can come close inshore during rough weather. Breeds on islands and rock stacks; burrowing in soil or using crevices and caves in cliffs or rock falls; can also nest in scrub, herbland, tussock or pasture.	Absent. No Associated PCTs Present	Unlikely. No BioNet record within 10km.	No. No Associated PCT's or record of occurrence found.
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel *BC-V* *EPBC-E* *PMST*	Gould's Petrel is a pelagic marine species, spending much of its time foraging at sea and coming ashore only to breed. The Australian subspecies breeds and roosts on two islands off NSW, Cabbage Tree and Boondelbah Islands, and the at-sea distribution is poorly known (NSW 2006a; D'Ombrain 1970; Fullagar 1976; Hindwood & Serventy 1941; Hull 1911b; Priddel & Carlile 1995b, 1997; Priddel et al. 1995). The breeding colonies on Cabbage Tree Island and Boondelbah Island are in the transitional zone between the subtropical (with maximum summer rainfall) and temperate climatic zones (with maximum winter rainfall) (NPWS 2003). On Cabbage Tree Island, Gould's Petrels mostly breed among rocky scree and beneath coarse woody debris in gullies dominated by dense rainforest, heavily vegetated with Cabbage Tree Palms (Livistonia australis), figs (Ficus) and Native Plums (Planchonella australis) (NSW 2006b; D'Ombrain 1970; Fullagar 1976; Hindwood & Serventy 1941; Hull 1911b; Priddel & Carlile 1995b, 1997; Priddel et al. 1995), but also occasionally among	Absent. No Associated PCTs Present	Unlikely. No BioNet record within 10km.	No. No Associated PCT's or record of occurrence found.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	tussocks of mat-rush (Lomandra longifolia) (D'Ombrain 1970). Nests occur from just above sea level to elevations of 120 m (Fullagar 1976). Boondelbah Island is relatively treeless, except for a few wind-sheared trees, and is dominated by low vegetation. Here Gould's Petrels breed in artificial nest boxes, in piles of rocks and in the cavities between rocks (Priddel & Carlile 1995, 1997a). The at-sea habitat preferences of Gould's Petrel are poorly understood. It often occurs in the warm waters of the East Australian Current, where the sea-surface temperature ranges from 9.7–23.0 °C (Barton 1980; Blaber 1986; Hindwood & Serventy 1941; Reid et al. 2002); and off south-western Western Australia, where cold subantarctic waters intrude into warmer waters with a sea-surface temperature of about 15 °C (Surman et al. 1997). Of the 965 records of Gould's Petrels from south-eastern Australia, 58% were over the continental slope, 39% over open ocean and 3% over the continental shelf (Reid et al. 2002). The species also occasionally occurs over seamounts, where upwelling probably occurs, but these observations may refer to other subspecies (Barton 1980; Blaber 1986; Reid et al. 2002).			
Rostratula australis Australian Painted Snipe BC-E EPBC-E	A small freshwater wader restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are	Absent. No associated PCTs.	Unlikely. No record in BioNet 10km radius.	No. No Associated PCTs or records in area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
PMST	from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella and wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The nest consists of a scrape in the ground, lined with grasses and leaves.			
Sternula nereis nereis Australian Fairy Tern EPBC-V PMST	The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayment's of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline (Higgins & Davies 1996; Lindsey 1986a). The bird roosts on beaches at night (Higgins & Davies 1996). The subspecies may migrate within southern Western Australia and Tasmania, where are seen less frequently during the winter months. The bird is more sedentary in the north of Western Australia, South Australia and Victoria (Hill et al. 1988).	Absent. No associated PCTs.	Unlikely. No record in BioNet 10km radius.	No. No Associated PCTs or records in area.
Thalassarche bulleri platei — Northern Buller's Albatross, Pacific Albatross *EPBC-V*	The Pacific Albatross is a marine, pelagic species. It occurs in subtropical and subantarctic waters of the South Pacific Ocean (Marchant & Higgins 1990). Habitat preferences are poorly known (Marchant & Higgins 1990). In New Zealand, the species has been observed in association with fishing boats close inshore and over	Present. There is streams present that may provide food (though they streams are fresh).	Unlikely. No BioNet Record in 10km radius.	No. individuals are unlikely to frequent the area, furthermore individuals will not likely be directly impacted by the works (small and

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
PMST	waters of 180–360 m depth (Robertson & Jenkins 1981; Secker 1969) although it is not so strongly associated with fishing grounds as are other albatrosses (Bartle 1974). In Australia, the species occurs over inshore, offshore and pelagic waters (Blaber 1986; Carter 1977; Rogers 1969) and off the coast of south-east Tasmania. The Pacific Albatross prefers waters of the East Australia Current where sea surface-temperatures are greater than 16.5 °C (Blaber 1986). The birds fly in low or medium airspace using updraft off sea swell for lift (Marchant & Higgins 1990). The species takes food from the surface with shallow dives to depth of 1 m observed (Fenwick 1978). The birds breed on subtropical and subantarctic islands and rock stacks in the New Zealand region, on sparsely vegetated slopes, cliff tops and ledges on rocky islands or stacks (Dawson 1973; Robertson 1974; Wright 1984).			manageable temporary impact to foraging habitat only).
Thinornis cucullatus cucullatus — *Hooded Plover (eastern), Eastern Hooded Plover* *EPBC-V* *PMST*	Its natural habitats are freshwater lakes, freshwater marshes, coastal saline lagoons, and sandy beaches. Heavy populations are found on beaches with seaweed and dunes. It is threatened by habitat loss because of its small population and limited native range. It is a non-migratory inhabitant of coastal and subcoastal Western Australia, South Australia, New South Wales, Victoria and Tasmania, and is a vagrant in Queensland.	Present. Sand flats and beach contiguous with site. Foraging habitat. Potential breeding habitat.	Possible.	Yes. Potential breeding habitat around bridge, targeted survey needed before works. Individuals will most likely avoid the site during works. Works should be put on hold if birds start to feed in the area, and resume when they vacate.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Tyto novaehollandiae Masked Owl *BC-V* *BioNet*	Found in dry eucalypt forests and woodlands from sea level to 1100 m.	Present. Foraging habitat.	Unlikely.	No. Will likely avoid site during works, (very shy nocturnal).
Tyto tenebricosa Sooty Owl *BC-V* *BioNet*	Found in rainforests, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Nests in very large tree-hollows. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (Pseudocheirus peregrinus) or Sugar Glider (Petaurus breviceps).	Absent.	Unlikely.	No.
Mammals				
Chalinolobus dwyeri Large-eared Pied Bat *BC-V* *EPBC-V* *PMST*	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Found in well-timbered areas containing gullies. Females have been recorded raising young in maternity roosts from November to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months.	Absent. Species is geographically restricted to area north of Batemans Bay.	Unlikely. No BioNet record in the area.	No. Due to geographical restrictions and lack of records in the area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Cercartetus nanus Eastern Pygmy-possum *BC-V*	Found in rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath. Woodlands and heath appear to be preferred, except in north-eastern NSW where most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes. Tree hollows are favoured for nesting.	Present. Associated PCT 721 in project area.	Unlikely. No hollow bearing trees or burrawangs on-site for nesting. Last record 1980, in Eucalypt vegetation 1km south of site. Habitat around bridge fragmented and unlikely to be adequate for the Pygmy-possum.	No.
Dasyurus maculatus maculatus (SE mainland population) — Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) *BC- V* *EPBC-E* *PMST*	The Spot-tailed Quoll has a preference for mature wet forest habitat (Belcher 2000b; Green & Scarborough 1990; Watt 1993), especially in areas with rainfall 600 mm/year (Edgar & Belcher 2008; Mansergh 1984). Unlogged forest or forest that has been less disturbed by timber harvesting is also preferable (Catling et al. 1998, 2000). This subspecies has been recorded from a wide range of habitats, including: • temperate and subtropical rainforests in mountain areas • wet schlerophyll forest • lowland forests • open and closed eucalypt woodlands • inland riparian and River Red Gum (*Eucalyptus camaldulensis*) forests	Present. Associated PCT 722 in project area. Foraging habitat only no den sites seen during site survey.	Unlikely. No BioNet record in the area.	No

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	• dry 'rainshadow' woodland • sub-alpine woodlands • coastal heathlands • occasional sightings from open country, grazing lands, rocky outcrops and other treeless areas (Edgar & Belcher 2008; Green & Scarborough 1990; Jones & Mansergh 1995a; Maxwell et al. 1996; NSW NPWS 1999; Reside 1997 cited in Dawson 2005; Rose 1996 cited in Dawson 2005). Belcher (2000b) observed that Spot-tailed Quolls at Suggan Buggan used escarpment and gully habitats. Possum, rat and antechinus scats were observed on the cliffs, rock ledges and outcrops along the escarpment suggesting that it was a prey-rich habitat. The gullies utilised by Spot-tailed Quolls featured an abundance of Rabbits (*Oryctolagus cuniculus*) and possums (Belcher 2000b). **Habitat requirements** The Spot-tailed Quoll is predominantly nocturnal and rests during the day in dens (Jones et al. 2001). Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves (NPWS 1999at). Individuals also require an abundance of food, such as birds and small mammals, and large areas of relatively intact vegetation through which to forage (NSW NPWS 1999at). This subspecies is moderately arboreal and approximately 11% of travelling is done in trees (Jones 1995 cited in Jones et al. 2001).			
Isoodon obesulus obesulus Southern	Found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River, southern coastal Victoria and the Grampian Ranges, south-eastern South	Present. Associated PCTs	Possible. BioNet Record within project area.	No. Species may frequent area foraging. The vegetation on site

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Brown Bandicoot (eastern) *BC-E* *EPBC-E* *Bionet, PMST*	Australia, south-west Western Australia and the northern tip of Queensland. Southern Brown Bandicoots are largely crepuscular. Found in heath or open forest with a heathy understorey on sandy or friable soils. Feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous (underground-fruiting) fungi. Searches for food often create distinctive conical holes in the soil. Nest during the day in a shallow depression in the ground covered by leaf litter, grass or other plant material. Nests may be located under Grass trees *Xanthorrhoea* spp., blackberry bushes and other shrubs, or in rabbit burrows.	721. Foraging habitat.		is fragmented and is likely no to have a population relying on it wholly. Impacts would be manageable and temporary to foraging habitat.
Myotis macropus Southern Myotis BC-V	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.	Present, there is potential for a colony residing in the bridge.	Likely.	Yes. Survey required to confirm species is not present on site.
Petauroides volans Greater Glider *EPBC-V,M* *PMST*	Arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. Feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. Shelter during the day in tree hollows and will use up to 18 hollows in their home range. Typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. Favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species.	Absent. No tall or hollow-bearing trees within the Development Site.	Possible. There is BioNet records within the area.	No, absence of hollow-bearing trees.
Petaurus australis	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great	Absent. Old-growth forest and	Unlikely.	No.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Yellow-bellied Glider *BC-V* *BioNet*	Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey.	hollow-bearing trees not present within the Site.		
Phascogale tapoatafa Brush-tailed Phascogale	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Nest and shelter in tree hollows with entrances 2.5 - 4 cm wide and use many different hollows over a short time span.	Absent. No associated with PCTs on site.	Unlikely.	No. Species may frequent area foraging. The vegetation on site is fragmented and is likely not to have a population relying on it wholly. Impacts would be manageable and temporary to foraging habitat.
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala *BC-V* *EPBC-V* *BioNet, PMST*	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery.	Marginal. Not associated with PCTs immediately on site.	Possible. BioNet records 2.5km away in PCT 1220.	No. Work will stop in the unlikely event a Koala is seen, and resume when species moves away. The vegetation on site is fragmented and is very likely not to have a population relying on it wholly. Impacts would be manageable and temporary to foraging habitat only.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Potorous tridactylus Long-nosed Potoroo, Cobaki Lakes and Tweed Heads West population *BC-V* *EPBC-V* *BioNet*	Habitat is characterised by dense groundcover for shelter in proximity to small open areas for foraging. At Cobaki, appear to prefer Scribbly Gum Heathland, although they have been recorded in a variety of other vegetation communities, including Scribbly Gum/Swamp Mahogany Forest, Tree Broom Heath, Scribbly Gum Forest, Black She-oak Heath and Swamp Mahogany Forest. Breeding occurs throughout the year, although there is a peak from late winter to early summer. Fruit-bodies of hypogeous (underground-fruiting) fungi are a large component of the diet and they are considered to play an important role in fungi dispersal. Also eat roots, tubers, insects and their larvae and other soft-bodied animals in the soil. Leave characteristic diggings as a result of their foraging, and may improve the soil through turnover and aeration. Nocturnal and crepuscular and rarely seen. Spend the day in "squats" in dense vegetation and their regular movement through the vegetation creates characteristic runways.	Present.	Possible. BioNet Records within 150m of site 1979.	No. Species may frequent area foraging. The vegetation on site is fragmented and is likely not to have a population relying on it wholly. Impacts would be manageable and temporary to foraging habitat only.
Pteropus poliocephalus Grey-headed Flying-fox *BC-V* *EPBC-V* *BioNet, PMST*	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, giving birth and rearing young. Annual mating commences in January and single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50km from the camp to forage; commuting distances are	Present. Associated PCTs 721.	Possible. BioNet Records within the area. But habitat constraints. Breeding camps absent from site	No.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	more often <20 km. Feed on the nectar and pollen of native trees, in particular *Eucalyptus, Melaleuca* and *Banksia,* and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.			
Scoteanax rueppellii Greater Broad-nosed Bat *BC-V* *BioNet*	Found in a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest. Open woodland habitat and dry open forest. Most common in tall wet forest. Usually roosts in tree hollows.	Marginal. Associated PCTs 721.	Possible. BioNet Records within the area. No Habitat trees on site.	No.
Sminthopsis leucopus White-footed Dunnart *BC-V* *BioNet*	The dunnarts are a group of mouse-like marsupial carnivores, found throughout the continent and in every habitat. Needle-shaped incisors, five toes on the forefoot and a furred, brown tail help distinguish them from the House Mouse, which has rodent-teeth, four front toes and a naked, pinkish tail. The fur on the back and face of the White-footed Dunnart is grey-brown, and the belly is off-white. It has a fox-like face with large, dark, protruding eyes and large deeply-notched, thin ears that can be laid back against the head. The feet are pink and are covered with fine white hair. Adults have a head and body length less than 10 cm. Males are usually larger and heavier, averaging around 26 grams, while females average 19 grams. It can easily be confused with the Common Dunnart S. murina; the characteristics used to tell them apart require expert knowledge (White-footed Dunnart has striated inter-digital footpads on the hindfeet, compared to the those of the Common Dunnart which are unfused and granular in appearance). The White-footed Dunnart is found in a range of different habitats across its distribution,	Present. Associated PCTs 721.	Possible. BioNet Records within the area. No Habitat trees on site for nesting. No records within 1km of coast.	No. Species may frequent area foraging. The vegetation on site is fragmented and is likely not to have a population relying on it wholly. Impacts would be manageable and temporary to foraging habitat only..

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	including coastal dune vegetation, coastal forest, tussock grassland and sedgeland, heathland, woodland and forest. They shelter in bark nests in hollows under standing or fallen timber, burrows in the ground, piles of logging debris, in the 'skirts' of grass trees Xanthorrhoea spp.and cycads Macrozamia spp. and rock crevices.			
Frogs				
Litoria aurea Green and Golden Bell Frog *BC-E* *EPBC-V* *Bionet*	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha spp.*) or spikerushes (*Eleocharis* spp.), Optimum habitat includes waterbodies that are unshaded, free of predatory fish such as Plague Minnow *(Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	Absent. Not associated with PCTs and habitat constraints.	Unlikely	No.
Heleioporus australiacus Giant Burrowing Frog *BC-V* *EPBC-V* *Bionet* PMST	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. Home ranges are approximately 0.04 ha in size. Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water.	Absent. Not associated with PCTs.	Unlikely	No.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Mixophyes balbus — Stuttering Frog, Southern Barred Frog (in Victoria) *BC-V* *EPBC-V* PMST	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Feed on insects and smaller frogs. Breed in streams during summer after heavy rain. Eggs are laid on rock shelves or shallow riffles in small, flowing streams. As the tadpoles grow, they move to deep permanent pools and take approximately 12 months to metamorphose. Occur along the east coast of Australia from southern Queensland to north-eastern Victoria.	Absent. Not associated with PCTs and habitat constraints.	Unlikely	No.
Fish				
Prototroctes maraena — Australian Grayling BC-E EPBC-V PMST	The Australian Grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval and/or juvenile stages in coastal seas (Miles et al. 2013). Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones (DEWHA 2008zzn) such as the Tambo River, which is also known to have granite outcrops (Berra 1982). The species has also been associated with clear, gravel-bottomed habitats in the Mitchell and Wonnangatta Rivers (Victoria) and in a muddy-bottomed, heavily silted habitat in the Tarwin River (Victoria) (Jackson 1980). The species has been found over 100 km upstream from the sea (Jackson & Koehn 1988). During January–November 1979 in the Tambo River, Victoria, water temperatures ranged from 5–26 °C and the pH was approximately 8 (Berra 1982). Hall and Harrington	Present.	Unlikely No BioNet record.	No. No record of species in the area. No in-stream obstructions.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	(1989) located a population of adult Australian Grayling in consecutive years in an urban area of the lower reaches of the highly turbid Barwon River, with a salinity of approximately 1.5 parts per thousand (ppt).			
Epinephelus daemelii Black Rockcod *EPBC-V* *PMST*	The Black Rockcod is a territorial species that inhabits caves, gutters and crevices. They are usually found in depths up to 50 m, although individuals have been collected from below 100 m. Juveniles are found inshore, often in coastal rockpools and estuaries.	Present.	Unlikely No BioNet record.	No. No record of species in the area. No in-stream obstructions.
Migratory Marine Birds				
Apus pacificus Fork-tailed Swift *EPBC-M* *BioNet,* *PMST*	Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW.	Present.	Unlikely. 3 Bionet record within 10km buffer. Foraging habitat only.	No. Aerial species. Does not rely on habitat resources in the development site.
Ardenna carneipes Flesh-footed Shearwater *BC-V* *EPBC-M* *PMST*	Marine bird that nests on Lord Howe Island in forests on sandy soils from Ned's Beach to Clear Place, with smaller colonies below Transit Hill and at Old Settlement Beach. Eggs are laid at the end of a burrow 1 - 2 metres in length. Ranges throughout the Pacific and Indian Oceans. There are two main breeding areas in the world: one in the South West Pacific includes Lord Howe Island and New Zealand; the other along the coast of Western Australia.	Absent: No associated PCT's present as is a marine species.	Unlikely. No BioNet record in the 10km buffer	No. No habitat in the project area

