



**Transport**  
Roads & Maritime  
Services



# **Burrill Lake Bridge**

## Review of Environmental Factors

**FEBRUARY 2014**

# Roads and Maritime Services

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## Burrill Lake Bridge

Review of environmental factors  
February 2014

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# Executive summary

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## The proposal

Roads and Maritime Services (Roads and Maritime) propose to replace the existing Burrill Lake crossing on the Princes Highway, around 230 kilometres south of Sydney, and six kilometres south of Ulladulla, New South Wales. The proposed works would include:

- A 290 metre long bridge spanning the lake on a new alignment to the east of the existing bridge.
- A roundabout on either side of the crossing to connect the A1 Princes Highway to local roads.
- A pedestrian and cycle path on the new bridge, connecting to new paths on both sides and linking to the Ulladulla cycle path.
- Pedestrian paths underneath both ends of the new bridge. There would be a total of five locations where pedestrians can safely cross the highway.
- The new bridge and highway would be higher than the 1 in 100 year flood level, taking into account climate change, and reduce the impact of flooding.
- Complete removal of the existing causeway and bridge.

## Need for the proposal

The key driver of the proposal is the imminent maintenance requirement of the existing Burrill Lake crossing. Works are required to address deterioration of the existing crossing. Upgrade or replacement of the crossing is required in the next five to seven years. The primary proposal objective is therefore to provide a safe and reliable crossing over Burrill Lake.

Additionally, the crossing is particularly affected by flooding and is currently the lowest point on the Princes Highway. The proposal would assist in meeting the aims and objectives of a number of key plans and strategies in NSW.

## Options considered

A value management/options assessment workshop was used to identify and evaluate options that would meet the proposal's functional requirements. The functional requirements were identified as:

- To provide safe and efficient regional movement of people and vehicles.
- To provide flood immunity in a 1:100 year event for the crossing and approaches.
- To maintain local connectivity.
- To maintain community and business viability.
- To not detract from the local character and amenity.
- To minimise impacts on the natural and cultural environment.

Eight options were evaluated:

- Do nothing- Existing crossing retained, unaltered.
  - Option 1 - Bypass Burrill Lake and upgrade and retain existing crossing for local traffic.
  - Option 2 - Maintain or upgrade the existing crossing.
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- Option 3- Construct a new highway crossing, existing crossing retained for pedestrian use only.
- Option 4 - Construct a new highway crossing, existing crossing retained for local vehicle and pedestrian traffic.
- Option 5 - Provide a new crossing on the existing alignment.
- Option 6 - Provide a new crossing on a new alignment (east).
- Option 7 - Provide a new crossing on a new alignment (west).

Option 6, to provide a new crossing on a new eastern alignment, is the preferred option. This option meets the primary functional requirement and best meets the range of secondary functional requirements. This is the only option assessed in this REF.

## Statutory and planning framework

Roads and Maritime is the proponent and determining authority for the proposed works. The proposed works would be determined under Part 5 of the *Environmental Planning and Assessment Act 1979*.

Under the *Fisheries Management Act 1994* (FM Act), Roads and Maritime is required to give written notification to the Minister for Fisheries for any dredging or reclamation work and consider any responses in accordance with Section 199 of the FM Act. Works would require a Fisheries Permit under part 7 of this act.

## Community and stakeholder consultation

Consultation with the Burrill Lake community has included updates, sessions, surveys, advertisements and in-person meetings. The key issues raised were the removal of the existing crossing, parking, pedestrians and urban design and landscaping. Roads and Maritime have considered community input throughout the development of the concept design, including in June and November 2013.

The Aboriginal community has been consulted in accordance with the Roads and Maritime *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI). Roads and Maritime initiated an Aboriginal stakeholder identification and consultation program in accordance with the Stage 3 PACHCI, which has included advertisements, letters, an Aboriginal Focus Group (AFG) and draft Cultural Heritage Assessment Report (CHAR) forwarded to the registered Aboriginal groups for comment. An Aboriginal Heritage Impact Permit (AHIP) for works that would directly impact two Aboriginal sites is required prior to works.

Under the *State Environmental Planning Policy (Infrastructure) 2007*, consultation is required with Shoalhaven City Council, with regard to impacts on specific council assets (public space, flood liable land), Office of Environment and Heritage (a stockpile site would be located adjacent to National Park) and internally with the Maritime arm of Roads and Maritime (a permanent structure would be constructed in navigable waters).

## Environmental impacts

The key environmental impacts of the works have been identified as soil and water, biodiversity, traffic and access, noise and vibration, visual amenity and waste.

Works within and near waterways constitute high pollution risks. A number of project specific plans would be implemented to protect the waterway and manage the impacts of earthworks within and adjacent to Burrill Lake. These include a soil and water management plan that would include measures to manage acid sulphate soils

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(if encountered), erosion and sediment control plans, Environmental Work Method Statements (EWMS) for high risk activities and an asbestos removal control plan. Additionally, temporary rock platforms, required to construct the new bridge, would be constructed with reference to specific criteria, developed with input from Department of Primary Industries (Fisheries).

Biodiversity impacts are primarily related to the construction stage. They include vegetation clearing as well as potential to indirectly affect habitat and injure fauna. While three Endangered Ecological Communities (EECs) would be affected, the areas are small and largely degraded and non-viable. Impacts to EEC and foraging habitat for threatened species are unlikely to be significant. Impacts are considered manageable with safeguards. In accordance with Roads and Maritime offsetting guidelines, an offset for areas of sea grass and saltmarsh is warranted and would be negotiated with the Department of Primary Industries (DPI).

Traffic impacts during construction and operation have largely been addressed by the proposal. Additional safeguards include the development of a traffic management plan, consultation with the community and monitoring of traffic volumes and accident records at one junction (Princes Avenue North).

Noise treatment has been incorporated into the proposal, to address acute noise impacts identified for one residential receiver. Additionally, a range of measures to minimise noise would be undertaken. Monitoring of noise and vibration would be undertaken during construction.

The change in landscape character and visual impact at several locations has been assessed as moderate to high. Urban design and landscape treatments have been incorporated into the design to ensure a high level of attention to detail, particularly for public spaces. The proposal includes landscaping along the highway as well as within Lions Park. Additional recreational areas will be achieved at either end of the old crossing, providing new opportunities to enjoy the water front close to the shopping areas.

A large amount of fill material (subsoil and gravel) will be required to raise the approaches to the new bridge. Removal of water, including contaminated material would be undertaken in accordance with a project specific waste management plan.

## **Justification and conclusion**

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development, which has been undertaken in conjunction with a number of specialist studies, including an Urban Design Report. Mitigation measures as detailed in this REF would ameliorate or minimise residual impacts. The proposal is required to provide a safe and reliable crossing over Burrill Lake. Additionally, it would improve maintenance requirements, flood immunity and connectivity between south coast communities and neighbouring regions. On balance the proposal is considered justified.

The environmental impacts of the proposal are not likely to be significant and therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought for the proposal from the Minister for Planning under Part 5.1 of the EP&A Act.

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## Display of the review of environmental factors

This review of environmental factors is on display for comment between 28 February 2014 and 28 March 2014. You can access the documents in the following ways:

### *Internet*

The documents will be available as pdf files on the Roads and Maritime Services website at website address:

[http://www.rms.nsw.gov.au/roadprojects/projects/princes\\_hway/burrill\\_lake/index.html](http://www.rms.nsw.gov.au/roadprojects/projects/princes_hway/burrill_lake/index.html)

### *Display*

The review documents can be viewed at the following locations:

- Burrill Lake Newsagency and Post Office, 117 Princes Highway Burrill Lake NSW. Mon – Fri 5:30am - 6:00pm and Sat – Sun 5:30am - 2:30pm

### *Purchase*

The review documents are available for purchase in hard copy (\$25.00) or CD (\$10.00) by contacting Peter Townsend, 4221 2506.

## How can I make a submission?

To make a submission on the proposal, please send your written comments to:

Roads and Maritime Services project manager:

Peter Townsend

PO BOX 477 Wollongong NSW 2500

Peter.Townsend@rms.nsw.gov.au

02 4221 2549

Submissions must be received by 26 March 2014.

## Privacy information

All information included in submissions is collected for the sole purpose of assisting in the assessment of this proposal. The information may be used during the environmental impact assessment process by relevant Roads and Maritime Services staff and its contractors.

Where the respondent indicates at the time of supply of information that their submission should be kept confidential, Roads and Maritime Services will attempt to keep it confidential. However there may be legislative or legal justification for the release of the information, for example under the *Government Information (Public Access) Act 2009* or under subpoena or statutory instrument.

The supply of this information is voluntary. Each respondent has free access at all times to the information provided by that respondent but not to any identifying information provided by other respondents if a respondent has indicated that the representation should be kept confidential.

Any respondent may make a correction to the information that they have provided by writing to the same address the submission was sent.

The information will be held by Roads and Maritime Level 4 90 Crown Street Wollongong NSW 2500.

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## What happens next?

Following the submissions period, Roads and Maritime Services will collate submissions. Acknowledgement letters will be sent to each respondent. The details of submission authors will be retained and authors will be subsequently advised when project information is released.

After consideration of community comments Roads and Maritime will determine whether the proposal should proceed as proposed, or whether any alterations to the proposal are necessary. The community will be kept informed regarding this Roads and Maritime determination.

If the proposal is approved, Roads and Maritime proceeds with final design and tenders are called for construction of the project.

If you have any queries, please contact the Roads and Maritime project manager on contact number 4221 2506.

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Appendix H	Urban design report and visual impact assessment
Appendix I	Cultural heritage assessment report
Appendix J	Statement of heritage impact

# 1 Introduction

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## 1.1 Proposal identification

Roads and Maritime Services (Roads and Maritime) propose to replace the existing Burrill Lake crossing on the Princes Highway, approximately 230 kilometres south of Sydney, and six kilometres south of Ulladulla, New South Wales (Figure 1-1). Burrill Lake is located in the Roads and Maritime Southern Region and the Shoalhaven Local Government Area (LGA).

The Princes Highway is the major road linking Sydney, Melbourne and Adelaide along the coast of New South Wales, Victoria and South Australia. At Burrill Lake, the highway carries local, commercial and freight traffic with seasonal increases in recreational and tourist traffic.

Local businesses located nearby include caravan parks and retail outlets. Several residential properties are located near the crossing along the lake foreshore. Burrill Lake and its surrounds contain vegetation and marine resources of conservation significance. Meroo National Park is located south and south-west of Burrill Lake.

The existing crossing was built in 1958 and is a six span, 54.85 metres long concrete bridge and 150m long causeway. It is proposed that the crossing be replaced with a new bridge and bridge approaches. Works are required to address deterioration of the existing crossing. Roads and Maritime has identified that upgrade or replacement in the next five to seven years is required to maintain a safe crossing at Burrill Lake.

The crossing is currently one of the lowest points above sea-level on the Princes Highway and is prone to inundation (currently estimated between 1 in 10 years and 1 in 20 years or 1:10 and 1:20 average recurrence interval; ARI). The alternative routes are lengthy and sometimes unsuitable to perform the functions of the highway.

The proposal would:

- Extend the design life of the crossing.
- Ensure the crossing design loading complies with current Australian Standard AS5100 Bridge Design.
- Retain a trafficable crossing at 1:100 ARI.
- Improve the safety of the crossing for pedestrians and cyclists.

The proposed approaches would extend about 540 metres north and 260 metres south of the proposed new crossing, total length of works being about 1.09 kilometres. They would include:

- Construction of a new simple plank bridge, about three metres higher and located to the east of the existing crossing.
- Construction of new bridge approaches.
- Construction of two roundabouts:
  - Construction of a new roundabout at the junction of the Princes Highway with Dolphin Point Road and Balmoral Road.
  - Construction of a new roundabout at the junction of the Princes Highway with McDonald Parade and Princess Avenue South.
- Removal of the existing bridge and causeway.

The proposal is expected to cost about \$31 million and would be funded by the NSW Government. Construction is expected to take between 15 to 18 months, and is anticipated to commence in early to mid-2015.

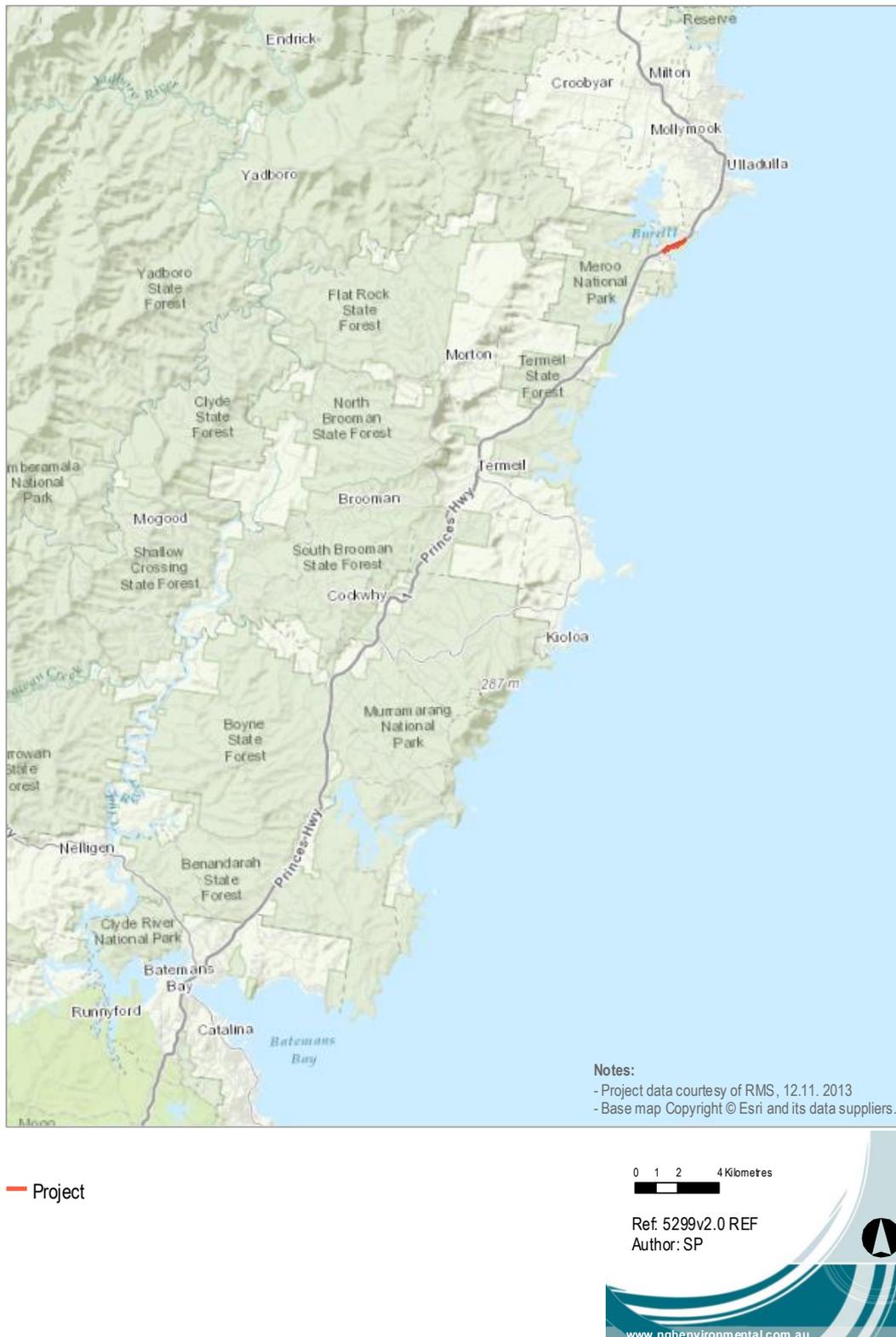


Figure 1-1 Regional location map of proposal site.

## **Definition of terms**

### *Study area*

For the purpose of this assessment, the 'study area' is bounded by:

- Burrill Lake to the west of the bridge.
- Residential properties on the northern foreshore of Burrill Lake.
- Commercial businesses adjacent to the Princes Highway along the southern approach to the bridge.
- Burrill Lake to the east of the bridge, and the Burrill Lake inlet east of the study area.
- Lions Park on the southern foreshore of Burrill Lake.
- Commercial and residential properties adjacent to the Princes Highway along the southern foreshore of Burrill Lake.

### *Crossing*

The existing Burrill Lake crossing consists of a causeway and a bridge. The term crossing is used to refer to these two structures together.

### *Approaches*

The Princes Highway is generally oriented north-south. For simplicity, the approaches will be referred to as the northern approach and southern approach. Similarly, the foreshore and banks of the estuary are referred to as the northern and southern banks.

### *The Proposal*

The footprint of the crossing, approaches, and all associated road, pedestrian and landscaping works proposed are shown in Figure 1-2.



Figure 1-2 Proposal footprint.

## 1.2 Purpose of the report

This Review of Environmental Factors has been prepared by **ngh**environmental on behalf of Roads and Maritime, Infrastructure Development Division, Southern Region. For the purposes of these works, Roads and Maritime is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail protective measures to be implemented.

The description of the proposed works and associated environmental impacts have been undertaken in context of clause 228 of the *Environmental Planning and Assessment Regulation 2000*, the *Threatened Species Conservation Act 1995* (TSC Act), the *Fisheries Management Act 1994* (FM Act), and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF helps to fulfil the requirements of section 111 of the EP&A Act that

Roads and Maritime examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Infrastructure under Part 5.1 of the EP&A Act.
- The significance of any impact on threatened species as defined by the TSC Act and/or FM Act, in section 5A of the EP&A Act and therefore the requirement for a Species Impact Statement.
- The potential for the proposal to significantly impact a matter of national environmental significance or Commonwealth land and the need to make a referral to the Australian Government Department of the Environment for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

## 2 Need and options considered

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### 2.1 Strategic need for the proposal

The proposal would assist in meeting the aims and objectives of a number of key plans and strategies in NSW, as outlined below.

#### 2.1.1 NSW 2021 - A plan to make NSW number one

*NSW 2021 – A plan to make NSW number one* (Department of Premier and Cabinet 2011) identifies goals, targets and actions to rebuild the economy, provide quality service, renovate infrastructure, restore government accountability and strengthen the local environment and communities in NSW.

The proposal is consistent with the plan's goals, targets and actions. Improved transport infrastructure at Burrill Lake Bridge would improve transport safety and efficiency, benefiting the local community and broader business networks.

#### 2.1.2 NSW Long Term Transport Master Plan

The NSW Government released the Long Term Transport Master Plan (NSW Government 2012) on 13 December 2012. The Master Plan sets a clear direction for transport in NSW for the next 20 years. It considers all modes of transport across all regions of the state, to deliver a world class, integrated transport network that puts the customer first. The Master Plan will be used to guide the NSW Government's transport funding priorities over the next 20 years.

The Princes Highway is identified in the Master Plan as infrastructure in rural and regional NSW requiring upgrade. Specific to the Princes Highway, the following two master plan aims are relevant to the Burrill Lake Bridge proposal:

- Upgrades to strengthen connections between centres along the coast from Nowra to Eden.
- To make the Princes Highway safer, specifically targeting trucks, black spots and school zones.

Replacement of the Burrill Lake Bridge would improve transport connections for businesses and the broader community between Nowra, Eden and beyond. The proposed works, which would include improvements to the lane width, pavement and footway, would provide a safer crossing at Burrill Lake, making the Princes Highway a more reliable and safer travel network for motorists, including heavy vehicles, cyclists and pedestrians. Specifically, the proposal would provide a Higher Mass Limit (HML) compliant structure (in accordance with Bridge Design AS5100).

#### 2.1.3 State Infrastructure Strategy 2012-2032

The NSW Government's 20-year State Infrastructure Strategy (Department of Premier and Cabinet 2012) sets out infrastructure projects and initiatives that the Government will prioritise for the short, medium and longer terms (0-5 years, 5-10 years and 10-20 years). It identifies strategies and new commitments for transport, water, energy, health and social infrastructure.

The strategy recognises that transport links (particularly the road network in regional areas) provide important economic connections. They facilitate employment and the movement of goods and services.

The Burrill Lake crossing is significant infrastructure for the movement of regional freight, local and regional communities and tourist traffic. The crossing is currently one of the lowest points above sea-level on the Princes Highway and is prone to inundation (currently estimated between 1:10 and 1:20 ARI). The alternative routes are lengthy and sometimes unsuitable to perform the functions of the highway.

Improvements to the Burrill Lake crossing would provide more reliable and safer regional road transport. The proposal includes a higher platform (three metres higher than the existing bridge platform) that would assist in addressing a pinch point for the area, consistent with the aims of this strategy.

#### 2.1.4 South Coast Regional Strategy 2006-2031

The South Coast Regional Strategy (Department of Planning 2007) sets out land use plans for the south coast of NSW, including for the Shoalhaven Local Government Areas (LGA). The strategy identifies transport and accessibility limitations in the south coast region due to the dispersed settlement pattern and lack of rail lines south of Bomaderry. The strategy identifies the Princes Highway as regionally significant infrastructure. It acknowledges the highway as being very important in connecting communities, supporting economic development and linking neighbouring regions.

At Burrill Lake, the Princes Highway carries local, commercial and freight traffic with seasonal increases in recreational and tourist traffic. The proposal would be consistent with the South Coast Regional Strategy as it would upgrade regionally significant infrastructure. The upgrade would enhance connectivity between south coast communities and neighbouring regions. By improving transport infrastructure, the proposal would support economic development in the region.

## 2.2 Existing road and infrastructure

### 2.2.1 Princes Highway

At the proposal site, the Princes Highway has one northbound and one southbound lane. Each lane is 3.5 metres wide with sealed shoulders of variable width. At the proposal site the road has kerb and gutter. Further away from the approaches kerb and gutters are present at roundabouts and intersections along the highway.

Street parking is located along the highway at both approaches to the crossing. On-street parking also occurs where no kerbs are present along the highway. Pedestrian paths are located along the northbound lane of the highway. A pedestrian island is located 45 metres from the southern end of the crossing.

The sign posted speed limit at the crossing is 60 kilometres per hour. The speed limit increases to 80 kilometres per hour about 600 metres north of the crossing and 100 kilometres per hour about 850 metres south of the crossing.

### **Bus stops**

There are four bus stops located on the Princes Highway. On the northern approach, there are two bus stops located about 150 metres north of the crossing. The northbound bus stop is located 45 metres south of McDonald Parade. The southbound bus stop is located 40 metres south of Princess Avenue South. On the southern approach, the northbound bus stop is located about 150 metres south of the crossing and about 45 metres south of Jorgys Way. The southbound bus stop is about 85 metres south of the crossing and about 30 metres north of Dolphin Point Road.

### 2.2.2 Existing crossing

The existing crossing over Burrill Lake includes a bridge and causeway. The current bridge structure was designed in 1956 and built in 1958. The bridge is 54.85 metres long and consists of six precast concrete spans, each 9.14 metres long, supported by six piers within Burrill Lake. The causeway is 150 metres long.

The existing crossing is one of the lowest points above sea level on the Princes Highway at 1.5 Australian Height Datum (AHD). It is prone to inundation during moderate frequency flood events. This has been estimated at between 1:10 and 1:20 ARI (BMT WBM 2012).

Consistent with the adjoining approaches, the crossing has two lanes, one north and one south-bound, each 3.5 metres in width. The shoulder widths on the bridge structure are 0.9 metres with a 1.35 metre wide footway on the western side. The shoulder widths on the causeway are as narrow as 0.4 metres. There is no barrier protection between pedestrians and vehicular traffic. The existing safety rails preventing pedestrians from falling into the water are non-standard.

The bridge drainage is on the eastern side and flows directly into Burrill Lake.

The following utilities are located adjacent to the existing bridge (Hyder 2013):

- Telecommunication cables located below the waterway adjacent to the proposed works.
- Overhead electricity lines on both sides of the bridge approaches.
- Street lighting at intersections along the approaches.
- Water and sewer lines are mounted on brackets on the western side of the bridge.
- Additional services may be located under the footway of the bridge.

### 2.2.3 Existing local roads

There are six local roads within 400 metres of the bridge approaches (Figure 1-2):

- Dolphin Point Road
- Jorgys Way
- Balmoral Road
- McDonald Parade
- Princess Avenue North
- Princess Avenue South

There are no traffic lights present at any intersections within the study area.

#### **Dolphin Point Road**

Dolphin Point Road joins the Princes Highway about 150 metres south of the Burrill Lake crossing. It is a through road changing into Highview Drive and Wuru Drive in residential areas. It provides access to residential areas, the Dolphin Point Tourist Park and Lions Park recreation area. Access to the Princes Highway is restricted to left out from Dolphin Point Road. A raised concrete barrier prevents a right turn from Dolphin Point Road onto the highway.