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Ardenna grisea Sooty Shearwater *EPBC-M* *PMST*	Forages in pelagic (open ocean) sub-tropical, sub-Antarctic and Antarctic waters, and may forage inshore occasionally, especially during rough weather. Migrates and forages in the North Pacific and Atlantic Oceans during the non-breeding season. Has been recorded in areas with sea surface-temperatures of 8.7-22.0° C (Reid et al. 2002). Breeds mainly on subtropical and sub-Antarctic islands, as well as on the mainland of New Zealand. Birds nest in burrows or rock crevices on coastal slopes, ridges and cliff tops, in herb fields, tussock grassland or forest. Areas with waterlogged or shallow soils and/or dense vegetation are avoided. At The Snares, they are excluded from areas occupied by Snares Penguins (*Eudyptes robustus*). Nesting Shearwaters are known to impact on the vegetation surrounding nesting sites, as they undermine trees, trample seedlings and remove leaf litter and ground vegetation for nest lining (Richdale 1963). Breeding birds roost solitarily at night, either in the burrow or on the ground near burrow entrance. Pre-breeders or failed breeders usually roost on the ground, but sometimes in burrows. Individuals often roost and 'loaf' offshore during the day, except when weather conditions are rough. Most birds leave the roost at dawn; although, some non-paired birds remain in burrows during day (Marchant & Higgins 1990).	Absent. Though there is some degraded native grass land it is not tussock or herb filed.	Unlikely. No BioNet record in the 10km buffer	No. No records or habitat in the project area.
Diomedea antipodensis Antipodean Albatross *BC-V* *EPBC-V,M*	The majority of birds breed on Antipodes Island, with a small number of pairs breeding on Campbell Island. Breeds biennially in colonies on ridges, slopes and plateaus of isolated subantarctic islands, usually in vegetation such as grass tussocks. This species regularly occurs in small numbers off the NSW south coast from	Absent: No associated PCT's Present as is a marine species.	Unlikely. No BioNet record in the 10km buffer	No. No habitat in the project area or record.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
PMST	Green Cape to Newcastle during winter where they feed on cuttlefish. Although representing a small proportion on its total foraging area, potential forage in NSW waters is nonetheless considered significant for the species. This species feeds pelagically on squid, fish and crustaceans. The species ranges across the southern Pacific Ocean, east to the coast of Chile and west to eastern Australia.			
Diomedea epomophora Southern Royal Albatross *EPBC-V,M PMST*	Inhabits terrestrial and marine environments - grasslands and marine neritic and marine oceanic. Nests on tussock grassland slopes, ridges, and plateaus. Feeds primarily on squid and fish, supplemented by salps, crustacea and carrion.	Present. Some degraded native grassland.	Unlikely. No BioNet record in the 10km buffer	No. No record in area.
Diomedea exulans Wandering Albatross BC-E *EPBC-V,M PMST*	Spend the majority of their time in flight, soaring over the southern oceans. Breed on a number of islands just north of the Antarctic Circle: South Georgia Island (belonging to the UK), Prince Edward and Marion Islands (South Africa), Crozet and Kerguelen Islands (French Southern Territories) and Macquarie Island (Australia). Breeding takes place on exposed ridges and hillocks, amongst open and patchy vegetation, in small, loose colonies among grass tussocks, using a large mud nest. They feed in pelagic, offshore and inshore waters, often at night, taking fish and cephalopods such as squid, crustaceans and carrion, and will often follow ships feeding on the refuse they trail. Visits Australian waters extending from Fremantle, Western Australia, across the southern water to the Whitsunday Islands in Queensland between June and Spetember. It has been recorded along the length of the NSW coast.	Absent: No associated PCT's Present as is a marine species.	Unlikely. No BioNet record in the 10km buffer	No. No habitat in the project area or record.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Diomedea sanfordi Northern Royal Albatross *EPBC-E,M* *PMST*	Primarily forages in inshore and offshore waters over the continental shelf to the shelf edge. It feeds mainly on cephalopods and fish, but also salps, crustacea and carrion. Ranges widely over the Southern Ocean, with individuals seen in Australian waters off south-eastern Australia.	Absent: No associated PCT's Present as is a marine species.	Unlikely. No BioNet record in the 10km buffer	No. No habitat in the project area or record.
Hydroprogne caspia Caspian Tern *BC* *EPBC-* *BioNet*	This species is gregarious when breeding, though single nesting does occur. Outside of breeding, the Caspian Tern occurs mostly singly or in small groups. Occasional larger groups of 30 or more birds are seen, often at rich fishing areas or at nightly roost sites, where they may roost with other terns. The species may also aggregate into flocks on passage (migration) (Higgins & Davies 1996). Within Australia, the Caspian Tern has a widespread occurrence and can be found in both coastal and inland habitat The Caspian Tern is mostly found in sheltered coastal embayment's (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred. They also occur on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks. They also use artificial wetlands, including reservoirs, sewage ponds and saltworks. In offshore areas the species prefers sheltered situations, particularly near islands, and is rarely seen beyond reefs (Higgins & Davis 1996).	Present. Potential breeding.	Possible. BioNet record in the 10km buffer.	Yes. Potential breeding habitat around bridge, targeted survey needed before works. Individuals will most likely avoid the site during works. Works should be put on hold if birds start to feed in the area, and resume when they vacate.
Limosa lapponica Bar-tailed Godwit *EPBC-M* *PMST*	Arrive in Australia each year in August from breeding grounds in the northern hemisphere. More numerous in northern Australia. Inhabit estuarine mudflats, beaches and mangroves. Common in coastal areas around	Unlikely. No associated PCTs.	Possible. BioNet record in the 10km buffer.	No. No records of species in the area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	Australia. They are social birds and are often seen in large flocks and in the company of other waders.			
Macronectes giganteus Southern Giant Petrel BC-E *EPBC-E,M* *PMST*	Has a circumpolar pelagic range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW. Over summer, it nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory. An opportunistic scavenger and predator and scavenges from fishing vessels and animal carcasses on land. Also, an active predator of cephalopods and euphausiids, as well as smaller birds (particularly penguins) both at land and at sea. Will desert their nests if disturbed at the breeding colony.	Absent: No associated PCT's Present as is a marine species.	Unlikely. No BioNet record in the 10km buffer	No. No associated PCT's or record of species in the area.
Macronectes halli Northern Giant-Petrel BC-V *EPBC-V,M* *PMST*	Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. Adults usually remain near the breeding colonies, while immature birds make long and poorly known circumpolar and trans-oceanic movements. Most birds recorded in NSW coastal waters are immature birds. Seldom breed in colonies but rather as dispersed pairs, often amidst tussocks in dense vegetation and areas of broken terrain. |Has a circumpolar pelagic distribution, usually between 40-64ºS in open ocean. Range extends into subtropical waters (to 28ºS) in winter and early spring, and they are a common visitor in NSW waters, predominantly along the south-east coast during winter and autumn.	Absent: No associated PCT's Present as is a marine species.	Possible. There is a BioNet record within 10km buffer.	No. No associated PCT's in project area as species is marine.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Numenius phaeopus Whimbrel *EPBC-M* *BioNet*	Regular migrant to Australia and New Zealand, with a primarily coastal distribution. Found in all states, but more common in the north. Found on the intertidal mudflats of sheltered coasts, in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. Occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms. Infrequently recorded using saline or brackish lakes near coastal areas. Also uses salt flats with saltmarsh, or saline grasslands with standing water left after high spring-tides, and in similar habitats in sewage farms and salt fields (Higgins & Davies 1996). Forages on intertidal mudflats, along the muddy banks of estuaries and in coastal lagoons, either in open unvegetated areas or among mangroves, and sometimes forages on sandy beaches or among rocks. It has occasionally been sighted feeding on exposed coral or rocky reefs and rock platforms. It is known to probe holes and crevices among rubble and on reef flats, but not on reef crests. Regularly roosts in mangroves and other structures flooded at high tide.	Absent. The habitats are saline or brackish and the project area is salt.	Possible. There is a BioNet record within 10km buffer.	No. No suitable habitat in project area
Phoebetria fusca Sooty Albatross *BC-V* *EPBC-V,M* *PMST*	This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea, and rarely occurs in continental shelf waters. While at sea, this agile species soars on strong winds and when calm, rests on the ocean. Generally solitary while at sea, although small groups of 2-3 birds have been recorded. Feeds on fish, crustaceans, offal and squid and although solitary, individuals may forage at night in mixed-species flocks. Species may follow fishing vessels for short periods. Nests in small breeding colonies of up to 100	Absent. The area is dry sclerophyll forest and degraded native grassland.	Unlikely. No BioNet record within 10km buffer	No. No record within the area or habitat suitable.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	nests, on subantarctic islands including Prince Edwards Island, Iles Crozet, Iles des Apotres and Iles Kerguelen. Nests are located amongst vegetation on steep cliffs and consist of a mound of mud and plant matter, lined with grass. Highly territorial and defends its nests with threat displays. Breeding occurs August-December. Occurs in the South Atlantic and southern Indian Oceans and has not been recorded in the Pacific Ocean between Australia and South America. In Australian waters, this species is generally recorded in winter off the south coast from Tasmania to Western Australia, while there are occasional sightings off the NSW coast, north of Grafton.			
Sternula albifrons Little Tern *BC-E* *EPBC-M* *PMST*	In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. It breeds in spring and summer along the entire east coast from Tasmania to northern Queensland, and is seen until May, with only occasional birds seen in winter months. Almost exclusively coastal, preferring sheltered environments; however, may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands. Nest is a scrape in the sand, which may be lined with shell grit, seaweed or small pebbles. Often seen feeding in flocks, foraging for small fish, crustaceans, insects, worms and molluscs by plunging in the shallow water of channels and estuaries, and in the surf on beaches, or skipping over the water surface with a swallow-like flight.	Present. Sand flats and beach contiguous with site. Foraging habitat.	Possible.	Yes. Potential breeding habitat around bridge, targeted survey needed before works. Individuals will most likely avoid the site during works. Works should be put on hold if birds start to feed in the area, and resume when they vacate.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Sterna hirundo Common Tern *EPBC-M BioNet*	Common Terns are marine, pelagic and coastal. In Australia, they are recorded in all marine zones, but are commonly observed in near-coastal waters, both on ocean beaches, platforms and headlands and in sheltered waters, such as bays, harbours and estuaries with muddy, sandy or rocky shores. However, off Wollongong, NSW, Common Terns were recorded in all marine zones but generally recorded in offshore and pelagic waters, 11–55 km from shore. Occasionally they are recorded in coastal and near-coastal wetlands, either saline or freshwater, including lagoons, rivers, lakes, swamps and saltworks. Sometimes they occur in mangroves or saltmarsh and, in bad weather, in coastal sand-dunes or coastal embayment's. Common Terns forage in marine environments, often close to the shore, including sheltered embayment's and in the surf-zone, but also well out to sea. They also forage in near-coastal terrestrial wetlands, including estuaries, rivers and swamps.	Absent. No marine habitat present.	Possible. BioNet record within 10km buffer.	No. No suitable habitat present.
Thalassarche bulleri Buller's Albatross *EPBC-V,M PMST*	Only nests on islands off New Zealand. The northern subspecies (*platei*) nests on islands off Chatham Island with an estimated population of around 18,200 breeding pairs. The southern subspecies (*bulleri*) breeds on the Snares and Solander islands with a total population of around 13,600 breeding pairs. After breeding both subspecies migrate to the seas off Peru and Chile. In NSW waters it is a relatively common visitor between March and October, with few sightings outside this period. Occurs in both inshore and offshore waters, including the continental shelf break and pelagic waters. Feeds mainly on squid, fish, tunicates, octopus and crustacea.	Absent. No associated PCTs as is marine species	Unlikely. No BioNet record within 10km buffer	No. No Associated PCT's or record in the area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Thalassarche cauta Shy Albatross *BC-V* *EPBC-E,M* *PMST*	Inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea. At sea, it soars on strong winds and when calm, individuals may rest on the ocean, in groups during the breeding season or as individuals at other times. Occasionally occurs in continental shelf waters, in bays and harbours. Feeds on fish, crustaceans, offal and squid and may forage in mixed-species flocks. Food may be caught by seizing prey from the water's surface and by scavenging behind fishing vessels. Known breeding locations include Albatross Island off Tasmania, Auckland Island, Bounty Island and The Snares, off New Zealand, where nesting colonies of 6-500 nests occur. Located on sheltered sides of islands, on cliffs and ledges, in crevices and slopes, nests are used annually and consist of a mound of mud, bones, plant matter and rocks. Breeding occurs September-December. Circumpolar in distribution, occurring widely in the southern oceans. Islands off Australia and New Zealand provide breeding habitat. Occurs along the east coast from Stradbroke Island in Queensland along the entire south coast of the continent to Carnarvon in Western Australia. Commonly recorded off southeast NSW, particularly between July and November.	Absent. No associated PCTs as is marine species	Unlikely.	No.
Thalassarche eremita Chatham Albatross *EPBC-E,M* *PMST*	Occasional individuals are encountered both in inshore and offshore over the continental shelf and in pelagic waters off the shelf break. Breeding for the Chatham Albatross is restricted to Pyramid Rock, Chatham Islands, off the coast of New Zealand.	Absent. The species as is marine.	Unlikely. No BioNet record within 10km buffer	No. No Habitat or records in the area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Thalassarche impavida Campbell Albatross *EPBC-V,M PMST*	Nests only at Campbell Island and the adjacent Isle de Jeanette Marie south of New Zealand, with a total population estimated at 24,600 pairs. It ranges widely in Australasian seas. In NSW waters it is probably frequently overlooked due to the difficulties of separating it from the Black-browed Albatross. Appears to be a regular visitor occurring in most months of the year with peaks in winter during the non-breeding season. Forages on fish, squid, crustacea, carrion and gelatinous organisms.	Absent. No associated PCTs as is marine species	Unlikely. No BioNet record within 10km buffer.	No. No Habitat or records in the area.
Thalassarche melanophris Black-browed Albatross *BC-V EPBC-V PMST*	Inhabits Antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents. Can tolerate water temperatures between 0-24ºC. Spends most of its time at sea, breeding on small, isolated islands. At sea, individuals soar on strong winds and rest on the ocean, often in groups. Feeds on fish, crustaceans, offal and squid and often forages in flocks with other seabirds. Individuals seize prey from the surface while swimming or landing, sometimes submerging their head and body to capture prey underwater, and they scavenge in large flocks behind fishing vessels. Nests annually on a mound of soil and vegetation, on the cliffs or steep slopes of vegetated Antarctic and subantarctic islands. Colonies of up to 100,000 nests are formed, occasionally containing Grey-headed Albatross, during which time the birds are territorial while nesting. Breeding September-December. Has a circumpolar range over the southern oceans and are seen off the southern Australian coast mainly during winter. Migrates to waters off the continental shelf from approximately May to November and is regularly recorded off the NSW coast during this period. Has been recorded in Botany Bay National Park.	Absent. No associated PCTs as is marine species	Unlikely. No BioNet record within 10km buffer.	No. No Habitat or records in the area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Thalassarche salvini Salvin's Albatross *EPBC- V,M* *PMST*	Occasional individuals are encountered both in inshore and offshore over the continental shelf and in pelagic waters off the shelf break. Nests on the Bounty Islands, with small numbers on the Western Chain Islets in the Snares Islands and a few pairs nesting on Pyramid Rock and The Forty-Fours in the Chatham Islands of New Zealand. A small number of pairs also nest on Iles Crozet in the French Southern Territories. Total population is estimated between 350,000 and 380,000 individuals, with 99% nesting on the Bounty Islands. Ranges widely through the South Pacific Ocean, particularly in the Humboldt Current off western South America. In NSW waters it is an uncommon visitor principally occurring between June and October, with the majority of sightings from waters south of Sydney.	Absent. The species as is marine.	Unlikely. No BioNet record within 10km buffer.	No. No Habitat or records in the area.
Thalassarche steadi White Capped Albatross *EPBC- V,M* *PMST*	A marine species and occurs in subantarctic and subtropical waters. It reaches tropical areas associated with the cool Humboldt Current off South America. In the southern Indian Ocean it has been observed in waters of 6.4–13.5 °C. Noted in shelf-waters around breeding islands and over adjacent rises. During the non-breeding season, birds have been observed over continental shelves around continents. Occurs both inshore and offshore. and enters harbours and bays. Scarce in pelagic waters. Birds gather to scavenge at commercial fishing grounds. Nest on slopes vegetated with tussock and succulents on Auckland Island. Common off the coast of south-east Australia throughout the year.	Absent. The species as is marine.	Unlikely. No BioNet record within 10km buffer.	No. No Habitat or records in the area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Migratory Terrestrial Species				
Cuculus optatus — Oriental Cuckoo, Horsfield's Cuckoo *EPBC- M* *PMST*	The Black-faced Monarch is a wet forest specialist, occurring mainly in rainforests and riparian vegetation. In wet sclerophyll forest, the species mostly frequents sheltered gullies and slopes with a dense understorey of ferns and/or shrubs. They forage mainly gleaning from foliage or branches of trees and shrubs or by taking insect prey from the air (sallying). Breeding generally occurs from October to February. The species builds solitary, inverted conical or pear-shaped nests, with a cup-like cavity at the top, and the base tapering to a point. The Blackfaced Monarch is a known nest-host to the Brush Cuckoo Cacomantis variolosus. Has an extensive breeding range in south-eastern Australia from Cooktown to eastern Victoria.	Absent.	Unlikely. No BioNet record in the 10km buffer.	No. No associated habitat or records of species in the area.
Hirundapus caudacutus White-throated Needletail *EPBC- V,M* *PMST* *BioNet*	In Australia, the White-throated Needletail is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground (Coventry 1989; Tarburton 1993; Watson 1955). Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable (Cramp 1985), but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (Higgins 1999). They also commonly occur over heathland (Cooper 1971; Learmonth 1951; McFarland 1988), but less often over treeless areas, such as grassland or swamps (Cooper 1971; Gosper	Present. Known in PCT 721 and 722. Lacking breeding habitat.	Unlikely on site. Potential to fly over site.	No. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	1981; Learmonth 1951). When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks (Emison & Porter 1978; Friend 1982; Tarburton 1993). In coastal areas, they are sometimes seen flying over sandy beaches or mudflats (Cooper 1971; Crompton 1936; Davis 1965), and often around coastal cliffs and other areas with prominent updraughts, such as ridges and sand-dunes (Cooper 1971; Dawson et al. 1991; Loyn 1980; Mitchell et al. 1996; Schulz & Kristensen 1994). They are sometimes recorded above islands well out to sea (Brandis et al. 1992; Cooper 1971; Warham 1957). Feeding habitat In Australia, White-throated Needletails almost always forage aerially, at heights up to 'cloud level', above a wide variety of habitats ranging from heavily treed forests to open habitats, such as farmland, heathland or mudflats (Learmonth 1951; McDonald 1938; Tarburton 1993; Templeton 1991), though they sometimes forage much closer to the ground in open habitats, once as low as about 15 cm in a coastal saltworks (Watson 1955). They sometimes forage over recently disturbed areas, such as forest that has been recently cleared or burnt, or above paddocks as they are being ploughed or slashed (Blakers et al. 1984; Bravery 1971). They often forage in areas of updraughts, such as ridges, cliffs or sand-dunes (Legge 1927; Loyn 1985a; Mitchell et al. 1996), or in the smoke of bushfires (McCulloch 1966), or in whirlwinds (Le Souëf & Campbell 1902). They often forage along the edges of low-pressure systems, which both lift their food sources and assist with their flight, and it is said that they follow these			

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	systems across Australia (Boehm 1939). They seldom alight on the ground or vertical substrates to catch insects (Carlyle 1982; McCaskill 1943; Quested 1980). Roosting habitat The species has been recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows (Corben et al. 1982; Day 1993; Quested 1982; Tarburton 1993), though the number of references to Needletails roosting in trees possibly over-emphasizes such occurrences (Higgins 1999). It has been suggested that they also sometimes roost aerially (Currie 1928; Dove 1919; Schulz & Kristensen 1994), and it was formerly erroneously thought that the species did not alight while in Australia (Pescott 1983). Breeding habitat The species breeds in wooded lowlands and sparsely vegetated hills, as well as mountains covered with coniferous forests (Chantler 1999; Dement'ev & Gladkov 1951). White-throated Needletails may take refuge during extreme conditions. Many birds were seen perching on the trunks of trees during a bushfire (Currie 1916; Currie 1928); during cold weather, one was found roosting during the day in the hollow branch of a eucalypt (Pettigrew & Wilson 1985) and some were seen sheltering in stunted scrub during bad weather on the high plains (Paterson 1930). They may also alight on the trunks or branches of trees during hot or inclement weather (Davies 1982; Littler 1910a; Loyn 1980; Whackett 1989; Wheeler 1959); and			

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	there is a record of Needletails resting on a lawn under sprinklers during hot weather (Davies 1982). The species does not rely on a listed threatened ecological community.			
Monarcha melanopsis Black-faced Monarch *EPBC- M* *PMST*	Found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. Builds a deep cup nest of casuarina needles, bark, roots, moss and spider web in the fork of a tree, about 3-6 m above the ground. Only the female builds the nest, but both sexes incubate the eggs and feed the young.	Absent	Unlikely. No BioNet record in the 10km buffer.	No. No records of species in the area.
Myiagra cyanoleuca Satin Flycatcher *EPBC- M* *PMST*	Found along the east coast of Australia in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. Nests in loose colonies of two to five pairs nesting at intervals of about 20-50 m apart. It builds a broad-based, cup-shaped nest of shredded bark and grass, coated with spider webs and decorated with lichen. The nest is placed on a bare, horizontal branch, with overhanging foliage, about 3-25 m above the ground.	Absent.	Unlikely. No BioNet record in the 10km buffer.	No. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).
Rhipidura rufifrons Rufous Fantail *EPBC-M* *PMST*	Found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas. Builds a small compact cup nest, of fine grasses bound with spider webs, that is suspended from a tree fork about 5 m from the ground. The bottom of the nest is drawn out into a long stem.	Absent.	Unlikely. No BioNet record in the 10km buffer.	No. No records of species in the area.
Migratory Wetland				

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Actitis hypoleucos Common Sandpiper *EPBC-M* *PMST*	Found along all coastlines of Australia and in many areas inland. The population that migrates to Australia breeds in the Russian far east. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags the species is known to perch on posts, jetties, moored boats and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks.	Present.	Unlikely. No BioNet record in the 10km buffer.	No. No habitat or records of species in the area.
Calidris acuminata Sharp-tailed Sandpiper *EPBC-M* *PMST*	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving	Absent.	Unlikely. No BioNet record in the 10km buffer.	No. No records of species in the area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	back during the wet season. They may be attracted to mats of algae and water weed either floating or washed up around terrestrial wetlands, and coastal areas with much beach cast seaweed. Sometimes they occur on rocky shores and rarely on exposed reefs (Higgins & Davies 1996). **Foraging** They forage at the edge of the water of wetlands or intertidal mudflats, either on bare wet mud or sand, or in shallow water. They also forage among inundated vegetation of saltmarsh, grass or sedges. They forage in sewage ponds, and often in hypersaline environments. After rain, they may forage in paddocks of short grass, well away from water. They may forage on coastal mudflats at low tide and move to freshwater wetlands near the coast to feed at high tide. Occasionally they forage on wet or dry mats of algae and among rotting beach cast seagrass or seaweed, and sometimes they are recorded foraging around the edges of stony wetlands or among rocks in water, and rarely on exposed reef (Higgins & Davies 1996). **Roosting** Roosting occurs at the edges of wetlands, on wet open mud or sand, in shallow water, or in short sparse vegetation, such as grass or saltmarsh. Occasionally, they roost on sandy beaches, stony shores or on rocks in water (Higgins & Davies 1996). They have also been recorded roosting in mangroves (Minton & Whitelaw 2000).			
Calidris canutus, Red Knot *EPBC-E,M*	A non-breeding migratory visitor from Arctic regions of Siberia. Birds arrive between September and October and leave between March and April, with a small number of	Absent. No associated PCTs	Possible. BioNet record in the 10km buffer.	No. No habitat in the project area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
PMST	individuals overwintering. In NSW, it is recorded in small numbers along some of the major river estuaries and sheltered embayment's of the coastline, in particular the Hunter River estuary. This environment is used as a staging area for birds to rest and replenish fat resources; large numbers arrive in September then most move south to Victoria by October. A rare visitor to wetlands away from the coast with a few records (mostly during southward migration) as far west as Lake Menindee and the Riverina. Mainly occurs in small numbers on intertidal mudflats, estuaries, bays, inlets, lagoons, harbours and sandflats and sandy beaches of sheltered coasts. It is occasionally found on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms and is a rare visitor to terrestrial saline wetlands and freshwater swamps. Birds roost on sandy beaches, spits, islets and mudflats close to feeding grounds, usually in open areas. Rarely found on inland lakes or swamps.	in the project area.		
Calidris ferruginea Curlew Sandpiper *BC-CE EPBC-CE,M PMST*	Generally, occupies littoral and estuarine habitats, and in NSW is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. Roosts on shingle, shell or sand beaches; spits or islets on the coast or in wetlands; or sometimes in salt marsh, among beach-cast seaweed, or on rocky shores. Feeds on worms, molluscs, crustaceans, insects and some seeds. Distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary,	Marginal. No Associate PCTs in area. Foraging sandy habitat contiguous with site.	Unlikely. No BioNet records within 10 km.	No. No Associated PCT's or BioNet records.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration.			
Calidris melanotos Pectoral Sandpiper *EPBC-M* *PMST*	In NSW, it is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum.	Present.	Unlikely. No BioNet record in the 10km buffer.	No. No records of species in the area.
Gallinago hardwickii Latham's Snipe *EPBC-M* *PMST*	Usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). Known to occur in the upland wetlands of the New England Tablelands and Monaro Plateau.	Absent.	Unlikely. No BioNet record in the 10km buffer.	No. No records of species in the area.
Gallinago megala Swinhoe's Snipe *EPBC-M* *PMST*	During the non-breeding season Swinhoe's Snipe occurs at the edges of wetlands, such as wet paddy fields, swamps and freshwater streams. Also known to occur in grasslands, drier cultivated areas (including crops of rapeseed and wheat) and market gardens. Habitat specific to Australia includes the dense clumps of grass and rushes round the edges of fresh and brackish wetlands. This includes swamps, billabongs, river pools, small	Absent.	Unlikely. No BioNet record in the 10km buffer.	No. No records of species in the area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	streams and sewage ponds. They are also found in drying claypans and inundated plains pitted with crab holes.			
Gallinago stenura Pin-tailed Snipe *EPBC-M* *PMST*	During non-breeding period the Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation. The species is also found in drier, more open wetlands such as claypans in more arid parts of species' range. It is also commonly seen at sewage ponds; not normally in saline or inter-tidal wetlands	Absent. Project area is no within a wetland.	Unlikely. No BioNet record in the 10km buffer.	No. No records of species in the area.
Numenius madagascariensis Eastern Curlew *EPBC-CE,M* *PMST*	In NSW, occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. Generally, occupies coastal lakes, inlets, bays and estuarine habitats, and in NSW is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. Forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. Roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. May also roost on wooden oyster leases or other similar structures. Is carnivorous, mainly eating crustaceans.	Unlikely. No associated PCTs.	Possible**.** BioNet record in the 10km buffer.	No. No associated PCTs in the area.