#### **Jorgys Way**

Jorgys Way joins the Princes Highway about 100 metres south of the crossing. It provides access to the Big 4 Caravan Park. A turning lane is provided from the southbound lane of the Princes Highway into Jorgys Way.

### **Balmoral Road**

Balmoral Road joins the Princes Highway about 50 metres south of the Burrill Lake crossing. It provides access to businesses and Burrill Lake Post Office (including a shopping centre on the corner of Balmoral Road) and residences. A footpath is present on the western side of the road.

### **McDonald Parade**

McDonald Parade joins the Princes Highway about 180 metres north of Burrill Lake crossing. It provides access to residential and recreation areas including McDonald Parade Reserve and the foreshore park area north of the crossing (including sporting fields). Several businesses are located along the highway between the crossing and McDonald Parade. Informal parking areas are located close to the junction on McDonald Parade, alongside the park area on the foreshore.

### **Princess Avenue North**

Princess Avenue North joins the Princes Highway about 375 metres north of the Burrill Lake crossing. It provides access to a small residential area. It joins with Commonwealth Avenue that accesses residential areas and Burrill Lake Community Hall.

### **Princess Avenue South**

Princess Avenue South joins the Princes Highway about 190 metres north of the Burrill Lake crossing. It provides access to five residences, Edgewater Motel and Burrill Lake Tourist Park. Walking tracks to the beach are also located off Princess Avenue South.

## **2.3 Proposal objectives**

The key driver of the proposal is the imminent maintenance requirement of the existing Burrill Lake crossing. Works are required to address deterioration of the existing crossing. Upgrade or replacement of the crossing is required in the next five to seven years. The primary proposal objective is therefore to provide a safe and reliable crossing over Burrill Lake.

In the context of the issues that have been identified with the existing crossing, secondary objectives have been identified as:

- Extend the design life of the crossing by improving the overall reliability of the Princes Highway and reducing future crossing maintenance.
- Provide a lake crossing and road approaches designed above the predicted 1:100 ARI.
- Improve road safety and traffic efficiency by providing 3.5 metre lanes and 2.5 metre shoulders on the bridge as well as new connections between local roads and the Princes Highway.
- Provide a Higher Mass Limit (HML) compliant structure on the Princes Highway crossing of Burrill Lake (Bridge Design AS5100).
- Provide the opportunity to improve pedestrian and cyclist access and safety.
- Maintain connectivity for local traffic, including to businesses that front Burrill Lakes.
- Provide new infrastructure that is consistent with the future provision of a Milton Ulladulla Bypass.
- Minimise environmental impacts.

- Provide value for money.

## 2.4 Alternatives and options considered

### 2.4.1 Methodology for selection of preferred option

A value management/options assessment workshop was held on the December 6 2012, involving Shoalhaven City Council, Milton Ulladulla Lions Club, Roads and Maritime (including Maritime staff). This workshop was used to identify and evaluate options that would meet the proposal's functional requirements.

The Values Management Workshop Report (Hyder 2013) documents the process undertaken and the results of the workshop. The workshop presented background information available from preliminary studies. 'Function analysis' was used to identify functions that the proposal must fulfil in order to be successful. The functions identified and their evaluated importance are outlined in Table 2-1.

Table 2-1 Primary and secondary functional requirements for the proposal.

<b>Function 1</b>	To provide safe and efficient regional movement of people and vehicles.	Primary functional requirements
<b>Function 2</b>	To provide flood immunity in a 1: 100 year event for the crossing and approaches.	Secondary functional requirements
<b>Function 3</b>	To maintain local connectivity.	
<b>Function 4</b>	To maintain community and business viability.	
<b>Function 5</b>	To not detract from the local character and amenity.	
<b>Function 6</b>	To minimise impacts on the natural and cultural environment.	

Each option was evaluated against the functions and its performance graded. Further investigations, including cost analysis and community and stakeholder engagement were undertaken, prior to the selection of a preferred option.

### 2.4.2 Identified options

The following provides an overview of the high-level options considered during the value management process. Including the do nothing option, eight options were identified. These are shown in Table 2-2 and discussed below.

Table 2-2 Identified options for the proposal.

<b>Do nothing</b>	Existing crossing retained, unaltered.
<b>Option 1</b>	Bypass Burrill Lake and upgrade and retain existing crossing for local traffic.
<b>Option 2</b>	Upgrade the existing crossing.
<b>Option 3</b>	Construct a new highway crossing, existing crossing retained for pedestrian use only.
<b>Option 4</b>	Construct a new highway crossing, existing crossing retained for local vehicle and pedestrian traffic.
<b>Option 5</b>	Provide a new crossing on the existing alignment.
<b>Option 6 (preferred option)</b>	Provide a new crossing on a new alignment (east).
<b>Option 7</b>	Provide a new crossing on a new alignment (west).

#### **Do nothing**

The do nothing option would retain existing crossing infrastructure. No improvements would be carried out.

**Option 1 Provide a complete bypass of Burrill Lake. Upgrade the existing crossing, retaining it for local traffic use only.**

Under this option, improvements would be carried out to address the maintenance requirements of the crossing. This option is limited by feasible bypass locations.

**Option 2 Upgrade the existing crossing.**

Under this option, the existing crossing would be repaired as required to address deteriorating pavement, safety rails, footpath etc. It would occur in response to identified deficiencies and would therefore not be proactive in addressing the safety risks of deteriorating infrastructure.

**Option 3 Provide a new highway crossing on a new alignment. Maintain or upgrade the existing crossing for pedestrian use only.**

Under this option, the existing crossing would be maintained or upgraded sufficient to address pedestrian safety issues. This would include repairing pedestrian paving and safety rails. A new bridge would be constructed for vehicular traffic only. The bridge could be constructed to be above the 1:100 year flood level and could be narrower, due to the pedestrian access remaining on the existing crossing. Alignment options are explored further in options 6 and 7.

**Option 4 Provide a new highway crossing on a new alignment. Maintain or upgrade the existing crossing for local vehicle and pedestrian traffic.**

Under this option, the existing crossing would be maintained or upgraded sufficient to address local traffic and pedestrian safety issues. This would include repairing pedestrian paving and safety rails. It may also require structural improvements to the bridge to allow continued vehicular traffic. A new bridge would be constructed to provide for other non-local traffic. The bridge could be constructed to be above the 1:100 year flood level and could be narrower, due to the pedestrian access remaining on the existing crossing. Alignment options are explored further in options 6 and 7.

**Option 5 Provide a new crossing on the existing alignment.**

Under this option, the existing crossing would be demolished and replaced by a new bridge able to meet the primary objective of the works. To achieve flood immunity of a 1:100 ARI, the new bridge would have to be higher than the existing crossing.

**Option 6 Provide a new crossing on a new alignment: east (preferred option)**

Under this option, the existing crossing would be demolished and replaced by a new bridge to the east of the existing crossing. This option would provide for local and through traffic and would provide for a 1:100 year flood level.

**Option 7 Provide a new crossing on a new alignment: west.**

Under this option, the existing crossing would be demolished and replaced by a new bridge to the west of the existing crossing. This option would provide for local and through traffic and would provide for a 1:100 year flood level.

### 2.4.3 Analysis of options

A matrix was used to identify the importance of each functional requirement (Table 2-3). Safe and efficient movement of people and vehicles and minimising impact on the natural and cultural environment were determined to be the most important requirements.

Table 2-3 Weight scoring of functional requirements.

	<b>Functional Requirements</b>	<b>Weighted score (importance)</b>
1	Safe and efficient movement of people and vehicles	5
2	Flood immunity in a 1 in 100 year event for crossing/approaches	1
3	Maintain local connectivity	2
4	Maintain community and business viability	3
5	Not detract from local character and amenity	0
6	Minimise impact on natural and cultural environment	4

Then each option identified above was analysed against the weighted score of the functional requirements, as summarised in Table 2-4.

Table 2-4 Evaluation of options against functional requirements.

Functional requirement	Safe and efficient regional movement of people and vehicles	Flood immunity in a 1 in 100 year event for crossing/ approaches	Maintain local connectivity	Maintain community and business viability	Not detract from local character and amenity	Minimise impact on natural & cultural environment	
Weighted Score	5	1	2	3	0	4	
Option	Performance rating 1 (poor) – 5 (excellent)						Total
1. Provide a complete bypass of Burrill Lake. Upgrade the existing crossing, retaining it for local traffic use only.	5	5	5	1	5	1	3.13
2. Upgrade the existing crossing.	2	1	4	5	5	5	3.60
3. Provide a new highway crossing on a new alignment. Maintain or upgrade the existing crossing for pedestrian use only.	4	4	4	3	3	3	3.53
4. Provide a new highway crossing on a new alignment. Maintain or upgrade the existing crossing for local vehicle and pedestrian traffic.	5	4	5	4	3	3	4.20
5. Provide a new crossing on the existing alignment.	3	5	2	2	2	4	3.07
6. Provide a new crossing on a new alignment: east.	5	5	4	3	3	2	3.67
7. Provide a new crossing on a new alignment: west.	5	5	2	1	1	3	3.27

**Option 1 Provide a complete bypass of Burrill Lake. Upgrade the existing crossing, retaining it for local traffic use only.**

This option performs best for regional movement of people and vehicles and flood immunity. It would also maintain the local character of the area. However, it includes potential visual impacts to the local community and decreases business viability by diverting traffic away from the area. The local topography provides no feasible alignment for a western bypass and limited opportunities for an eastern bypass. An eastern bypass would be constrained by coastal sand dunes, uncleared woodland, the estuary entrance and ocean foreshore. The impact of an eastern bypass on the natural and cultural environment has the potential to be significant.

**Option 2 Upgrade the existing crossing.**

This option would retain the local connectivity and character of the area. It would not impact on the local community and business viability. The impacts on the natural and cultural environment would be likely to be short term only; this option scored the best against the environmental functional requirement. Parts of the existing crossing would remain susceptible to flooding in between 1:10 and 1:20 ARIs. Any maintenance or refurbishment would be constrained by the existing crossing elevation and therefore, no improvement to flood immunity would be achieved. This would not meet the requirement to provide safe regional movement of people and vehicles.

**Option 3 Provide a new highway crossing on a new alignment. Maintain or upgrade the existing crossing for pedestrian use only.**

Under this option a new crossing would be located either to the east or west of the existing crossing. These options are discussed further below (options 6 and 7). Retaining the existing crossing for pedestrians would reduce impacts related to the demolition of the existing crossing. This option would also be beneficial to the local community and business viability and local connectivity. However, the existing crossing would still be limited by flooding and the local character would be likely to be impacted by retaining two crossings.

**Option 4 Provide a new highway crossing on a new alignment. Maintain or upgrade the existing crossing for local vehicle and pedestrian traffic.**

Under this option a new crossing would be located either to the east or west of the existing crossing. These options are discussed further below (options 6 and 7). As for option 3, retaining the existing crossing for pedestrians and local traffic would reduce impacts related to the demolition of the existing crossing. This option would also be beneficial to the local community and business viability and local connectivity. However, the existing crossing would still be limited by flooding.

**Option 5 Provide a new crossing on the existing alignment.**

This option would provide a new crossing above the flood constraints. It scored well with the environmental functional requirement, as only short term impacts on the natural and cultural environment would be likely. This option scored poorly for local connectivity, local character and business viability. There would also be challenges connecting the new crossing to existing intersections at different elevations and maintaining through traffic during the construction stage.

**Option 6 Provide a new crossing on a new alignment: east (preferred option)**

This option would provide enhanced safety and efficient movement for regional traffic and improve flood immunity for the crossing. It would also maintain local connectivity. This option scored poorly against the functional environmental requirement. Impacts on the natural and cultural environment would need to be managed. Due to the height of the new crossing, it may also impact on the local character of the area.

### **Option 7 Provide a new crossing on a new alignment: west.**

This option would provide enhanced safety and efficient movement for regional traffic and improve flood immunity for the crossing. This option scored poorly against the functional environmental requirement with impacts likely on the natural and cultural environment. The alignment, and especially the elevation, of this route would directly pass through most of the existing businesses on both sides of the crossing. It would also introduce significant difficulties with connections to local roads, hence the low score for the local connectivity requirement. The poor performance of this option on the local connectivity requirement would also translate into poor community and business viability in that the lack of connectivity would further impact negatively on any remaining businesses that rely on passing trade. The proximity of this option to dwellings alongside the lake would increase its visual impact.

## **2.5 Preferred option**

Option 6, to provide a new crossing on a new eastern alignment, is the preferred option. This option meets the primary functional requirement and best meets the range of secondary functional requirements. It would:

- Provide enhanced safety and efficient movement for regional traffic.
- Extend the design life of the crossing by improving the overall reliability of the Princes Highway and reducing future crossing maintenance.
- Provide flood immunity in a 1 in 100 year event for crossing/approaches.
- Provide a Higher Mass Limit (HML) compliant structure on the Princes Highway Crossing of Burrill Lake (Bridge Design AS5100).
- Provide the opportunity to improve pedestrian and cyclist access and safety.
- Maintain local connectivity.
- Maintain community and business viability.
- Provide new infrastructure that is consistent with the future provision of a Milton Ulladulla Bypass.
- Provide value for money.

Some environmental impacts are anticipated. Soil and water pollution risks associated with construction in and adjacent to the waterway would be present. Aquatic and terrestrial ecology impacts would result from clearing seagrass and terrestrial vegetation. The visual character of the crossing and access for local retail traffic would be altered. In view of the alternatives however, these impacts are considered manageable with the implementation of appropriate safeguards when compared to the benefits of obtaining a safe and reliable crossing in the long-term at Burrill Lake.

The principles of ecological sustainable development (ESD) have been applied to this proposal. The format of this REF and the environmental safeguards herein have been designed with the objective of minimising potential impacts on the surrounding environment.

A detailed description of the preferred option (the proposal) is present in Chapter 3. This would be further developed during detailed design.

Option six (the proposal) is the option assessed in this REF.

## **2.6 Design refinements**

Extensive community consultation has been undertaken to develop this proposal in a way that best meets the needs of the local community. Specific issues raised during community consultation and now featured in the proposal include:

- A roundabout would be constructed at the northern end of the bridge, connecting MacDonald Parade and Princess Avenue South to the Princes Highway.
- The Balmoral Road roundabout and new Balmoral road connection would cater for all vehicles up to and including semi-trailers.
- A pedestrian connection under the bridge from Balmoral Road to Lions Park would be constructed to achieve a head clearance of around 2.2 metres.
- A pedestrian connection under the northern bridge approach would be constructed to achieve a head clearance of around 2.2 metres.
- Five pedestrian crossing opportunities would be provided, including under the bridge, at both roundabouts and near shops on the northern approach.
- Additional parking spaces would be provided.
- Landscaping improvements would be provided.
- The southern abutment of the existing bridge would be retained as a recreational fishing platform.
- Four bus stops in total will be reinstated, one in each direction on either side of the bridge, would be provided.
- Design measures to reduce the overall bulk of the bridge and make it appear more slender (including the reduction in number of piers and an increase in their distance apart) would form part of the proposal.

## 3 Description of the proposal

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### 3.1 The proposal

The proposal to replace the existing Burrill Lake crossing would include the construction of a new bridge, changes to bridge approaches and local traffic conditions and the demolition of the existing crossing. The bridge would be constructed about 20 metres to the east of the existing bridge. An 80 per cent concept plan has been developed (provided in Appendix B). The design has been informed by the Urban Design Report for the proposal (Jackson Teece 2013).

The general features of the proposal are:

- A 290 metre long bridge spanning the lake on a new alignment to the east of the existing bridge.
- A roundabout on either side of the crossing to connect the A1 Princes Highway to local roads.
- A pedestrian and cycle path on the new bridge, connecting to new paths on both approaches and linking to the Ulladulla cycle path.
- Pedestrian paths underneath both ends of the new bridge. There would be a total of five locations where pedestrians can safely cross the highway.
- The new bridge and highway would be higher than the future 1 in 100 year flood level and reduce the impact of flooding.
- Removal of the existing causeway and bridge (southern abutment to be retained, refer to additional features below).

#### Bridge

- The finished bridge deck would be about three metres higher and located about 20 metres east of the existing crossing.
- Pier spans would be 18 metres apart and would be bored. The total set of piers would be 16. Six piers would be required within the lake and channel.
- Bridge lane width would be 3.5 metres, accommodating the potential for an increased lane, if required in the future.
- Shoulders would be asphalt and 2.5 metres wide.
- Two traffic barriers on the bridge either side of the shoulders, one would be separating the footway from the lanes of traffic and the other would be on the edge of the bridge.
- A pedestrian railing on the edge of the bridge, securing the footway from Burrill Lake.
- A shared path for cyclists and pedestrians would be three metres wide on the western side of the bridge (and 2.5 metres wide at all other places).
- A temporary rock platform would be required for the construction of the new bridge (described in more detail in Works methodology, section 3.3.1).
- The bridge posted speed limit would be 60 kilometres per hour.

#### Road approaches

The proposal would include construction of new road approaches:

- 540 metres of raised approach to the north.
- 320 metres of raised approach to the south.

Approaches would include:

- Two-lanes (one northbound and one southbound) with a width of 3.5 metres.
- Nominal 2.5 metres wide asphalt shoulders.
- One metre verges, except where a shared path is required where the width would be 2.5 metres.

The approaches would have road batter slopes of varying grades, the steepest being 2:1 and the gentlest being 4:1.

### **Additional features**

Additional features of the proposal include:

- Two new roundabouts:
  - Construction of a new roundabout at the junction of the Princes Highway with Dolphin Point Road and Balmoral Road.
  - Construction of a new roundabout at the junction of the Princes Highway with McDonald Parade and Princess Avenue South.
- Relocation of the Lions Park ablutions block, in consultation with the Shoalhaven City Council. (A site has not yet been selected; this aspect of the works would be subject to further assessment).
- Installation of street lighting at intersections.
- New north and south bound bus stops 30 metres north and south of the new bridge
- New 90 degree parking spaces on the existing highway (an overall increase in the number of parking spots available outside shops will be provided) for access to shops and new fishing platform adjacent to the southern approach.
- Cul-de-sacing of the existing highway adjacent to the northern approach. While the existing crossing would be removed, the end of the approach would be retained to provide a turning circle for local traffic accessing retail facilities.
- Retention of the southern abutment of the existing bridge as a recreational fishing platform.
- New shared pedestrian and cycle paths on both sides of the new alignment and pedestrian facilities:
  - On the north, south and west legs of the roundabout at the intersection of the Princes Highway and McDonald Parade and Princess Avenue South.
  - On all four legs of the roundabout at the intersection of the Princes Highway and Dolphin Point and Balmoral Roads.
  - Around 100 metres from the northern approach.
- Stairs providing access from the pedestrian refuge to the existing highway.
- Pedestrian underpasses at both bridge abutments.
- Stairs providing access from the southern approach of the bridge to the carpark, shops, and fishing platform.
- Ancillary construction facilities including a compound site and five potential stock pile sites.
- Installation of noise barrier, 1.2 metre high and 104 metres in length, on the top of the northern approach embankment.

## 3.2 Design

### 3.2.1 Engineering constraints

Engineering constraints identified for the design and construction of the proposal include:

- Local topography:
  - The area is low lying and to achieve a trafficable crossing in a 1:100 ARI the crossing is required to be considerably higher than the existing built structure.
  - The raised structure would block views of the lake from several vantages.
  - The hydrology of the estuary would be affected by new structures as well as by the removal (or part removal) of existing structures.
- Presence of existing utilities (detailed in section 3.5).
- Close proximity of neighbouring properties:
  - Property acquisitions are required (detailed in section 3.6).
  - Three additional properties have been identified as likely to be highly impacted.
- Large amount of fill required to raise approaches.
- Foreshore access:
  - Impacts on existing parkland.
  - Impacts on pedestrian and vehicle foreshore access.
- Construction works (removal and addition of structures) within the waterway.
- Removal of Contaminated materials associated with the existing crossing and located within the works footprint.

### 3.2.2 Major design feature

The major design features of the proposal include:

- The existing bridge currently discharges directly off the deck into the lake. The proposal would include a deck drainage system that diverts water away from the crossing. The requirement for permanent detention basins would be investigated during detailed design and may be subject to a separate environmental assessment.
- The new Burrill Lake Bridge and approaches (Figure 3-1 and 3-2). To provide improved flood immunity, the bridge deck would be required to be three metres higher than the existing bridge deck (Figure 3-3). This would require extensive fill to raise the northern and southern approaches to connect with local roads.

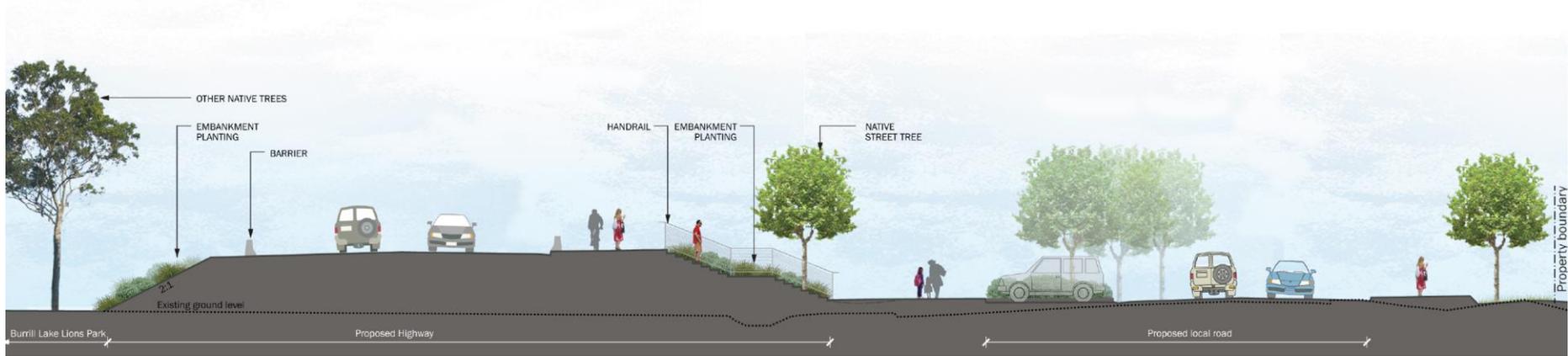


Figure 3-1 Southern approach cross section (Jackson Teece 2013).

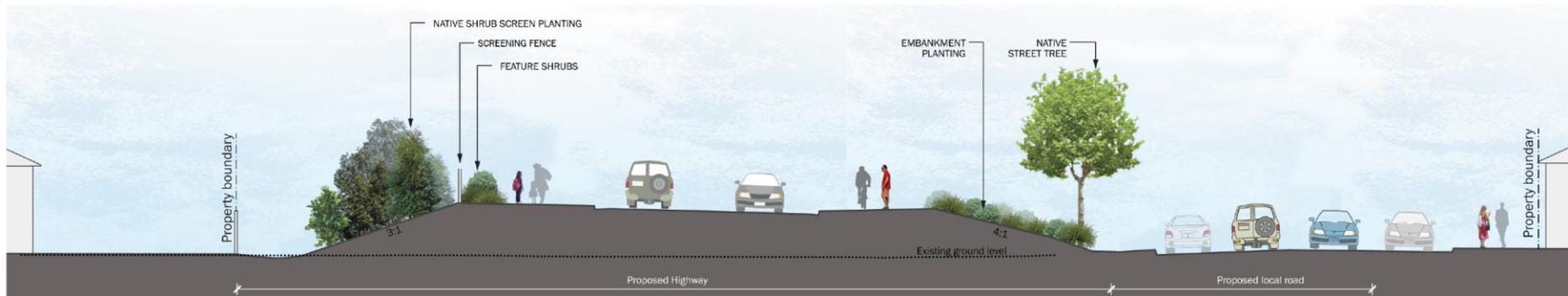


Figure 3-2 Northern approach cross section (Jackson Teece 2013).

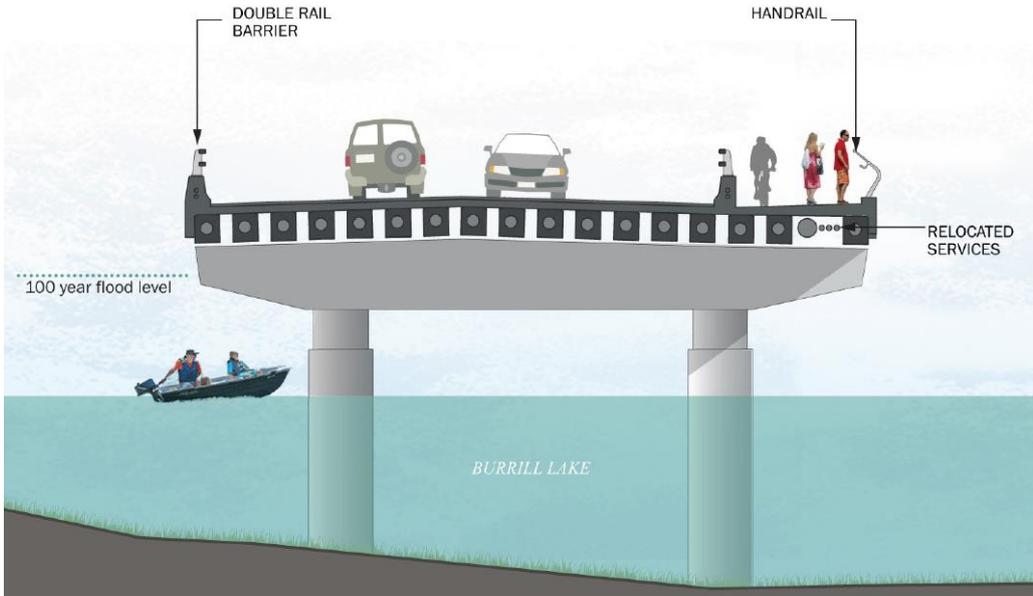


Figure 3-3 Bridge cross section (Jackson Teece 2013).

- Four bus stops would be relocated; two on the north and two on the south side of the new bridge. Two new roundabouts would be installed (Figure 3.4 and 3.5). These would accommodate semi-trailers and would be located at the junction of the Princes Highway with Dolphin Point Road and Balmoral Road and the junction of the Princes Highway with McDonald Parade and Princess Avenue South.



Figure 3-4 Southern Approach Roundabout and bus stops (Jackson Teece 2013).



Figure 3-5 Northern approach roundabout, bus stops and noise barrier (Jackson Teece 2013).

- Noise barriers, as shown in Figure 3-5; a 1.2 metre high barrier will be installed along the eastern side of the northern approach for a distance of about 100 metres. The barrier would be located about five metres from the edge of road kerb. The barrier has been designed to achieve a noise reduction for adjacent residences and ensure compliance with the road traffic noise criteria.
- Temporary rock working platforms (Figure 3-6), to be installed with the waterway and decommissioned at the completion of the construction stage. These would be installed adjacent to each bank and extended as works commence. They have been specified (refer to Appendix C) in consultation with the Department of Primary Industries to minimise impacts on the waterway.



Figure 3-6 Temporary working rock platform example (RMS, 2013).

- Demolition works. Demolition of the existing crossing will require extensive works within the waterway. A small barge (and support vessel) would be used to remove material.

### 3.3 Construction activities

#### 3.3.1 Work methodology

The work methodology for the proposal would be refined during the detailed design stage. Construction activities would be guided by a Construction Environmental Management Plan (CEMP) to ensure that works are carried out within the specified works area and are completed to incorporate all safeguards as described in this REF and any measures identified as a result of submissions to the REF.

The proposal is expected to involve the following work methodology:

#### **Early works – site establishment**

- Progressive installation of temporary erosion, sedimentation and drainage controls.
- Utility adjustment (sewer, water, electricity and telecommunications) as required (refer to section 3.5).
- Establish site compound between the existing road alignment and the proposed road alignment (refer to section 3.4).
- Establish stockpile sites adjacent to north and south abutments, and at the junction of Princes Highway and Wheelbarrow Road, around two kilometres south of Burrill Lake (refer to section 3.4).

### **Contaminated material**

- Removal, treatment and disposal of contaminated materials including asbestos and acid sulfate soils within the works footprint in accordance with a project specific management plan.

### **Construction of new bridge and approaches**

- Two rock platforms would be constructed for the construction of the new bridge, one at each approach:
  - Northern platform: 13 metres wide x 1.5 metres deep x 206 metres long = 4,000 cubic metres.
  - Southern platform: 13 metres wide x 1.5 metres deep x 103 metres long = 2,008 cubic metres.
  - Geofabric would be placed on the lake bed then 300 - 500 millimetres rock would be placed on top followed by smaller rock of 100 - 200 millimetres diameter. A layer of geofabric would then be placed on top and capped with clean gravel to provide a safe working platform. Example technical criteria have been provided in Appendix C.
- Construction of abutments and piles.
  - Install new piles for new abutments – piles would be bored.
  - Install temporary shoring for abutment - work to be undertaken from the approaches using hand tools.
  - Excavate to underside level of the new abutment - work to be undertaken from the approaches using heavy plant.
  - Install new central piles - work to be undertaken from the approaches and temporary platform in Burrill Lake using pile driving plant and equipment.
  - Excavate behind new abutments.
  - Construct new abutments and approach slabs.
  - Backfill behind abutments.
- Place new girders using crane.
- Install utility services on structure and connect to new utility services on approaches.
- Construct deck and kerbs.

### **Roundabouts**

- Early installation of permanent drainage controls in the vicinity of the new roundabout at Dolphin Point Road, as far as practical.
- Import material and construct embankments using graders, dozers, scrapers and other equipment.
- Install utility services in embankment and connect to new utility services on new bridge.
- Compact the resultant surface using compaction equipment.
- Install roadside drainage structures.
- Construct roadside batters.
- Construct roadside gutters and berms.
- Apply wearing surface.
- Install line marking, signs and guide posts.
- Site clean-up and disposal of all surplus waste materials.

### **Demolition of the existing crossing**

- The bridge would be demolished first, then the causeway crossing.
- Saw cut through the existing road pavement, deck and planks - work to be undertaken from the existing abutment using hand tools and small plant.
- Core holes in the end of deck sections with hand tools and remove using lifting chains and a crane.
- Saw cut existing headstocks.

- Remove headstocks and piles at base or one metre below bed level (subject to DPI consultation). Works would be undertaken from the abutments using heavy plant (excavator or crane). Depending on the condition of the piles, this may require assistance of diving personnel working in the water and using underwater cutting equipment to cut the reinforcing steel and loosen concrete, which would then be removed by hand to the small barge (or floating platform). A support vessel would be used during the works to manoeuvre the barge and provide access to the barge for workers. The support vessel would be moored to the barge overnight. Refer to Figure 3-7 for location of access point.
- Material would be removed from west to east with equipment working back towards shore. The barge (or floating platform) would be used to remove material from the bridge, to then be trucked off site for disposal.



Figure 3-7 Access to the foreshore in order to launch the barge (indicated by arrow). Yellow circle and red circle indicates fence and bench respectively to be temporarily removed for access purposes (NSW Department of Lands 2013).



Figure 3-8 Foreshore of Burrill Lake where the barge would be launched. Bench would need to be temporarily removed for access (nghenvironmental, 2013).

### Rehabilitation

- Rehabilitation of disturbed areas.
- Implementation of landscaping treatments.
- Decommission temporary facilities e.g. site compounds.

### 3.3.2 Construction hours and duration

Construction is estimated to commence in early to mid-2015 and last for 15 to 18 months.

Works would be generally undertaken during the following standard working hours in accordance with the *Interim Construction Noise Guideline* (DECC 2009), as follows:

Monday to Friday	7:00am to 6:00pm
Saturdays	8:00am to 1:00pm (7 - 8am inaudible work permitted)
Sundays and Public Holidays	no works

It is anticipated that some work may be required outside of the standard working hours to avoid major delays to commuter traffic and maintain the safety of the workforce.

There is likely to be a need for night works during the construction of the connections between the newly constructed highway alignment and the existing highway. There is likely to be a maximum of three weeks night work at each end of the project.

Where works would be required outside the standard working hours outlined above, the procedure contained in RMS's *Environmental Noise Management Manual 2001*, "Practice Note vii – *Roadworks Outside of Normal Working Hours*" as well as the *Interim Construction Noise Guidelines* (DECC 2009) and any safeguards contained within the REF would be adhered to. This would include notifying the local community of any works planned to be undertaken outside standard construction hours.

### 3.3.3 Plant and equipment

The following plant, equipment and machinery would be used during the project:

- Site establishment – excavators, chainsaws, mulching plant and chipper, cranes, generators, bobcats, powered hand tools, air compressors.
- Earthworks – road trucks, compactors, graders, multi-tyred vibratory rollers, asphalt paving plant, backhoes, sweepers, compressors, generators, rock crushers.
- Bridge works –piling rig, cranes, small barge or floating platform and associated support vessel.
- Paving – road trucks, compactors, jackhammers, multi-tyred vibratory rollers, asphalt paving plant, backhoe, concrete saws, road profiler, sweeper, compressor, generators.

The plant and equipment listed above may be change upon refinement of design and during the construction planning stage.

Depending on the nature of the construction, not all the above plant and equipment would be present on the construction site at any one time and a number of pieces of identified equipment would only be used on an intermittent or temporary basis.

### 3.3.4 Earthworks

Excavation would be required for the construction of the new bridge and approaches and the removal of the existing crossing. Cutting is required at one location on the southern approach and two locations on the northern approach. Fill would be required along both approaches to raise the elevation of the road. A substantial fill deficit is expected.

Estimated quantities are:

- Strip and respread topsoils 240 cubic metres
- Cut to spoil 900 cubic metres
- Fill 33,000 cubic metres
- Rock 6,000 cubic metres

Any excess material that cannot be reused onsite would be removed from site. Final quantities would be determined during detailed design.

### 3.3.5 Source and quantity of materials

Materials required for the work include:

- Concrete
- Steel
- Gravel and aggregate
- Prefabricated elements (road furniture)

Estimated quantities are not yet available for these materials. All of the new and purchased materials to be used would be sourced from commercial suppliers as close to the work site as possible to reduce transport costs, including fuel usage. The nearest quarry being considered for use is 106 kilometres from the site.

No resource is expected or likely to become in short supply as a result of the work.

Final quantities of materials would be determined after the completion of the detailed design and specifications.

### 3.3.6 Traffic management and access

The existing crossing would remain in use while the new bridge is constructed. Demolition of the existing crossing would not commence until tie in is completed to the new bridge.

Local traffic changes would be required while works occur at

- The junction of the Princes Highway with Dolphin Point Road and Balmoral Road.
- The junction of the Princes Highway with McDonald Parade and Princess Avenue South.
- Access to Lions Park.

Lane and road closures would occur for limited periods during construction in these areas.

Additionally, four bus stops would be affected by the works. Alternative temporary locations may be considered for these as the works progress.

Construction impacts of the proposal would be managed through a traffic management plan (as part of the CEMP), in accordance with AS1742 3-2009 and *Traffic control at work sites* (RTA 2010) (see Section 6.4). The traffic management plan would include the guidelines, general requirements and procedures to be used when activities or areas of work have a potential impact on existing traffic arrangements.

### 3.4 Ancillary facilities

#### 3.4.1 Compound and stockpile site

Four sites have been identified close to the works areas as suitable for use as compound and stock pile sites. An additional stockpile site two kilometres south of Burrill Lake at the junction of Princes Highway and Wheelbarrow Road is also likely to be used. The locations of the sites are shown in Figure 3-9 and detailed in Table 3-1.

Table 3-1 Stockpile and compound sites.

Site 1:	Two vacant lots would be acquired by Roads and Maritime at the corner of the Princes Highway and Macdonald Parade junction. These are required for the construction stage only and would be sold at the completion of construction.
Site 2:	Three vacant lots adjacent to 15 Princess Avenue South would be acquired by Roads and Maritime. These are required for the construction stage only and would be sold at the completion of construction.
Site 3:	The vacant lots at the rear of the Edgewater Motel have been acquired by Roads and Maritime. After construction, residual land would revert to Crown Land.
Site 4:	Part of Lyons Park on the south-eastern foreshore of Burrill Lake would be leased from Crown Lands for the duration of the construction only.
Site 5:	This is an existing Roads and Maritime stockpile at the junction of the Princes Highway and Wheelbarrow Road, approximately two kilometres south of Burrill Lake.

The compound site would consist of a meal room, office and toilets. This area would also be used to store plant, equipment and materials including stockpiles of road and bridge construction materials.

Stockpile sites would be used during the construction stage for the storage of equipment and materials. The compounds would be secured with temporary man-proof fencing.



Figure 3-9 Compound and stockpile sites.

The combined footprint of the compound and stockpile sites would be about 5,800m<sup>2</sup>. The location of the compound and stockpiles are located in previously disturbed areas. No vegetation clearing would be required to establish the compound and stockpiles sites. The sites would be managed to avoid impact on adjacent areas.

### 3.5 Public utility adjustment

The following utilities are along the existing bridge (Hyder 2013):

- Telecommunication cables located below the waterway adjacent to proposed works.
- Overhead wiring, Endeavour Energy, power located on both sides.
- Piped services including Shoalhaven water, water and sewer) located on the western side of the bridge structure mounted on brackets.
- Services located under the walkway of the bridge which are not full known.

Water and sewer services are carried in the existing bridge and buried in the existing causeway. The existing services will be redirected from the vicinity of the junction of Dolphin Point Road and the Princes Highway onto the new bridge, carried along the new bridge and the northern approach before reconnecting with the existing services in the vicinity of the junction of McDonald Parade and the Princes Highway. The services will be laid underneath the new road embankment and carried below the deck of the new bridge.

A number of minor transmission lines around the vicinity of the junction of Dolphin Point Road and the Princes Highway and the junction of McDonald Parade and the Princes Highway will be relocated and replaced with matching power poles and low voltage lines, within the project footprint but outside of the road clear zones.

Additional consultation will be undertaken to locate utilities prior to works.

### 3.6 Property acquisition

One residential property has been acquired and the building would be demolished (not considered as part of this assessment) to make way for the new northern approach (1, Figure 3-10). Two additional property acquisitions are required on the northern approach (2 and 3) nearby. Property 2 is part of a residential block and Property 3 is a vacant lot. On the southern approach, four properties would be acquired. Three properties would be acquired to make way for the southern approach (4, 5, 6) and with the other property acquired (7) will also be used for stockpiling and compound sites. All properties to be acquired on the southern approach are currently used as open recreational areas including an amenities block and car parking.

- 1 Lot 369, DP 15648 (already acquired).
- 2 Lot 378, DP 15648 (only the northern portion of the lot is to be acquired).
- 3 Lot 379, DP 15648 (to be acquired).
- 4 Lot 7021 DP 1115776 (northern portion to be acquired).
- 5 Lot 155 DP 755972 (to be acquired).
- 6 Lot 7022 DP 1115777 (northern portion to be acquired).
- 7 Lot 2 DP811329 (eastern portion to be acquired).

All property acquisition would be undertaken in accordance with the *Land Acquisitions (Just Terms Compensation) Act 1991* and the Roads and Maritime Land Acquisition Policy.



 Property acquisition  
 Cadastre

0 10 20 40 Metres

Ref: 5299v2.0 REF  
 Author: SP



[www.nghenvironmental.com.au](http://www.nghenvironmental.com.au)

Figure 3-10 Properties to be acquired.

## 4 Statutory and planning framework

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### 4.1 State Environmental Planning Policies

#### 4.1.1 State Environmental Planning Policy (Infrastructure) 2007

*State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) aims to facilitate the effective delivery of infrastructure across the State.

Clause 94 of ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for a road and road infrastructure facilities and is to be carried out on behalf of Roads and Maritime Services, it can be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*. Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not affect land or development regulated by *State Environmental Planning Policy No. 14 - Coastal Wetlands*, *State Environmental Planning Policy No. 26 - Littoral Rainforests*, *State Environmental Planning Policy (State and Regional Development) 2011* or *State Environmental Planning Policy (Transitional Major Projects) 2005*.

Part 2 of the ISEPP contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by ISEPP (where applicable), is discussed in chapter 5 of this REF.

#### 4.1.2 State Environmental Planning Policy 71 – Coastal Protection

State Environmental Planning Policy No. 71 encourages the appropriate development of the NSW coastal zone by ensuring the use of consistent and strategic approach to coastal planning and management and a clear development assessment framework.

The proposal is being assessed under Part 5 of the EP&A Act therefore this SEPP is not applicable.

#### 4.1.3 State Environmental Planning Policy 14 - Coastal Wetlands

*State Environmental Planning Policy 14 – Coastal Wetlands* (SEPP 14) seeks to control development within coastal wetland areas for environmental and economic considerations. Any development within or near listed wetlands must be considered for the impact it might have on the environment, and whether or not the proposal is avoidable within these areas, before consent is granted.

A number of SEPP 14 coastal wetlands are associated with Burrill Lake. These are located over four kilometres upstream of the study area. No SEPP 14 coastal wetlands would be affected by the proposed works. The biodiversity assessment (attached in Appendix E and summarised in section 6.3) assesses ecological constraints regarding estuarine habitats associated with Burrill Lake.

## 4.2 Local Environmental Plans

### 4.2.1 Shoalhaven Local Environmental Plan 1985<sup>1</sup>

The proposal site is located within the Shoalhaven LGA. Development within the LGA is controlled by the *Shoalhaven Local Environmental Plan 1985* (Shoalhaven LEP).

This proposed new bridge, alignment and properties to be acquired would be located within land proposed 5(d) Special Uses (Proposed Arterial Roads Reservation and Widening of existing arterial roads reservation) zone on Shoalhaven City Council's Local Environment Plan. Stockpiles sites and some works will occur within land zoned as Open Space - Recreation (Existing).

The provisions of the ISEPP override any development consent requirements of the Shoalhaven LEP. Development consent from Council would not be required. Consultation requirements under the ISEPP are discussed in section 5.4.

### 4.2.2 Draft Shoalhaven Local Environmental Plan 2013

Shoalhaven City Council has prepared a *Draft Shoalhaven Local Environment Plan 2013* in accordance with *Standard Instrument (Local Environmental Plans) Order 2006* and requirements set by the NSW Department of Planning & Infrastructure (DP&I). The draft LEP was submitted to The Department of Planning and Infrastructure for finalisation in October 2013.

As discussed above, development consent from Council would not be required. Consultation requirements under the ISEPP are discussed in section 5.4.

## 4.3 Other relevant legislation

### 4.3.1 *Threatened Species Conservation Act 1995*

The *Threatened Species Conservation Act 1995* aims to conserve and protect threatened, endangered and vulnerable species, populations and ecological communities.

Section 5A of the EP&A Act lists a number of factors to be taken into account when deciding if there is the likelihood of a significant impact on threatened species, populations and their habitat or on ecological communities. If there is potential for adverse impact, then an Assessment of Significance is required to characterise the significance of the impact. If there is likelihood for a significant impact on threatened species, populations and their habitat or on ecological communities then a Species Impact Statement (SIS) is required.

Small areas of clearing of Endangered Ecological Communities (EEC) listed under this act are proposed. The works also have potential to impact threatened species listed under this act. Potential impacts to listed flora and fauna are assessed in Biodiversity, section 6.3. Significant impacts have been assessed as unlikely to occur and therefore referral and an SIS is not considered to be required.

### 4.3.2 *Noxious Weeds Act 1993*

This act aims to prevent the establishment, reduce the risk of spread and minimise the extent of noxious weeds. The *Noxious Weeds Act 1993* guides the management of declared noxious weeds within Local Government Areas (LGAs). One noxious weed occurs within the development footprint and would require treatment. Impacts are assessed in Biodiversity, section 6.3.

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<sup>1</sup> At time of writing the 1985 LEP remains current.

#### 4.3.3 *Protection of the Environment Operations Act 1997*

The *Protection of the Environment Operations Act 1997* (POEO Act) provides an integrated system of licensing for polluting activities within the objective of protecting the environment.

The contractor and Roads and Maritime are obliged to notify the Environment Protection Authority (EPA) when a 'pollution incident' occurs that causes or threatens 'material harm' to the environment. Potential for pollution is assessed separately in this REF (Geology, topography, soils and contamination, section 6.1 and Hydrology, flooding and water quality, section 6.2).

No licences are required under this act.

#### 4.3.4 *Protection of the Environment Operations (Waste) Regulation 2005*

Clause 42 of this Regulation specifies the special requirements relating to asbestos waste and applies to any activity that involves the transportation, disposal, re-use or recycling of any type of asbestos waste, regardless of whether the activity is required to be licensed.

Asbestos was identified within the study area and would be removed as part of the proposed works. To ensure that transportation and disposal of asbestos removed from the site prior to demolition works is in accordance with the specifications in this Clause, an Asbestos Survey and Management Plan would be required, as discussed in section 3.3.1.

#### 4.3.5 *National Parks and Wildlife Act 1974*

The *National Parks and Wildlife Act 1974* (NPW Act) is administered by the Office of Environment and Heritage (OEH). It provides legislative protection for Aboriginal heritage NSW. Part 6 of the Act refers to Aboriginal objects and places and prevents persons from impacting on an Aboriginal place or relic, without consent or a permit. The Roads and Maritime *Procedure for Aboriginal cultural heritage consultation and investigation* was followed.

Impacts to Aboriginal heritage values are assessed Appendix I and summarised in section 6.7 of this REF. A permit to impact on known Aboriginal sites would be required.

Additionally, the act aims to conserve nature, habitat, ecosystems, ecosystem processes and biological diversity at the community, species and genetic levels. Under this act, all native fauna is protected, threatened or otherwise. Schedule 13 of the act lists protected plants which shall not be harmed or picked on any land either on or off National Park estate. Biodiversity impacts are assessed Appendix E and summarised in Biodiversity, section 6.3 of this REF.

#### 4.3.6 *Heritage Act 1977*

The *NSW Heritage Act 1977* (Heritage Act) is a statutory tool developed to conserve the cultural heritage of NSW. It is used to regulate development impacts on the State's heritage assets. Administered by the NSW Heritage Office, the Act details the statutory requirements for protecting historic buildings and places and includes *any place, building, work, relic, movable object or precinct, which may be of historic, scientific, cultural, social, archaeological, natural or aesthetic value*.

Heritage items include items listed:

- On the NSW State Heritage Register.
- On the National and Commonwealth Heritage Lists.
- By the Shoalhaven City Council, sourced from the State Heritage Inventory (SHI) and the Local Environment Plan for locally listed heritage items.

### **State Heritage Register**

Under Section 60 of this act, applications to carry out works on items listed on the State Heritage Register (SHR) are required to be made to the Heritage Council. A search of the study area and surrounds indicated that no items in the vicinity of the bridge are included on the SHR; therefore no Section 60 applications are required.

#### **State agency heritage and conservation registers**

State agencies in NSW are required to keep a register of heritage places under their management under Section 170 (s.179) of the Act. These s.170 registers are also held in the NSW Heritage Branch's State Heritage Inventory (SHI), an electronic database of statutory listed heritage items in NSW. A search of the study area and surrounds indicated that no items in the vicinity of the bridge are included on the s.170 registers.

Historic heritage values are assessed Appendix J and summarised in Non-Aboriginal heritage, section 6.9 of this REF. An archival recording is recommended for the existing bridge and causeway, prior to demolition.

#### **4.3.7 Fisheries Management Act 1994**

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of the State for the benefit of present and future generations, including conserving fish stocks and key fish habitats (KFH) and promoting ecologically sustainable development.

The definition of 'dredging work' under Section 198A of the FM Act includes:

- *Any work that involves excavating water land, or*
- *Any work that involves the removal of material from water land that is prescribed by the regulations as being dredging work to which this Division applies.*

The definition of 'reclamation work' under that Section includes any work that involves:

- *Using any material (such as sand, soil, silt, gravel, concrete, oyster shells, tyres, timber or rocks) to fill in or reclaim water land, or*
- *Depositing any such material on water land for the purpose of constructing anything over water land (such as a bridge), or*
- *Draining water from water land for the purpose of its reclamation.*

The definition of 'water land' under the FM Act includes land submerged by water:

- *Whether permanently or intermittently, or*
- *Whether forming an artificial or natural body of water, and includes wetlands and any other land prescribed by the regulations as water land to which this Division applies.*

The proposal would involve both dredging and reclamation work as defined by the FM Act. Roads and Maritime is required to give written notification to the Minister for Fisheries for any dredging or reclamation work and consider any responses in accordance with Section 199 of the FM Act. Consultation with the Department of Primary Industries is detailed in chapter 5 of this REF.

The removal of the causeway and construction of the new bridge have potential to harm marine vegetation including seagrass and saltmarsh. Works would require a Fisheries Permit under part 7 of this act.

#### 4.3.8 *Water Management Act 2000*

The objects of this Act are to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations.

Under this Act, licences and approvals are required for certain activities and works, including water supply works, water access licences, and water use approvals. Some provisions of the Act (e.g. for stock and domestic uses and harvestable rights) enable some activities or works to be undertaken without the need for licences, provided certain conditions are met.