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
Numenius minutus Little Curlew *EPBC-M* *PMST*	Most often found feeding in short, dry grassland and sedgeland, including dry floodplains and black soil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used. Generally, foraging is in relatively short grass (around 20 cm tall) as the birds avoid dense tall grasses. When resting during the heat of day, they congregate around pools, riverbeds and water-filled tidal channels, and shallow water at edges of billabongs. Prefers pools with bare dry mud (including mudbanks in shallow water) and they do not use pools if they are totally dry, flooded or heavily vegetated	Unlikely. Some derived grassland, but no associated PCTs.	Unlikely. No BioNet record in the 10km buffer.	No. No records or associated PCTs within the area.
Pandion haliaetus Osprey *EPBC-M* *PMST*	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia (Johnstone & Storr 1998; Marchant & Higgins 1993; Olsen 1995). They require extensive areas of open fresh, brackish or saline water for foraging (Marchant & Higgins 1993). They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes (Czechura 1985; Domm 1977; Fleming 1987; Gosper 1983; Gosper & Holmes 2002; Johnstone & Storr 1998; Olsen 1995; Roberts & Ingram 1976). They exhibit a preference for coastal cliffs and elevated islands in some	Present	Unlikely. No BioNet record in the 10km buffer.	No. Though they may frequent the area, individuals will not likely be directly impacted by the works (small and manageable temporary impact to foraging habitat only).

Species	Description of habitat[3]	Presence of habitat	Likelihood of occurrence	Possible impact?
	parts of their range (Boekel 1976; Domm 1977), but may also occur on low sandy, muddy or rocky shores and over coral cays (Marchant & Higgins 1993). They may occur over atypical habitats such as heath, woodland or forest when travelling to and from foraging sites (Czechura 1985; Hembrow 1988; Pruett-Jones & O'Donnell 2004; Roberts & Ingram 1976).			
Tringa nebularia Common Greenshank	Does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. In NSW, the species has been recorded in most coastal regions. It is widespread west of the Great Dividing Range, especially between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions.	Present.	Unlikely. No BioNet record in the 10km buffer	No. No records in the area.
	E EPBC = listed as Endangered under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.* *V EPBC = listed as Vulnerable under the Commonwealth Environment Protection & Biodiversity Conservation Act 1999.* M EPBC = listed as Migratory under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*	CE EPBC = listed as Critically Endangered under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.* CAMBA = Chinese-Australia Migratory Bird Agreement JAMBA = Japan-Australia Migratory Bird Agreement ROKAMBA = Republic of Korea–Australia Migratory Bird Agreement		

Appendix G Tests/Assessments of Significance

G.1 NSW 5 Part Test (Test of Significance)

Part 1 Section 1.7 of the *Environment Planning and Assessment Act 1979* (EP&A Act) gives reference to the *Biodiversity Conservation Act 2016* (BC Act) and the five factors which must be considered in deciding whether a development is likely to significantly affect threatened species, populations or ecological communities, or their habitats.

This Five-part Test characterises the significance of likely impacts associated with the proposal on the following TECs and species:

- Matted Bush-pea (*Pultenaea pedunculata*) - Endangered
- Square Raspwort (*Haloragis exalata subsp. exalata var. exalata*) – Vulnerable
- Narrow leafed Wilsonia (*Wilsonia backhousei*) – Vulnerable
- Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions - Endangered Ecological Community

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,

Matted Bush-pea (*Pultenaea pedunculata)*

A single plant of this species has been recorded on the eastern road verge within the impact zone in 2000 and 2019 (at the base of the first white post south of the bridge), and is very likely still present in the location, although difficult to detect when not flowering. There are other occurrences of this species consisting of multiple individuals scattered on the verges of the Tathra-Bermagui Road north of the Cuttagee Lake bridge, between Head of Cuttagee Road and Gealls Road (e.g. https://www.inaturalist.org/observations/60338855). Those near Head of Cuttagee Road are located on an area of previously disturbed ground on both sides of the road, which may have formerly been used for road base extraction. The species, being a low mat-forming sub-shrub, favours areas with sparse groundcover vegetation where it is not shaded by other plants, and as such frequently grows in disturbed sites such as erosion gully walls in the Windellama area of the Southern Tablelands, road verges and firebreaks such as around Tathra, or on the edge of an occasionally slashed walking track on Green Cape in Ben Boyd National Park south of Eden. It may depend for its persistence on occasional removal of competing taller vegetation, and has been observed to proliferate within nearby forest after the 2018 fire in the Tathra area.

The plant at this location could be destroyed as a result of the proposed works and any seed deposited by it in the soil (as a pea, likely to be of considerable longevity in the soil) could be lost, but as there are multiple plants located on the road verges between one and two km north of the site, this loss would not place a viable local population at risk of extinction.

However, the area of bare ground on the eastern verge just south of the Head of Cuttagee Road intersection should not be used as a laydown area for the development, as this would threaten a larger population of the species.

Square Raspwort (*Haloragis exalata subsp. exalata var. exalata)*

This species also favours disturbed sites, including occasionally road verges if adjacent to water, and is capable of proliferating after disturbance. There are records of it from several locations around the edge of Cuttagee Lake, which are the most southerly known records in NSW (Miles and Cameron, 2007). It is unlikely to occur near the bridge, as it is mostly associated with freshwater, such as where freshwater creeks and gullies drain into coastal saline or brackish lakes such as Cuttagee Lake and Wallaga Lake. It tends to come and go in the landscape in response to disturbance events such as changing lake levels associated with droughts and floods. Its seed is transported in water, so that plants could appear anywhere around the lake shore, but might only persist where there is sufficient freshwater in the soil to maintain them. It is quite sensitive to drought and has not been found to grow in estuaries which are permanently open to the sea, so presumably does not do well in sea water. Plants exposed to salt water spray during storm events have been observed to wilt. The probability of this species occurring close to the site is therefore quite low, despite the presence of nearby records upstream on the lake, and it is very unlikely that the proposed works will have any impact on the local population.

Narrow leafed Wilsonia (*Wilsonia backhousei*)

There are numerous populations of this species recorded in coastal lakes and estuaries of the NSW south coast, some of them very large. Locally the species is known from Wallagoot Lake, Nelson Lake, Wapengo Lake, Cuttagee Lake, Baragoot Lake, the Bermagui River estuary, and Nangudga and Mummaga Lakes in Eurobodalla LGA with large populations also present in the Jervis Bay area. It grows in saline areas, with the largest populations being located in coastal saltmarsh, but it may also occur in crevices in rocky shorelines of both coastal lakes (as on Baragoot Lake) and on the sea shore (as at Potato Point and at Monument Beach in Conjola National Park).

There are three records from Cuttagee Lake, where local resident Stuart Cameron has recorded it persisting for many years in spite of extreme variation in lake levels. The plant can be submerged quite deeply for long periods when the lake mouth is closed and still recover when the water level drops again (S. Cameron, pers. comm.). A survey of the species in 2019 (State of New South Wales and Department of Planning Industry and Environment, 2019) relocated the most easterly of these records on the western tip of Snake Island 200 metres upstream of the bridge, but did not include a search for the other sites due to high water levels at the time. On Snake Island the species was colonising what appeared to be a relatively recently deposited sand bar on the north-western edge of the island, along with various other saltmarsh species such as *Juncus kraussii, Cotula coronopifolia, Suaeda australis* and *Chenopodium glaucum*. At this time a single plant was also recorded on a sand spit just upstream from the southern end of the bridge. The population located 200m upstream of the bridge will not be affected by the proposed works. The plant closer to the road could possibly be affected although it is on the lake shore, not on the road verge. It is not known if this plant is still present at this location. The plant can colonise areas of bare sand which are subsequently removed in floods, and given the occurrence of some heavy rainfall events in 2020 and 2021, it may have been washed out by now. The apparent loss of a small number of plants from a lake mouth location such as this has been previously observed to occur on Lake Mummaga at Dalmeny, where a large population

upstream of the lake mouth persisted over several years and was relocated in 2019, but three plants found on a new sand deposit near the lake mouth in 2006 could not be relocated during the 2019 surveys.

The proposed works would not place a population of this species at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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.**

Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions TEC

A small area of this TEC was observed to occur on Snake Island about 200m upstream of the bridge (see under *Wilsonia backhousei* above). The next small island to the west of Snake Island has also been recorded as harbouring *Wilsonia backhousei* in the past and therefore could also be said to carry saltmarsh. These areas are well outside the potential impact zone of the proposed works and will not be affected.

c) in relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

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

iii. **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,**

The proposal should not remove or modify habitat of *Haloragis exalata*, which is not known to occur on or near the site, nor of Coastal Saltmarsh TEC or *Wilsonia backhousei* which both occur 200m upstream of the bridge. It is possible that a single plant of *Wilsonia backhousei* on the lake shore close to the road and its associated habitat of the sandy lake shore could be affected and a single plant of *Pultenaea pedunculata* within the development footprint is likely to be destroyed. The road verge at this site is presumably only marginal habitat for *P. pedunculata*, since only a single plant has ever been recorded there, unlike areas of road verge north of the site. It is possible that seed was dispersed to this location from the population further north on a vehicle or in translocated soil. The amount of habitat removal for this species will therefore be very small, as long as the roadside areas further north are not used as laydown areas during the works. Any areas being considered for this purpose should be checked for this species.

The proposal will not have the effect of fragmenting or isolating habitat for any of these species or the TEC. The importance of the habitat which will be removed is very minor in terms of the local occurrence of *Pultenaea pedunculata* and *Wilsonia backhousei*. The other two entities would not be affected at all.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

Not applicable. There are no nearby areas of outstanding biodiversity value.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

Invasion of native plant communities by exotic perennial grasses

The proposal has the potential to exacerbate this Key threatening process in the region. A survey of the occurrence of roadside weeds which might present a threat to *Pultenaea pedunculata* for Bega Valley Shire Council (Miles, 2019) found that African Lovegrass (**Eragrostis curvula*) and Whisky Grass (**Andropogon virginicus*) were scattered along the road verges south from Bermagui to Cuttagee Lake, but nowhere south of this point until the northern outskirts of Tathra. The occurrence at Cuttagee Lake was of a single plant which was subsequently removed. The proposed works have the potential to introduce or consolidate the hold of these and other exotic grasses in the Cuttagee Lake area, from which they could continue to advance along the road verges and into adjacent native vegetation. Coastal vegetation on sandy soils is very vulnerable to invasion by African Lovegrass as has been amply demonstrated in the area around the Merimbula airport, and in the Tura Beach area. The TEC Bangalay Sand Forest occurs to the north and south of the site, and could be placed under threat if this and other exotic grasses become more firmly established in the area.

It would be possible to prevent this by suitable mitigation measures such as wash down of vehicles and machinery used on site, and monitoring of the site for one to two years after the work is completed for weed incursions.

Conclusion

The proposed works would result in the removal of a single plant of *Pultenaea pedunculata*, and any seed which it may have produced in the twenty plus years that it has been known from this location. This would not be a significant impact on local populations of this species.

It is very unlikely that there would be a significant impact on the other species and TEC assessed.

G.2 Commonwealth 7 Part Assessment of Significance

SQUARE RASPWORT

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

a) Lead to a long-term decrease in the size of an important population

An 'important population' is defined as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

Square Raspwort is not known to occur on the site, and is quite unlikely to do so, based on its habitat preference for areas where there is freshwater inflow into coastal saline or brackish lakes (see BC Act assessment above).

b) Reduce the area of occupancy of an important population

The proposed works will not have this effect (see above).

c) Fragment an existing population into two or more populations

The proposed works will not have this effect. All the recorded populations are upstream of the site, around the edges of Cuttagee Lake.

d) Adversely affect habitat critical to the survival of a species

The proposed works will not have this effect (see above).

e) Disrupt the breeding cycle of a population

The proposed works will not have this effect (see above).

f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposed works will not have this effect (see above).

g) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposed works will not have this effect (see above). Although the proposal has the potential to introduce or exacerbate weed populations on the road verge, this should have no impact on Square Raspwort populations occurring further upstream on the lake.

h) Introduce disease that may cause the species to decline, or

The proposed works will not have this effect.

i) Interfere with the recovery of the species.

The proposed works will not have this effect. There is no Recovery Plan for this species.

Conclusion:

It is considered as a result of the above assessment that this action would not have a significant impact upon Square Raspwort and thus would not require an EPBC referral.

Appendix H Cuttagee Bridge Heritage Assessment

Pip Giovanelli
Heritage and Conservation Consultant

Cuttagee Bridge Heritage Assessment

Report prepared for BVSC by Pip Giovanelli

August 2021

Rev	Issue	By	Date
0	Review	BVSC	July 21
1	Issue to BVSC	Pip Giovanelli	4 Aug 21

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EXECUTIVE SUMMARY

In June 2021 Bega Valley Shire Council engaged heritage consultant Pip Giovanelli to undertake a Heritage Assessment of the existing Cuttagee Bridge.

Copies of original plans dating back to 1892, articles from Trove and other relevant documentation enabled a reliable history of Cuttagee Bridge to be prepared. The bridge was assessed against NSW Heritage Criteria to provide the following summary Statement of Significance

> The Cuttagee Bridge is of historic interest as one of a group constructed in the later part to the 19th century to facilitate transport between Tilba Tilba, Tanja and the port at Bermagui. Designed by the NSW Public Works Department in 1892 it was one of many that used the 'simple beam' structural system. Built from native Australian hardwoods, the bridge was extended twice in response to shifting sands and suffered major flood damage in 1934 and again in 1974.
>
> It was recognised as a component of a significant tourist drive as early as 1934 by the NRMA Touring Department and continues to be valued in like manner by many of the local community as well as visiting tourists. The bridge is considered to have aesthetic value for its traditional character, its setting within the immediate landscape as well as being a component of the drive between Bermagui and Tanja. It is highly valued by the local community who consider that many of the bridge's characteristics align with their own values and way of life.
>
> Timber bridges of this type and period are coming to the end of their functional life and are being replaced with modern concrete structures, and consequently bridges such as Cuttagee are becoming increasingly rare.

The report summarises the attributes that contribute to Cuttagee Bridge's heritage value and looks at five other restored or replacement bridges that address heritage attributes in differing ways.

Contents

1 History of Cuttagee Bridge

1.1 Historical context

By the latter half of the 19th Century much of the land south of Cuttagee Lake that was not reserved for forests had been taken up by European settlers. JE Gowing purchased freehold land from the Polack family at Murrah in 1858 and Samuel Wilton selected land at Cuttagee in about the 1870s. Produce included butter, pigs, wattle bark and timber for Sydney tanneries and mills. Transport to market was by boat although options were limited. Before the land was cleared and the rivers silted up, Cuttagee Lake was accessible to smaller sailing vessels of less than 90 ft in length that were chartered by squatters to take produce to markets (Hearn p11). Tracks headed south and west from Murrah to Tathra and Bega, but transport still had to cross the Bega River. The transport difficulties for farmers and timber getters between Cuttagee Lake and the Bega River constrained their ability to market their produce.

The site for Bermagui was proclaimed in 1868, at which time most transport was by sea. Gold was discovered at Montreal goldfield in 1880 and a wharf built on the north side of the Bermagui River the same year. To provide for increasing trade and passenger transport, and the larger boats of the Illawarra Steam Navigation Company (ISNC) a deep-sea wharf was constructed in Horseshoe Bay in 1887. The first bridge across the Bermagui River opened in 1888 at which time the population in the town was approximately 200 adults and 40 children. Transport between Tilba Tilba and Bermagui wharf was often thwarted by the need to cross the mouth at Wallaga Lake until a causeway and bridge were built in 1894 (Hearn). The same challenges confronted those south of Cuttagee Lake.

Early parish maps indicate that the road from Murrah to Bega was surveyed and fairly well established in comparison to the track from Murrah to the ford across the Cuttagee Lake entrance - the section south of the lake being more of a dotted track along the beach rather than a surveyed and formed road. On the north side of the ford, across the lake entrance, the road reserve was surveyed through to Bermagui. The ford was obviously problematic and constrained by tides, storms and the difficulty of moving heavy loads across soft sand.

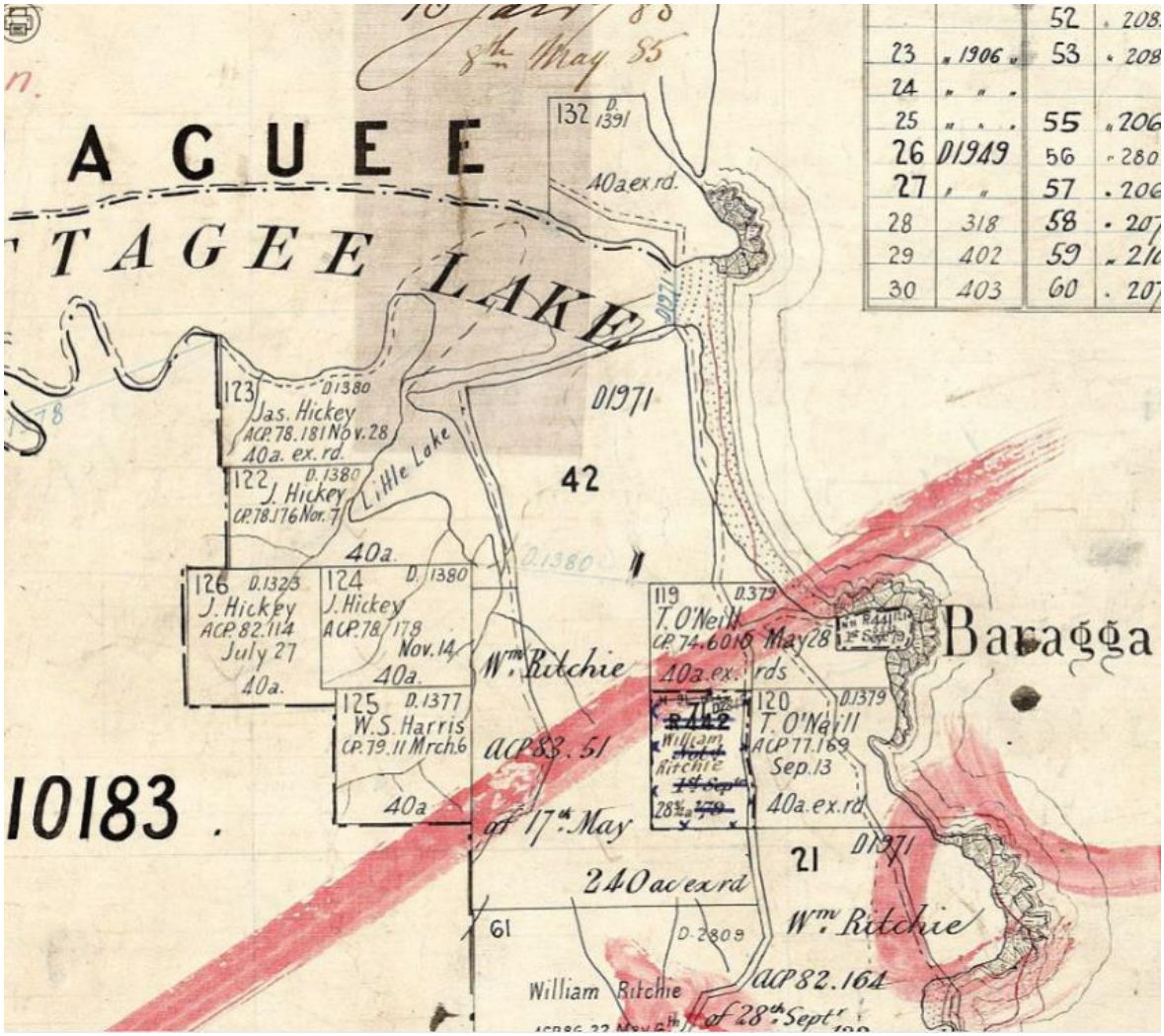
To overcome these challenges, which were by no means peculiar to Cuttage Lake, a bridge was designed by the Department of Public Works - Roads and Bridges and Sewerage Branch in 1892 (and presumed to have been opened in 1893). This was a period of extensive public works with many road and railway bridges being constructed. Most of these were constructed from timber, and most were ‘simple girder’ bridges like that at Cuttagee, rather than truss bridges such as the New Buildings Bridge over Towamba River (built 1921).

In 1861 the NSW parliament decreed that local materials and labour should be used wherever practicable in government-funded construction. Steel and iron were in short supply

and expensive and had to be imported. Even after the State's first steelworks were set up in Lithgow in 1878, steel continued to be in short supply until some years after the end of the Great War of 1914–18. (Timber Bridge Management, RTA report 2002)

During this period bridge structures in America and Europe moved to all-steel trusses because steel was readily and dependably available and their timbers had lesser quality, strength and durability. But in Australia the abundance of good timber and its relatively low cost, compared to steel and masonry or concrete, meant that timber remained the dominant construction material for bridges in the late 19th and early 20th centuries. This was particularly so in New South Wales, with its abundant supplies of superior hardwoods. By 1902, approximately 3,700 timber beam bridges [for both road and rail] had been built, making up 87% of the bridge population of the day. The construction of these bridges substantially improved road transport in the State and made a major contribution to economic activity, particularly in the agricultural sector. (Timber Bridge Management, RTA report 2002)

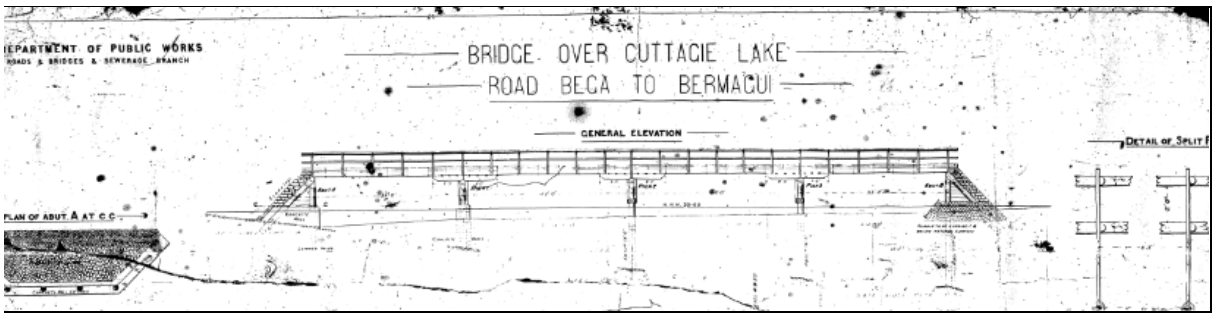
Within a short period of time, multi-span timber bridges were built at Wallaga Lake, Bermagui River, Cuttagee Lake and Murrah River. The smaller bridges at Barragoot, Wapengo and Sandy Creek are likely to have been built at much the same time allowing a reliable road network from Tilba Tilba, via Bermagui to Bega and Tathra linking population, production and ports.