Under the WM Act, a controlled activity approval is required from the NSW Office of Water for certain types of developments and activities that are carried out in or near a river, lake or estuary.

Under the WM Act a controlled activity means:

- The erection of a building or the carrying out of a work (within the meaning of the Environmental Planning and Assessment Act 1979), or
- The removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or
- The deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or
- The carrying out of any other activity that affects the quantity or flow of water in a water source.

A public authority (which includes Roads and Maritime) is exempt from the requirements to obtain a controlled activity approval under Clause 38 of the *Water Management (General) Regulation 2004*.

### 4.4 Commonwealth legislation

#### 4.4.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), a referral is required to the Australian Government for proposed 'actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix E and chapter 6 of the REF.

The assessment of the proposal's impact on matters of national environmental significance and the environment of Commonwealth land found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Accordingly, the proposal has not been referred to the Australian Government Department of the Environment.

### 4.5 Confirmation of statutory position

The State Environmental Planning Policy (Infrastructure) 2007 is the mechanism used to determine the approval pathway for the proposal. The proposal does not require development consent and is subject to environmental impact assessment under Part 5 of the EP&A Act. The proponent and determining authority is Roads and Maritime.

## 5 Stakeholder and community consultation

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### 5.1 Consultation strategy

Consultation with the Burrill Lake community has been undertaken in accordance with the RMS Community Participation and Communications: A resource manual for staff (RTA 2010) to:

- Inform residents of Roads and Maritime's proposal to replace Burrill Lake Bridge and upgrade its approaches.
- Canvass comments and issues about the concept designs for the new crossing from those who may be affected.
- Advise stakeholders how they may obtain further information or communicate concerns, complaints or suggestions.

Additionally, this REF will be public exhibited and submissions from the community sought. It will be published on the Roads and Maritime's website and made available upon request.

### 5.2 Community involvement

Roads and Maritime began widespread consultation with the Burrill Lake Community in May 2012. The aim of the consultation was to inform the community of the need for the crossing upgrade and to identify potential upgrade options, while gathering feedback from the community on their values and potential issues with upgrade options.

Consultation activities have included:

- Community updates.
- Community drop in sessions.
- Community information sessions.
- Shopper survey: this was undertaken to understand the local socio-economic environment and community opinions of the upgrade works.
- Local businesses survey: this was undertaken to understand the issues associated with local businesses.
- Other: advertisements, in-person meetings.

#### **May and June 2012 community consultation**

In May 2012 a community information brochure was distributed to more than 5000 properties in the Burrill Lake, Dolphin Point, Kings Point, Ulladulla, Mollymook and Milton areas. The brochure sought feedback from the community on issues of local value and importance in relation to the Burrill Lake crossing.

The May 2012 information brochure explained the need for the crossing upgrade. It stated that Roads and Maritime had not yet made a decision about whether replacement or maintenance would be the preferred option. The newsletter advised that the *Strategic Concept and Options Study: Burrill Lake Bridge* (Aurecon 2010) was available as background information on the Roads and Maritime website.

The brochure provided information on how the community could get involved with the proposal; providing feedback and attending community drop sessions or information sessions.

#### **Community drop in sessions**

Two drop in sessions were held in Ulladulla on 22 May and 2 June 2012. Around 30 community members in total attended the two sessions. Following on from the sessions and the distribution of the community information brochure, a total of 49 written submissions were received by email and post. This included 23 submissions on a petition requesting a new

bridge on a new alignment.

The main issues raised by the community at the drop in sessions and in written submissions included (in no order):

- Traffic congestion and safety.
- Access for emergency services.
- Sea level rise and flooding.
- The status of the Milton Ulladulla Bypass.
- Construction impacts such as:
  - Noise
  - Dust
  - Drainage
- The impact of the existing crossing on the lake's ecology and hydrology:
  - There was a perception that the existing crossing has a negative impact on these features.
- Potential for a new bridge:
  - There was general support for the idea of replacing the existing crossing with a new structure.
  - There were suggestions that the old crossing should be retained as a community asset.
  - There were suggestions to ensure any new bridge would be integrated into the character of the area.
- Pedestrian access:
  - There was general support for the idea of improving pedestrian access.
- Consultation:
  - There were concerns about the level of consultation undertaken as part of the project.

### **Shopper survey**

The survey was administered to shoppers at Burrill Lake on Saturday 3 November 2012 between 11am and 3pm at the shopping village, including the post office on the west side of the existing bridge.

A total of 42 people completed the survey. The main issue raised by respondents was the suggestion to replace the existing crossing with a new bridge. Other themes and comments from this survey included:

- Raise the bridge to a higher level to allow boats to pass underneath and to improve flooding issues.
- Improve traffic congestion.
- Improve environmental issues with the lake.
- Address pedestrian safety.
- Impacts on businesses and tourism industry.

### **Local business survey**

A survey of local businesses in Burrill Lake was conducted in November 2012 on nine local businesses. The survey revealed that businesses depended heavily on trade from tourists as well as passing motorists. Local shops, such as those in the shopping village, also rely on trade from local residents.

Key issues identified for Roads and Maritime consideration included maintaining access to businesses both during and after the construction stage. Most respondents commented on the need to ensure that passing motorists could continue to park in locations convenient to accessing local business and that businesses remain visible from the highway.

Roads and Maritime used the information gathered during this consultation period to inform the further development of the project. Community feedback and socio-economic considerations were a major input into the subsequent value management process, undertaken between December 2012 and April 2013.

### **May and June 2013 community consultation**

In May 2013 a second community information brochure was distributed to more than 5000 properties in the Burrill Lake, Dolphin Point, Kings Point, Ulladulla, Mollymook and Milton areas. The information brochure provided details of the Roads and Maritime preferred option based on the results of investigations at that point in time.

Roads and Maritime favoured replacing the existing crossing immediately to the east, with a new higher bridge spanning the lake. It outlined the benefits of this preferred option and outlined that further investigations were required before making a final decision. A summary of the community feedback conducted in May, June and November 2012 was also provided.

The brochure provided information on how the community could get involved with the proposal; providing feedback and attending community drop sessions or information sessions.

### **Community Information sessions**

Two community information sessions were held on 29 May and 3 June 2013 from 6.30pm to 8.30pm at the Burrill Lake Community Hall. A total of 55 people attended the community information sessions. The sessions involved presentations by Roads and Maritime members on the process of the proposal including the process of selecting the preferred option.

### **Other community consultation**

Additional to the activities above, Roads and Maritime have consulted with the Burrill Lake community through the media and in meetings during May and June 2013, as follows:

- Letters to landowners located adjacent to the proposal.
- In-person meetings with directly affected residential and business landowners and tenants.
- Paid advertisements in the Milton-Ulladulla Times on 22 and 29 May 2013.
- Publication of information including the Aurecon Strategic Concept and Options Study Burrill Lake Bridge 2010, the Burrill Lake Crossing Value Management Workshop Report, The Burrill Lake Preliminary Environmental Investigations and other information on the Roads and Maritime proposal website.

Roads and Maritime received 37 submissions from the community in response to this consultation. This included verbal submissions from in-person meetings and telephone conversations documented by the project team, as well as written correspondence including emails, letters and feedback forms.

The key issues raised were:

- Removal of existing crossing:
  - There was general support for the removal of the existing causeway.
- Parking:
  - The need to provide suitable parking and access arrangements for businesses on the north and south sides of the bridge.
- Pedestrians:
  - The need to provide adequate pedestrian facilities and connections.
- Urban design and landscaping.

- The need to keep new infrastructure in keeping with the existing character of the area.

**Roads and Maritime response to community involvement**

Roads and Maritime have considered community input throughout the development of the concept design, including at intervals; in June and November 2013. Table 5-2 summarises the Roads and Maritime response to key issues that have affected the proposal. Note: this table does not provide a response to all issues raised by the community, only those where a change to the proposal has resulted.

Table 5-1 Response to consultation.

Issue / feedback	Roads and Maritime response June 2013	Roads and Maritime update November 2013
Parking and vehicular access arrangements		
<p>Parking on the south side of the bridge</p>	<p>Roads and Maritime is investigating parking arrangements around the shops on both sides of the bridge. Roads and Maritime anticipates that once the new bridge is constructed there will be more parking spaces than are currently available.</p>	<p>The preferred option includes an overall increase in the number of parking spots available outside shops.</p> <p>On the southside of the crossing around Balmoral Road there will be more parking spaces than are currently available.</p> <p>On the northside of the crossing there will be the same number of spaces available outside of the shops as are currently available.</p>
<p>Suggestion to include a roundabout on the north side of the bridge</p>	<p>Roads and Maritime is investigating a number of potential changes to the proposed intersection arrangements on the northern approach to the new bridge, including the provision of a new roundabout in the vicinity of MacDonald Parade. Any roundabout design would need to involve a typical 'four-leg' roundabout. Roads and Maritime will provide more information on these investigations late in 2013.</p>	<p>The preferred option includes a roundabout on the north side of the bridge connecting MacDonald Parade and Princess Avenue South to the Princes Highway.</p>
<p>Suggested amendments southern roundabout</p>	<p>The connection between the roundabout and Balmoral Road is currently being adjusted by Roads and Maritime to cater for all vehicles up to semi-trailers.</p> <p>Roads and Maritime has no plans to close the connection between Dolphin Point Road and the Princes Highway at Lions Park as part of the preferred option.</p> <p>Roads and Maritime has considered a direct connection between Balmoral Road and the southern approach to the proposed bridge. Such a connection would be impractical due to the difference in height between Balmoral Road and the new road alignment and the heavily constrained location.</p>	<p>The southern roundabout complies with the Austroads <i>Guide to Road Design</i>, the national standard for road infrastructure.</p> <p>The connection between the roundabout and Balmoral Road will cater for all vehicles up to and including semi-trailers.</p>

Issue / feedback	Roads and Maritime response June 2013	Roads and Maritime update November 2013
Suggestions for the proposed intersections on the north side	<p>Roads and Maritime is investigating a number of potential changes to the proposed intersection arrangements on the northern approach to the new bridge, including t-junctions, roundabouts and combinations of both.</p> <p>The provision of traffic lights at Princess Avenue is not one of the options currently being considered as Roads and Maritime believes there are other suitable ways to provide safe access to and from Princess Avenue.</p>	The preferred option includes a roundabout on the north side of the bridge connecting MacDonald Parade and Princess Avenue South to the Princes Highway.
Question as to whether the turn into Balmoral Road is wide enough to take a bus or a caravan.	The connection between the roundabout and Balmoral Road as shown in the currently favoured option is suitable for cars with caravans. The connection is currently being adjusted by Roads and Maritime to cater for all vehicles up to semi-trailers.	The connection between the roundabout and Balmoral Road will cater for all vehicles up to and including semi-trailers.
Pedestrian access arrangements		
East-west pedestrian access on the south side of the bridge	Roads and Maritime is currently investigating a pedestrian connection from Balmoral Road, under the bridge near the southern abutment, to Lions Park. This connection is likely to have an undesirably low, but passable, overhead clearance. Roads and Maritime will provide more information on these investigations late in 2013.	The preferred option includes a pedestrian connection under the bridge from Balmoral Road to Lions Park. This footpath will have a head clearance of approximately 2.1 metres.
East-west pedestrian access on the north side of the bridge	<p>Roads and Maritime is currently investigating a pedestrian connection under the bridge near the northern abutment. This connection currently appears to be unacceptably low, and unpassable, but this is subject to further design investigations.</p> <p>Roads and Maritime is also investigating a pedestrian crossing in the vicinity of the existing bus stop on the north side of the crossing.</p> <p>Roads and Maritime will provide more information on both these investigations late in 2013.</p>	<p>The preferred option includes a pedestrian connection under the bridge on both sides of the lake.</p> <p>The southside footpath under the bridge from Balmoral Road to Lions Park will have a head clearance of approximately 2.2 metres.</p> <p>The northside footpath under the bridge will have a head clearance of approximately 1.9 metres.</p>

Issue / feedback	Roads and Maritime response June 2013	Roads and Maritime update November 2013
North-south pedestrian access	Roads and Maritime intends to provide a shared pathway on the bridge for pedestrians and cyclists.	The preferred option includes a three metre wide shared pathway on the bridge for pedestrians and cyclists.
Pedestrian safety	Roads and Maritime intends to provide a safety barrier and handrail on the bridge.	The preferred option includes a safety barrier and handrail on the bridge.
Pedestrian accessibility	<p>Roads and Maritime is currently investigating the pedestrian connections and will provide more information on these investigations late in 2013.</p> <p>Roads and Maritime intends to provide pedestrian paths that meet accessibility requirements, but this level of detail, specifically the minimum grade requirement on all connections, can't be confirmed until detailed design is underway. This is currently planned for 2014.</p> <p>Roads and Maritime intends to provide pedestrian paths at both ends of the proposed bridge.</p>	The preferred option includes five pedestrian crossing opportunities. There are crossings underneath the highway on both sides of the proposed bridge, crossings at both roundabouts and a crossing near the shops on the northern side.
Include lighting at pedestrian crossing points.	Roads and Maritime intends to provide street lighting at the Dolphin Point Road/Balmoral Road roundabout and at the new junctions on the northern approach.	<p>The preferred option does not include street lighting details, which will be investigated during the detailed design stage.</p> <p>Roads and Maritime intends to provide street lighting at both roundabouts.</p>
<b>Local amenity issues for businesses</b>		
Concern that the businesses will suffer from reduced trade due to the loss of frontage and access and location of roundabout on the southern approach and reduced amenity.	To minimise the impact of the changed access arrangements on local businesses, Roads and Maritime intends to develop plans for the public spaces around the shops on both sides of the bridge in consultation with Shoalhaven City Council and taking into account the feedback received during consultations to date. This plan will include appropriate signposting arrangements, additional parking spaces, landscaping improvements, and the potential to re-use the southern abutment of the existing bridge and the northern approach to the existing	<p>Roads and Maritime recognises the importance of retaining Burrill Lake as an attractive place for through traffic to stop.</p> <p>Roads and Maritime has developed an urban design concept plan for the public spaces around the shops on both sides of the bridge and the public spaces around the road. This plan includes additional parking spaces, landscaping improvements, and the re-use the southern abutment of the existing bridge as a recreational fishing</p>

Issue / feedback	Roads and Maritime response June 2013	Roads and Maritime update November 2013
	causeway, as recreational fishing platforms. Roads and Maritime will also conduct an assessment of the socio-economic impacts of the proposal as part of the environmental impact assessment.	platform. Roads and Maritime will continue to work with Shoalhaven City Council and stakeholders on other aspects including signposting, public park infrastructure such as chairs, tables and new public toilets following the environmental assessment and during the detailed design.
<b>Urban design and landscaping</b>		
Comment that the bus stops at both sides of the highway need to be retained.	Roads and Maritime is currently investigating provision of bus stops on both sides of the highway and the lake. Roads and Maritime will provide more information on these investigations late in 2013.	The preferred option includes four bus stops in total, one in each direction on either side of the bridge.
Comments that planting native species and low shrubs/ grasses on the embankments on the proposed bridge will improve the bridge's attractiveness.	Roads and Maritime notes this feedback. A landscaping plan will be developed as part of the project planning.	Roads and Maritime has developed an urban design concept plan for the public spaces around the shops on both sides of the bridge and the public spaces around the road. This includes a landscaping plan with suggested species.
Connect a cycleway on the proposed bridge to the existing cycleways to the north of the lake.	Roads and Maritime intends to provide a shared pathway on the bridge for pedestrians and cyclists and to extend this north of the lake to the vicinity of Princess Avenue North.	The preferred option includes a shared pedestrian cycleway that will connect to the existing cycleways to the north of the lake and to Shoalhaven City Council's Ulladulla cycleway.
Part of the causeway should be retained as a fishing platform and other comments that suggested fishing should be banned.	Roads and Maritime would install signposting prohibiting fishing from the new bridge on safety grounds. Roads and Maritime will examine the potential to re-use the southern abutment of the existing bridge and the northern approach to the existing causeway as recreational fishing platforms.	The preferred option includes the removal of the causeway and the existing bridge.
Concerns about the visual impact of proposed bridge	Roads and Maritime acknowledges a new bridge built above the future 1:100 flood level will change the visual	The preferred option includes a number of improvements to minimise the visual impact of the proposed bridge.

Issue / feedback	Roads and Maritime response June 2013	Roads and Maritime update November 2013
	<p>character of the area.</p> <p>Roads and Maritime intends to design the new bridge in a way that minimises the appearance of 'bulk' in the structure.</p> <p>Roads and Maritime will conduct a visual impact assessment of the proposed new bridge as part of the environmental impact assessment.</p>	<p>The bridge height has been set as low as possible while still keeping the highway above the future 1:100 year flood level.</p> <p>A number of design measures have also been taken to reduce the overall bulk of the bridge and make it appear more slender.</p> <p>The length of each span of the bridge has been increased from 14 to 18 metres, reducing the total sets of piers from 20 to 16. The number of piers at the end of each span has been reduced from three to two.</p> <p>As a result of these changes, the total number of concrete piers supporting the bridge has been reduced from 60 to 32.</p> <p>Roads and Maritime has prepared visualisations to help demonstrate the approximate appearance of the preferred option after construction.</p>
<p>Suggestion that the inclusion of bus lay-bys (one near to MacDonald Parade and another at Dolphin Point Road) will improve traffic flow and safety.</p>		<p>The preferred option includes four bus stops in total, one in each direction on either side of the bridge.</p>
<p>Suggestion to include street lighting on the bridge.</p>	<p>Roads and Maritime will investigate the potential need for lighting on the bridge.</p>	<p>The preferred option does not include street lighting details, which will be investigated during the detailed design stage.</p> <p>Roads and Maritime intends to provide street lighting at both roundabouts.</p>
<p>Suggestion to include jumping mitigation measures.</p>	<p>Roads and Maritime intends to provide a safety barrier and handrail on the bridge, which is in line with other new bridges in similar environments and with high pedestrian activity. The height of this barrier will be finalised in</p>	<p>No change or update.</p>

Issue / feedback	Roads and Maritime response June 2013	Roads and Maritime update November 2013
	detailed design but is expected to be approximately 1.3 metres.	
Suggestion that the bridge needs to be high enough for small boats to travel underneath.	<p>Roads and Maritime notes this feedback. The height of the bridge has been driven by the need to provide the new bridge and road approaches at a level that would allow them to remain free of floodwaters and open to traffic during predicted 1 : 100 year flood events. This will result in a significantly improved clearance between the water level and the underside of the bridge when compared to the existing bridge. The bridge structure and levels are still in design and therefore subject to change. The clearance will also vary at different points under the bridge and during different tides.</p> <p>The distance between the water and the underside of the bridge is likely to be between 1.8 metres and 2.5 metres at high tide (assuming a high tide water level of 0.8 metres AHD).</p>	<p>The preferred option will allow small boats to travel underneath the bridge.</p> <p>The underside of the bridge is between 1.8 and 2.5 metres above the water level (assuming a tide level of 0.8 metres AHD).</p>
Suggestion to provide a safety barrier along the embankments to prevent cars from driving off the highway.	Roads and Maritime is currently investigating the need to provide safety barriers in line with the guidance provided in Austroads <i>Guide to Road Design</i> , the national standard for road infrastructure. Roads and Maritime will provide more information on these investigations late in 2013.	<p>The preferred option includes concrete barriers on both sides of the road on the approaches to the bridge where the embankments are highest.</p> <p>At other locations throughout the preferred option the embankments are sufficiently low and/or gently sloped that no concrete barriers are required. This has been assessed in line with the Austroads <i>Guide to Road Design</i> the national standard for road infrastructure.</p>
Suggestion that bridge signage should indicate the location of businesses to facilitate passing trade.		Signage and signposting will be designed in full during the detailed design, currently scheduled for 2014.
Comment that utilities need to be	Roads and Maritime notes this feedback. Designs for utility relocations are currently scheduled for 2014, but it is	No change or update.

Issue / feedback	Roads and Maritime response June 2013	Roads and Maritime update November 2013
hidden on the bridge.	likely that any relocated utilities would be contained within the new bridge structure and not generally visible.	
Comment that recreational access needs to be retained.	Roads and Maritime notes this feedback.	The preferred option generally retains and in some ways enhances recreational access to the lake and lake foreshores.
Comment that the length of the bridge should be decreased from 290m to 260m to reduce cost.		Roads and Maritime undertook hydraulic modelling to investigate the potential to shorten the bridge length by adjusting the abutment.
Suggestion to provide additional space around the connection of Princess Avenue South and the Princes Highway to accommodate large vehicles.		The preferred option includes a roundabout on the north side of the bridge connecting MacDonal Parade and Princess Avenue South to the Princes Highway.
<b>Noise impacts and mitigation</b>		
Mixed responses about noise walls – some like noise walls and others do not.	<p>Roads and Maritime has conducted a preliminary noise assessment which is available on the project website. A noise survey undertaken as part of this assessment indicated that existing road traffic noise levels are at a level of acute impact.</p> <p>Once the concept design is finalised Roads and Maritime will complete an operational noise assessment as part of the environmental impact assessment. This will determine any predicted changes in noise levels and whether mitigation measures should be considered.</p> <p>While the results of this noise assessment are not yet known, Roads and Maritime does not currently consider the provision of large scale noise walls in Burrill Lake to be reasonable or feasible mitigation measures.</p>	<p>Roads and Maritime has undertaken a construction and operational noise assessment as part of the environmental assessment of the preferred option. This assessment includes modelling of the current and predicted road traffic noise levels and identifies mitigation measures that should be considered.</p> <p>Preliminary results indicate residences in Princess Avenue South are likely to require and benefit from the provision of a small noise screen or fence between them and the new highway, near the road.</p>
<b>Other issues</b>		

Issue / feedback	Roads and Maritime response June 2013	Roads and Maritime update November 2013
Concern about flooding	<p>Roads and Maritime has undertaken a range of preliminary hydraulic examinations, including flood modelling of the predicted impacts of removing the causeway. Although this modelling predicted negligible impacts on peak flood levels, Roads and Maritime will complete a more detailed hydraulic assessment of the proposal once the concept design is complete.</p> <p>Roads and Maritime notes the feedback regarding the cul-de-sac, which will be designed in full during the detailed design, currently scheduled for 2014.</p>	<p>Roads and Maritime is undertaking a hydraulic assessment as part of the environmental assessment of the preferred option. This assessment includes modelling the impact of the preferred option on flooding and flow velocities in the lake.</p> <p>This hydraulic assessment is still underway but preliminary results indicate the preferred option and the removal of the causeway will not significantly change the existing flooding regime.</p>
Concern about the ground conditions near to proposed southern roundabout due to sewage pumping station.	Roads and Maritime has initiated dialogue with Shoalhaven Water regarding potential changes to and impacts on their assets and facilities in the area, including the pumping station.	No change or update.
Comment that Roads and Maritime must ensure hydraulic modelling is undertaken based on the removal of the causeway.		<p>Roads and Maritime is undertaking a hydraulic assessment as part of the environmental assessment of the preferred option. This assessment includes modelling the impact of the preferred option on flooding and flow velocities in the lake.</p> <p>This hydraulic assessment includes modelling the removal of the causeway.</p>
Comments about whether the proposal is consistent with the proposals for the Ulladulla bypass.	The proposal is consistent with a future Milton Ulladulla bypass. The corridor reserved for this future bypass on the Shoalhaven City Council Local Environment Plan connects with the existing Princes Highway around 500 metres north of the limit of the currently favoured option.	No change or update.
Concern that the favoured option will lead to the social isolation of properties in Princess Avenue South.	Roads and Maritime notes this feedback and will mitigate this by providing a design that retains pedestrian connectivity across the highway to the west from Princess Avenue South. Roads and Maritime will also conduct an	The preferred option includes five pedestrian crossing opportunities, including a crossing underneath the highway on the north side of the proposed bridge near Princess Avenue South, as well as a crossing between

Issue / feedback	Roads and Maritime response June 2013	Roads and Maritime update November 2013
	assessment of the socio-economic impacts of the proposal as part of the environmental impact assessment.	Princess Avenue south and the shops. The preferred option also includes urban design features that seek to minimise the impact of the proposal on residents of Princess Avenue South.

### 5.3 Aboriginal community involvement

The Aboriginal community has been consulted in accordance with the Roads and Maritime *Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI)*. This is consistent with the NSW Office of Environment and Heritage (OEH) *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* and the *National Parks and Wildlife Amendment Regulation 2009* (Roads and Maritime 2011).