Murrah Parish Map circa 1885 showing road reserves north and south of Cuttagee Lake entrance.

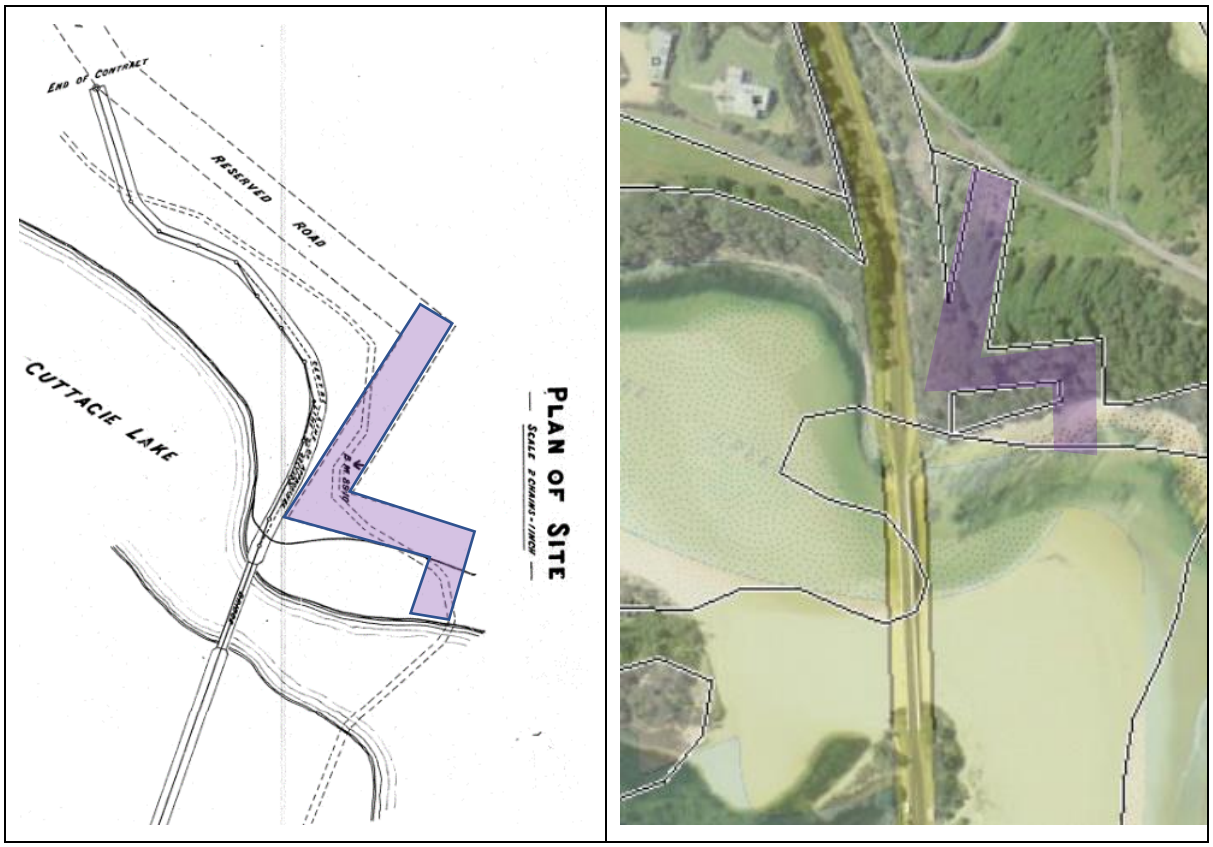
1.2 The first bridge over Cuttagee Lake – a four span bridge (1892-93)

The first bridge was only 4 spans long (130ft), supported by three sets of piers and an abutment at either end. The north abutment (Bermagui end) was in approximately the same position as the current bridge and the south abutment was where the fourth set of piers from the north currently is. The bridge was less than half its current length.



General elevation of the proposed bridge over Cuttagee Lake, 1892. Part of the set of plans prepared for its construction by the Department of Public Works, Roads and Bridges and Sewerage Branch.

The site plan included on the 1892 set of drawings shows the old track that enabled a crossing of the estuary when the conditions were favourable. The track was within a surveyed Road Reserve that remains evident in current Lot and DP boundaries



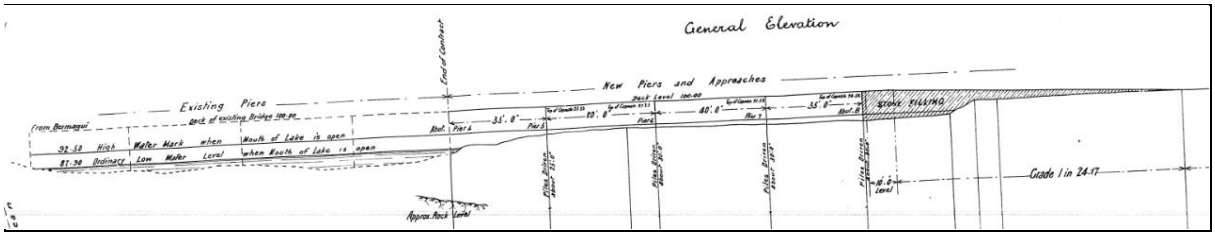
Detail of the northern approach road showing the historic track and earlier road reserve shaded mauve for clarity on both the 1892 Cuttagee Bridge plan and the 2021 SIX Maps view of the bridge and surroundings, with property boundaries highlighted.

1.3 Extension of first bridge to eight spans (1898)

The southern approach to the four-span bridge was on what turned out to be an unstable sand spit and only six years after the bridge was built it became necessary to double its length to a total of 8 spans. What had been the southern abutment was adapted to become pier 4, and additional piers were added to become piers 5, 6 and 7. A new southern abutment was formed 35 feet beyond Pier 7, to make a bridge of 8 spans in total with a combined length of 280 feet. The plan shows the bedrock level at pier 4 descending to the south. The width of the former abutment at pier 4 was retained even though it was considerably wider than the bridge deck. The southern abutment was backfilled with rock to provide an easy gradient down to natural ground level.

Unfortunately, there was no accessible bedrock on which to 'found' the new piers or the southern abutment. The timber piles had to be driven into the wet sand to the point of resistance.

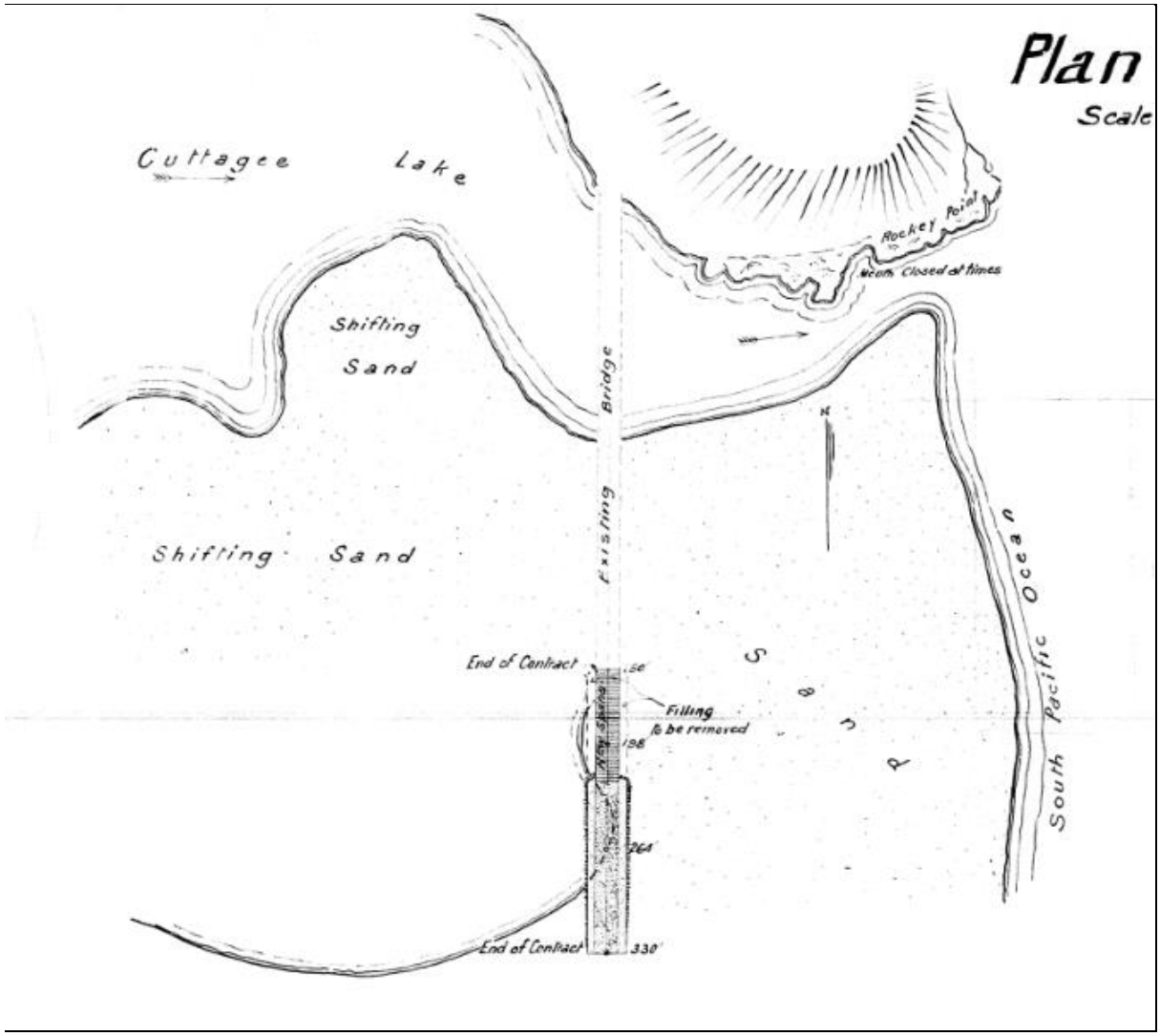
The Australian Star of Tuesday 13 Sep 1898, reported that the contract to provide '*Additional timber beam spans to bridge over Cuttagee Lake, on road Bega to Bermagui*,' had been awarded to J*. W. Stephenson of Dignam's Creek, for a sum of £498/ 17s*.



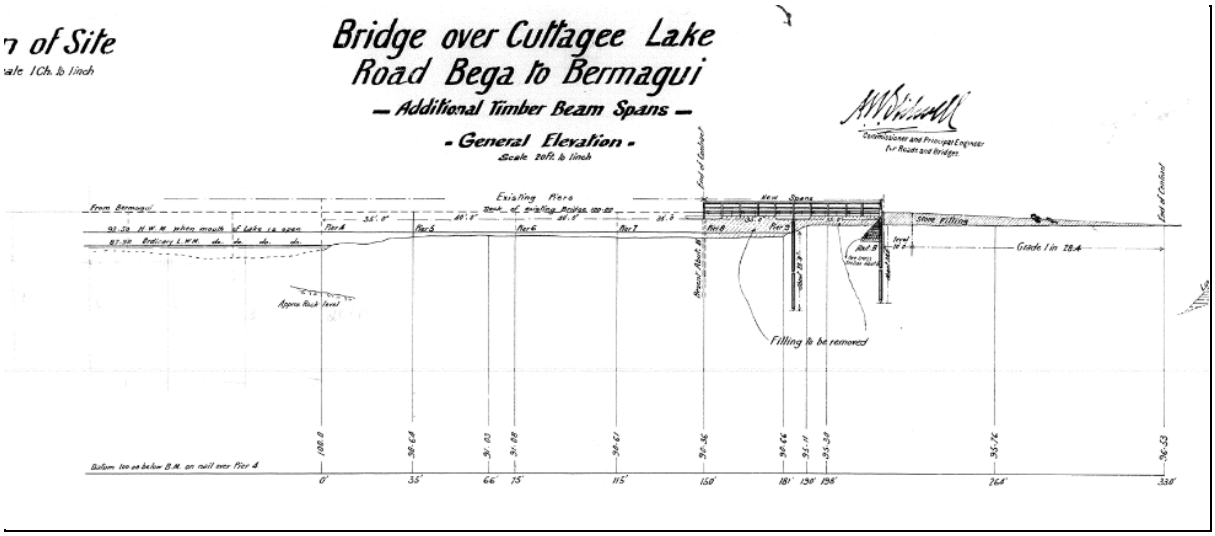
Part of the 1898 plan showing existing piers on the left hand (Bermagui) side of the elevation and the new piers and approaches on the right hand (Tanja) side of the line marked *End of Contract*. Piers 5, 6, 7 and the abutment include the notation '*piles driven'* to depths of 25 -30ft (approximately 8 – 10 metres).

1.4 Extension to a ten-span bridge (1903)

Within a few years there were further problems with the southern abutment which seems to have eroded or become unstable as a result of shifting sands and water levels. To remedy the situation the bridge was extended a further two spans. The stone filling under the old abutment was removed and a new stone-filled gradient added beyond the southern abutment. The work contract was awarded to Jakob Nybeck, Bega for a sum of £236 10s Od, and notified in the press on Tuesday 20 Oct 1903. At completion of that stage the bridge was a total of ten spans in length, which it has remained.



The site plan that accompanied the contract for the additional two southern spans shows the water level on the lake side extending under the southern approach and that the contract included building up the southern gradient to overcome the issue.



Bridge Over Cuttagee Lake, Additional Bridge Spans, General Elevation. Date obscured. Source BVSC O drive 4981-06. The drawing style closely matches that of the earlier plan that was dated 28/9/98 and is presumably drawn by the same person.

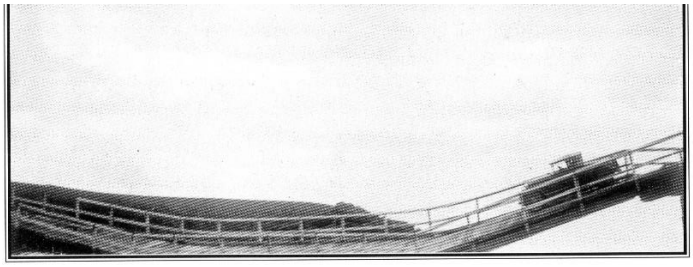
1.5 Collapse of original four spans and reconstruction in concrete and steel (1934)

In 1934 bad weather caused the collapse of piers 2 and 3 as can be seen in the images below.

Cuttagee bridge looking south following collapse of spans 2 and 3 during heavy storms in 1934.

'*The piles on the upstream of Cuttagee Bridge were undermined, tipping the bridge sideways so that it could be used only by light traffic using extreme caution'*. Looking back: The floods of 1934, Bega District News 23 MARCH 2018.

West elevation of collapsed bridge.1934. Source Murrah Hall Committee



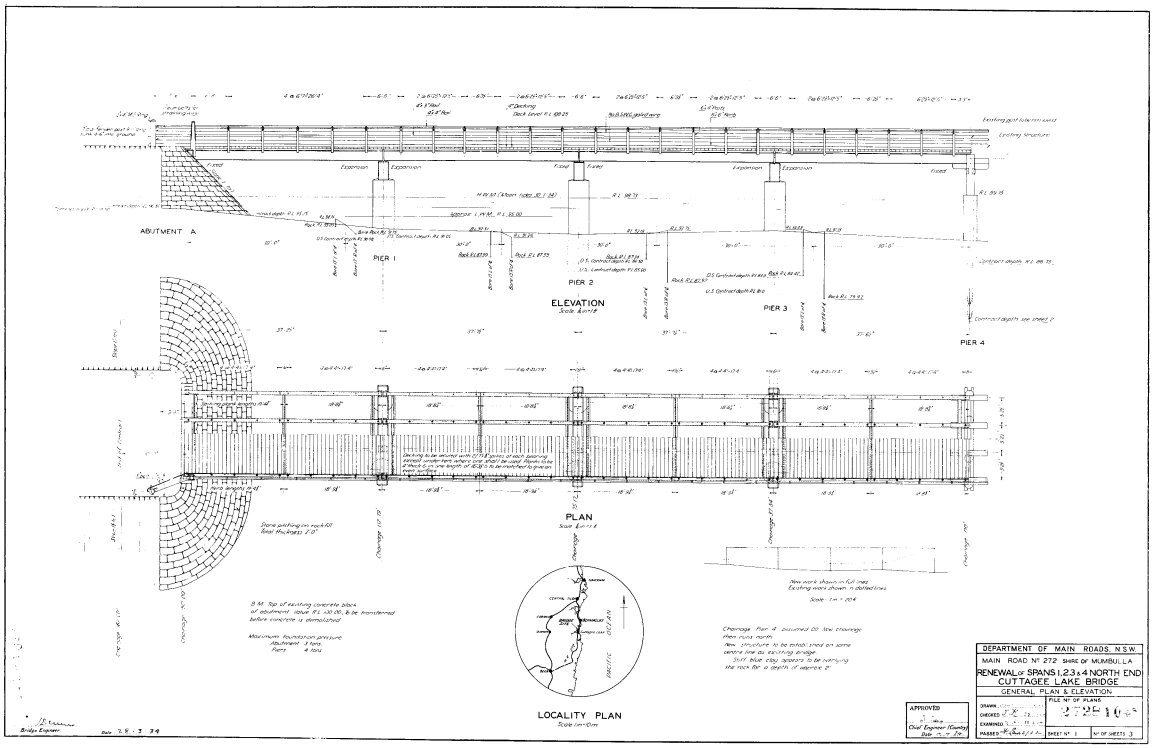
West elevation with car. Source: *Pictorial History of the Bega Valley Shire,* H Swinbourne and J Winters

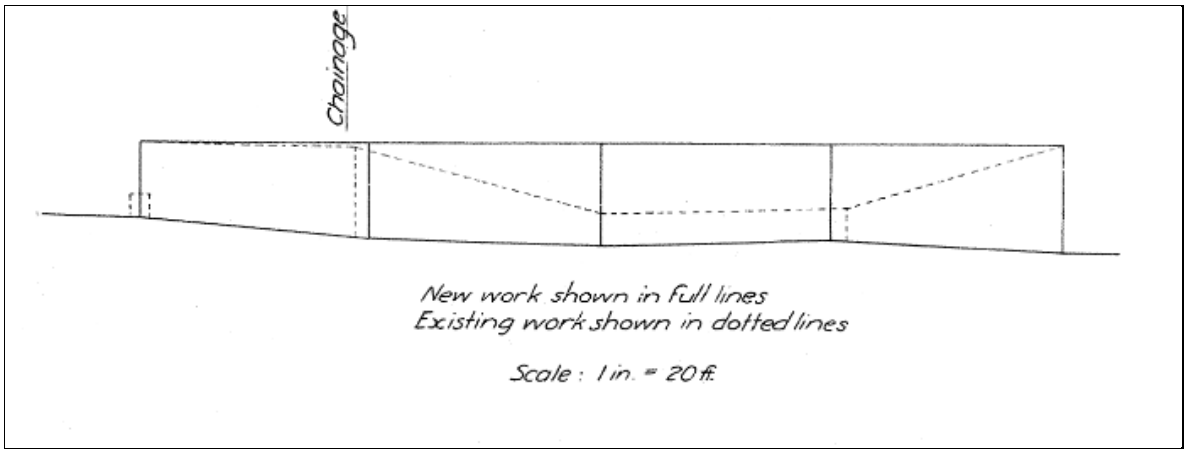
The NRMA of the day ran a series of notices in local papers across NSW advising of the bridge collapse:

> *CUTTAGEE BRIDGE.*
>
> *The N.R.M.A. Touring Department has been advised that repair work is in progress on Cuttagee Bridge, between Bermagui and Bega, and that the detour at the present time is almost impassable. During the summer months, this road appeals to motorists, as it keeps close to the coast for practically the whole way, and the scenery in parts is very fine. However, while the work is in progress, motorists are advised to keep to the highway through Cobargo. If it is desired to visit Bermagui, there is a fair road leaving Prince's Highway near Tilba Tilba, and going by way of Wallaga Lake to Bermagui, from which place the highway may be rejoined at Cobargo.* The Katoomba Daily Thu 31 Jan 1935.
>
> Source: https://trove.nla.gov.au/newspaper/article/193883415?searchTerm=cuttagee#

The Department of Main Roads chose to rebuild the collapsed piers in reinforced concrete and replace the timber girders that spanned the piers with four steel beams for each of the four spans. A traditional timber deck with timber side rails was fixed to the surface of the steel beams. The plans are detailed and specific regarding the deck and rails and it is fair to assume that all the timber used in the 1935 re-build was new, especially considering that timbers in the original section of bridge had

been exposed to the elements for over forty years. Before reconstruction could begin the collapsed 1892 bridge was demolished from the northern abutment to pier 4.





Renewal of Spans 1, 2, 3 & 4 North End Cuttagee Lake Bridge, General Plan and Elevation, sheet 1 of 3, drawn 27/3/1934. Source BVSC O drive 4981-02. The drawing provides a detailed plan and elevation of the proposed work from the north abutment through to pier 4. Also included is a small schematic drawing of “existing work” being the approximate shape of the collapsed section of bridge.

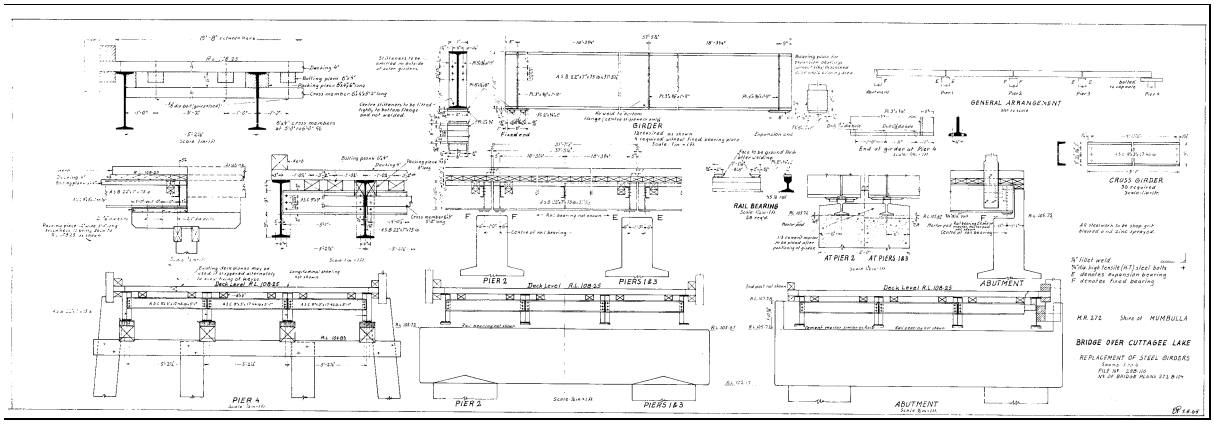
Cuttagee bridge looking north from about pier 4 showing demolition of the northern end of the bridge circa 1934-35. Source Murrah Hall Committee.