The results of the Stage 2 PACHCI assessment identified potential impacts to identified Aboriginal cultural heritage values. On this basis, the Roads and Maritime initiated an Aboriginal stakeholder identification and consultation program in accordance with the Stage 3 PACHCI.

Consultation for Stage 3 has included:

- An advertisement in Koori Mail on 16 January 2013, seeking expressions of interest from Indigenous stakeholders.
- Letters seeking information of knowledge holders to the following agencies:
  - Southern Rivers Catchment Authority
  - National Native Title Tribunal
  - The Registrar Aboriginal Land Rights Act 1983
  - Campbelltown City Council
  - Shoalhaven Council
  - Native Title Services Corporation (NTSCORP)
  - OEH
  - Ulladulla Local Aboriginal Land Council
- An Aboriginal Focus Group (AFG) was convened by Roads and Maritime on 14 March 2013. The aim of the AFG was to discuss the proposal, the test excavation methodology and the cultural significance of the study area.
- The draft Cultural Heritage Assessment Report (CHAR) was forwarded to the registered Aboriginal groups by Roads and Maritime for their comment.

Aboriginal heritage is discussed further in section 6.7 of this REF.

### 5.4 ISEPP consultation

Clauses 13, 14, 15 and 16 of the *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) require that public authorities undertake consultation with councils and other public authorities, when proposing to carry out development without consent. Three triggers for consultation relevant to the proposal have been identified below.

Table 5-2 ISEPP consultation requirements.

Item	Response
<b>Clause 13</b>	
1(a) A substantial impact on stormwater management services provided by a council.	The proposal would include kerb guttering for the new alignment. No significant impacts on stormwater management services provided by council are anticipated.
1(b) Likely to generate traffic to an extent that will strain the capacity of the road system in a local government area.	There is likely to be an increase in traffic generation during construction. They would be managed to limit impact through a traffic management plan.  No change to long-term traffic levels are anticipated on account of the proposed works.
1(c) Involves connection to, and a substantial	The proposal would require relocation of sewer

Item	Response
impact on the capacity of, any part of a sewerage system owned by a council.	lines however no impact on the capacity or connection to the system is proposed.
1(d) Involves connection to, and use of a substantial volume of water from, any part of a water supply system owned by a council.	The proposal would not involve connection to or substantial use volumes of water from a council-owned water supply system.
1(e) Involves the installation of a temporary structure on, or the enclosing of, a public place that is under a council's management or control that is likely to cause a disruption to pedestrian or vehicular traffic that is not minor or inconsequential.	The proposal would involve impacts on Lions Park, south of the Burrill Lake bridge. This would include the temporary removal of the public amenities block at the park and changes to access.  <b>Formal consultation with Shoalhaven City Council is required.</b>
1(f) Involves excavation that is not minor or inconsequential of the surface of, or a footpath adjacent to, a road for which a council is the roads authority under the <i>Roads Act 1993</i> .	The proposed works affect footpaths adjacent to Roads and Maritime administered roads. No impacts on council road footpaths are anticipated.
<b>Clause 14</b>	
Likely to have an impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area.	The proposal does not affect any local heritage items or heritage conservation areas.  Formal consultation with Shoalhaven City Council is not required.
<b>Clause 15</b>	
Development that is to be carried out on flood liable land that may be carried out without consent and that would change flood patterns other than to a minor extent.	The proposal would be located within the centre of a lake. Hydrological modelling has been undertaken as part of the concept design process as impacts are expected.  <b>Formal consultation with Shoalhaven City Council is required.</b>  The proposed works would improve the flood immunity of the highway.
<b>Clause 16</b>	
Clause 16 of the ISEPP states that a consent authority must not carry out any of the following development without giving written notice to the specified authority and taken their responses into consideration:  <i>(a) development adjacent to land reserved under the National Parks and Wildlife Act 1974 – the Department of Environment and Climate Change [now the Office of Environment and Heritage].</i>  <i>(b) development adjacent to a marine park declared under the Marine Parks Act 1997 –</i>	One stockpile site is located adjacent to land reserved as Meroo National Park. While no vegetation clearing is proposed and direct impacts are not anticipated outside of the stockpile site, <b>formal consultation with OEH is recommended.</b>  The proposed works involve the installation of a bridge in Burrill Lake, a navigable water. <b>Consultation will be conducted internally<sup>2</sup> by Roads and Maritime.</b>  The proposal is not: <ul style="list-style-type: none"> <li>• Adjacent to a declared a marine</li> </ul>

<sup>2</sup> It is noted that the Maritime Authority of NSW no longer exists as a separate entity.

Item	Response
<p><i>the Marine Parks Authority.</i></p> <p><i>(c) development adjacent to an aquatic reserve declared under the Fisheries Management Act 1994 – the Department of Environment and Climate Change [now the Office of Environment and Heritage].</i></p> <p><i>(d) development in the foreshore area within the meaning of the Sydney Harbour Foreshore Authority Act 1998 – the Sydney Harbour Foreshore Authority.</i></p> <p><i>(e) development comprising a fixed or floating structure in or over navigable waters – the Maritime Authority of NSW.</i></p> <p><i>(f) development for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes, in an area that is bush fire prone land (as defined by the Act) – the NSW Rural Fire Service.</i></p>	<p>park declared under the Marine Parks Act 1997</p> <ul style="list-style-type: none"> <li>• Adjacent to an aquatic reserve declared under the Fisheries Management Act 1994</li> <li>• In the foreshore area within the meaning of the Sydney Harbour Foreshore Authority Act 1998 f</li> <li>• Development for the purposes of an educational establishment, health services facility, correctional centre or group home, or for residential purposes.</li> </ul> <p>Therefore, no further consultation is required due to these factors.</p>

## 5.5 Government agency and stakeholder involvement

### 5.5.1 Shoalhaven City Council

Roads and Maritime began consultation with Shoalhaven City Council in March 2010, regarding the future of the Burrill Lake crossing. This has included in-person meetings and updates on the status of Roads and Maritime investigations.

Shoalhaven City Council wrote to Roads and Maritime in mid 2012 advising of their support for the provision of a new crossing over Burrill Lake, conditional with further consultation between the organisations. Council have been involved in Roads and Maritime value management process and considerations of the full range of options.

### 5.5.2 NSW Department of Primary Industries (Fisheries)

The proposal would involve both dredging and reclamation work. Under Section 199 of the *Fisheries Management Act 1994* (FM Act), Roads and Maritime is required to give written notification to the Minister for Fisheries (which can be done by notifying the NSW Department of Primary Industries, Fisheries section), of any proposed dredging or reclamation work. Roads and Maritime must also consider any responses in accordance with Section 199 of the FM Act.

NSW Department of Primary Industries (Fisheries) was involved in the Roads and Maritime value management process, considering the full range of options regarding the crossing upgrade. Roads and Maritime met with NSW Department of Primary Industries (Fisheries) at the site on the 14 August 2013. The site visit gave an opportunity for Roads and Maritime and Fisheries to discuss specifics of the proposal and for Fisheries to give suggestions on reducing the impact on the aquatic environment. Follow-up consultation included discussing examples of works methodologies at other Roads and Maritime projects similar to Burrill Lake.

Roads and Maritime would conduct further consultation with Fisheries in seeking a fisheries permit for the works.

## 5.6 Ongoing or future consultation

Roads and Maritime would continue to consult with key stakeholders as the proposal progresses. This review of environmental factors will be placed on public display to provide the community with the opportunity to comment.

Following public display, submissions will be collated and a submission report would then be prepared to address all issues raised by stakeholders. The submission report will be made public via the Roads and Maritime website. The community will be informed of any design changes that are required to address community concerns. In addition, the following consultation activities will be undertaken:

- Meetings with Shoalhaven City Council and other relevant stakeholders including government agencies, utility providers and community stakeholders as required.
- The provision of project updates to the local community during the construction planning stage and the construction period.
- Updates on the Roads and Maritime project webpage, as required.

## 6 Environmental assessment

This section of the REF provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal. All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of the factors specified in the guideline *Is an EIS required?* (DUAP 1999) as required under clause 228(1) (b) of the *Environmental Planning and Assessment Regulation 2000*. The factors specified in clause 228(2) of the *Environmental Planning and Assessment Regulation 2000* are also considered in Appendix A. Site-specific safeguards are provided to ameliorate the identified potential impacts.

The depth of investigation in each chapter reflects the degree of risk which it may pose to the environment, if no mitigation is applied. Most high impact areas have been investigated in specialist reports, appended to this REF (hydraulics, biodiversity, traffic, noise and vibration, visual amenity, Aboriginal and non-indigenous cultural heritage).

Table 6-1 Risk criteria.

Likelihood	Consequence				
	Negligible	Minor	Moderate	Major	Catastrophic
Remote	Negligible	Low	Low	Moderate	Moderate
Unlikely	Negligible	Low	Low	Moderate	High
Possible	Negligible	Low	Moderate	High	High
Likely	Negligible	Low	Moderate	High	High
Almost certain/inevitable	Negligible	Low	High	High	High

Table 6-2 Risk ratings for proposed Burrill Lake crossing works.

Environmental aspect	Likelihood	Consequence	Risk rating
Geology, topography and soils	Almost certain	Moderate	High
Hydrology, flooding and water quality	Almost certain	Moderate	High
Biodiversity	Almost certain	Moderate	High
Traffic and access	Almost certain	Moderate	High
Noise and vibration	Almost certain	Moderate	High
Visual amenity	Almost certain	Moderate	High
Waste and resources	Likely	Moderate	High
Aboriginal heritage	Almost certain	Moderate - low	Moderate
Non-Aboriginal heritage	Almost certain	Moderate	Moderate
Air quality	Likely	Moderate	Moderate
Socio-economic	Possible	Moderate	Moderate
Greenhouse gas and climate change	Possible	Minor	Low
Land use	Possible	Minor	Low
Cumulative impacts	Possible	Minor	Low

Note: the risk ratings take into account the ability to mitigate the impact.

In the assessment chapters below, the assessment is separated into two components which reflect different types and levels of impacts:

1. Construction and demolition works – involving extensive earthworks, demolition and waste removal.
2. Operation – involving the ongoing use of the new crossing and road alignments, after the completion of the new crossing.

## 6.1 Geology, topography, soils and contamination

### 6.1.1 Approach

Several investigations have informed the assessment presented in this chapter.

- A geotechnical investigation was completed by Roads and Maritime in 2012, specific to the causeway and surrounding areas (RMS 2012). This included taking bore samples at three locations.
- A contamination and hydrogeology desktop assessment was completed by GHD in September 2012. This study identified that the soils beneath the causeway may be impacted by contamination. Further investigations were recommended to understand the material and potential for contaminants.
- A contamination investigation was completed by GHD in October 2013. This investigation included soil sampling for preliminary in-situ waste classification and assessed Acid Sulfate Soils (ASS) at six locations on the causeway.
- Roads and Maritime undertook asbestos investigations in September 2013.

### 6.1.2 Existing environment

#### **Geology**

The geology of the study area is mapped as quaternary sediments and Permian bedrock (Sheet 1 56-13, Rose 1996). The quaternary sediments are alluvium gravel, swamp deposits and sand dunes. The Permian bedrock is Conjola formation of the Shoalhaven group. It is comprised of conglomerate, sandstone and silty sandstone. This geology is typical for the landscape setting; a flat coastal plain. This geology produces soils of low strength and stability.

#### **Topography**

The study area ranges from 5 – 20 metres Australian Height Datum (AHD) (NSW Department of Lands 2012). The southwest portion of the study area slopes gradually east towards the sea.

The lake bed itself consists of a shallow sand flat for most of the width of the crossing (about 150 metres) and a narrow deep channel adjacent to the southern bank (about 40m). Sand is deposited on the north side of the bridge and is shallower in this area.

#### **Soil types and properties**

The soils in the study area consist of marine sand and alluvial soils. These soils are often flood prone with low permeability (GHD 2012). The nearest soil profile is described as poorly drained and with extreme erosion risk (NSW Government 2013a; Figure 6-16). The soil type is Ferric Intertidal Hydrosol. This soil type is normally bare of vegetation and often salt-encrusted. Tidal inundation is noted as infrequent (spring tides) and a saline water table is present at shallow depths (CSIRO 2012). These characteristics mean that vegetation that may assist soil stability is limited to salt tolerant species. Flooding may further increase erosion risks.

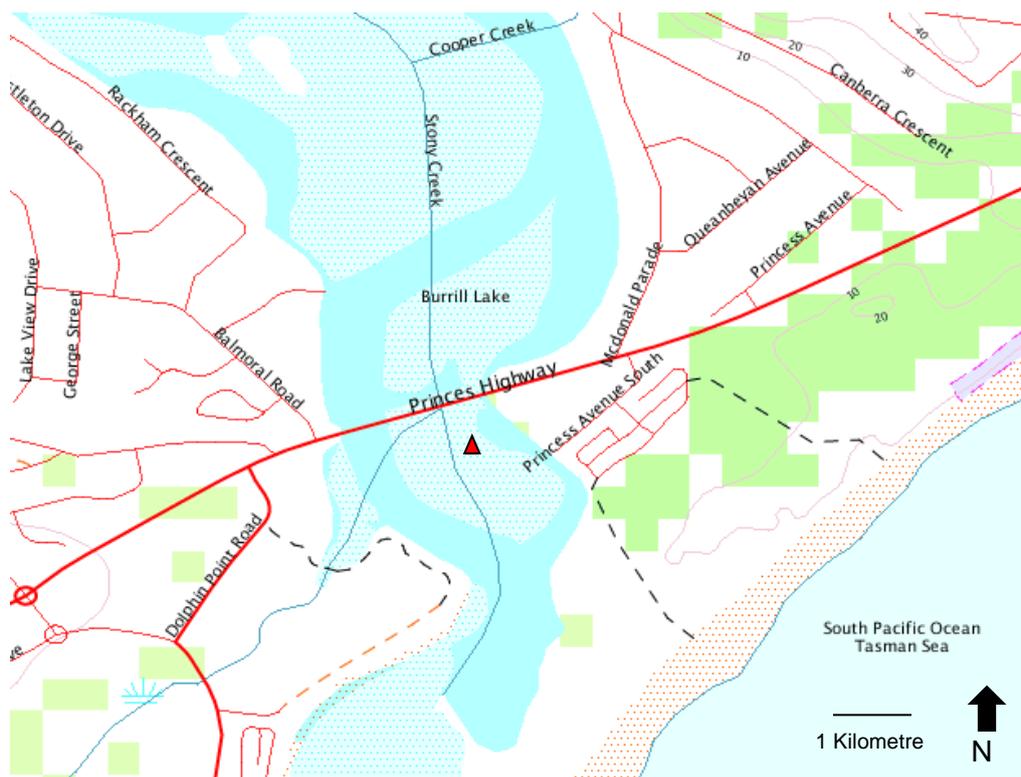


Figure 6-1 Soil profile near proposal (red triangle). Source: NSW Government (09/08/2013). NSW Natural Resource Atlas website. <http://www.nratlas.nsw.gov.au>

Soil samples from six bore holes taken in the causeway contained varying levels of fill material. The fill material included road pavement materials (asphalt, road base and concrete) as well as clay with sand and gravel (GHD 2013). The results are presented in Table 6-3.

Table 6-3 Soil conditions summary.

Strata	Depth to top (m bgl)	Thickness (m)
Fill, comprised material including asphalt road base (sand gravel), and concrete	Ground level	0.5 to 0.7
Fill, comprised reworked natural soils of clay, gravel and sand (Fill 1)	0.5 to 0.7	0.5 to 1.2
Fill, comprised reworked natural soils or gravelly sand (Fill 2)	1.1 to 1.8	0.3 to 0.8
Alluvial sands, comprised of fine to medium grained sand with some marine shells	1.8 to 2.2	<0.5 (not determined)

Table 6-3 shows that fill material to a maximum depth of 2.2 m below ground level is present within the study area. The fill material was considered to be reworked natural soils overlaying natural alluvial sands. It is present in two layers:

- Fill 1 - gravelly clay.
- Fill 2 - sandy clay.

### Contaminated land

A search of the NSW OEH Contaminated Sites Register on 9 August 2013 did not identify any premises listed within a one kilometre radius of the study area (NSW Government 2013b). Additionally, the proposal site does not appear on the List of NSW contaminated sites notified to EPA (NSW Government 2013b), as at 7 November 2013. However, a

vacant property located near the corner of the Princes Highway and MacDonalds Avenue has been identified as the location of a former service station. The site still contains underground fuel storage tanks, which have potential for contamination from leakage. The proposed works in this area would not impact on the tanks but potential contaminants may occur in soils in this area.

GHD (2012) also identified potential contamination sources from the existing Burrill Lake crossing. The bridge structure contains scupper pipes, 10 metres in length and these are known to contain asbestos. During archaeological test excavations conducted as part of the Roads and Maritime cultural heritage investigations, asbestos was identified in four locations (refer to Figure 6-2). Follow-up investigations delineated two areas where asbestos occurs.



Figure 6-2 Asbestos locations identified during archaeological test excavations.

The causeway fill material was investigated in detail for potential to contain contaminants such as heavy metals, petroleum products or asbestos. Samples of the fill material identified in table 6-3 were tested for contaminants. Concentrations of the contaminants of potential concern were below the adopted site investigation criteria. Specifically, no asbestos containing fibers were observed. Based on the contaminant concentrations all material would classify as general solid waste. Waste soil excavated from the causeway is therefore able to remain onsite or be reused (GHD 2013).

### **Acid Sulfate soils**

Mapping for the Burrill Lake area indicates there is a low potential for acid sulfate soils within the alluvial deposits of the estuary area. However, analysis of samples from boreholes within the study area exceeded the criteria for 'possible' acid sulfate soils (PASS) at three locations. The GHD (2013) report concludes that PASS are likely to be present in the Fill 2 and Alluvial Sand soil layers (depths of 1.1 – 2.2 metres). The sample at Fill 1 did not exceed the criteria and therefore PASS are unlikely at this lesser depth (0.5 – 0.7 metres).

#### **6.1.3 Potential impacts**

##### **Construction and demolition works**

Construction works would require extensive soil excavation, reuse of excavated soils, importation of soils (to meet a soil deficit), and deposition of fill material within the proposal footprint. Because of the nature of the impacts, there is potential to affect adjacent land within the study area. Potential impacts on soils and landforms may include:

- Landform instability and erosion:
  - Stockpiles and earthworks closest to the new bridge approaches where batters would be steepest would involve bare and unstabilised areas susceptible to wind and water erosion. This can deposit sediments in adjacent areas, including Burrill Lake and Burrill Inlet, near the southern bank. Similarly, some materials (mulch, cement powder) may also be susceptible to erosion and sedimentation.
  - The highest risk activity in relation to destabilisation of soils is the work related to the new and existing bridge abutments and existing causeway. Soils in these areas are likely to be saturated and non-cohesive. Works are required in, as well as in very close proximity, to the lake. Works would include excavation in the lake and on the foreshore to install the new bridge abutments. Piles would be driven or bored into the lake bed. The removal of existing abutments and causeway material within the channel represent a high sedimentation risk. Flooding, heavy rain and high tides all exacerbate the risk and represent a very high risk of a pollution event.
  - Access would be required from Lions Park near Burrill Inlet to float a small barge into the lake, to assist with waste removal from the causeway. No formalised boat launch site can be used. The support vessel has the potential to disturb bottom sediments if it is manoeuvred in the shallower areas of the lake. This has the potential to result in a minor and temporary increase in water turbidity at the site and downstream sedimentation.
- Compaction of soils:
  - Traffic and material laydown can compact soils and limit their ability to support vegetation. Maximising the use of existing areas of disturbance for compound sites would be achieved. Traffic movements in and out of these sites, as well as construction traffic movements along the proposal site would require management to rationalise and reduce impacts.
  - Highest risk activities occur on the foreshore, where soils are likely to be saturated and non-cohesive. This includes abutment work but also access required to float a small barge into the lake, to assist with waste removal from the causeway. No formalised boat launch site can be used.
- Contamination of soils:
  - The proposal would result in a number of potential contaminant sources being introduced to the site during construction. These include construction materials such as hydrocarbons, herbicides and fertilisers, water containing biological contaminants such as nutrients and bacteria from site toilets and taps, dust or leachate from concrete or concrete wash.

- The highest risk activities would be refuelling, particularly, and use of equipment on the working platform and barge proposed to be constructed in the lake (refer to section 6.2 below for impacts to water quality).
- Contaminants may also include materials excavated during works, such as acid sulfate soils, asbestos and other buried contaminants. In small quantities, these materials can contaminate soil, limiting their ability to support vegetation. At higher levels, contaminants may run off into surrounding areas causing a pollution event and / or public safety risk (refer to section 6.2 below for impacts to water quality). Removal (treatment where required) and disposal of these wastes in accordance with relevant guidelines would be required. This will include:
  - Scuppers on existing bridge and two mapped occurrences of asbestos, refer to Figure 6-2.
  - Acid sulfate soils at depths of 1.1 – 2.2 metres.
- Uncovered loads or inappropriate carting of materials could also lead to contamination of soils. During loading, transport and unloading, contaminated materials may become mobilised if not secured.

Management of these risks would centre on appropriate site layout (of stockpiles, materials, access and parking for construction staff), installation and maintenance of erosion and sediment controls until such time as landforms have become stabilised, as well as management of specific contaminants.

Impacts at stockpile and compound sites are considered to be of lesser risk. These areas are flat and have been previously disturbed. Minimal additional excavation is proposed in these areas. The stockpile site located at the junction of Princes Highway and Wheelbarrow Road has potential to impact on the adjacent Meroo National Park. Works however, would be confined to the existing stock pile site.

Excavation will also be required for the relocation of minor transmission lines around the vicinity of the junction of Dolphin Point Road and the Princes Highway and the junction of McDonald Parade and the Princes Highway will be relocated and replaced with matching power poles and low voltage lines, within the project footprint but outside of the road clear zones.

### **Operation**

Once completed, landforms are expected to be stabilised with vegetation and other treatments (sealed road surface, concrete footpaths etc.). The new crossing and road alignments may generate the following impacts to soils and landforms:

- Landform instability and ongoing erosion, if landforms and drainage structures are not adequately designed and stabilised. Increased hard surfaces would increase the amount and velocity of water run-off from the new crossing and alignment. As the existing crossing would be removed, the overall increase in hard surfaces would be negligible.
- Pollution risks from spills (e.g. of oil or fuels) as a result of an accident, or during maintenance activities. It is noted that this risk is an existing risk and is present with or without the proposal (refer to section 6.2 below for impacts to water quality).

Management of these risks would centre on appropriate design of the new crossing, alignment and associated drainage structures.

#### 6.1.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Soil management	<ul style="list-style-type: none"> <li>• Construction would be managed in accordance with the Blue Books 1 and 2D; Managing Urban Stormwater, Soils &amp; Construction, Volume 1 (Landcom 2004) and Managing Urban Stormwater, Soils and Construction, Volume 2D, Main Road Construction (DECC 2008).</li> <li>• As the disturbance area is in excess of 2.5 hectares, a soil and water management plan would be prepared as part of the construction environmental management plan.</li> <li>• Environmental Work Method Statements (EWMS) would be developed and implemented for high risk activities including abutment removal, construction of working platform and causeway removal.</li> <li>• Site-specific erosion and sediment control plan/s would include the following:               <ul style="list-style-type: none"> <li>○ Measures to ensure that the site is adequately protected when rain is forecast.</li> <li>○ 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.</li> <li>○ Measures to minimise the area of disturbance and the amount of disturbance (traffic or compaction from material laydown) over areas that would, on completion, be retained as vegetated areas.</li> <li>○ Measures to protect drainage lines from disturbance or the entry</li> </ul> </li> </ul>	Construction contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>of polluted run-off.</p> <ul style="list-style-type: none"> <li>○ Measures to contain sediments during works near water sources (silt curtain).</li> <li>● Stockpiles would be managed in accordance with the Stockpile Site Management Guideline (RTA 2011a).</li> </ul>		
Contamination: Acid Sulfate Soils	<ul style="list-style-type: none"> <li>● The soil and water management plan would include management measures for excavation near and within Potential Acid Sulfate Soils (PASS) (Fill 2 and Alluvial sediments).</li> <li>● The 'Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze' (RTA, 2005) would be used as a guide for management of ASS.</li> <li>● Additional testing of the stockpiled soil arising from construction to ascertain the correct liming rate for the stockpile would be undertaken.</li> </ul>	Construction contractor	Construction
Contamination: Asbestos	<ul style="list-style-type: none"> <li>● Known areas of asbestos within the works footprint would be removed prior to earth works. This includes scupper pipes from the existing bridge as well as two additional locations (near the proposed southern roundabout and near the proposed northern bridge abutment) where asbestos fibres were identified in fill material.</li> <li>● Asbestos removal and disposal shall be undertaken by a Class A licensed asbestos remover. Removal would be undertaken in accordance with the Safe Work Australia How To Safely Remove Asbestos Code of Practice (December 2011). This would include the</li> </ul>	Construction contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>preparation and compliance with an approved Asbestos Removal Control Plan.</p> <ul style="list-style-type: none"> <li>The transport and disposal of asbestos would be undertaken under a license obtained in accordance with Clause 42 of Protection of the Environment Operations (Waste) Regulation 2005.</li> </ul>		
Contamination: Other	<ul style="list-style-type: none"> <li>If signs of contaminated soils are discovered (e.g. smell, discolouration, suspect rubbish), the site would be marked and the soil replaced to cover the contamination. The soil would be analysed without delay to determine the type of contamination and an appropriate management plan would then be developed and followed.</li> </ul>	Construction contractor	Construction
Pollution	<ul style="list-style-type: none"> <li>Materials that could be pollutants in soil (including fuels, cement) would be stored and handled in accordance with their material safety data sheets.</li> </ul>	Roads and Maritime	Construction
Pollution	<ul style="list-style-type: none"> <li>Drainage systems would be checked at regular intervals and maintained to ensure they are operating at full capacity (e.g. clearance of debris from drainage lines).</li> </ul>	Roads and Maritime	Operation

Spill controls are detailed below in section 6.2.4.

## 6.2 Hydrology, flooding and water quality

### 6.2.1 Approach

Several reports specific to Burrill Lake were referenced in the preparation of this chapter. These include:

- Burrill Lake Flood Study (BMT WBM 2007) – a detailed flood study of the Burrill Lake catchment was undertaken on behalf of Shoalhaven City Council. Central to this study was the development of appropriate hydrological and hydraulic models of the catchment flood behaviour to establish design flood conditions. The models originally developed in this study have been applied in the current investigations.
- Burrill Lake Floodplain Risk Management Study and Plan (BMT WBM 2013) - the outcomes of this study provide the basis for the Floodplain Risk Management Plan, containing management measures and strategies, to help direct and coordinate the responsibilities of Government and the community in undertaking immediate and future flood management works and initiatives.

- Burrill Inlet Causeway Options Study (WBM Oceanics 2001) – a detailed modelling study was undertaken to assess the impact of the existing bridge and causeway on tidal hydrodynamics and sediment transport and investigate the merit of modifications to the causeway configuration and dredging options.
- Strategic Concept and Options Study Burrill Lake Bridge (Aurecon 2010) – this report provides an evaluation of potential upgrade options to the existing Burrill Bridge and Causeway.
- Burrill Bridge Upgrade Options Investigation (BMT WBM 2013) - this study provides an assessment of the impacts of the concept designs on the flow conditions with the Burrill Inlet and broader estuary.

## 6.2.2 Existing environment

### **Catchment and estuary description**

The Burrill Lake catchment covers an area of 78 square kilometres (Shoalhaven City Council 2002). Burrill Lake has a surface area of around four square kilometres. It is connected to the ocean by a three kilometres long entrance channel. The entrance to the sea is located between a rock platform at Dolphin Point and the Burrill Beach shoal resulting in a highly constricted mouth. The lake has one major tributary, Stoney Creek at the northern end of the lake.

A number of SEPP 14 coastal wetlands are associated with Burrill Lake. The closest is located over four kilometres upstream of the study area and would not be affected by the proposed works.

The major land uses of the catchment include agricultural grazing to the north and National Park to the south and west. There are a number of aquaculture licences within the catchment, none are located near the works areas. The closest aquaculture area is about 800 metres west of the proposed works.

Burrill Lake is a barrier-type estuary. It is classified as an intermittently closed and opened lake or lagoon which is generally open to the sea, however, displays very little tidal fluctuation. Burrill Lake is generally open to the sea and has sufficient tidal exchange to maintain good water quality. Closure to the lake generally occurs naturally from sand deposits during storms and large swells. Closure and open periods of Burrill Lake can be variable (Table 6-4).

Table 6-4 Burrill Lake closures and openings in the past 10 years (Shoalhaven City Council 2002).

<b>Closed</b>	<b>Open</b>
January 2005 due to coastal storm.	June 2005 manually by Shoalhaven City Council.
August 2006 due beach berm after heavy swells.	March 2007 manually by Shoalhaven City Council.
May/June 2007 gradual closures.	June 2007 manually by Shoalhaven City Council after heavy rainfall.

### **Hydrology and flooding**

The existing Burrill Lake crossing is one of the lowest points above sea level on the Princes Highway at 1.5 AHD. The existing causeway projects out into Burrill Lake, causing a physical barrier to flow across about two thirds of the estuary width at this point. The crossing is prone to inundation during moderate frequency flood events. This has been estimated at between 1:10 and 1:20 year flood level (BMT WBM 2013).

BMT WBM (2013) identified that the primary mode of flooding for the Burrill Lake crossing is from periods of intense rainfall. Additionally, it can occur from:

- The ocean (including from high tides, wave penetration and storm surges).
- Gradual and prolonged rises in lake levels during periods of entrance closure.

Shoalhaven City Council has a policy to breach the sand deposits at the lake's entrance to the ocean at specific levels. Currently this occurs when the causeway gauge reaches 1.2 metres AHD. Most of the Burrill Lake urban area, which includes over 400 residences, is within the 1:100 year flood line (Shoalhaven City Council 2002).

The height of the existing Burrill Lake bridge deck is about 1.5 metres AHD. The height of the existing causeway ranges between 1.5 and 2 metres AHD. The modelled flood levels for 100, 20 and 5-year Average Recurrence Intervals (ARI) are shown in Table 6-5 (GHD 2012). They indicate that the road and causeway would be under water during a 1:100 year flood event and in a 1:20 year flood. The road and causeway would be partially or substantially under water during the 1:5 year flood event, dependent on lake entrance conditions (BMT WBM 2013; GHD 2012).

Table 6-5 Modelled flood levels of existing conditions.

<b>Peak flood level (AHD)</b>	<b>100-year flood (1% event)</b>	<b>20-year flood (5% event)</b>	<b>5-year flood (20% event)</b>
Catchment flooding (lake entrance fully closed)	2.4 m AHD	2.2 m AHD	1.9 m AHD
<b>Catchment flooding (lake entrance fully open)</b>	2.2 m AHD	1.9 m AHD	1.5 m AHD
<b>Ocean flooding</b>	2.6 m AHD	2.25 m AHD	1.9 m AHD

With the exception of the proposed stock pile site at the junction of the Princes Highway and Wheelbarrow Road (about two kilometres south of Burrill Lake), all construction and demolition works proposed, including ancillary facilities, would be located within the 1:10 year flood level.

Predicted future flooding in relation to climate change is discussed separately in section 6.13.

### **Water quality**

The Burrill Lake Estuary and Catchment Management Plan (Shoalhaven City Council 2002), sets out the following water quality objectives:

- Nitrogen below 0.5 mg/ml.
- Phosphorous below 0.05 mg/ml.
- Turbidity to remain in very low range.
- pH not to fall below 6.5.
- Waters should be free of floating debris and litter.
- Bacterial counts:
  - Creeks used for household water = zero bacterial colony forming units (CFUs<sup>3</sup> per 100 ml).
  - Waterways used by oyster industry = or < 14 CFUs per 100 ml.
  - Primary contact recreation waterways = or < 150 CFUs per 100 ml.

The 2008/2012 State of the Environment Report (Shoalhaven City Council 2012) for

<sup>3</sup> Colony forming units – a measure of viable bacterial numbers.

Shoalhaven City Council found the water quality for Burrill Lake was good despite high rainfall during summer, which can stir up sediments and wash pollutants into the lake from upper catchment areas. All water quality objectives were below the set targets. It is noted that in 2007, water quality was rated poor. This was due to low water levels.

Shoalhaven City Council (2012) notes the primary factors affecting water quality in Burrill Lake as:

- Catchment runoff - in particular the effects of runoff from upstream grazing, dairy and urban uses.
- Tidal flushing and large flood events - these events add and remove nutrients from the lake.

Drainage at the existing Burrill Lake crossing directly discharges into the lake, also contributing to the water quality of the lake.

### **Groundwater**

A preliminary desktop assessment found that localised aquifer systems are likely to form to the north and south of Burrill Lake Inlet with Burrill Lake Inlet acting as a primary discharge point for these aquifer systems. Groundwater is anticipated to be relatively shallow across the study area.

A search of NSW Natural Resources Atlas (NSW Government 2013a) for groundwater bores indicated there are six groundwater bores within two kilometres of the proposal site (Figure 6-3). Only four of the six bores have standing water levels recorded, they include:

- GW057911 at 1.30 metres below ground level.
- GW053964 at 6.00 metres below ground level.
- GW104019 at 1.36 metres below ground level.
- GW031493 at 1.30 metres below ground level.

Additionally, groundwater was encountered at all crossing borehole locations (BH101 to BH106) investigated by GHD in 2013 (GHD 2013). Groundwater was recorded between 1.9 and 2.2 metres below ground level.

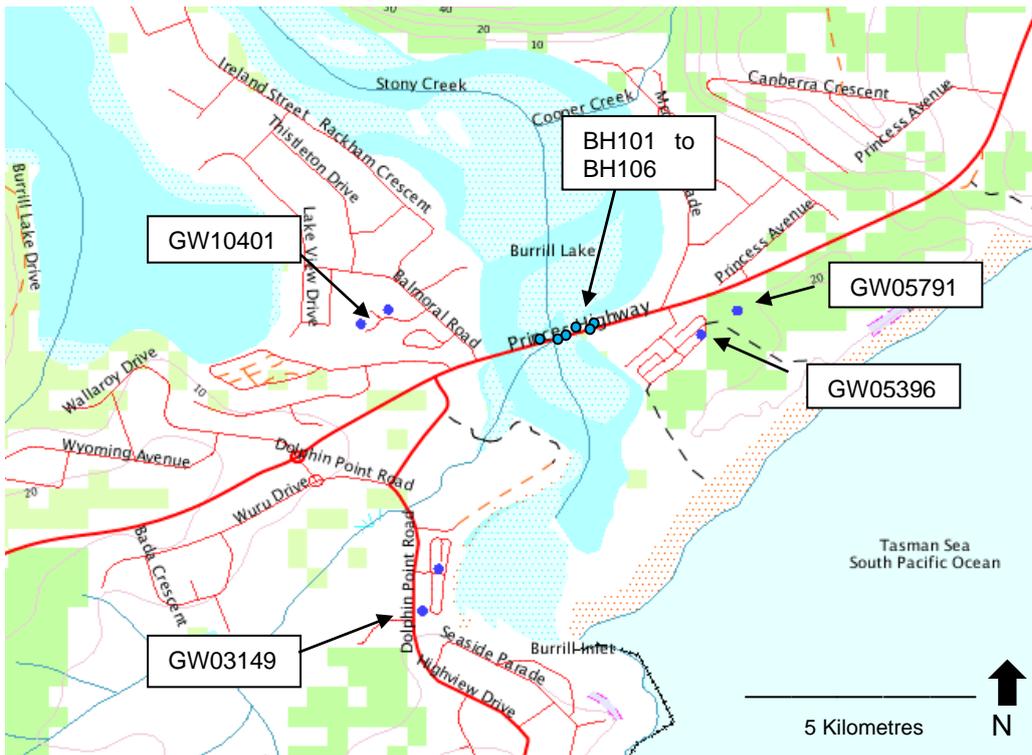


Figure 6-3 Groundwater bores (blue circles) located in and surrounding the proposal area. Source: NSW Government (06/09/2013). NSW Natural Resource Atlas website. <http://www.nratlas.nsw.gov.au>

### 6.2.3 Potential impacts

#### **Construction and demolition works**

##### *Catchment hydrology*

No clearing or changes of land use are proposed in the upper catchment.

##### *Flooding, channel morphology and local hydrology*

Removal of the existing causeway, which currently forms a barrier across about two thirds of the lake's width, has potential to change local hydrology and flooding patterns. The works would affect local hydrology and, depending on how much of the channel is blocked during works, could affect the timing and duration of entrance opening. This is relevant because extended closures of the lake entrance can affect water levels and adversely affect water quality. Poor water quality can then extend into the upper reaches of the lake. Additional sources of pollution due to the works would add to other sources (such as run off) and could exacerbate water quality issues under these conditions. Specific flooding impacts are discussed below with reference to the Design Impact Assessment, completed by BMT (2013) for this proposal.

Installation of temporary rock working platforms within the waterway may affect local hydrology temporarily. Two working platforms are intended to be constructed, one on each approach bank, during the construction of the new bridge. The platforms would be extended as work commences. Removal of causeway material and installation and removal of rock platforms both have potential to disrupt flow.

The construction of the proposed works would have no substantial impact on the existing tidal flow exchange of Burrill Lake (BMT WBM 2012). With the working platforms in place, no substantial impact on the 1:100 flood levels is expected, due to the significant amount of overtopping of both the existing causeway and working platforms at flood levels of this magnitude. During a 1:50 flood event, the working platforms would result in a general

increase of water velocity. This is due to the main flow of water being confined to a narrower channel downstream of the existing bridge opening. These changes are, however, localised, with the broader flow distribution in the estuary unaffected (BMT WBM 2012).

The 1:100 year flood levels would also not be substantially impacted, when the new bridge is in place with the original crossing yet to be removed. There would be a small reduction in peak flood levels on the eastern side of the northern approach of the new bridge. This stage of the proposed works would also have little impact on the velocity of water during 1:50 flood event (BMT WBM 2012).

The installation and operation of the temporary rock platforms would compact the lake bed due to their weight. The construction of the platform would be designed in accordance with a technical criteria (example provided in Appendix C), which would limit impacts to the lake bed and the surrounding environment. The removal of existing bridge piers, causeway material and the temporary rock platforms would have a direct impact on the lake bed. Scour holes could be exacerbated by tidal action. The outgoing tide can be strong in narrow channels. Controls would be required to ensure a stable lake bed results.

Due to the potential to increase lake bed instability and increase pollution risks, undertaking works within a waterway during periods of flow velocities greater than 2 metres / second is considered a high risk activity and specific controls to manage environmental impacts would be required.

#### *Water quality*

Construction and demolition activities have the potential to degrade water quality within Burrill Lake and adjacent drainage lines, both in the immediate area and downstream. Floating barges, removal of the existing crossing (bridge and causeway) and installation and later removal of temporary rock working platforms in the waterway create risks of material spills, affecting water quality. There is potential for a wide range of pollutants to enter the lake and nearby drainage lines, particularly during high rain events. These include:

- Sediment and soil nutrients, from stockpile sites and disturbed areas of soil.
- Contaminated soils and materials, as discussed in section 6.1.
- Construction waste such as road pavement, concrete, rock and aggregate, steel, timber and including potential contaminants, as discussed in section 6.7.
- Fuels spilt during refuelling of plant and equipment.
- Hydraulic and lubricating oil leaking from plant and equipment.
- Rinse water from plant washing.
- Concrete wash from concreting.

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

- Reduction in photosynthetic productivity of water bodies from increasing turbidity.
- 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.

Highest risk activities would include works in and near waterways as follows:

- Installation of sediment and erosion controls in and around the foreshore. This may require excavation in saturated soils. If not properly maintained, sediments would spill into the lake or be washed in from nearby areas.
- Installation of rock platforms. Sediments could be brought in with the rock. Lake bed disturbance would disturb sediments.

- Excavation behind the new abutments has the potential to destabilise the lake banks and cause sedimentation of the lake waters.
- Pile driving can cause local sedimentation when working in the lake waters. There is also a risk of hydraulic spills during pile driving works.
- Backfilling behind abutments could lead to sedimentation in adjacent areas if materials are not adequately compacted or if high rainfall or tides affect the works areas.
- Removal of the existing causeway and decking presents pollution risks. Materials would be loaded onto a small barge, unloaded on the foreshore and then transported by truck for disposal. Loading, unloading and cartage carries risks of spillage.
- Underwater excavation works would include removing headstocks and piles on the existing bridge. These would disturb sediments and leave holes that may scour with tidal action.

Environmental Work Method Statements (EWMS) would be required to manage these activities. Furthermore, staff amenities located near waterways present a pollution risk. Operation of machinery, including cranes, near waterways carries a risk of fuel and lubricant spills. Pouring (if precast concrete approach slabs are not used) approach slabs presents risks of cement or concrete wash being washed into the lake. Controls to properly locate and manage these activities would also be required. Additionally, as discussed in Section 6.1, access would be required from Lions Park near Burrill Inlet to float a small barge into the lake, to assist with waste removal from the causeway. The support vessel has the potential to disturb bottom sediments if it is manoeuvred in the shallower areas of the lake. This has the potential to result in a minor and temporary increase in water turbidity at the site and downstream sedimentation.

#### *Groundwater*

Construction works to install new bridge piers and excavation for the approaches is likely to intercept groundwater. It is unlikely that the groundwater network structure would be affected. Pouring of concrete presents a risk of pollution, however, piers are likely to be precast and bored. Considering the location of works however, risks to groundwater are considered low.

### **Operation**

#### *Local hydrology*

Once constructed, the absence of the existing causeway protruding into the lake and the presence of the (much smaller by comparison) new approaches and piers within the channel and on the foreshore are likely to change local hydrology and flooding patterns.

BTM (2013) determined that the final bridge alignment and removal of the existing crossing would not have a significant impact on the 1:100 flood levels. There would be a small reduction in peak flood levels on the eastern side of the northern approach of the new bridge. There would also be a minor increase in the flood levels along the alignment of the existing causeway within the waterway. This would be due to the minor change of the flow distribution associated with the removal of the existing causeway.

Changes in flow due to the removal of the causeway would have the following impacts:

- Decrease in flow through the existing bridge opening and main channel alignment.
- Increased current speeds on the eastern side of the channel upstream and downstream of the causeway.

During a 1:50 year flood event, the flow distribution would be evenly distributed across the channel, due to the absence of the existing causeway. There would be a significant reduction in peak flow velocity in the vicinity of the existing deep channel (near the southern bank) and a corresponding increase in velocity along the eastern side, presently occupied by the existing causeway. The increase in velocity is approximately in the order of 0.4 - 0.5m/s, however, this would be localised near the existing causeway. Peak flood tide velocities in the order of 0.2m/s would be anticipated in the vicinity of the existing causeway. Over the region the increase would be less than 0.1m/s.

BTM (2013) concluded:

- The causeway removal would have limited influence on broader shoaling patterns within the entrance channel. There would be limited movement of marine sand beyond the immediate vicinity of the entrance.
- The changes in main channel velocities and hence sediment transport potential would be minor, particularly given the variability and range of existing velocities experienced under typical tidal and flooding regimes.
- The causeway removal would have no impact on the net tidal exchange between the ocean and the lake. This is predominantly controlled by the entrance conditions rather than the causeway.
- Removal of the causeway would provide for increases in velocity over these shoals that currently occur in the lee of the existing causeway. This may scour some of the finer siltation as the channel adjusts to a new equilibrium. This affect would be local to the causeway alignment and not affect broader areas along the inlet foreshore.

#### *Water quality*

Water quality impacts during operation may occur as a result of accidental spills and leaks from vehicles using the new bridge and roadway. The impact would be no greater than currently occurs.

The existing bridge currently discharges directly off the deck into the lake. The proposal would include a deck drainage system that diverts water away from the crossing. The requirement for permanent detention basins would be investigated during detailed design.

Groundwater is not anticipated to be affected by any operational impacts.

#### 6.2.4 Safeguards and management measures

In addition to soil controls listed in the chapter above, the following safeguards are also required to manage hydrology and water quality impacts. Safeguards include EWMS for high risk activities.

<b>Impact</b>	<b>Environmental safeguards</b>	<b>Responsibility</b>	<b>Timing</b>
Disturbance to lake bed	<ul style="list-style-type: none"> <li>• Temporary rock platforms would be designed and constructed in accordance with the technical criteria example, Appendix C.</li> </ul>	Roads and Maritime	Pre-construction
Water pollution	<ul style="list-style-type: none"> <li>• As part of the construction environmental management plan, EWMS would be prepared and implemented for pile driving works and the demolition of the existing bridge and causeway. The content of the EWMS would</li> </ul>	Construction contractor	Pre-construction & construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>include but not be limited to:</p> <ul style="list-style-type: none"> <li>○ Description of the works/activities including machinery to be used.</li> <li>○ Outline of the sequence of the work/activities, including interfaces with other construction activities.</li> <li>○ Identification of potential environmental risks/impacts due to the works/activities <i>and</i> associated with wet weather events.</li> <li>○ Evaluation of methods to eliminate/reduce the environmental risk.</li> <li>○ Mitigation measures to reduce environmental risk.</li> <li>○ Any safeguards resulting from consultation with public authorities and other stakeholders, when appropriate.</li> <li>○ A map indicating the locations of sensitive locations (such as threatened species or heritage items), likely potential environmental impacts, and work areas.</li> <li>○ Identification of work area and exclusion areas.</li> <li>○ A process for progressive review, eg monitoring processes and methods to eliminate/reduce environmental risks/impacts.</li> </ul>		
Flooding	<ul style="list-style-type: none"> <li>• As part of the construction environmental management plan, a procedure would be prepared to identify potential flood threats and an evacuation procedure for dispersible materials, hazardous materials and equipment containing such materials. The procedure would include: <ul style="list-style-type: none"> <li>○ Regular consultation of the Bureau of Meteorology website for weather forecasts and flood warnings</li> <li>○ Scheduling of activities on land subject to flooding to avoid high flow periods.</li> <li>○ A process for removing</li> </ul> </li> </ul>	Construction contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>equipment and materials off site and out of flood risk areas quickly.</p> <ul style="list-style-type: none"> <li>○ Storing and use of fuels and chemicals away from the flood zone, in bunded areas.</li> </ul>		
Pollution (water and soil)	<ul style="list-style-type: none"> <li>● Concrete wash areas would be clearly sign posted and would allow for the chute only to be cleaned on site.</li> </ul>	Construction contractor	Construction
Pollution (water and soil)	<ul style="list-style-type: none"> <li>● As part of the construction environmental management plan, a spill management plan would be developed and implemented and would include measures for refuelling, maintenance of machinery and response and notification procedures. It would also include storage of potential pollutants: <ul style="list-style-type: none"> <li>○ All fuels, chemicals, and liquids would be stored at least 50 metres away from any waterways or drainage lines and would be stored in an impervious bunded area. If this is not possible, storage would be undertaken as far from waterways as possible on flat ground in an impervious double bund.</li> <li>○ Refuelling of plant and maintenance of machinery would be undertaken in impervious bunded areas at least 50 metres away from any waterways or drainage lines. If this is not possible, refuelling would be undertaken as far from waterways as possible on flat ground in an impervious double bund.</li> <li>○ Vehicle wash downs would be undertaken within a designated impervious bunded area or undertaken off-site.</li> <li>○ Machinery would be regularly checked to ensure there is no oil, fuel or other liquids leaking from the</li> </ul> </li> </ul>	Construction contractor	Pre-construction & construction

Impact	Environmental safeguards	Responsibility	Timing
	machinery, including daily checks of machinery and equipment to be used for bridge works.		
Pollution (water and soil)	<ul style="list-style-type: none"> <li>• If a spill occurs: <ul style="list-style-type: none"> <li>○ The Roads and Maritime's Environmental Incident Classification and Management Procedure would be followed and the Roads and Maritime Contract Manager notified as soon as practicable.</li> <li>○ EPA would be informed of all notifiable spills.</li> </ul> </li> </ul>	Construction contractor	During construction
Pollution (water)	<ul style="list-style-type: none"> <li>• The requirement for permanent detention basins would be investigated during detailed design and, if required, may be subject to a separate environmental impact assessment.</li> </ul>	Roads and Maritime	Pre-construction

### 6.3 Biodiversity

A Biodiversity Assessment (BA) was prepared by **ngh**environmental (2014). The aim of the study was to augment existing surveys completed in the study area and provide a detailed assessment of the potential biodiversity impacts of the proposal. The specialist report documenting the investigation is included as Appendix E and summarised in this chapter.

An Ecological Constraints Assessment was conducted by GHD (2012) to describe the natural environment at the site, identify resident flora, fauna and their habitats, determine the site's conservation significance and identify ecological constraints and opportunities for future replacement or upgrade of the bridge. The Ecological Constraints Assessment identified the need for follow-up targeted surveys to further assess the impact of the proposal. The BA (**ngh**environmental 2014) cites results presented in GHD (2012), building on the exiting information that has been collected. It provides the results of the targeted surveys undertaken and completes the impact assessment for the concept design.