The following year the NRMA informed it readers that the Cuttagee Bridge was open.

> *The N.R.M.A. Touring Department has been advised by the Association's Bega representative that the bridge over Cuttagee Lake, on the coast road between Bermagui and Bega, is now open to traffic, construction work having been completed recently. This road affords an interesting alternative route to Prince's Highway, some fine coastal scenery being taken in on the trip. Care should be exercised, however, to wet weather*. Glen Innes Examiner, Thu 25 Jul 1935.

1.6 New steel girders (1965)

By 1965 the steel girders that had been installed to support the four northern spans of the bridge after its collapse in 1934-35 were now in need of replacement, probably due to rust.



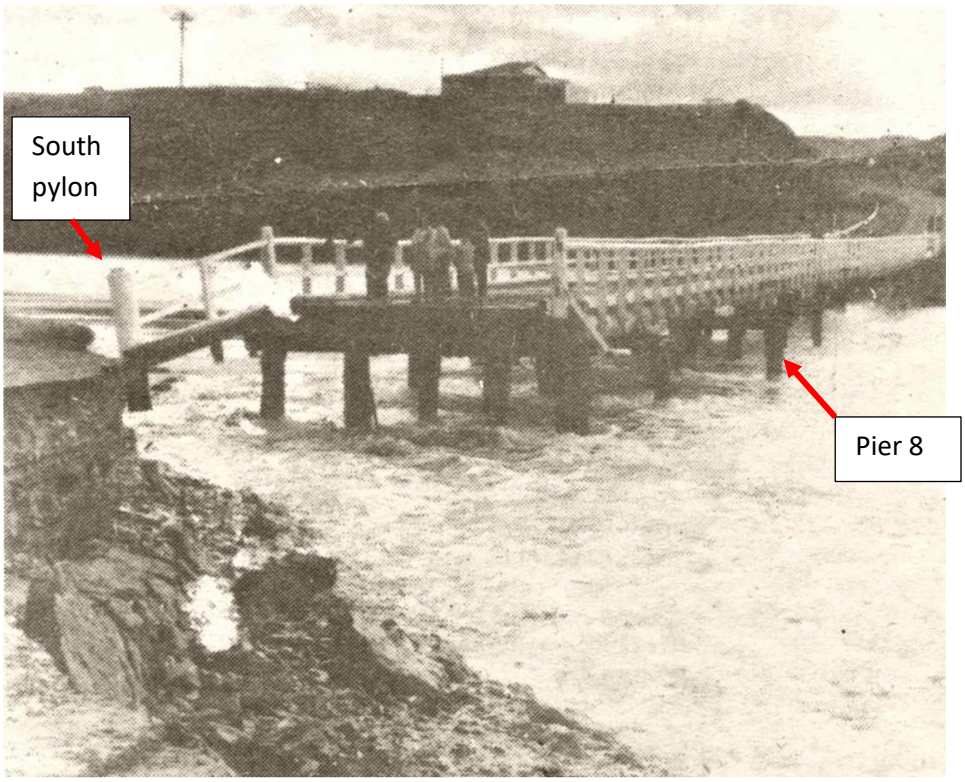
Bridge Over Cuttagee Lake, replacement of steel girders - Spans 1-4. MR 272 Shire of Mumbulla. Dated 7/6/65. Source BVSC O drive 4981 – 03.

A photograph taken in the late 1960s shows the bridge in apparently stable form but with a secondary channel forming toward its southern end. Close inspection of the photo shows apparent subsidence at pier 4 which, in the first iteration of the bridge circa 1892, was the southern abutment (note that the old timber piles were encased in concrete in 1934-5). The wider headstock on top of the piles can also be seen. Pier 8 was the southern abutment in the bridge's second iteration of 1898 and it too is wider as a consequence. There are no additional steel piles, or lateral or diagonal bracing between piles at the time of this image.

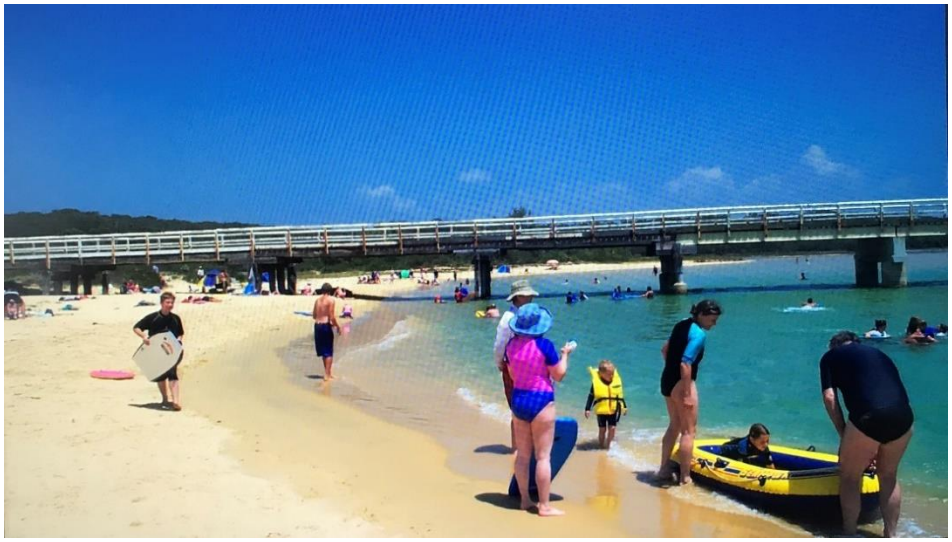
Cuttagee Bridge in the late 1960s. Photo taken by Sister Harris. Source Bermagui Historical Society.

1.7 Washout of southern abutment (1974)

Less than a decade later, in 1974, the southern abutment was washed away, leaving the pylon and guard rails hanging in space as water rushed beneath.



Cuttagee bridge 1974. Viewed from southern abutment looking north



Recreation at Cuttagee Bridge January 2004, showing popular use of lake. Source: BVSC

1.8 Pile strengthening and extensive repairs

Over recent decades there have been extensive repairs to the bridge as many of the piles and headstocks reached the end of their life. The new or recycled headstocks can be seen extending beyond the edge of the bridge, supported on additional piles. Steel piles have been driven into the sand either side of the former timber piles. Diagonal bracing and horizontal ties have been added to the piles to provide additional strength and there is evidence of numerous repairs to the decking

The RTA Timber Bridge Management Study of 2002 makes the point that

> *Timber degrades when left exposed to the elements, and therefore has a high maintenance demand if used for permanent outdoor structures. An unprotected timber structure will need to be continually rebuilt throughout its service life. A timber structure more than 50 years old will in all probability have had all its timber elements replaced at least once—and in the case of its decking, as many as four times.*

This is the case with Cuttagee along with numerous timber bridges throughout the State. The deterioration rate at Cuttagee is probably worse than many due to the fluctuating tides, severe storms and wind-blown salt spray.

View from South abutment looking north at pier 9. June 2021. Note extended headstocks, introduced steel piers, butt-spliced timber piers and rust at base of steel work.

Cuttagee Bridge girders at Span 9, photographed June 2021. The good condition of the underside of decking suggests that timbers were replaced in relatively recent times.

Typical cracking in under-beam caused by coach bolt fixing of decking. This can lead to decay and failure.

Cuttagee Bridge looking south. The many irregularities in the substructure are reflected in the 'wavey' lines of handrails, kerbing and the deck surface itself. Many timbers have decayed, and metal is rusting. June 2021

Decayed posts and kerbs. June 2021

Rusting girders. June 2021

Rusting fixings holding down kerbs, June 2021

Failing deck timber. This common problem is caused by water entering the timber via the screw holes and causing decay. June 2021.

2 Condition

It is not the role of this report to analyse the condition of the bridge, but rather to determine how its condition impacts or influences the heritage significance of the structure. Notwithstanding the above, a cursory inspection reveals the bridge is in less-than-ideal condition and that many of its members are coming to the end of their functional life. Repair, replacement, and on-going change to the fabric will be necessary if it is to continue to fulfill its role. As has happened with the pier repairs and replacements since 1934, attempts to stabilise and reinstate the structural integrity of the bridge have been pragmatic, and often done at the cost of the bridge's initial design elegance.

3 Integrity

Integrity refers to the degree to which the item has been altered from its initial designed and built form. Integrity can be applied to both the form of the item as well as the fabric. In some situations the fabric can be altered with relatively little impact on the integrity of the design, and is usually necessary where timber structures are exposed to the elements. Where elements are replaced in a like-for-like manner the structural integrity is retained. Where the new deviates from the old, integrity is weakened. Such is the case with the substructure at Cuttagee which has been extensively altered over time.

On the other hand, the deck, kerbs and handrails have been repaired and replaced like-for-like and have continued to respect the visual and functional integrity of the upper part of the bridge – the part that most travellers see when driving across.

4 Assessment against NSW Heritage Criteria

The NSW heritage assessment criteria encompass the four values in the Australia ICOMOS Burra Charter, which are commonly accepted as generic values by Australian heritage agencies and professional consultants:

- historical significance
- aesthetic significance
- scientific significance
- social significance

These basic values are expressed as a set of criteria against which an individual place, or indeed a complex of individual items can be assessed. A place does not need to meet all criteria, and often a place will meet only one criterion and still be deemed significant. If a place meets the criterion to a high degree, it may meet the threshold for entry to the local heritage schedule or the State Heritage Register. It is customary to include a summary statement of significance that clarifies the nature and degree of significance.

A copy of the NSW heritage assessment guide (Assessing Heritage Significance) can be found at https://www.heritage.nsw.gov.au/search-for-heritage/publications-and-resources/ .

4.1 NSW Heritage Criteria

Criterion (a)

An item is important in the course, or pattern, of the cultural or natural history of the local area;

The Cuttagee Bridge was one of many such bridges designed by the NSW Public Works Department and built to improve the transportation network throughout NSW in the latter part of 19th and early 20th centuries. It greatly facilitated access to ports and markets for those operators located south of Cuttagee Lake. It was effectively a link in a transport chain that included Murrah Bridge, Wapengo, Sandy Creek and various one and two span bridges over lesser creeks.

Its historic significance is confined to the local area only.

Criterion (b)

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

The bridge is one of possibly thousands designed by the Public Works Department but is not known to be associated with any significant individual, unlike for example the timber truss bridges that are named after their design engineer (Allan, McDonald, Dare and de Burgh).

The Cuttagee bridge is not significant against this criterion.

Criterion (c)

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

The bridge does not demonstrate a high degree of creative or technical achievement however it does have important aesthetic attributes. While different people will have different tastes, aesthetic values are generally established if they are held by a group or community. This can be demonstrated for example by an item being a regular subject of photography, or of painting or discussion, or indeed by collective agitation if the item is at risk of change or demolition. Aesthetic value can be a component of social value.

The demolition of timber bridges frequently generates concern, distress, agitation and strong feeling in community groups who mourn the loss of the item because of the way it looks, its character and its setting.

The aesthetic attributes of the Cuttagee bridge relate to the deck and above, to:

- its human scale (in this case width of deck and height of rails)
- its use of repeated elements (posts and rails, ends of deck timbers etc),
- its materiality (primarily painted timber and old metal fixings),
- its texture (wood grain, multiplicity of components, varied deck surface)
- its irregularities that show how it has aged and responded to settlement (handrails, deck kerbs, deck surface),
- Its sound when driven over (the knocking of deck boards and the ‘slap’ as the tyre moves from one deck board to another – the bridge could be said to have an ‘acoustic’).

In summary the bridge has a high degree of aesthetic value that is subtly embedded in its scale, detail and material that combine to evoke an emotive response that is held by many in the community. In this particular bridge the values are in the deck and above, not the piles and girders that have been extensively altered.

Criterion (d)

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

There is a design simplicity evident in the many hundreds of timber bridges that were built like Cuttagee. They used quality Australian hardwoods, often from the local area, in a structure that was conceptually simple, and able to be built using local skills and labour. Structures that continue to demonstrate this quality sit comfortably in their landscape setting and resonate with the local community. The Cuttagee Bridge has strong social and associative values for members of the local community who have initiated a campaign for its retention.

Important values expressed recently by some community members could be summarised as the tourist, aesthetic and amenity aspects of the bridge.

Criterion (e)

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

Does not apply to Cuttagee Bridge

Criterion (f)

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

Most of the 3000 or so timber bridges for both road and rail across NSW were constructed approximately between about 1870 and 1930. In 2009 the timber bridge study undertaken for Bega Valley Council identified 65 timber bridges in the shire. Since that time a number have been burnt in bush fires or replaced as part of the Shire's on-going bridge replacement program. Most of the bridges are coming to the end of their functional life or may not meet modern codes and standards. A bridge typology that was once common across the shire is diminishing and as a consequence surviving timber bridges will become rare. It is fair to say that Cuttagee Bridge possesses endangered aspects of the Bega Valley Shire's cultural heritage.

Criterion (g)

An item is important in demonstrating the principal characteristics of a class of the local area's cultural or natural places

From the deck up, the Cuttagee bridge is a fair, if aged, example of the timber bridge type however, below the deck, it is now a poor example of the type, with multiple modifications to the piers and abutments.

4.2 Statement of Significance

The Cuttagee Bridge is of historic interest as one of a group constructed in the later part to the 19th century to facilitate transport between Tilba Tilba, Tanja and the port at Bermagui. Designed by the NSW Public Works Department in 1892 it was one of many that used the 'simple beam' structural system. Built from native Australian hardwoods, the bridge was extended twice in response to shifting sands and suffered major flood damage in 1934 and again in 1974.

It was recognised as a component of a significant tourist drive as early as 1934 by the NRMA Touring Department and continues to be valued in like manner by many of the local community as well as visiting tourists. The bridge is considered to have aesthetic value for its traditional character, its setting within the immediate landscape as well as being a component of the drive between Bermagui and Tanja. It is highly valued by the local community who consider that many of the bridge's characteristics align with their own values and way of life.

Timber bridges of this type and period are coming to the end of their functional life and are being replaced with modern concrete structures, and consequently bridges such as Cuttagee are becoming increasingly rare.

5 Examples of adaptation

This section looks at examples of bridges that have incorporated elements of bridges they replaced.

5.1 Murrah Bridge

Murrah Bridge, located south of the Cuttagee Bridge, has had all its former timber piers replaced with concrete piers and concrete headstocks. Girders, deck and rails remain in timber, although it is likely that most of the timber has been replaced over the course of the bridge's life. The bridge is a single lane wide, although there may be capacity to expand it to double-lane given the width of the concrete piers. From the tourist perspective the bridge 'reads' as a timber structure and it continues to contribute to the historic character of the scenic drive.

Murrah Bridge 2021. From the tourist perspective the bridge presents as a timber structure.

The timber upper structure is supported on relatively recent concrete piers that may be wide enough to support a second lane if the bridge needs to be widened.

5.2 Glenmurray Bridge

Located in the Kangaroo Valley on Tourist Drive 7, the Glenmurray Bridge is a two-lane concrete bridge with steel handrails modelled on traditional timber detailing. The spacing of posts and rails, the dimensions of members and the diamond top rail closely reflect timber bridge construction. The pylons comprise a short sandstone pillar followed by a bespoke steel cylinder. The railing posts are bolted onto small concrete plinths in lieu of a kerb which prevents the build-up of detritus, and visually opens the bridge to the landscape. The small amount of leaf litter on the side of the carriageway reduces the visual impact of the concrete and contributes to the bridge's rural character.

Glenmurray bridge sits well within its context. Google Image of 2021

Glenmurray Creek Bridge

Note the combination of sandstone and painted steel pylon, plus absence of concrete kerb.

5.3 Turallo Creek Bridge

The reconstructed Turallo Bridge at Bungendore is a concrete bridge that has a bevelled kerb structurally integrated into a half-height concrete wall. The white steel guard rail follows traditional details and proportions including a short obelisk pylon.

This bridge does not incorporate traditional details as successfully as the one at Glenmurray Creek.

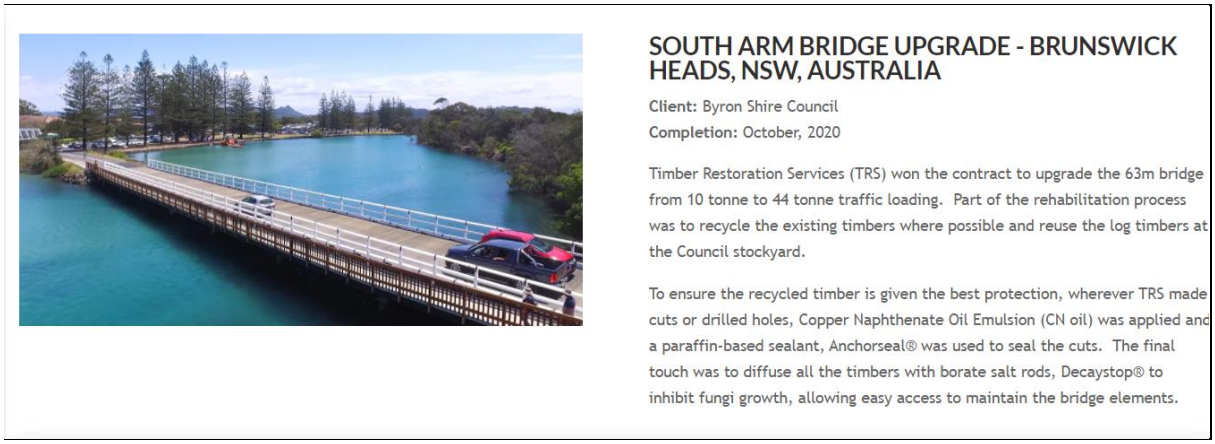
Turallo Creek, Bungendore (Palerang Shire), prior to demolition

Turallo Creek, Bungendore april 2009

5.4 Brunswick Heads Bridge

The two-lane timber bridge at Brunswick Heads is much valued by the community and seen as part of their tourist offering. The 63metre bridge was upgraded from 10 tonne to 44 tonne traffic loading. The attached pedestrian footbridge was also addressed as part of the restoration.

Brunswick Heads timber bridge. Google image capture dated January 2010



SOUTH ARM BRIDGE UPGRADE - BRUNSWICK HEADS, NSW, AUSTRALIA

Client: Byron Shire Council
Completion: October, 2020

Timber Restoration Services (TRS) won the contract to upgrade the 63m bridge from 10 tonne to 44 tonne traffic loading. Part of the rehabilitation process was to recycle the existing timbers where possible and reuse the log timbers at the Council stockyard.

To ensure the recycled timber is given the best protection, wherever TRS made cuts or drilled holes, Copper Naphthenate Oil Emulsion (CN oil) was applied and a paraffin-based sealant, Anchorseal® was used to seal the cuts. The final touch was to diffuse all the timbers with borate salt rods, Decaystop® to inhibit fungi growth, allowing easy access to maintain the bridge elements.

The road and pedestrian bridge after restoration

The historic timber railings on the vehicle bridge have been upgraded and painted. The balustrade on the pedestrian bridge has also been upgraded by changing from galvanised steel pipe to clear finished timber.

5.5 Tharwa Bridge

Tharwa bridge was designed by Percy Allen of the NSW Public Works Department and opened 1895. It utilised four pair of timber trusses supported on timber piers over the main part of the Murrumbidgee River. Simple timber girders linked the truss component to the abutments on either bank.

The timber piers were encased in concrete around the 1930s, and the whole bridge underwent major restoration in the early 1990's. The bridge retained its single width and the tight curve on the western approach. Timber girders were replaced with steel and the timber trusses fully restored using timber and steel components as per their original design. Light guage folded colorbond sheet was fitted to the top of the upper truss member to prevent weathering.

New cross-beams supporting the deck were made from a welded steel box section (painted white) that supports a modern timber deck made from laminated timber and steel through-rods.

Steel side rails reflect traditional timber design with a diamond top rail. Mesh has been added, presumably to provide for pedestrian security.

The bridge has historic significance for providing a reliable transport link across the river. It is technically significant as the first Allen's Truss bridge designed and built in NSW and has aesthetic value for its form and setting. Additionally, it has social value for the residents of Tharwa and beyond. It is on a tourist trail and is within the visual catchment of both historic Lanyon Homestead and Tharwa village.

The welded steel cross-beams support the laminated timber deck. Photo July 2021.

Tharwa bridge is one lane wide, with white painted steel rails closely modelled on traditional detail. Steel mesh is added to the rails to provide greater pedestrian security. The concrete deck on the approach spans has an asphalt surface which unifies the surface and visually ties the concrete approach spans and timber truss spans together.

6 Towards a Heritage Hybrid

The physical attributes of the Cuttagee Bridge that contribute to its heritage value can be summarised as:

- timber deck and rails,
- spacing of posts and rails,
- diamond top rail,
- timber kerb,
- white paint,
- (historic photos show black paint on straps holding top rail to posts and collars around pylon tops)
- tapered timber pylons at abutment end of railings,
- post and rail fence either side of the abutment,
- an acoustic response to vehicles (knock of timber – slap of wheel)
- traffic calming measure (a repeated comment from the community has been that the bridge required vehicles to slow down – which had a benefit for pedestrian safety and contributed to an appreciation of the scenic drive).

It is possible to suggest a bridge design that finds a balance between the above heritage values and a simply functional asset. The attributes can apply to either a single or a two-lane bridge. In the case of Cuttagee the substructure is not a major heritage component as for the most part the bridge is perceived from above.

7 References

Bermagui by the Sea, Hearn J, Penmark Press 1996

Spanning Two Centuries, O'Connor C, University of Queensland Press 1985

Timber Bridge Management, Roads and Traffic Authority of NSW, January 2002

Timber Bridges, Giovanelli P, Unpublished report prepared for BVSC 2009

Cuttagee Bridge Options - Investigation Report for BVSC, Marshman O'Neill Engineers 2021

Various articles from 'Trove', National Library Australia

Historic parish maps, Historical Land Records Viewer - NSW Land Registry Services

Appendix 1

Heritage Design Attributes

This section of the report seeks to provide more specific guidance on how the elements that contribute to Cuttagee Bridge's heritage character could be treated in the design of a replacement structure.