#### 6.3.1 Methodology

Potential impacts were investigated by literature review and database searches, targeted surveys and assessment. Biodiversity surveys and assessment considered the direct impacts within the development footprint (which includes the existing crossing and approaches, the new crossing and approaches and the temporary site compound and stockpile sites) as well as potential for indirect impacts on adjacent terrestrial and aquatic habitat within the study area.

#### Literature review and database searches

Literature relevant to this assessment was reviewed and included:

- OEH Threatened Species Profiles.
- Department of the Environment EPBC Act Species Profiles and Threats Database (SPRAT).
- Construction methodology and concept designs.

- Aerial imagery of the study area.
- Burrill Lake Bridge Ecological Constraints Assessment (GHD 2012).
- Native vegetation mapping for the area (Tozer *et al.* 2010).
- Shoalhaven City Council Endangered Ecological Community (EEC) mapping.

Databases as listed in Table 6-6 were accessed.

Table 6-6 Database searches undertaken for threatened entities and noxious weeds.

Resource	Target	Search Date	Search Area
OEH Wildlife Atlas Database	Threatened flora and fauna and populations.	08/10/13	10 kilometre radius of study area
EPBC Act Protected Matters Search Tool	Threatened flora and fauna, endangered populations and ecological communities and migratory species.	08/10/13	10 kilometre radius of study area
DPI Fishing and Aquaculture threatened and protected species records viewer	Threatened and protected species of fish and marine vegetation	08/10/13	Shoalhaven City Council
DPI Noxious Weed Database	Noxious weeds declared in the relevant LGA.	08/10/13	Shoalhaven City Council

### Flora surveys

Based on preliminary concept designs, GHD (2012) undertook:

- Terrestrial vegetation mapping using random meander surveys to characterise vegetation type, structure and condition. Vegetation condition was assessed in the categories of poor, moderate and good.
- Threatened flora surveys using random meander surveys within and around the study area.
- Ground-truthing of seagrass mapping by undertaken by NSW Department of Primary Industries (DPI) to map seagrass extent and changes in cover and density within the study area.

Using the refined concept design to define the development footprint, **ngh**environmental (2014) undertook further surveys including:

- Review of the terrestrial vegetation mapping reported by GHD (2012) within the study area. Extent and condition of vegetation types were mapped.
- Review of the seagrass mapping reported by GHD (2012) within the study area. Transects perpendicular to the shore were conducted on foot initially at 10 metre spacings and then at 20 metre spacings, once it was determined that variability was low and would be adequately detected using a spacing of 20 metres.
- Targeted survey for threatened flora species identified by GHD (2012) as having potential for impact including:
  - The Leafless Tongue Orchid (*Cryptostylis hunteriana*).
  - East Lynne Midge Orchid (*Genoplesium vernale*).
  - Tangled Bedstraw (*Galium australe*).

### Fauna surveys

Based on preliminary concept designs, GHD (2012) undertook:

- Fauna habitat assessments, to record type of habitats present within the study area and specific habitat features.
- Diurnal bird surveys, to record all bird species present.

- Microchiropteran bat surveys to target species potentially roosting under the Burrill Lake Bridge.
- Opportunistic observations of any fauna species seen or heard during other fauna surveys.

Using the refined concept design to define the development footprint, **ng**henvironmental (2013a):

- Revised the extent of fauna habitat Factors such as canopy resources, ground-layer resources, vegetation structure, connectivity and existing levels of disturbance were noted and compared to the results presented in 2012 by GHD.
- Undertook further targeted surveys including:
  - Microchiropteran bats (several are listed as having potential to occur) were surveyed using a ground mounted stationary Anabat detector. The primary aim of the survey was to determine if microbats were roosting under the Burrill Lake Bridge.
  - Green and Golden Bell Frog (*Litoria aurea*) surveys within a drain supporting potential habitat on the south side of the Burrill Lake. The site was surveyed according to the NSW NPWS (2003) survey guidelines and EPBC Act (DEWHA 2009) survey guidelines for this species. Surveys were undertaken over four separate nights to increase the chance of detecting the species.
  - Threatened shorebirds and migratory birds: Eastern Osprey (*Pandion cristatus*), Pied Oystercatcher (*Haemotopus longirostris*), Sooty Oystercatcher (*Haemotopus fuliginosus*), White-fronted Chat (*Epthianura albifrons*), Bar-tailed Godwit (*Limosa lapponica*), Double-banded Plover (*Charadrius bicinctus*), Eastern Curlew (*Numenius madagascariensis*), Great Egret (*Ardea alba*), and White-bellied Sea-Eagle (*Haliaeetus leucogaster*); four bird surveys were undertaken within the study area.

Detailed flora and fauna survey methodology and effort is provided in Appendix E and summarised below in Table 6-7.

Table 6-7 Survey effort summary.

Date	Method	Survey effort	Target species
<b>Flora</b>			
14 November 2013	Random meander and targeted searches	3.5 person hours	All species East Lynne Midge Orchid
14 November 2013	Supplementary seagrass surveys	3 person hours	All seagrass species
<b>Habitat</b>			
9 Oct 2013	Habitat inspection	1.5 hours	All species
<b>Birds</b>			
9 <sup>th</sup> and 24 <sup>th</sup> Oct 2013; 20 <sup>th</sup> and 26 <sup>th</sup> Nov 2013	Diurnal bird survey	45 minute to 2 hours (4.50 person hrs)	All species, but primarily threatened shorebirds
<b>Microbats</b>			
24 <sup>th</sup> Oct 2013 and 14 <sup>th</sup> Nov 2013	Anabat Survey	Two overnight surveys	Threatened Microbats
<b>Green and Golden Bell Frog</b>			
14 <sup>th</sup> , 20 <sup>th</sup> , 26 <sup>th</sup> November 2013; 6 <sup>th</sup> December 2013	Nocturnal survey	Four surveys at 1 hour each (4 person hrs)	Green and Golden Bell Frog

### 6.3.2 Existing Environment

#### Weeds and disturbance

Blackberry (*Rubus fruticosus aggregate spp.*) was identified within the study area. It is listed as a Class 4 noxious weed within the Shoalhaven Local Control area (growth must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction) as well as a Weed of National Significance (WONS). Asparagus Fern, although not listed as noxious within the Shoalhaven local control area, is also a listed WONS.

#### Vegetation communities

Four native vegetation communities occur within the study area:

- Seagrass Meadows (*Zostera*)
- Estuarine Saltmarsh (EEC)
- Coastal Sand Forest (equivalent to the EEC *Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions*, listed under the TSC Act)
- Estuarine Fringe Forest (equivalent to the EEC *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*, listed under the TSC Act)

Additionally areas of exotic vegetation (parkland and lawn) occur within the study area. The condition of the vegetation varied between poor and good, using the GHD condition classes<sup>4</sup>. General characteristics are detailed below.

#### Seagrass Meadows

Seagrass meadows (dominated almost entirely by *Zostera muelleri* subsp. *capricorni*) occur extensively on all stable sand bars within Burrill Lake. The distribution and density and/or cover of seagrass varies across the study area from single stands to patchy or fairly continuous beds of moderate to high densities (Figure 6-4). The mapped distribution of seagrass in 2013 is somewhat different to the 2012 mapping (GHD 2012), demonstrating the dynamic nature of seagrass beds. About 4 hectares of this community occur within the study area. This vegetation community is not listed as an Endangered Ecological Community (EEC) under either the TSC or EPBC Acts. Seagrass communities are however, protected under the *Fisheries Management Act 1994* (FM Act). The NSW DPI has management responsibility for fish and marine vegetation, including seagrasses, under the FM Act and a permit under Part 7 of the Act will be required to harm seagrass.

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<sup>4</sup> While the GHD condition classes of poor, moderate and good are used in this assessment, all of the native terrestrial vegetation types within the study area would be considered to be in 'moderate to good' condition, according to the NSW OEH Biometric definitions.



Figure 6-4 Examples of varying seagrass coverage and densities across the study area.

### *Estuarine Saltmarsh*

Estuarine Saltmarsh occurs in the intertidal zone on the shores of Burrill Lake (Figure 6-5). About 4.7 hectares of this community occur within the study area. The condition of this community ranges from moderate to good. *Hydrocotyle bonariensis* is a common weed throughout the majority of the upper saltmarsh levels throughout the study area. This community is equivalent to the endangered ecological community (EEC) *Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions*, listed under the TSC Act. Saltmarsh is considered marine vegetation under the FM Act and will require a permit to harm under Part 7 of the FM Act.



Figure 6-5 Examples of Estuarine Saltmarsh within the study area.

### *Coastal Sand Forest*

Coastal Sand Forest occurs in several locations in varying condition. Most areas heavily invaded by exotics in the understorey. Some areas in the south-west where exotics are less prevalent and moderate native species diversity occurs but generally coincides with heavily shaded areas where the general abundance of individuals is low. About 4.8 hectares of this community occur within the study area (Figure 6-6). This community is equivalent to the EEC *Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions*, listed under the TSC Act.



Figure 6-6 Coastal Sand Forest in the west of the study area.

### *Estuarine Fringe Forest*

Regrowth Estuarine Fringe Forest occurs in small patches near the edges of Burrill Lake south of the Highway and around Burrill Inlet (Figure 6-7). About 1.7 hectares of this community occur within the study area. The condition of this vegetation is poor. The structure of the community within the study area has been extensively modified and weed invasion is extensive. This community is equivalent to the EEC *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*, listed under the TSC Act.



Figure 6-7 Estuarine Fringe Forest in the south-west of the study area.

### **Endangered Ecological Communities (EECs) and marine vegetation**

Three threatened ecological communities listed under the TSC Act and two types of marine vegetation protected under the FM Act are present in the study area (Table 6-8).

Table 6-8 Endangered ecological communities and marine vegetation identified within the study area.

<b>Vegetation Community</b>	<b>Endangered Ecological Community and/or protected marine vegetation</b>	<b>Status</b>
Seagrass Meadows (Zostera) (SL e70)	Protected Marine Vegetation	FM Act
Estuarine Saltmarsh (SL p509)	Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions Protected Marine Vegetation	EEC – TSC Act FM Act
Coastal Sand Forest (DSF p64)	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	EEC – TSC Act

Vegetation Community	Endangered Ecological Community and/or protected marine vegetation (EEC- TSC Act)	Status
Estuarine Fringe Forest (FOW p106)	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC – TSC Act

The distribution of vegetation communities including EECs is shown in Figure 6-8.

### Flora species

The Burrill Lake Bridge Ecological Constraints Assessment (GHD 2012) identified a total of 39 flora species within the study area. These included 24 native species and 15 introduced species. The surveys conducted in 2013 identified a further 23 native species and 17 introduced species. A full species list of all flora species recorded from both surveys is provided in Appendix B of this Appendix E.

Background database searches produced a total of eight threatened flora species with potential to occur in the study area, with the NSW Wildlife Atlas Database identifying four species and the Commonwealth Protected Matters Search Tool identifying seven species. Habitat evaluation by GHD (2012) determined that potential habitat for three species occurred within the study area, including Leafless Tongue Orchid (*Cryptostylis hunteriana*), Tangled Bedstraw (*Gailum austral*) and East Lynne Midge-Orchid (*Genoplesium vernale*). Targeted surveys in 2013 determined that no threatened flora species are likely to occur within the study area due to the:

- Absence of required abiotic habitat features.
- High levels of disturbance.
- Absence of associated vegetation communities or flora species.
- Lack of nearby (within 10 kilometre) records of the species.

### Fauna habitat and species

Five broad fauna habitats occur within the study area:

- Burrill Lake and lake margins
- Burrill Lake Bridge
- Open parkland
- Woodland and forest patches
- Drains and drainage lines

(Habitat attributes are detailed in Appendix E).

A total of 42 species were recorded within the study area (GHD 2012 and **ngh**environmental 2013 surveys combined). The species recorded included 35 bird species, two frog species and five fish species. Of the 35 bird species recorded during the field surveys, 15 species were waterbirds. This included two individuals of the threatened Pied Oystercatcher (listed as Endangered under the TSC Act) and one migratory species (listed under the EPBC Act); the Eastern Great Egret (*Ardea modesta*). No Green and Golden Bellfrogs or microchiropteran bats were identified in the targeted surveys.



Figure 6-8 Distribution of vegetation communities within the study area.

Background database searches produced a total of 80 threatened fauna species with potential to occur in the study area, with the NSW Wildlife Atlas Database identifying 43 species (22 bird species, 17 mammal, 1 reptile and 3 amphibian species). The Commonwealth Protected Matters Search Tool identifying 50 species (24 bird, 5 reptile, 5 amphibian, 11 mammal, 2 fish and 3 shark species). Table 6-8 identifies those threatened species with greater than a low likelihood of occurrence within the subject site, based on the further survey and assessment carried out by **ngh**environmental (2014).

Table 6-9 Threatened species with potential to occur in the proposal area.

Species	TSC Act	EPBC Act	Likelihood of occurrence (nghenvironmental 2013)
<b>Diurnal Birds</b>			
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo	V		<b>Moderate.</b> Marginal foraging habitat, but may forage on occasion in the study area. No breeding habitat present.
<i>Epthianura albifrons</i> White-fronted Chat	V		<b>Moderate.</b> May forage on occasion along the Burrill Lake Bridge embankment and in saltmarsh.
<b>Raptors</b>			
<i>Lophoictinia isura</i> Square-tailed Kite	V		<b>Moderate.</b> Minimal foraging and breeding habitat present in the study area, may fly over area during foraging bouts.
<i>Pandion cristatus</i> Eastern Osprey	V	M	<b>Moderate.</b> May forage over Burrill Lake. Ospreys are known to nest in a communications tower in Ulladulla.
<b>Shorebirds</b>			
<i>Haemotopus fuliginosus</i> Sooty Oystercatcher	V		<b>Moderate.</b> May forage on occasion along edge of lake or within exposed mud flats during low tide.
<i>Haemotopus longirostris</i> Pied Oystercatcher	E		<b>Present.</b> Recorded during nghenvironmental 2013 surveys. Observed foraging along edge of lake during low tide.
<i>Sternula albifrons</i> Little Tern	E	M	<b>Moderate.</b> Small area of potential foraging habitat present in study area.
<b>Microbats</b>			
<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle	V		<b>Moderate.</b> Limited foraging habitat and no breeding habitat present in the study area.
<i>Miniopterus schreibersii oceanensis</i> Eastern Bentwing-bat	V		<b>Moderate.</b> Could forage in study area on occasion. Minimal roosting habitat present.
<i>Mormopterus norfolksensis</i> Eastern Freetail-bat	V		<b>Moderate.</b> Limited foraging habitat and no breeding habitat present in the study area.
<i>Myotis macropus</i> Southern Myotis	V		<b>Moderate.</b> Limited foraging habitat and no breeding habitat present in the study area.
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	V		<b>Moderate.</b> Limited foraging habitat and no breeding habitat present in the study area.
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	V	V	<b>Moderate.</b> Some foraging habitat and no breeding habitat present in the study area.

### Threatened and protected fish and marine vegetation

A search of the DPI Fishing and Aquaculture threatened and protected species records viewer identified eight records of the threatened Australian Grayling within the Shoalhaven local government area. All records were from Yalwal Creek and the Clyde River which are over 20 kilometres south of the proposal site.

Members of the Syngnathidae (seahorses, pipefish, seadragons) are protected under the FM Act and the EPBC Act. Syngnathidae are known to occur in various habitats, including seagrass habitat, and have the potential to occur on site.

### Migratory Species

The EPBC Act protected matters search tool revealed 49 migratory species listed under the EPBC Act as potentially occurring within 10 kilometres of the subject site. Many of these species are marine and/or pelagic (e.g. albatrosses and whales) and are unlikely to occur in the study area. There are no known migratory fish species listed for Burrill Lake. The Eastern Great Egret (*Ardea modesta*) was recorded by GHD (2012) during the field surveys and during this current assessment. Migratory species with a greater than low potential to occur are provided in Table 6-10 below.

Table 6-10 Migratory species with the potential to occur within the proposal area (from GHD, 2012).

Species	EPBC Act	Likelihood of occurrence
<i>Limosa lapponica</i> Bar-tailed Godwit	M	<b>High.</b> May forage around saltmarsh and seagrass in the study area.
<i>Charadrius bicinctus</i> Double-banded Plover	M	<b>High.</b> May forage around saltmarsh and seagrass in the study area.
<i>Numenius madagascariensis</i> Eastern Curlew	M	<b>High.</b> May forage around saltmarsh and seagrass in the study area.
<i>Ardea modesta</i> Great Egret	M	<b>Present.</b> Recorded foraging on edges of Burrill Lake.
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	M	<b>High.</b> Likely to regularly forage over Burrill Lake.

**KEY:** M: Migratory.

### Critical habitat

The study area does not contain any areas that have been declared as critical habitat under either the TSC Act or EPBC Act.

### Wildlife connectivity corridors

Wildlife corridors are generally defined as a link of habitat between two or more larger areas of wildlife habitat. Corridors are critical for the maintenance of ecological processes. They allow for the movement of animals and the continuation of viable populations.

Vegetation within the study area provides limited connectivity to other areas of habitat as cleared residential land is prevalent throughout the surrounding landscape and the proposal is adjacent the Princes Highway. Burrill Lake itself provides an aquatic corridor for marine or aquatic species.

### 6.3.3 Potential Impacts

The potential biodiversity impacts of construction and operation of the proposal include:

- Direct loss of vegetation / habitat (clearing).
- Potential injury and mortality to resident fauna.
- Potential increase of weeds, pests and pathogens.
- Changed hydrology and seagrass impacts within Burrill Lake.
- Water quality impacts from accidental spills.
- Threatened species.
- Increase of key threatening processes.
- Cumulative impacts.

These are discussed separately for construction and operation below, with the exception of threatened species, key threatening processes and cumulative impacts, which are discussed at the end of this chapter.

### Construction and demolition works

#### *Loss of vegetation/habitat*

The extent of clearing of terrestrial and marine vegetation proposed is outlined below for each community. No hollow-bearing trees will be removed as part of the proposal. As well as clearing for infrastructure, impacts may also occur from use of boats/barges in shallow areas (the propellers could damage the seagrass as well as the use of anchors in seagrass beds) during construction (this latter area has not been quantified).

Table 6-11 Estimated removal of vegetation communities within the development footprint.

Vegetation community	Threatened status?	Condition	Area of vegetation estimated to be removed (hectares)
Seagrass Meadows	No (but considered protected marine vegetation)	Variable	0.23
Estuarine Saltmarsh	Yes	Moderate to good	0.04
Coastal Sand Forest	Yes	Good	0.15
Coastal Sand Forest	Yes	Poor to moderate	0.07
Coastal Sand Forest	Yes	Poor	0.17
Coastal Sand Forest (highly modified)	No	Poor	0.06
Estuarine Fringe Forest	Yes	Poor	0.13
Estuarine Fringe Forest (highly modified)	No	Poor	0.09
Exotic Grassland and Planted Trees	No	NA	1.7
<b>TOTAL (ha)</b>			0.94 hectares native vegetation; 1.7 hectares exotic vegetation

#### *Wildlife connectivity and habitat fragmentation*

The construction would not affect any movement corridors for ground-dwelling wildlife as the area of direct works is already fragmented and existing corridors are not present. Species that would currently use the corridor would already be tolerant of a level of fragmentation and are more likely to be highly mobile, wide ranging species.

The removal of 0.9 hectares of native vegetation (including seagrass) from the study area would not substantially fragment the remnant vegetation in the local landscape. As such, the removal of habitat within the study area is unlikely to significantly isolate or fragment the site from other areas of habitat to the extent that species currently using the corridor would be adversely affected.

#### *Injury and mortality*

The removal of the existing bridge has the potential to remove habitat and disturb roosting Welcome Swallows and potentially microbats. While no microbats were been observed in current studies, mitigation measures have been recommended to minimise impacts to any fauna that may be utilising the existing bridge.

The Pied Oystercatcher is a mobile species that would avoid the area during construction activities and is highly unlikely to be injured during the works. It is considered aquatic

species are also highly likely to vacate the immediate area during construction due to vibration and noise impacts and are therefore unlikely to be affected by the proposal.

Injury or mortality to other common fauna species is considered to be minor and unlikely given the location of the proposal in an already disturbed parkland environment that supports no important habitat features such as hollow-bearing trees. However, many smaller and more common species such as skinks and frogs are difficult to locate or remove during pre-clearing surveys. It is likely there will be some loss of individuals from these common populations.

The proposal has the potential to cause injury and mortality to sessile aquatic fauna species, in particular those slow moving or attached invertebrates located within the sediment, seagrass or attached to boulders around the causeway. These impacts are likely to occur during the removal of the causeway and construction of the new bridge, in particular during piling activities. Invertebrate species would be common and found in high abundance in these types of habitat and any injury or mortality would only have a minor impact on their abundance in the locality. More mobile aquatic species such as stingray and other fish species could potentially vacate the immediate area during construction due to vibration and noise impacts and other impacts to habitat. Due to the availability of similar aquatic habitats in surrounding areas, impacts are likely to be minor and temporary, with species moving back to the area following works.

#### *Weeds, pests and pathogens*

Spread of the one Class 4 noxious weed species (Blackberry) and two WONS (Blackberry and Asparagus Fern) observed in the study area may occur during vegetation removal and movement of vehicles and machinery into or out of the site. Weeds are easily transported as seeds and propagules on machinery brought to the site. Equally, they can be carried away to other areas from the site or spread within it. Each species of weed requires particular treatment and follow-up management in order to successfully minimise any impacts on biodiversity, and much of this information can be sought from the *Noxious and Environmental Weed Control Handbook* (DPI 2011). Rehabilitation of disturbed areas and ongoing weed management after the completion of construction activities would limit the establishment and spread of weed species during operation.

Several pathogens in NSW have the potential to impact on the environment and biodiversity. These may be introduced and spread during the construction of road projects and roadside maintenance works. Pathogens that have the potential to be introduced and spread during the proposal include but are not limited to:

- Phytophthora (*Phytophthora cinnamomi*).
- Myrtle rust (*Uredo rangelli*).
- Fusarium wilt/Panama disease (*Fusarium oxysporum*)

Phytophthora is listed as a Key Threatening Processes (KTPs) under both the TSC Act and EPBC Act, and myrtle rust is listed under the TSC Act. The likelihood of encountering Myrtle rust in the southern coastal areas of NSW has increased over the past two years, with the distribution of the pathogen spreading south of the Shoalhaven LGA in 2011. This fungus affects plants in the Myrtaceae family, and there is a large number of known host species (DPI 2012). Of the known host species, two were recorded within the Coastal Sand Forest in the south-west section study area in low densities, namely Blackbutt (*Eucalyptus pilularis*) and Kanooka (*Tristaniopsis laurina*). No infestations were noticed during the survey. As Myrtle rust is known from the region, it is possible that construction activities within the study area could introduce or contribute to the spread of the pathogen. Mitigation measures have been included in Section 7.1 to prevent the introduction and/or spread of any pathogens

within the study area.

#### *Changed hydrology and seagrass impacts within Burrill Lake*

With the exception of the proposed stock pile site at the junction of the Princes Highway and Wheelbarrow Road (about two kilometres south of Burrill Lake), all construction and demolition works proposed, including ancillary facilities, would be located within the 1:10 year flood level.

The construction of the new bridge has the potential to disrupt local flow temporarily, primarily through the installation of temporary rock working platforms within the waterway; however these structures would not prevent blockage of Burrill Lake to the coast and would not contribute to flooding in significant rainfall events (BMT WBM 2013). As Burrill Lake displays little tidal fluctuation naturally, the construction activities are not expected to alter flow velocities, increase water turbulence, or realign the existing waterways to any substantial degree. No significant changes in local hydrology are expected from the proposal.

Impacts to water quality, discussed in section 6.2 of this REF, could adversely affect aquatic habitat. Sedimentation of seagrass beds could impact this habitat as well as temporary increases in turbidity, which could prevent light penetration to the bed and reduce growth and/or lead to die back. However, the likelihood of lack of light being of concern is low considering how shallow the waters are at the site. Environmental safeguards are required as part of the proposal to implement standard best practice erosion and sedimentation controls. Sediment controls such as silt curtains, have the potential to harm seagrass beds if they are used improperly (e.g. dragged along the bottom).

#### **Operation**

##### *Loss of vegetation/habitat*

Shading of the new bridge may affect the extent of sea grass meadows. Loss of seagrass is expected immediately under the deck of the new bridge as a result of shading. The removal of the existing bridge and causeway will provide new areas of shallow water habitat (around 0.17 hectares). *Zostera* is abundant within existing seagrass beds and is likely to colonise these new areas.