Width of the deck	Only as wide as necessary
Surface of deck	The most sympathetic heritage solution is to reconstruct a single lane timber deck. If the deck is concrete it is preferable to finish the surface in asphalt at least to the width of the carriageway. If surface must be concrete then vary the surface to reduce its monolithic appearance. eg grind or otherwise treat some or all of the surface to expose the aggregate, or incise the surface with grooves at right angles to bridge length, spaced at 150 mm centres. This latter treatment will reflect the appearance or character of multiple deck boards and provide an acoustic response when crossed by vehicles.
Kerb	Ideally the kerb would be timber. If the kerb is concrete keep size to a minimum and paint it white as per timber kerb. The Glenmurray bridge deleted the kerb altogether and there may be merits in doing this as it provides a more direct visual link between the vehicle and the landscape. Tathra bridge has a smaller concrete kerb that works well. Large kerbs such as on the Turallo bridge have no heritage connection and should be avoided.
Rails and posts	Ideally these would be timber as per traditional dimensions and spacings. If steel, retain as per traditional proportions and include diamond top rail. Consider introducing black painted tie down strap as per historic bridge as this will add interest and mitigate against uniformity of steel. See details on Brunswick Heads bridge.
Pylons	The term 'Pylons' in this document refer to the stout vertical elements at the four corners of the bridge that define the ends of the side rails. Pylons on a new bridge should replicate traditional timber bridge pylons. Ideally these will be timber, but could be painted steel eg a tapered four-sided obelisk that finishes with a round head and black collar. The Turallo bridge pylon is an alternative model, although if used at Cuttagee should be anchored at ground level. Pylons could have a bespoke treatment provided by the community which would provide an opportunity for local community engagement.
Abutment fence	Utilise same details as per bridge side rails. Anchor to pylon or provide secondary pylon. If a guard rail is required, introduce it low down and finish in white powder-coat. Fix to face of the abutment fence and anchor to pylon or secondary pylon.
Acoustic response	Use coarse aggregate in asphalt, or grooves at right angles to bridge.
Traffic calming	Bond bands of proprietary product to the road surface at the approach to the bridge. This product is used to great effect on the approach to certain roundabouts in Canberra. Speed limiting signage should also be used.

Pedestrian bridge	None of the bridges on the road between Bermagui and Tanja had pedestrian paths. In other parts of the state certain timber bridges had 'pop-outs for pedestrian refuge. It is questionable if Cuttagee warrants a separate pedestrian bridge or whether refuges would be sufficient. The addition of a timber pedestrian bridge should not be used to hide or camouflage an unsympathetic road bridge. For many travellers, the Cuttagee road bridge is seen from the road rather than the beach, and so a pedestrian bridge would not enhance the road bridge in this instance. A pedestrian bridge would have its own construction and maintenance costs which arguably would be better incorporated into the road bridge to make the latter more historically sympathetic. If a pedestrian bridge is considered necessary at Cuttagee it should be at the same level as the road bridge and utilise traditional post and rail details with the same spacings. If gaps need be no greater than 125mm, this can be achieved by using heavy gauge bronze (or similar) mesh as per the Tharwa bridge.

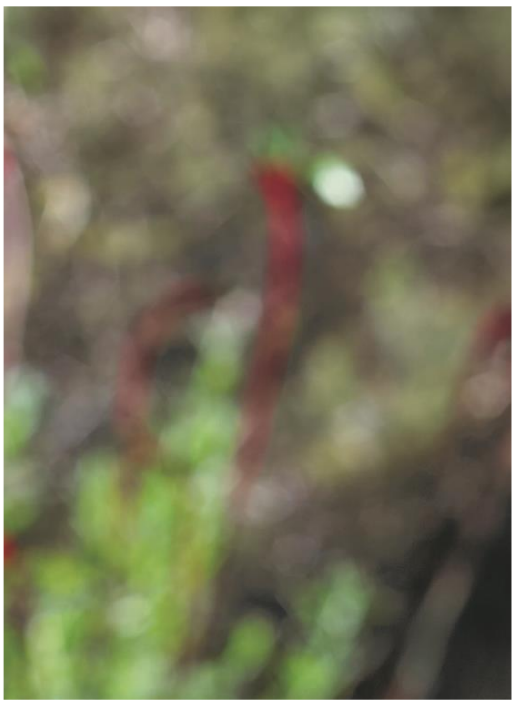
Appendix I Due Diligence

ABORIGINAL DUE DILIGENCE ASSESSMENT

Cuttagee Bridge Replacement

July 2021

Project Number: 21-143



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Revision	Date	Prepared by	Reviewed by	Approved by
Draft	14/07/2021	Jasmine Tearle	Ali Byrne	
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TABLE OF CONTENTS

Figures

Tables

ACRONYMS AND ABBREVIATIONS

AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
BVSC	Bega Valley Shire Council
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DPIE	Department of Planning, Industry and Environment (NSW)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
ha	hectares
Heritage Act	*Heritage Act 1977* (NSW)
km	kilometres
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
m	metres
NGH	NGH Pty Ltd
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSW	New South Wales
PAD	Potential Archaeological Deposit
Proposal Area	Area subject to this assessment
WBAS	Williams Barber Archaeological Services

EXECUTIVE SUMMARY

NGH Pty Ltd was commissioned by the Bega Valley Shire Council to undertake a Due Diligence assessment for Aboriginal heritage sites for the replacement of Cuttagee Bridge over Tathra-Bermagui Road, Cuttagee in south-eastern NSW. This assessment evaluates whether Aboriginal objects are present, or likely to be present, within the Proposal Area which may be affected by the proposed works.

Background and Desktop Assessment

No previously recorded sites are listed on the Aboriginal Heritage Information Management System (AHIMS) database within 30 km of the Proposal Area. The Proposal Area is located at the saline coastal lagoon estuary of Cuttagee Lake which has been highly disturbed by the construction and maintenance of the bridge and road, underground cables, signage, and fencing and is within a low-lying landform that is commonly inundated with water. However, there is potential for sites to occur on the sand dunes in the south-west of the Proposal Area where undisturbed sand deposits may be present.

Field Assessment

The visual inspection identified that there are significant areas of previous land disturbance within the Proposal Area because of the initial road and bridge construction and ongoing maintenance activities, as well as infrastructure comprising beach wall and steps, underground services, fencing, signage, and erosion. The sand dunes on the south-western side appeared to have high levels of disturbance close to the road corridor, however the dune crest exhibited less evidence of ground disturbance. Exposures on the crest showed modern oyster shell and young sands, suggesting recent accretion and limited potential for *in situ* subsurface cultural deposits in the upper stratigraphic layers. However, the deeper sands within the dune landform have the potential to contain *in situ* subsurface cultural deposits, and therefore it was concluded this area has low-moderate potential to contain such deposits and is an area of archaeological sensitivity.

No Aboriginal objects or areas were identified but one area of archaeological sensitivity was recorded.

Impact Assessment Conclusion

It was determined that the sand dune crest in the south-western portion of the Proposal Area is an area of archaeological sensitivity with low-moderate potential to contain *in situ* subsurface cultural deposits. The remainder of the Proposal Area outside the dune crest has low potential to contain *in situ* subsurface deposits due to the high level of disturbance.

To negate the need to conduct further archaeological assessment BVSC would need to ensure the proposed works avoid the area of archaeological sensitivity. Works within the Proposal Area, as assessed in this report, which are outside the boundary of the area of archaeological sensitivity do not require further heritage investigation and works can proceed with caution.

Recommendations

The following recommendations are based on a number of considerations including:

- Background research into the area;
- Previous salvage programmes undertaken within the area
- Landscape assessment;
- Field inspection;
- Consideration of the proposed works, and
- Legislative context for the development proposal.

It is recommended that:

1. The area of archaeological sensitivity identified on the dune, as shown in Figure *6-1*, must be avoided by the Proposed works. A temporary barrier fence must be placed between this area and the works area during construction.
2. Works within the Proposal Area that are not within the area of archaeological sensitivity may proceed with caution.
3. Further heritage assessment in the form of an Aboriginal Cultural Heritage Assessment (ACHA) must be completed prior to any works being undertaken within the archaeologically sensitive area, if this cannot be avoided. The ACHA can then be used in support of an Aboriginal Heritage Impact permit (AHIP) if required. To negate the need to conduct further archaeological assessment BVSC must contain their works to the previously disturbed area of the dune comprising the incised, sloped area adjacent to the road corridor.
4. Any activity proposed outside of the current assessment area should also be subject to an Aboriginal heritage assessment.
5. If any items suspected of being Aboriginal in origin are discovered during the works all work in the immediate vicinity must stop and Heritage NSW notified. The find will need to be assessed and if found to be an Aboriginal object an AHIP may be required.
6. In the unlikely event that human remains are identified during development works, all work must cease in the immediate vicinity and the area must be cordoned off. The proponent must contact the local NSW Police who will make an initial assessment as to whether the remains are part of crime scene or possible Aboriginal remains. If the remains are thought to be Aboriginal, Heritage NSW must be notified by ringing the Enviroline (131 555).

BVSC is reminded that it is an offence under the *NSW National Parks and Wildlife Act 1974* to disturb, damage or destroy and Aboriginal object without a valid AHIP.

1. INTRODUCTION

NGH Pty Ltd (NGH) was commissioned by the Bega Valley Shire Council (BVSC) to undertake an Aboriginal heritage assessment in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010) (Due Diligence Code). The purpose of the assessment is to assess the potential for impacts to Aboriginal objects as a result of the proposed replacement of Cuttagee Bridge over Tathra-Bermagui Road, Cuttagee in south-eastern NSW (the Proposal Area) as shown in Figure 1-1. The existing bridge has reached the end of its operational life and needs to be replaced to maintain safe and reliable access to the surrounding area. As such, BVSC proposes to replace the existing two-lane timber bridge with a new two-lane concrete structure.

This Due Diligence assessment was undertaken to evaluate the presence of Aboriginal sites and the potential for Aboriginal objects to occur within the Proposal Area which may be affected by the proposed works.

1.1 Proposal Area

The Proposal Area includes portions of Lot 7004/DP1024289, Lot 3/DP813056, Lot 5/DP250280, Lot 2/DP813056 and road reserve and is within a coastal rural environment located in the Parishes of Bermagui and Murrah in the County of Dampier. Lot 7004/DP1024289, which is identified as Crown land, will be the main works area. The Proposal Area is within the township of Cuttagee, approximately 29 km north-east of Bega, in the Bega Valley Local Government Area (LGA). The Proposal Area, as shown in Figure 1-2, extends along the existing road, an additional 150 m at either end of the existing bridge, and approximately 115 m wide at either side to allow for some realignment.

1.2 Project Personnel

The Due Diligence assessment was carried out by qualified archaeologists Kirsten Bradley and Jasmine Tearle of NGH. Jasmine Tearle completed the background research, desktop assessment and this report. Jasmine Tearle and Kirsten Bradley undertook the fieldwork. Ali Byrne, Senior Heritage Consultant, reviewed the report for quality assurance purposes and approved the report for distribution.

The due diligence process does not formally require consultation with Aboriginal community groups. No Aboriginal groups were contacted for this due diligence level assessment. The Proposal Area is within the boundaries of the Merrimans Local Aboriginal Land Council (LALC).

1.3 Approach and Format of this Report

This report has been drafted in keeping with the sequence of steps identified in the Heritage NSW guideline *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010). The Due Diligence Code provides a five-step approach to determine if an activity is likely to cause harm to an Aboriginal object, as defined by the *NSW National Parks and Wildlife Act 1974*. The steps follow a logical sequence of questions, the answer to each question determines the need for the next step in the process.

The Due Diligence Code sets out the steps which the Proponent is required to take in order to:

- Identify whether Aboriginal objects are, or are likely to be, present in the Proposal Area;
- Determine whether or not their activities are likely to harm Aboriginal objects (if present) in the Proposal Area; and
- Determine whether an AHIP application is required.

Each section within this report follows the relevant step outlined in the Due Diligence Code as noted in Table *1-1* below.

Table 1-1 Due Diligence Steps for this report

Due Diligence Steps
Step 1. Will the activity disturb the ground surface?
Step 2a. Search the AHIMS database and use any other sources of information of which you are already aware
Step 2b. Are activities proposed in areas where landscape features indicate the presence of Aboriginal objects?
Step 3. Can you avoid harm to the object or disturbance of the landscape feature?
Step 4. Undertake a desktop assessment and visual inspection. Is it likely that Aboriginal objects will be impacted by the proposed works?
Step 5. Further investigations and impact assessment

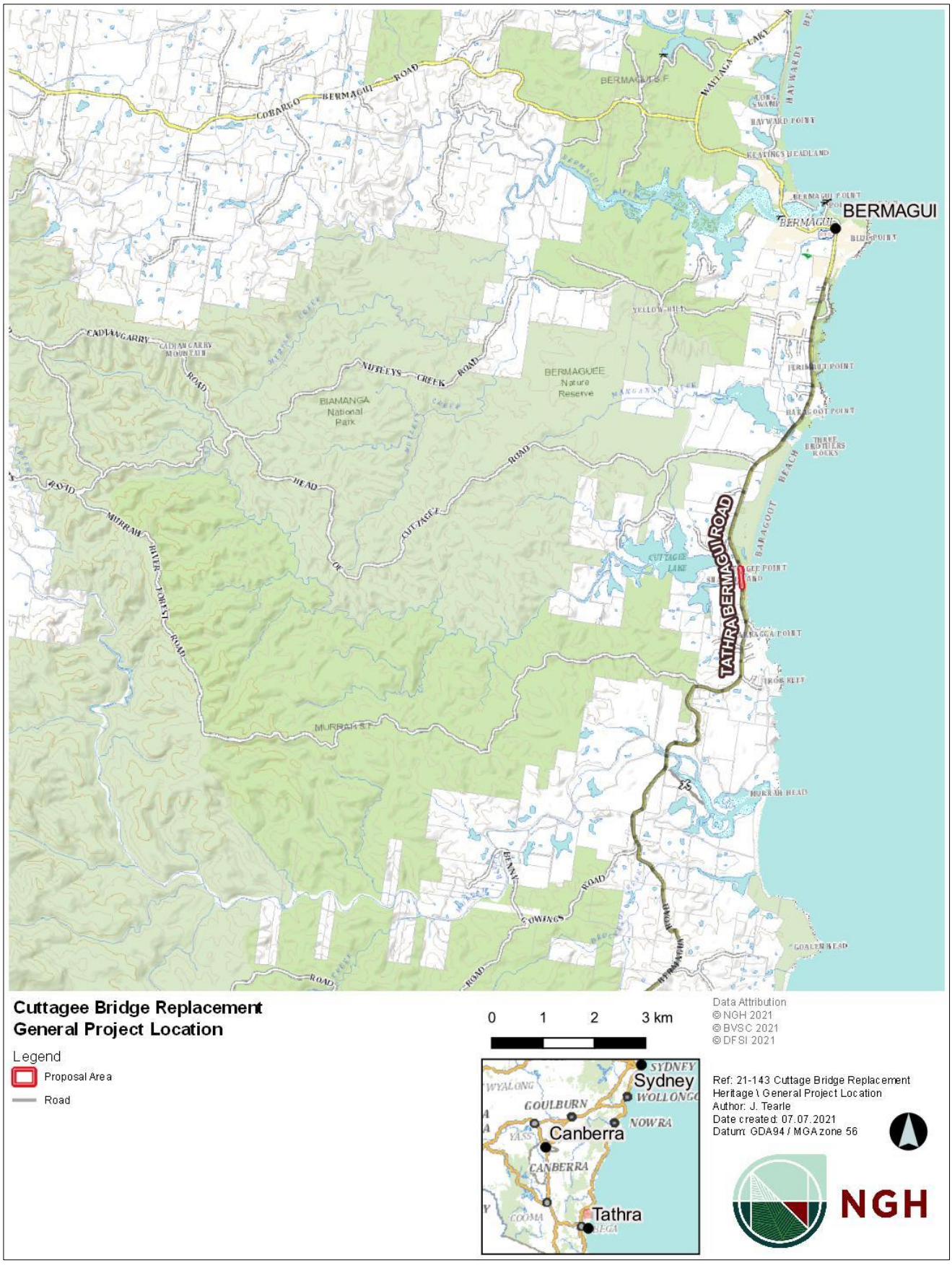

Figure 1-1 General Project Location

Figure 1-2 Proposal Area

2. LEGISLATION

In NSW, Aboriginal heritage is principally protected by two legislative acts:

- The *National Parks and Wildlife Act 1974* (NSW) (NPW ACT); and
- The *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).

1.4 The National Parks and Wildlife Act 1974

Part 6 of the NPW Act concerns Aboriginal objects and places and various sections describe the offences, defences and requirements to harm an Aboriginal object or place. All Aboriginal material receives blanket protection under the NPW Act of NSW. The main offences under section 86 of the NPW Act are:

- A person must not harm or desecrate an object that the person knows is an Aboriginal object.
- A person must not harm an Aboriginal object.
- For the purposes of this section, "circumstances of aggravation" are:
    - that the offence was committed in the course of carrying out a commercial activity; or
    - that the offence was the second or subsequent occasion on which the offender was convicted of an offence under this section.
- A person must not harm or desecrate an Aboriginal place.

Under section 87 of the NPW Act, there are specified defences to prosecution including authorisation through an Aboriginal Heritage Impact Permit (AHIP) or through exercising due diligence or compliance through the regulation.

Section 89A of the Act also requires that a person who is aware of an Aboriginal object, must notify the Director-General in a prescribed manner. In effect, this section requires the completion of AHIMS site cards for all sites located during heritage surveys.

The strict liability offence of harming Aboriginal objects has a number of defences and include the statutory defence of Diligence through complying with an adopted industry code of practice, or compliance with the conditions of an AHIP.

1.5 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is legislation for the management of development in NSW. It sets up a planning structure that requires developers (individuals or companies) to consider the environmental impacts of new projects. Under this Act, cultural heritage is considered to be a part of the environment. It provides for the identification, protection and management of heritage items through inclusion of these items into schedules off planning instruments, such as Local Environmental Plans (LEPs), Regional Environmental Plans (REPs) or State Environmental Planning Policies (SEPPs). This Act requires that Aboriginal cultural heritage and the possible impacts to Aboriginal heritage that development may have are formally considered in land-use planning and development approval processes.

1.5.1 Bega Valley Local Environmental Plan 2013

The Proposal Area is located within the Bega Valley LGA. Clause 5.10 of the Bega Valley LEP requires that proposed developments which will impact on Aboriginal or non-Aboriginal heritage require consent from Council or other relevant authority.

Schedule 5 of the LEP 2013 details the environmental heritage items covered by the plan. No Aboriginal sites or places are identified within proximity (10 km) to the Proposal Area in the Bega Valley LEP.

3. GROUND DISTURBANCE

Step 1. Will the activity disturb the ground surface or any culturally modified trees?

BVSC propose to demolish and re-construct Cuttagee Bridge in a staged approach. The works would involve three steps:

1. Construction of the eastern half of a new seven span two-land concrete bridge with 6 piers and concrete abutments, keeping the existing timber bridge open to vehicular traffic.
2. Deconstructing the existing timber bride, with the downstream half of the new bridge open to vehicular traffic.
3. Constructing the upstream half of the new concrete bridge, with the downstream half of the new bridge open to vehicular traffic.

Other activities associated with the works would include:

- Relocation of existing services along the bridge.
- Excavation and vegetation clearing to modify the Tathra-Bermagui Road alignment along 150m of the northern approach to the new bridge.
- Resealing of approaches.
- Installation of rock lined batters.

The proposal footprint is provided in Figure *1-2*. The proposed design and staged process is described and illustrated in Appendix A

A construction compound and laydown area would be required at the proposal site. This would be located in the existing Tathra-Bermagui Road reserve within the proposal site. The area would be located at least 40m from the waterway and only on previously disturbed areas. No clearing would occur for the compound and laydown area. The compound would comprise of transportable buildings, toilets and ablution facilities, a laydown and stockpiling area. At the completion of construction, the compound site and site access would be rehabilitated as appropriate.

No property acquisition would be required for the proposal.

These activities require high levels of ground disturbance, including the use of heavy machinery. Any Aboriginal sites within the disturbance footprint could therefore be subject to harm. The confirmation that ground disturbance will occur requires the next step in the due diligence process to be completed.

4. REGISTER SEARCH AND LANDSCAPE ASSESSMENT

Step 2a. Search the AHIMS Database and other information sources

A search of relevant heritage registers for Aboriginal sites and places provides an indication of the presence of previously recorded sites. A register search cannot be considered to be conclusive evidence for the presence or absence of sites, as it requires that an area has been inspected and any sites are provided to the relevant body to add to the register. However, as a starting point, the search will indicate whether any sites are known within or adjacent to the Proposal Area. The Aboriginal Heritage Information Management System (AHIMS) provides a database of previously recorded Aboriginal heritage sites in NSW. A search provides basic information about any sites previously identified within a search area. The results of the search are valid for 12 months for the purposes of a due diligence level assessment.

On the 22nd of June 2021, a search of the AHIMS database was undertaken over an area of approximately 26 km x 26 km with a 50 m buffer centred on the Proposal Area. The AHIMS Client Service ID was 600189. There were 108 Aboriginal sites recorded within this search area and two declared Aboriginal Places. A total of eight AHIMS sites were identified as restricted. On the 22nd of June 2021, email correspondence from Carlos Torres, Senior Heritage Information Analyst of Heritage NSW to NGH confirmed none of the restricted sites are within proximity to the Proposal Area and will not be impacted by the proposed works. No other sites were located within or in proximity to the Proposal Area, with the closest site approximately 30 km north-west. Table 4-1 below shows the breakdown of site types and Figure 4-1 shows the location of the AHIMS sites in relation to the Proposal Area. AHIMS #62-3-0058 which plots approximately 2km out to sea has the name Dignams Hill;31/94B and is a midden. Dignams Hill lies approximately 20km to the northwest of the recorded location and is potentially a result of data entry error. This area lies more than 16 km from the Proposal Area and will not be impacted.

Table 4-1 Breakdown of Previously Recorded Aboriginal Sites in the Region.

Site Type	Number
Artefact	68
Artefact; Shell	18
Restricted	8
Shell	2
Modified Tree (carved or scarred)	2
Ceremonial Ring	2
Shell; PAD	2
Artefact; PAD	2
Aboriginal Ceremony and Dreaming	1
Burial	1

Site Type	Number
Stone Arrangement	1
Water Hole	1
TOTAL	**108**

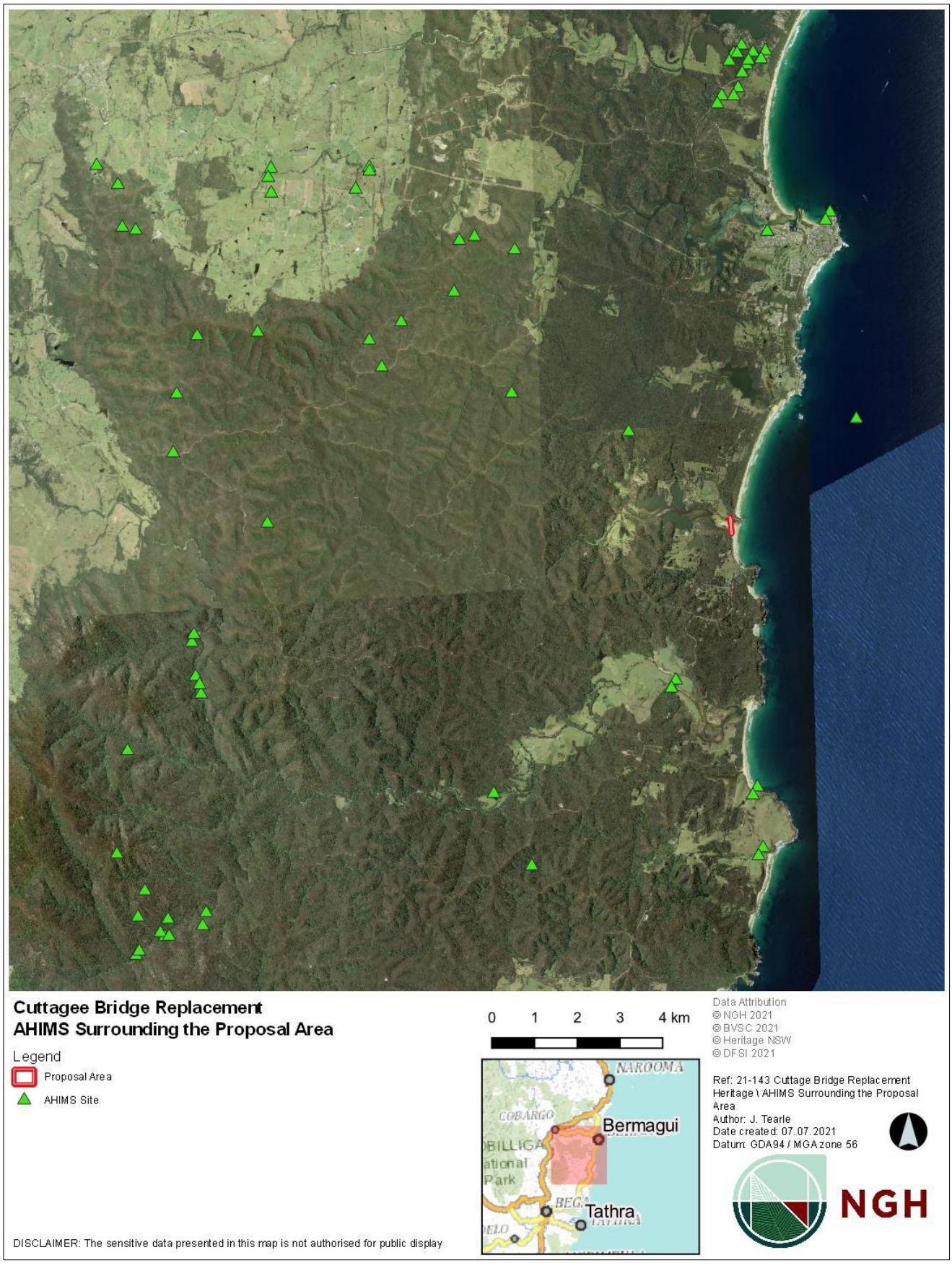

Figure 4-1 AHIMS sites surrounding the Proposal Area

4.1.1 Other Heritage Register Searches

Other heritage register searches were also undertaken to identify any items or places in proximity to the Proposal Area, with a focus on the Proposal Area and its immediate surrounding landscape. The following resources were used as part of this assessment:

- The NSW State Heritage Inventory (SHI), this includes items on the State Heritage Register and items listed by state agencies and local Government, to identify any items currently listed within or adjacent to the proposal site.
- The Australian Heritage Database, this includes items on the National and Commonwealth Heritage Lists, to identify any items that are currently listed within or adjacent to the proposal site.

The results of the Australian Heritage Database search identified 92 items in the Bega Valley LGA. None of the sites are located within or adjacent to the Proposal Area.

The results of the NSW SHI database search indicated there are three recorded Aboriginal Places, listed under the *National Parks and Wildlife Act* within the NSW State Heritage Inventory within the Bega Valley LGA. None of the sites are located within or adjacent to the Proposal Area.

The results of the NSW SHI database search indicated that 12 previously recorded heritage sites are listed under the *NSW Heritage Act* within the Bega Valley LGA. None of the sites are located within or adjacent to the Proposal Area.

The results of the NSW SHI database search indicated that 423 previously recorded heritage sites are listed by the Local and State Agencies within the Bega Valley LGA. The Cuttagee Bridge is listed as heritage item under the Bega Valley LEP (I655). No other sites are located within or adjacent to the Proposal Area. Assessment of the heritage item Cuttagee Bridge is outside the scope of this report and will be addressed in a separate report.

1.6 Archaeological context

Few studies have been completed in the south-coast region ranging from broad-scale regional studies to local infrastructure driven ones. Below is a summary of studies relevant to the current Proposal Area.

In 1978, Sullivan and Hughes undertook a preliminary archaeological survey of five forests on the south coast, NSW, which incorporated the Cuttagee region (Hughes & Sullivan 1978). Based on previous work, the study identified several landforms of potential archaeological sensitivity, including stream crossings, ridge crests and saddles, and in areas with massive granite outcroppings, and estuarine shorelines. A total of 24 sites were identified, comprising 15 open coast and four estuarine middens and five small inland artefact scatters. The midden sites consisted of diffuse layers of poorly preserved oyster and/or cockle shell. Sullivan and Hughes determined that the apparent density of inland sites is low compared to coastal and estuarine sites and suggested this may be due to the higher exploitation of coastal and estuarine areas. It was considered likely that further archaeological sites would be found in the five estuaries within the Bermagui and Murrah State Forests, which include portions of the Cuttagee Lake and estuary.

Feary (1992) conducted an archaeological assessment of the Wallaga Lake Koori Village and emphasised the richness of sites, particularly middens, in the area. Old recordings were re-evaluated and new artefact sites and middens recorded.

In 1996, Williams Barber Archaeological Services (WBAS) completed an archaeological survey over an area of approximately four hectares in relation to a proposed boat launching ramp and associated

facilities on the southern shore of the Bermagui River estuary at Bermagui, approximately 7 km north of the current Proposal Area (Williams Barber Archaeological Services 1996). Based on previous works completed in the south coast, predictive modelling identified several features:

- The most likely site types to occur within the study area were middens or middens with artefacts.
- Open artefact scatters were more likely to be present on the ridges and spurs at distance from the beach front.

Additionally, WBAS noted the area would have been reasonably well suited to occupation by Aboriginal people due to abundant coastal, fresh-water and terrestrial resources including food and stone procurement areas such as Congo Point at Moruya and Wallagoot Lake, and shelter provided by higher ground to the east. No Aboriginal sites were identified during the survey. This may have been due to extensive European disturbances, and investigation of the walls of a sand quarry showed it contained undisturbed beach deposit under the ground surface, shown through clear stratigraphic layering of fine beach sand and layers with high pebble content. It was concluded that this sand body had potential for archaeological material to occur.

Williams (1996) surveyed a road route in Hidden Valley, within Mimosa Rocks National Park. The survey covered an area of 3.5 hectares along the crest and upper slopes of a major ridgeline leading down to the coast where it crossed gentle spurs before terminating a distance of 100m from the shoreline. In conditions of poor visibility one isolated find and one outcropping of poor-quality rhyolite as a potential stone source were located. The study concluded that whilst it was anticipated that several sites would be located along the road route these would be of low density and low significance as sufficient visibility had been available to allow the detection of much denser sites. The area of a proposed campground at the end of the route in Hidden Valley was identified as having significant archaeological potential because of the increased likelihood of potentially stratified deposits.

Australian Archaeological Survey Consultants (1997) surveyed four areas proposed for upgrade in the form of road and campground facility improvements at Aragunnu, also within Mimosa Rocks National Park. On the spur side-slopes and basal slopes with some areas located behind the foredunes and adjacent to Aragunnu Creek two sites were identified in conditions of variable visibility. AS1 was a low-density artefact scatter consisting of six Eden Rhyolite stone artefacts and AS2 a highly disturbed and sparse deposit of shell material (believed to be part of a large midden site previously identified in the area). All areas were considered to have some level archaeological sensitivity and a program of sub-surface testing was recommended.

Australian Heritage Consultants (1997) surveyed three areas adjacent to Gillards Beach and Tommys Bay at Mimosa Rocks National Park. The survey was conducted in relation to the redesigning of camping and associated public facilities for the NSW NPWS. In circumstances described as being fair visibility in a shoreline environment, no sites were found within the area of proposed impact. However, a midden beach site was located eroding out of the upper layers of a low seaward facing headland.

Boot (2001) surveyed the Middle Beach picnic and camping area to determine whether the proposed redevelopment would impact on any Aboriginal sites that may be present in the area. Despite low levels of visibility two sites were located, a shell midden exposure, located on level ground about 200m from the rock platforms and reefs at the northern end of Middle Beach. The other was an isolated stone artefact situated 100m west of the midden exposure. These sites were interpreted as being indicative of an Aboriginal camping area positioned close to the conjunction of several resource zones with the potential to be much more extensive if visibility were greater.

Webster and Kuskie (2001) surveyed an area of 0.4 hectares at Murruna Point for a proposed car park and walking trail. In a coastal lowland context, over ridge and spur crests, simple slopes and drainage depressions, with at least one source of spring fed fresh water. Eight sites were identified, three shell middens with stone artefacts, two shell middens with no stone artefacts and three artefact scatters. A total of 201 artefacts were recorded (with one site only a sample of the stone artefacts were recorded). Silcrete and quartz were the dominant materials with chert, fine-grained volcanic and a single ochre specimen also identified. The middens were comprised of estuarine species with cockle (Anadara trapezia) being the most frequent. Overall, the site was interpreted as being representative of multiple episodes of occupation relying on the procurement and consumption of shellfish gathered from the adjacent Wallaga Lake.

Dibden (2004) conducted an assessment of the proposed Bermagui Country Club subdivision at which time a number of stone artefacts were recorded. A program of test excavation was subsequently undertaken across the property which revealed sub-surface artefacts were distributed at a variable density across the site.

ERM (2005) conducted a survey of the proposed Bermagui/ Wallaga Lake Sewerage Scheme. The survey area extended from Wallaga Lake Heights south to Bermagui via Regatta Point, Beauty Point and Fairhaven. Several previously recorded midden exposures were updated as a result. Test excavations were also carried out in the vicinity of the midden sites. The predominant shell species recovered was cockle and mud oyster reflecting exploitation of the lake environment. Small amounts of other materials including stone artefacts, charcoal and bone were also recovered. The excavation results led to the conclusion that the midden was not widespread or intact.

Dibden (2007) conducted an assessment of a proposal for the Koori Village Sewerage Upgrade. Three survey units contained very sparse distributions of old shell for which provenience was unclear, but the conclusion was that the distribution was suggestive of very old, highly disturbed midden material. Four areas within a single survey unit contained both shell and stone artefacts. All sites had been heavily disturbed during the construction of the road, however two were deemed to have Potential for intact stratigraphy in adjoining areas. All sites, due to levels of prior disturbance were assessed as having low archaeological sensitivity.

1.7 Landscape Assessment

Step 2b. Are there undisturbed landscape features likely to contain Aboriginal objects?

The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* outlines a range of landscape features that have higher potential to contain Aboriginal objects. It is also necessary to consider whether there are landscape features of undisturbed land that may contain Aboriginal objects. These include land that is:

- within 200 m of water;
- located within a sand dune system;
- located on a ridge top, ridge line or headland;
- located within 200 m below or above a cliff face; or
- within 20 m of a cave, rock shelter or cave mouth.

Understanding the landscape context of the Proposal Area may also assist us to better understand the archaeological modelling of the area and assist to identify local resources which may have been utilised by Aboriginal people. This information can then potentially be used in predicting the nature

of Aboriginal occupation across the landscapes within and adjacent to the Proposal Area. Factors that are typically used to inform the archaeological potential of landscapes include the presence or absence of resources that would have been utilised by Aboriginal people including water, animal and plant foods, stone and other resources.

1.7.1 Geology

The Proposal Area falls in the sedimentary silliclastic Adaminaby Group and consists of Ordovician interbedded quartz-rich sandstone, siltstone and mudstones deposited via turbidity currents (DPIE 2009; Raymond et al. 2012). Additional lithologies include shale, carbonaceous shale, greywacke, chert quartzite, phyllite and slate. Any lithologies of suitable material for knapping and other activities have the potential to have been utilised in the past by Aboriginal people. Previous archaeological studies highlight the use of rhyolite accessed from local headlands whilst other materials found in local Aboriginal sites consist predominantly of silcrete and quartz which may have been sourced from alluvial contexts with minor amounts of chert and fine-grained volcanics.

1.7.2 Topography

The Proposal Area is located at the saline coastal lagoon estuary of Cuttagee Lake with the south-western area extending into sand dunes and the northern area extending into the steep incised slopes of the road corridor. Elevation across the Proposal Area varies from 0 m to 17 m.

The low ground of the Proposal Area, regular inundation of water, and movement of the sand in the dunes reduces the potential for past Aboriginal use to have occurred across the majority of the area. However, there is potential for sites to occur on the south-west in the sand dunes where older sand deposits may be present.

1.7.3 Soils

The Proposal Area falls within the three soil landscapes of Murrah (mu) and Tanja (tj) in the north, and Tathra (ta) in the south (State of NSW and Department of Planning, Industry and Environment 2020). The soil descriptions for each landscape are provided in Table 4-2 below. The erosion hazards and waterlogging of the soils mean they are unlikely to have subsurface deposits of cultural materials however the well-drained dunes of the Tathra landscape have been identified as archaeologically sensitive.

Table 4-2 Soil Profile Descriptions across the Proposal Area (Tulau 2002)

Soil Profile	Description
Murrah (mu)	Soil depths may vary greatly over short distances due to differing bedrock and lithological weathering. Most soils have gradational A-B boundaries with well-structured clayey subsoils. Crests and midslopes contain 50–100 cm, moderately to well-drained Red Podzolic Soils, Red Soloths, and well-drained Yellow Podzolic Soils Lower slopes and open depressions contain 100–200 cm, well-drained Brown Earths and imperfectly drained Yellow Solodic Soils. The soils are vulnerable due to steep slopes, seasonal waterlogging and erosion hazards.
Tanja (tj)	Soil depths may vary greatly over short distances due to differing bedrock and lithological weathering. Most soils have gradational A-B boundaries with well-structured clayey subsoils. Crests and slopes contain 50–150 cm, moderately well-drained to imperfectly drained Yellow

	Podzolic Soils. Lower slopes and drainage depressions contain 50–150 cm, moderately well-drained to imperfectly drained Yellow Podzolic Soils. On and near headlands are 50–150 cm, well-drained black headland soils/Yellow Podzolic Soils. The soils have poor drainage, seasonal waterlogging and gully erosion risks.
Tathra (ta)	Well-drained dunes and beach ridges contain >150 cm, well-drained Podzols and Siliceous Sands that are highly permeable, non-cohesive, erodible and infertile soils subject to water and severe wind and groundwater pollution hazards.

1.7.4 Historic Land Use

The area has historically been used primarily for logging, agriculture and recreation, which has resulted in land clearing, the construction of road networks and housing and related infrastructure. The Proposal Area itself has been subject to high levels of disturbance through the construction and maintenance of the Tathra-Bermagui Road and ongoing recreational use of the beach area. These high levels of disturbance have likely reduced the potential for Aboriginal sites to occur.

1.8 Aboriginal Site Prediction

The Proposal Area has been highly disturbed by the construction and maintenance of the bridge and road, underground cables, signage, and fencing and is within a low-lying landform that is commonly inundated with water, which decreases the potential for sites to occur.

Based on the assessment of information from the environmental context and results of previous archaeological studies in and around the area, several predictive modelling statements can be made. These are included in Table *4-3* below.

Table 4-3. Aboriginal Site Prediction Statements

Site Type	Site Description	Potential
Middens	Agglomeration of shell material disposed of after consumption.	Such places are found along the edges of significant waterways and are known to occur in this region in coastal and estuarine environments. Potential to occur in the Proposal area in sand dune areas.
Stone artefact scatters and isolated artefacts	Artefact scatter sites can range from high-density concentrations through to isolated finds.	Low potential to occur in low densities in association with crests, spurs, and elevated flat land.
Potential Archaeological Deposits (PADs)	Potential subsurface deposits of archaeological material	Potential to occur within Proposal Area in undisturbed areas of sand dune.
Burial		Generally found in elevated sandy contexts. A single site has been identified in the broader region and due to the small size of the sand dune in the Proposal Area, there is potential for such sites to occur in the Proposal Area.

Site Type	Site Description	Potential
Modified trees	Trees that have undergone cultural modification.	Low potential to occur as no such sites have previously been identified in the Proposal Area.

1.8.1 Landscape Assessment Summary

Based upon the initial desktop assessment using satellite imagery, topographic data and previous archaeological reports it appears there is potential for Aboriginal objects to occur in the sand dunes on the south-western edge within the Proposal Area. The remainder of the Proposal Area outside the sand dunes has been subject to high levels of disturbance, which has reduced the likelihood of Aboriginal objects occurring there. The nature of the works being undertaken at the Proposal Area will involve significant ground disturbance and it is therefore important that a visual inspection be undertaken.

5. IMPACT AVOIDANCE

Step 3. Can any AHIMS listed objects, or landscape features be avoided?

The proposed demolition and replacement of the Cuttagee Bridge is required to ensure ongoing safe and reliable access to the surrounding area. No known AHIMS sites will be impacted by the proposed works. The proposed works may have some potential to be adjusted within the footprint to avoid or minimise impacts to any landscape features that have potential to contain Aboriginal objects.

The desktop assessment alone is not sufficient to conclusively appraise presence and/or absence of Aboriginal objects and sites within the Proposal area. Therefore, the next step in the process, a visual inspection, must be conducted to determine if the proposed works would impact Aboriginal objects. The results of the visual inspection should also be taken into consideration where there is potential to realign the proposed track works to avoid any heritage sites or areas of potential archaeological deposit that may be identified or confirmed to be present within the Proposal Area.

6. DESKTOP ASSESSMENT AND VISUAL INSPECTION

Step 4. Does the desktop assessment confirm that there are likely to be Aboriginal objects present or below the ground surface?

The assessment process is primarily a desktop exercise, using available information such as the AHIMS search results and relevant archaeological reports that have been previously completed in the area. Visual inspection is also required where landscape features are present that may contain sites. A visual inspection of the Proposal Area was undertaken on the 22nd of June 2021 by qualified archaeologists Kirsten Bradley and Jasmine Tearle. The following provides a summary of the landscape and the Proposal Area in relation to the archaeological potential for Aboriginal objects to occur.

The Proposal Area consists primarily of the existing Cuttagee Bridge and Tathra-Bermagui Road. The northern section of the Proposal Area extends width-wards on either side of the road up the steeply incised slopes of the road cutting. The southern portion extends width-wards onto the beach

on the eastern side and onto sand dunes on the western side. The entirety of the Proposal Area was examined on foot, focusing on areas of proposed works, exposures and any areas that appeared to be less disturbed. Both sides of the existing bridge and road were examined. Visibility within the Proposal Area varied from 100% along the roadway and beach to approximately 10% in the vegetated sand dunes.

The Proposal Area was noted to be highly disturbed through the initial road and bridge construction and ongoing maintenance activities, as well as infrastructure comprising beach wall and steps, underground services, fencing, signage, and erosion. The sand dunes on the south-western side appeared to have high levels of disturbance on the road corridor edge, where the dune has been incised and is steeply sloping, and lower disturbance on the raised flat area of the dune, which comprises the dune crest. This crest area may have been conducive to Aboriginal use. Exposures on the crest and incised edge showed modern oyster shell and young sands, suggesting recent accretion and limited potential for *in situ* subsurface cultural deposits. However, the deeper sands within the dune landform have the potential to be of appropriate ages to contain *in situ* subsurface cultural deposits, and therefore it was concluded this area has low-moderate potential to contain such deposits and is an area of archaeological sensitivity, as shown in Figure *6-1*.

Given the majority of the Proposal Area has been highly disturbed by past use, it was concluded there was limited potential for *in situ* subsurface cultural deposits to occur within the works area outside the dune crest.

All old growth trees within and adjacent to the Proposal Area were examined for the presence of Aboriginal cultural modification. For a tree to have been a mature specimen suitable for bark extraction at the time Aboriginal people were last practicing tradition ways, the tree would have to be over 100 years old. The majority of trees were either too young or did not conform in any way to the standard scarring morphology accepted for Aboriginal modification (Long 2005).

No other Aboriginal objects or area of Potential Archaeological Deposit were recorded within the Proposal Area.

Plate 1 View west from northernmost extent of site showing steep slope of incised road cutting.

Plate 2 View south from north side of bridge, note existing disturbance.

Plate 3 View south from north side of bridge showing lake entrance area of tidal flats.

Plate 4 View south from south side of bridge showing incised sand dune slope with modern sands and oyster shell.

Plate 5 View north from south-east of roadside showing low-lying dune with dense vegetation cover.

Plate 6 View north from southern most edge of Proposal Area. Note extent of existing disturbance.

Plate 7 Close up showing modern sand and shell in dune.

Plate 8 View west from south edge of bridge showing underground services, signage and post disturbances in sand dune.

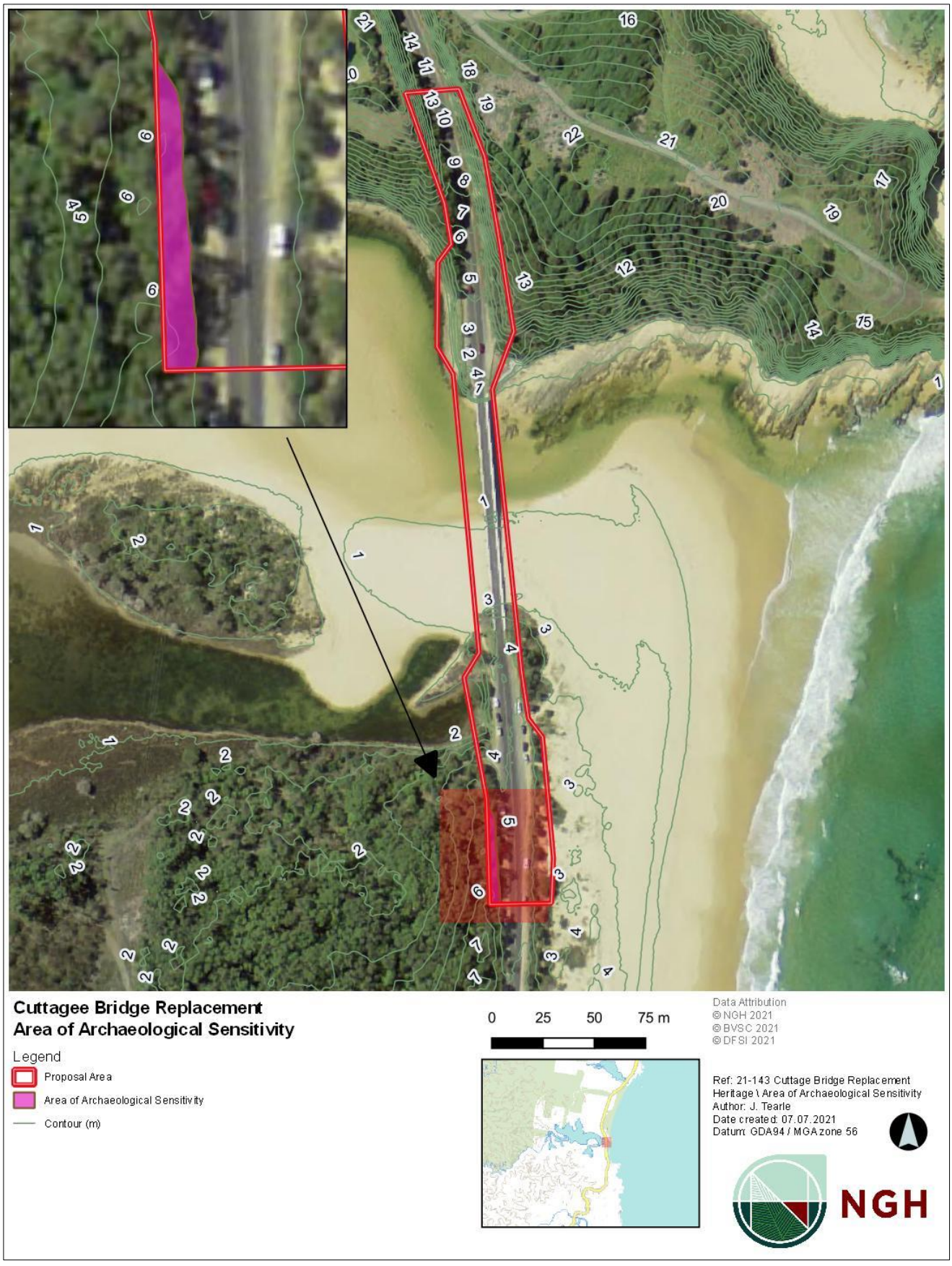

Figure 6-1 Area of Archaeological Sensitivity

7. FURTHER ASSESSMENT

Step 5. Is further investigation or impact assessment required?

The Due Diligence Code of Practice states that if, after the desktop research and visual inspection is completed, it is evident that harm will occur to Aboriginal objects or heritage places then further and more detailed assessment is required. However, if the research and inspection conclude that there are no, or unlikely to be any, objects impacted by the proposed activity, then the activity can proceed with caution.

It was determined that the sand dune crest in the south-western portion of the Proposal Area is an area of archaeological sensitivity with low-moderate potential to contain *in situ* subsurface cultural deposits, as shown in Figure *6-1*. The remainder of the Proposal Area outside the dune crest has low potential to contain *in situ* subsurface deposits due to the high level of disturbance.

To negate the need to conduct further archaeological assessment BVSC would need to ensure the proposed works avoid the area of archaeological sensitivity as shown in Figure *6-1*. Works within the Proposal Area, as assessed in this report, which are outside the boundary of the area of archaeological sensitivity do not require further heritage investigation and works can proceed with caution.

8. RECOMMENDATIONS

The following recommendations are based on a number of considerations including:

- Background research into the area;
- Previous salvage programmes undertaken within the area
- Landscape assessment;
- Field inspection;
- Consideration of the proposed works, and
- Legislative context for the development proposal.

It is recommended that:

4. The area of archaeological sensitivity identified on the dune, as shown in Figure *6-1*, must be avoided by the Proposed works. A temporary barrier fence must be placed between this area and the works area during construction.
5. Works within the Proposal Area that are not within the area of archaeological sensitivity may proceed with caution.
6. Further heritage assessment in the form of an Aboriginal Cultural Heritage Assessment (ACHA) must be completed prior to any works being undertaken within the archaeologically sensitive area, if this cannot be avoided. The ACHA can then be used in support of an Aboriginal Heritage Impact permit (AHIP) if required. To negate the need to conduct further archaeological assessment BVSC must contain their works to the previously disturbed area of the dune comprising the incised, sloped area adjacent to the road corridor.

7. Any activity proposed outside of the current assessment area should also be subject to an Aboriginal heritage assessment.
8. If any items suspected of being Aboriginal in origin are discovered during the works all work in the immediate vicinity must stop and Heritage NSW notified. The find will need to be assessed and if found to be an Aboriginal object an AHIP may be required.
9. In the unlikely event that human remains are identified during development works, all work must cease in the immediate vicinity and the area must be cordoned off. The proponent must contact the local NSW Police who will make an initial assessment as to whether the remains are part of crime scene or possible Aboriginal remains. If the remains are thought to be Aboriginal, Heritage NSW must be notified by ringing the Enviroline (131 555).

BVSC is reminded that it is an offence under the *NSW National Parks and Wildlife Act 1974* to disturb, damage or destroy and Aboriginal object without a valid AHIP.

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Appendix J Noise Calculations

Project name	Example
Scenario name	Bridge Constuction
Receiver address	Tathra-Bermagui Road
Select area ground type	Developed settlements (urban and suburban areas)
Select type of background noise level input	Representative Noise Environment

		Representative Noise Environment	User Input
Noise area category		R1	
RBL or L_{A90} Background level (dB(A))	Day	40	
	Evening	35	
	Night	30	
$L_{Aeq(15minute)}$ Noise mangement level (dB(A))	Day	50	
	Day (OOHW)	45	
	Evening	40	
	Night	35	

Is all plant at the same representative distance to the receiver? Y/N	Y
Representative distance (m)	35

All at Representative Distance

Type/ model plant (See Sources Sheet)	SWL L_{Aeq} (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
Tracked Excavator	110	85	1		Yes	0	0	35	69
Mobile Crane	113	88	1		Yes	0	0	35	72
Small Hand Tools	105	80	2		Yes	3	0	35	67
Water cart	108	83	0		Yes	0	0	35	-888
Backhoe	111	86	1		Yes	0	0	35	70
Compactor	113	88	0		Yes	0	0	35	-888
Asphalt truck/ sprayer	106	81	1		Yes	0	0	35	65
Concrete Truck	109	84	1		Yes	0	0	35	68
Delivery Truck	108	83	0		Yes	0	0	35	-888
Dump Trucks	108	83	1		Yes	0	0	35	67
Concrete pump	109	84	1		Yes	0	0	35	68
Vibratory Roller	109	84	1		Yes	0	0	35	68
Welding equipment	105	80	0		Yes	0	0	35	-888
Pneumatic Jackhammer	113	88	0		Yes	0	0	35	-888
BM800 Crane	113	88	0		Yes	0	0	35	-888
Light vehicles	103	78	1		Yes	0	0	35	62
Grader	110	85	1		Yes	0	0	35	69
Piling rig - driven	116	91	1		Yes	0	0	35	75
People Talking	76	51	5		Yes	7	0	35	42
					Yes	0	0		-888

Total SPL L Aeq(15minute) (dB(A))		***80***							
			Non-residential receivers						
		Residential receiver	***Classroom at schools and other educational institutions***	***Hospital wards and operating theatres***	***Place of worship***	***Active recreation***	***Passive recreation***	***Industrial premise***	***Offices, retail outlets***
Noise Management Level (dB(A))	**Standard hours**	***50***	55	65	55	65	60	75	70
	Day (OOHW)	***45***	55	65	55	65	60	75	70
	OOHW Period 1	***40***		65	55	65	60	75	70
	OOHW Period 2	***35***		65	55			75	70
Level above background (dB(A))	**Standard hours**	***40***							
	Day (OOHW)	***40***							
	OOHW Period 1	***45***							
	OOHW Period 2	***50***							
Level above NML (dB(A))	**Standard hours**	***30***	25	15	25	15	20	5	10
	Day (OOHW)	***35***	25	15	25	15	20	5	10
	OOHW Period 1	***40***		15	25	15	20	5	10
	OOHW Period 2	***45***		15	25			5	10
Additional mitigation measures	**Standard Hours**	***N, V, PC, RO***	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO
	Day (OOHW)	***V, IB, N, R1, DR, PC, SN***	V, IB, N, R1, DR, PC, SN	V,N, R1, DR	V, IB, N, R1, DR, PC, SN	V,N, R1, DR	V,N, R1, DR	N, R1, DR	N, R1, DR
	OOHW Period 1	***V, IB, N, R1, DR, PC, SN***		V,N, R1, DR	V, IB, N, R1, DR, PC, SN	V,N, R1, DR	V,N, R1, DR	N, R1, DR	N, R1, DR
	OOHW Period 2	***AA, V, IB, N, PC, SN, R2, DR***		V, IB, N, PC, SN, R2, DR	AA, V, IB, N, PC, SN, R2, DR			V, N, R2, DR	V, N, R2, DR

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Project name	Example
Scenario name	Bridge Constuction
Receiver address	Tathra-Bermagui Road
Select area ground type	Developed settlements (urban and suburban areas)
Select type of background noise level input	Representative Noise Environment

		Representative Noise Environment	User Input
Noise area category		R1	
RBL or LA90 Background level (dB(A))	**Day**	40	
	Evening	35	
	Night	30	
LAeq(15minute) Noise mangement level (dB(A))	**Day**	50	
	Day (OOHW)	45	
	Evening	40	
	Night	35	

Is all plant at the same representative distance to the receiver? Y/N	Y	
Representative distance (m)	41	***All at Representative Distance***

Type/ model plant (See Sources Sheet)	SWL LAeq (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
Tracked Excavator	110	85	1		Yes	0	0	41	68
Mobile Crane	113	88	1		Yes	0	0	41	71
Small Hand Tools	105	80	2		Yes	3	0	41	66
Water cart	108	83	0		Yes	0	0	41	-888
Backhoe	111	86	1		Yes	0	0	41	69
Compactor	113	88	0		Yes	0	0	41	-888
Asphalt truck/ sprayer	106	81	1		Yes	0	0	41	64
Concrete Truck	109	84	1		Yes	0	0	41	67
Delivery Truck	108	83	0		Yes	0	0	41	-888
Dump Trucks	108	83	1		Yes	0	0	41	66
Concrete pump	109	84	1		Yes	0	0	41	67
Vibratory Roller	109	84	1		Yes	0	0	41	67
Welding equipment	105	80	0		Yes	0	0	41	-888
Pneumatic Jackhammer	113	88	0		Yes	0	0	41	-888
BM800 Crane	113	88	0		Yes	0	0	41	-888
Light vehicles	103	78	1		Yes	0	0	41	61
Grader	110	85	1		Yes	0	0	41	68
Piling rig - driven	116	91	1		Yes	0	0	41	74
People Talking	76	51	5		Yes	7	0	41	41
					Yes	0	0		-888

Total SPL $L_{Aeq(15minute)}$ (dB(A))		79							
			Non-residential receivers						
		Residential receiver	Classroom at schools and other educational institutions	Hospital wards and operating theatres	Place of worship	Active recreation	Passive recreation	Industrial premise	Offices, retail outlets
Noise Management Level (dB(A))	Standard hours	50	55	65	55	65	60	75	70
	Day (OOHW)	45	55	65	55	65	60	75	70
	OOHW Period 1	40		65	55	65	60	75	70
	OOHW Period 2	35		65	55			75	70
Level above background (dB(A))	Standard hours	39							
	Day (OOHW)	39							
	OOHW Period 1	44							
	OOHW Period 2	49							
Level above NML (dB(A))	Standard hours	29	24	14	24	14	19	4	9
	Day (OOHW)	34	24	14	24	14	19	4	9
	OOHW Period 1	39		14	24	14	19	4	9
	OOHW Period 2	44		14	24			4	9
Additional mitigation measures	Standard Hours	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO	N, V, PC, RO
	Day (OOHW)	V, IB, N, R1, DR, PC, SN	V,N, R1, DR	N, R1, DR	V,N, R1, DR	N, R1, DR	V,N, R1, DR	-	N, R1, DR
	OOHW Period 1	V, IB, N, R1, DR, PC, SN		N, R1, DR	V,N, R1, DR	N, R1, DR	V,N, R1, DR	-	N, R1, DR
	OOHW Period 2	AA, V, IB, N, PC, SN, R2, DR		V, N, R2, DR	V, IB, N, PC, SN, R2, DR			N	V, N, R2, DR

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Please input information into yellow cells
Please pick from drop-down list in orange cells

Project name	Example
Scenario name	Bridge Constuction
Receiver address	Tathra-Bermagui Road
Select area ground type	Developed settlements (urban and suburban areas)
Select type of background noise level input	Representative Noise Environment

		Representative Noise Environment	User Input
Noise area category		R1	
RBL or L_{A90} Background level (dB(A))	Day	40	
	Evening	35	
	Night	30	
$L_{Aeq(15minute)}$ Noise mangement level (dB(A))	Day	50	
	Day (OOHW)	45	
	Evening	40	
	Night	35	

Is all plant at the same representative distance to the receiver? Y/N	Y	
Representative distance (m)	90	*All at Representative Distance*

Type/ model plant (See Sources Sheet)	SWL L_{Aeq} (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
Tracked Excavator	110	85	1		Yes	0	0	90	61
Mobile Crane	113	88	1		Yes	0	0	90	64
Small Hand Tools	105	80	2		Yes	3	0	90	59
Water cart	108	83	0		Yes	0	0	90	-888
Backhoe	111	86	1		Yes	0	0	90	62
Compactor	113	88	0		Yes	0	0	90	-888
Asphalt truck/ sprayer	106	81	1		Yes	0	0	90	57
Concrete Truck	109	84	1		Yes	0	0	90	60
Delivery Truck	108	83	0		Yes	0	0	90	-888
Dump Trucks	108	83	1		Yes	0	0	90	59
Concrete pump	109	84	1		Yes	0	0	90	60
Vibratory Roller	109	84	1		Yes	0	0	90	60
Welding equipment	105	80	0		Yes	0	0	90	-888
Pneumatic Jackhammer	113	88	0		Yes	0	0	90	-888
BM800 Crane	113	88	0		Yes	0	0	90	-888
Light vehicles	103	78	1		Yes	0	0	90	54
Grader	110	85	1		Yes	0	0	90	61
Piling rig - driven	116	91	1		Yes	0	0	90	67
People Talking	76	51	5		Yes	7	0	90	33
					Yes	0	0		-888

Total SPL $L_{Aeq(15minute)}$ (dB(A))	**72**

		Residential receiver	*Non-residential receivers*						
			Classroom at schools and other educational institutions	*Hospital wards and operating theatres*	*Place of worship*	*Active recreation*	*Passive recreation*	*Industrial premise*	*Offices, retail outlets*
Noise Management Level (dB(A))	**Standard hours**	***50***	55	65	55	65	60	75	70
	Day (OOHW)	***45***	55	65	55	65	60	75	70
	OOHW Period 1	***40***		65	55	65	60	75	70
	OOHW Period 2	***35***		65	55			75	70
Level above background (dB(A))	**Standard hours**	***32***							
	Day (OOHW)	***32***							
	OOHW Period 1	***37***							
	OOHW Period 2	***42***							
Level above NML (dB(A))	**Standard hours**	***22***	17	7	17	7	12		2
	Day (OOHW)	***27***	17	7	17	7	12		2
	OOHW Period 1	***32***		7	17	7	12		2
	OOHW Period 2	***37***		7	17				2
Additional mitigation measures	**Standard Hours**	***N, V***	N, V	-	N, V	-	N, V	-	-
	Day (OOHW)	***V, IB, N, R1, DR, PC, SN***	V,N, R1, DR	N, R1, DR	V,N, R1, DR	N, R1, DR	N, R1, DR	-	-
	OOHW Period 1	***V, IB, N, R1, DR, PC, SN***		N, R1, DR	V,N, R1, DR	N, R1, DR	N, R1, DR	-	-
	OOHW Period 2	***AA, V, IB, N, PC, SN, R2, DR***		V, N, R2, DR	V, IB, N, PC, SN, R2, DR			-	N

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Project name	Example
Scenario name	Bridge Constuction
Receiver address	Tathra-Bermagui Road
Select area ground type	Developed settlements (urban and suburban areas)
Select type of background noise level input	Representative Noise Environment

		Representative Noise Environment	User Input
Noise area category		R1	
RBL or LA90 Background level (dB(A))	**Day**	40	
	Evening	35	
	Night	30	
LAeq(15minute) Noise mangement level (dB(A))	**Day**	50	
	Day (OOHW)	45	
	Evening	40	
	Night	35	

Is all plant at the same representative distance to the receiver? Y/N	Y
Representative distance (m)	150

All at Representative Distance

Type/ model plant (See Sources Sheet)	SWL LAeq (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
Tracked Excavator	110	85	1		Yes	0	0	150	55
Mobile Crane	113	88	1		Yes	0	0	150	58
Small Hand Tools	105	80	2		Yes	3	0	150	53
Water cart	108	83	0		Yes	0	0	150	-888
Backhoe	111	86	1		Yes	0	0	150	56
Compactor	113	88	0		Yes	0	0	150	-888
Asphalt truck/ sprayer	106	81	1		Yes	0	0	150	51
Concrete Truck	109	84	1		Yes	0	0	150	54
Delivery Truck	108	83	0		Yes	0	0	150	-888
Dump Trucks	108	83	1		Yes	0	0	150	53
Concrete pump	109	84	1		Yes	0	0	150	54
Vibratory Roller	109	84	1		Yes	0	0	150	54
Welding equipment	105	80	0		Yes	0	0	150	-888
Pneumatic Jackhammer	113	88	0		Yes	0	0	150	-888
BM800 Crane	113	88	0		Yes	0	0	150	-888
Light vehicles	103	78	1		Yes	0	0	150	48
Grader	110	85	1		Yes	0	0	150	55
Piling rig - driven	116	91	1		Yes	0	0	150	61
People Talking	76	51	5		Yes	7	0	150	28
					Yes	0	0		-888

Total SPL $L_{Aeq(15minute)}$ (dB(A))		**66**

		Residential receiver	Non-residential receivers						
			Classroom at schools and other educational institutions	Hospital wards and operating theatres	Place of worship	Active recreation	Passive recreation	Industrial premise	Offices, retail outlets
Noise Management Level (dB(A))	Standard hours	50	55	65	55	65	60	75	70
	Day (OOHW)	45	55	65	55	65	60	75	70
	OOHW Period 1	40		65	55	65	60	75	70
	OOHW Period 2	35		65	55			75	70
Level above background (dB(A))	Standard hours	26							
	Day (OOHW)	26							
	OOHW Period 1	31							
	OOHW Period 2	36							
Level above NML (dB(A))	Standard hours	16	11	1	11	1	6		
	Day (OOHW)	21	11	1	11	1	6		
	OOHW Period 1	26		1	11	1	6		
	OOHW Period 2	31		1	11				
Additional mitigation measures	Standard Hours	N, V	N, V	-	N, V	-	-	-	-
	Day (OOHW)	V, N, R1, DR	N, R1, DR	-	N, R1, DR	-	N, R1, DR	-	-
	OOHW Period 1	V, IB, N, R1, DR, PC, SN		-	N, R1, DR	-	N, R1, DR	-	-
	OOHW Period 2	AA, V, IB, N, PC, SN, R2, DR		N	V, N, R2, DR			-	-

Abbreviation	Measure
N	Notification
SN	Specific notifications
PC	Phone calls
IB	Individual briefings
RO	Respite offer
R1	Respite period 1
R2	Respite period 2
DR	Duration respite
AA	Alternative accommodation
V	Verification

Project name	Example
Scenario name	Bridge Constuction
Receiver address	Tathra-Bermagui Road
Select area ground type	Developed settlements (urban and suburban areas)
Select type of background noise level input	Representative Noise Environment

		Representative Noise Environment	User Input
Noise area category		R1	
RBL or LA90 Background level (dB(A))	**Day**	40	
	Evening	35	
	Night	30	
LAeq(15minute) Noise mangement level (dB(A))	**Day**	50	
	Day (OOHW)	45	
	Evening	40	
	Night	35	

Is all plant at the same representative distance to the receiver? Y/N	Y
Representative distance (m)	1000

All at Representative Distance

Type/ model plant (See Sources Sheet)	SWL LAeq (dB(A))	SPL @7m (dB(A))	Quantity	Individual distance to receiver (m)	Is there line of sight to receiver? Y/N	Quantity correction (dBA)	Shielding correction (dBA)	Distance used in calculation (m)	Contribution SPL (dB(A))
Tracked Excavator	110	85	1		Yes	0	0	1000	32
Mobile Crane	113	88	1		Yes	0	0	1000	35
Small Hand Tools	105	80	2		Yes	3	0	1000	30
Water cart	108	83	0		Yes	0	0	1000	-888
Backhoe	111	86	1		Yes	0	0	1000	33
Compactor	113	88	0		Yes	0	0	1000	-888
Asphalt truck/ sprayer	106	81	1		Yes	0	0	1000	28
Concrete Truck	109	84	1		Yes	0	0	1000	31
Delivery Truck	108	83	0		Yes	0	0	1000	-888
Dump Trucks	108	83	1		Yes	0	0	1000	30
Concrete pump	109	84	1		Yes	0	0	1000	31
Vibratory Roller	109	84	1		Yes	0	0	1000	31
Welding equipment	105	80	0		Yes	0	0	1000	-888
Pneumatic Jackhammer	113	88	0		Yes	0	0	1000	-888
BM800 Crane	113	88	0		Yes	0	0	1000	-888
Light vehicles	103	78	1		Yes	0	0	1000	25
Grader	110	85	1		Yes	0	0	1000	32
Piling rig - driven	116	91	1		Yes	0	0	1000	38
People Talking	76	51	5		Yes	7	0	1000	5
					Yes	0	0		-888