##### *Wildlife connectivity and habitat fragmentation*

Once constructed, the new bridge would not prevent marine fauna or shorebirds utilising the lake or passing under/over the bridge. Thirteen piers would be constructed in discrete locations, as the lake at the area of the proposal is approximately 205 metres wide, the new bridge would not create a barrier to movement of aquatic fauna.

##### *Effects on seagrass meadows from altered hydrology*

Although no substantial changes in overall local hydrology are expected, the BMT WBM (2013) report states that the proposed removal of the causeway represents a noteworthy change from existing conditions in terms of both flood and tidal flow distributions and that these impacts are confined to the near vicinity of the causeway. The more extensive areas of seagrass within the study area are immediately east of the causeway and given their close proximity are potentially susceptible to changes in flood and tidal flows and associated movements of sediment. Sedimentation and scouring may affect seagrass meadows as the channel adjusts to a new equilibrium. Significant scouring would need to occur over a relatively large area to increase the depth of the shoals in this area to that which would be unsuitable for seagrass. Scouring to this extent is considered unlikely. In regards to the relocation of sediments that may occur and smother seagrass habitat, the locations that would receive the scoured sediment and the quantity of sediments that would be relocated are currently unknown. It is therefore not possible at this stage to quantify the area of seagrass that would be impacted or how its distribution and/or cover would be modified and

whether there will be a net loss or gain as a result of the proposal. However, based on existing information (i.e likely minor impact on local hydrology and sediment movements; creation of new potential seagrass habitat as a result of the removal of the causeway), the effect on the distribution and abundance is likely to be minor..

### **Threatened species**

#### *TSC Act Assessment of Significance*

An Assessment of Significance (AoS) was conducted for threatened species or communities considered to have moderate to high likelihood of utilising areas that would be directly impacted by the proposal. These species and communities included:

- Bangalay Sand Forest EEC.
- Coastal Saltmarsh EEC.
- Swamp Oak Floodplain Forest EEC.
- White-fronted Chat (*Epthianura albifrons*), Vulnerable.
- Sooty Oystercatcher (*Haemotopus fuliginosus*), Vulnerable.
- Pied Oystercatcher (*Haemotopus longirostris*), Endangered.
- Little Tern (*Sternula albifrons*), Endangered.

The results of the assessment are summarised below.

#### Bangalay Sand Forest

The proposal would remove approximately 0.4 hectares of Bangalay Sand Forest which is highly disturbed and generally in poor condition. Weeds are already prevalent within the community. The proposal would not cause further fragmentation or isolation and the habitat to be removed is not considered important to the community's survival in the locality. A significant impact to the Bangalay Sand Forest EEC is considered unlikely.

#### Coastal Saltmarsh

The proposal would remove 0.04 hectares of Coastal Saltmarsh which is considered a very minor amount in the context of the occurrence of the community around Burrill Lake. The increase in fragmentation would be negligible and would not result in any additional isolation. The potential to introduce weeds is considered to be low and highly manageable. The habitat to be removed is not considered important to the long-term survival of the community in the locality. A significant impact to the Coastal Saltmarsh EEC is considered unlikely however, it is considered protected marine vegetation and will require a permit under the FM Act to harm.

#### Swamp Oak Floodplain Forest

The proposal would remove approximately 0.13 hectares of Swamp Oak Floodplain Forest which is highly disturbed and generally in poor condition and already fragmented from other remnant habitats. This community is highly fragmented and restricted within the locality and remaining remnants are considered to be of high conservation significance. The existing high levels of disturbance within a parkland environment however, severely compromise the viability of this community within the areas to be impacted. The habitat to be impacted is not considered important to the long-term survival of the community in the locality given the area affected is already highly modified. A significant impact to the Swamp Oak Floodplain Forest is considered unlikely.

#### White-fronted Chat

The proposal will affect 0.04 hectares of potential foraging habitat (Coastal Saltmarsh) within Burrill Lake, but no nesting habitat. The White-fronted Chat is not a permanent resident of the area. The extent of habitat to be removed is considered a relatively small in the context of the available resources remaining within the study area. It is considered unlikely that the

proposal will result in significant impacts to the White-fronted Chat.

Shorebirds (Sooty Oystercatcher, Pied Oystercatcher, and Little Tern)

The proposal will affect 0.5 hectares of potential foraging habitat within Burrill Lake for the Pied and Sooty Oystercatcher and 2 hectares for the Little Tern, but no nesting habitat for any of these species. The extent of habitat to be removed is considered a relatively small impact in the context of the available resources remaining within the study area. The construction of the new bridge will not substantially affect habitat connectivity, nor increase fragmentation as these species are highly mobile, forage over larger distances, and contiguous habitat within Burrill Lake will remain available. It is considered unlikely that the proposal will result in significant impacts to the Pied Oystercatcher, Sooty Oystercatcher or the Little Tern.

#### *EPBC Act significant impact criteria*

A review of significant impact criteria for migratory species was undertaken for species listed under the EPBC Act with high potential to occur within the study area that would be directly impacted by the proposal. These included:

- Little Tern (*Sternula albifrons*), Migratory.
- Bar-tailed Godwit (*Limosa lapponica*), Migratory.
- Double-banded Plover (*Charadrius bicinctus*), Migratory.
- Eastern Curlew (*Numenius madagascariensis*), Migratory.
- Great Egret (*Ardea modesta*), Migratory.

The Bar-tailed Godwit, Eastern Curlew and Double-banded Plover do not breed in Australia. The major Australian breeding populations for the Little Tern are not known near Burrill Lake however, the species will nest on sandy beaches and this habitat type is not available for this species within the study area. The Great Egret will breed within Australia and is widespread but no breeding habitat is available for this species within the study area.

Burrill Lake is not known as a site of international importance for these species and is not known to support an ecological significant proportion of a population of any of these migratory species. The study area supports foraging habitat only for these species; 2 hectares of habitat will be temporarily disturbed for the Little Tern and 0.5 hectares will be affected for the Bar-tailed Godwit, Double-banded Plover, Eastern Curlew and Great Egret. As these birds are highly mobile, widespread (apart from the Little Tern), can forage over large distances and similar habitat is available within the locality, the proposal is not expected to disrupt the lifecycle of these species.

#### **Impact on relevant key threatening processes**

Five key threatening processes have been identified as relevant to the proposal and are outlined in Table 6-12. These are of most relevance to the construction stage. Alteration to the natural flow is also relevant to operation.

Table 6-12 Relevant key threatening processes.

TSC Act	EPBC Act	FM Act	Relevance
<b>Clearing of native vegetation.</b>	Land clearance.	The degradation of native riparian vegetation along New South Wales water courses.	Native vegetation would be removed as part of the proposal. Given the area is already degraded and a small area will be cleared (up to 0.9 hectares), the proposal is not considered to contribute to this KTP.
<b>Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.</b>			Proposal for construction and removal of the bridge are required in Lake Burrill and have the potential to alter the local hydrology. Studies of flow velocities and impacts to sediment transport were undertaken (BMT WBM 2013) and concluded no significant impacts were expected from the works. The proposal is not considered to contribute to this KTP.
<b>Infection of native plants by <i>Phytophthora cinnamomi</i>.</b>	Dieback caused by the root-rot fungus ( <i>Phytophthora cinnamomi</i> ).		The pathogen is well established in higher rainfall areas. The level of threat and its distribution can increase if human activities alter site conditions to favour the spread and intensification of the species. Guide 7 (Pathogen management) of the Roads and Maritime Biodiversity Guidelines (RTA 2011) have been recommended to prevent the spread of infected material.
<b>Invasion of native plant communities by exotic perennial grasses.</b>			A number of exotic perennial grasses (Appendix B) were recorded across the site, and can become dominant in the landscape due to disturbance. Weed management at the site has been recommended to prevent these species from spreading further.
<b>Introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae.</b>			No evidence of Myrtle Rust was observed during the field survey but two host trees are present in the south west of the study area; therefore, there is the potential for its introduction. With adherence to Roads and Maritime Biodiversity Guidelines Guide 7 (Pathogen Management) it is considered unlikely that the proposal would contribute to this KTP.
		Instream structures and other mechanisms that alter natural flow.	The establishment of the new bridge will contribute to the alteration of natural flow, however, the removal of the existing bridge is likely to reinstate a more natural flow regime than currently exists. The proposal would not contribute to this KTP.

### Cumulative impacts

As the study area is located in a residential regional area with agriculture, national parks and nature reserves as dominant land uses, the number of developments occurring is relatively low. There are no known Roads and Maritime projects, major projects, or other large scale

developments occurring in the region that are considered relevant to the upgrade. The clearing of native vegetation, which is a key threatening process at both State and Commonwealth level, is considered a major factor in the loss of biological diversity. At least 61% of the native vegetation in NSW has been cleared or highly modified since European settlement, and the removal of vegetation for this upgrade is contributing to this process, although that contribution is relatively minor (0.94 hectares). Given minor clearance is associated with the proposed works and the new bridge will be located adjacent the existing bridge in a predominantly cleared area, the proposal is not considered to add to cumulative impacts in the local region.

### Offsetting

The Guideline for Biodiversity Offsets is an internal Roads and Maritime document. It is designed to assist in deciding whether biodiversity offsets are required for a project and to guide the implementation of offsets if they are required. The offsets should be considered depending on the conservation value of the habitat (very high, high etc.). Vegetation of *very high conservation value* at the proposal site includes:

- Type 1 or Type 2 sensitive key fish habitat (as identified by NSW Fisheries) where the impact cannot be otherwise mitigated.

The proposal will impact on Type 1 highly sensitive key fish habitat in the form of *Zostera* seagrass beds and saltmarsh. Rehabilitation and/or compensation measures in line with DPI (2013) should be considered for these areas. Appropriate measures would ultimately be determined by DPI as part of permit conditions.

Due to the small area of clearing for other areas of high conservation value (Bangalay Sand forest and Swamp Oak Floodplain Forest EECs), offsetting would not be required.

### 6.3.4 Safeguards and management measures

Controls relevant to managing biodiversity impacts already mentioned in other sections of the REF (soil and water management, minimisation of the works footprint) are addressed in sections 6.1 and 6.2 and are not duplicated here.

Impact	Mitigation measures	Responsibility	Timing
Clearing	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Trees designated for clearing would be removed in such a way as not to cause damage to surrounding vegetation. This would ensure groundcover disturbance would be kept to a minimum.</li> <li>• 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).</li> <li>• Where possible, work would not</li> </ul>	Contractor	Pre-construction and construction

Impact	Mitigation measures	Responsibility	Timing
	<p>encroach into dripline of trees to be retained. This zone is defined as the Tree Protection Zone (TPZ) and is ordinarily around 5m from the base of the tree.</p> <ul style="list-style-type: none"> <li>• All vegetation removal would be in accordance with the Roads and Maritime Biodiversity Guidelines – Protecting and Managing Biodiversity on RTA Projects (RTA 2011).</li> <li>• A permit under Part 7 of the Fisheries Management Act to harm saltmarsh would be required.</li> </ul>		
Erosion and/or disturbance to Burrill Lake and lake margins	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Erosion control would include: <ul style="list-style-type: none"> <li>○ Measures to ensure that the site is adequately protected when rain is forecast.</li> <li>○ 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.</li> <li>○ 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.</li> </ul> </li> </ul>	Roads and Maritime, contractor	Pre-construction and construction
Damage to native vegetation outside of impact zone	<ul style="list-style-type: none"> <li>• Stockpiling materials and equipment and parking vehicles would be avoided within the dripline of any tree.</li> </ul>	Contractor	Construction
Introduction and spread of noxious weeds and pathogens	<ul style="list-style-type: none"> <li>• A Weed Management Plan would be developed for the sites to prevent/minimise the spread of weeds in and between sites, in accordance with Guide 6 (Weed Management) in the Roads and Maritime Biodiversity Guidelines (RTA 2011) and Shoalhaven City Council control plan for each noxious weed.</li> <li>• Declared noxious weeds would be managed according to the requirements stipulated by the Noxious Weeds Act 1993, and any weed removal activities would be in</li> </ul>	Contractor	Construction

Impact	Mitigation measures	Responsibility	Timing
	<p>accordance with Guide 6 (Weed Management) in the Roads and Maritime Biodiversity Guidelines (RTA 2011).</p> <ul style="list-style-type: none"> <li>• Regular targeted control of noxious and environmental weeds would take place during construction to manage noxious weeds. <ul style="list-style-type: none"> <li>○ 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 to prevent spread of potential pathogens and weeds. Vehicle wash downs would be undertaken within a designated impervious bunded area.</li> </ul> </li> <li>• All plant material containing seed heads, weeds that have allopathic properties, and weeds that are able to reproduce vegetatively (e.g. Wandering Jew and Willows), including topsoil containing weed propagules, would be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth.</li> <li>• Weed-free fill would be used for on-site earthworks.</li> <li>• All 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.</li> <li>• Any occurrences of pathogens such as Myrtle Rust and Phytophthora will be monitored and treated as per Guide 7 (Pathogen Management) of the Roads and Maritime Biodiversity Guidelines (RTA 2011).</li> </ul>		
Disturbance to seagrass meadows	<ul style="list-style-type: none"> <li>• A permit under Part 7 of the Fisheries Management Act to harm seagrass would be required.</li> <li>• If used, silt curtains would be placed at strategic locations to prevent any sedimentation of seagrass. Care</li> </ul>	Roads and Maritime, contractor	Construction, Post-construction

Impact	Mitigation measures	Responsibility	Timing
	<p>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).</p> <ul style="list-style-type: none"> <li>• The use of boats and barges in seagrass beds would be minimised where possible.</li> <li>• 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).</li> <li>• Anchoring would not occur within seagrass beds. Support vessels would be moored to the barge to prevent any damage to seagrass beds.</li> <li>• A seagrass monitoring design following a Before After Control Impact (BACI) shall be prepared and implemented prior to the commencement of construction to determine the degree of impact to seagrass.</li> </ul>		
Disturbance to fallen timber, dead wood and bush rock	<ul style="list-style-type: none"> <li>• 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 (refer to Guide 5 Re-use of woody debris and bushrock of the Roads and Maritime Biodiversity Guidelines (RTA 2011) for guidance).</li> </ul>	Contractor	Construction
Removal and replacement of native vegetation and/or fauna habitat	<ul style="list-style-type: none"> <li>• A 'Clearing and Grubbing Plan' would be developed in accordance with Guide 4 (clearing of vegetation) of the Roads and Maritime Biodiversity Guidelines (RTA 2011). This will include best practice methods for the removal of woody vegetation and non-woody vegetation.</li> <li>• A pre-clearing process and unexpected threatened species finds procedure would be implemented before clearing begins according to Guide 1 of the Roads and Maritime</li> </ul>	Roads and Maritime, contractor	Construction and post-construction

Impact	Mitigation measures	Responsibility	Timing
	Biodiversity Guidelines (RTA 2011). This would include checking bridge piers and infrastructure for microbats prior to any construction works. <ul style="list-style-type: none"> <li>• Revegetation of any bare soil or cleared areas with locally-occurring native flora species typical of the original habitat types should occur (refer to flora species list in Appendix B of the Biodiversity Assessment for guidance).</li> </ul>		

## 6.4 Traffic and access

### 6.4.1 Methodology

A Traffic Impact Study was prepared by Bega Duo Designs (2013). The aim of the study was to validate existing and future traffic volumes, conduct intersection counts and analyse the performance of the proposed junctions. The study provides a technical appraisal of the traffic and safety implications arising from the proposal and makes recommendations to minimise traffic impacts during construction and operation. It is summarised in this chapter and appended in full in Appendix F.

### 6.4.2 Existing environment

#### Traffic conditions

The Princes Highway is the major road linking Sydney, Melbourne and Adelaide along the coast of New South Wales, Victoria and South Australia. At Burrill Lake, the Princes Highway is the only route to Ulladulla, in the north. Ulladulla is the main shopping and business destination for all Burrill Lake residents (Ulladulla shopping centre is 4.5 km to the north with a travel time of 7 minutes; Batemans Bay shopping centre is 48 kilometres south with a travel time of 35 minutes).

During the summer school holidays and Easter holidays, daily traffic volumes can be more than double the numbers experienced during the winter periods. This traffic can cause queuing for northbound traffic, which extends from central Ulladulla for around six kilometres through Burrill Lake. A diagram showing the seasonal traffic trends is included in Appendix F.

Burrill Lake had a population of 1328 in 2011; almost half the population is over 50 years of age (Hyder 2013). As the community is small with a high population of retirees, travel can take place in the off-peak periods. This trend in deferred travel combined with a low population is reflected in the recent traffic counts where the vehicle numbers counted in the peak hours were not significantly higher than other hours throughout the day.

Bus services provide the only public transport at Burrill Lake. Information provided in Roads and Maritime (Hyder 2013) suggest that only 6.8 per cent of surrounding residents travel by public transport.

Ulladulla Bus Lines operate a bus service on week days between 7.30am and 5.00pm and Saturday mornings. Four school buses operate in the morning and afternoon on school days. Six long distance coach services utilise the bus stops on the southern side of the bridge.

Pedestrians appear to belong to the following categories:

- School children and travellers walking to and from the bus stops.
- Residents walking to and from the shops.
- Recreational walkers including tourists whose destinations are normally the ocean beach or lakeside areas.

### **Accident history**

The accident records for the five years from 2007 to 2012 (RMS 2013b) indicate that there were 10 crashes with five injury accidents on the Princes Highway within the study area. One of these injury accidents was linked to excessive speed and one to a kangaroo collision. Two of the remaining three injury accidents were rear end collisions and the third involved a car turning into Macdonald Avenue. No accidents involved pedestrians.

### **Existing traffic flows and future trends**

The Roads and Maritime maintains a permanent traffic counter (No. 07.063) located 1.5km south of Burrill Lake. The Average Annual Daily Traffic (AADT) at the proposal site is 6,144 (Roads and Maritime 2006). Of these vehicles, 9 per cent comprise of heavy vehicles.

Bega Duo Designs conducted traffic counts on Tuesday 13th of August 2013 for three hours in the morning and three hours in the evening, to determine peak hours. The counts show all movements at the junctions on the Princes Highway with Dolphin Point Road, Jorgys Way, Balmoral Road, Macdonald Avenue and Princess Avenue (north and south). The results are displayed in Figures 1 and Figure 2 in Appendix F.

A *Long time trend chart*, in Appendix F, shows the AADT counts over a 20 year period. This information indicates a growth of 1700 vehicles. This growth rate was used in the traffic capacity calculations to extend the 2012 volumes to the 2032 design year.

Boat traffic and impacts on the recreational use of Burrill Lake are discussed in section 6.11.2.

#### **6.4.3 Potential impacts**

##### **Construction and demolition**

Construction is estimated to commence in early to mid-2015 and last for 15 to 18 months. Impacts during construction would occur during construction of the bridge and road and intersection activities. They would include temporary traffic delays as well as traffic hazards associated with changed traffic conditions and equipment operating close to through traffic.

During the construction stage, it is expected that the existing highway and all cross streets would remain open during construction. Some lane closures and road deviations may be necessary at each extremity of the road construction, as the bridge approaches are transitioned into the existing highway levels. Final tie in works are likely to be undertaken at night. Impacts would be highest where they coincide with peak traffic, in school hours, through school holidays and other holiday periods.

As well as local vehicle traffic changes, the construction program will affect pedestrian access, access to the retail and recreational areas adjacent to works. It will affect bus and cycle access.

A Traffic Management Plan would be required to detail vehicle movement and traffic controls for the various stages of the work, to address safety risks during construction.

##### **Operation**

Potential operational impacts would occur at different locations along the highway including Dolphin Point Road and roundabout, MacDonald Avenue roundabout and northern shopping

area and the junction with Princes Avenue North (including cycle paths and bus stops). Due to the new alignment, wider approaches, higher bridge deck and changes to local junctions, several beneficial operational impacts would be realised. Anticipated positive, negative and neutral traffic impacts are summarised below.

- Raising the deck of Burrill Lake crossing will have a positive impact on traffic for the local area.
- Dolphin Point Road and roundabout
  - Delays would be minimised and the potential for collisions reduced under the proposal.
  - Relocation of the Princes Highway towards the east would result in the loss of highway frontage for the local shops which may impact on trade. A loss of parking spaces in Lions Park may also impact on the trade from highway travellers using the park area and its facilities. Parking space numbers would be increased on the southern side, however, to address these impacts.
  - Eastbound traffic would increase in Dolphin Point Road as the right turn movement onto the Princes Highway becomes available.
  - Construction of the southern bridge abutment would interrupt the current access to Balmoral Road from the Lions Park.
  - The existing bus stops on the Princes Highway would require relocation (this forms part of the proposal).
- MacDonald Avenue roundabout and northern shopping area
  - Access from Macdonald Avenue and Princes Avenue South to the Princes Highway would be improved in respect to delays during peak periods and accident potential. The impact on passing trade may be partly offset by safer conditions for motorists and pedestrians accessing shops, due to the lower volume and speed of traffic. It is noted that parking space numbers would be retained on the northern side of the crossing.
  - The left turn from Princess Avenue South onto the highway would have a restricted turning radius, requiring articulated vehicles to make a 180 degree turn through the proposed roundabout to travel south on the highway.
  - School children may be required to make an additional highway crossing, if bus stops are reinstated on the new highway.
- Junction with Princes Avenue North
  - This junction does not provide a protected right turn for traffic travelling from Ulladulla to the adjacent residential area<sup>5</sup>.
  - Pedestrians from the residential areas may cross near this junction to access the main track to the beach. It is noted that five pedestrian crossing points form part of the proposal.
- Cyclists bound for Ulladulla may be required to negotiate a relatively narrow section of existing highway to connect with the cycle path. Part of this section has an 80km/h speed restriction, creating an increased accident potential. The

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<sup>5</sup> Guidelines given in Austroads (2005) 'Guide to Traffic Engineering Practice, Part 5 Intersections at Grade' indicate that a protected right turn treatment could be justified. Various options for this junction were considered. The "BAR" right turn treatment utilising the 2.5 metre wide sealed shoulder for passing of a turning vehicle was considered to be the most appropriate treatment based on the relatively low number of right turning vehicles recorded and the existing accident record. The crash data base for five years from 2007 to 2012 does not record any accidents at the site. However, there was one crash near the junction in 2008 between two motorcyclists (16 and 17 years). The crash was apparently related to driver behaviour, not road environment.

proposal now includes connecting the cycle way to the Ulladulla cycle path which mitigates this risk.

Management of operational impacts is most relevant to the detailed design stage of the project, as set out below.

#### 6.4.4 Safeguards and management measures

Safeguards exclude those measures now incorporated into the proposal.

Impact	Environmental safeguards	Responsibility	Timing
Traffic safety during construction	<ul style="list-style-type: none"> <li>• A detailed Traffic Management Plan would be prepared in accordance with the Roads and Maritime Traffic Control at Work Sites Manual Version 4 (RTA 2010), and approved by Roads and Maritime and Council prior to implementation. The Traffic Management Plan would consider other developments that may also be under construction close to proposed works and be submitted for approval prior to any works commencing. The plan would include consideration of the following items:               <ul style="list-style-type: none"> <li>○ Continuing safe access during construction should be provided for pedestrians between the public rest area (Lions Park) adjacent to the southern bridge abutment and the shops near Balmoral Road. This route would also provide for shoppers and recreational walkers.</li> <li>○ Continuing safe access during construction should be provided for pedestrians Princess Avenue South and the shops on Princes Highway.</li> </ul> </li> <li>• The number of parking spaces adjacent to shops should be maintained during construction.</li> <li>• Provision for regular consultation with residents and business operators regarding changed traffic conditions.</li> <li>• Restriction of construction during NSW school holiday periods.</li> <li>• Monitoring of traffic delays and</li> </ul>	Construction contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>accidents.</p> <ul style="list-style-type: none"> <li>• Adoption of minimum delay times for control of traffic.</li> <li>• A code of conduct for the operators of delivery vehicles accessing the work site.</li> <li>• Provision for the continuing operation of all bus services during construction (allocation of alternative bus stopping bays).</li> <li>• Detailed haulage protocols to minimise the impacts of cartage (i.e. fill, spoil etc.) on adjacent properties. For example, consideration of: <ul style="list-style-type: none"> <li>○ Minimising of truck numbers and haulage distance (i.e. maximising reuse where appropriate).</li> <li>○ Provision of temporary highway access for waste removal.</li> <li>○ Covering of loads to minimise dust and odour.</li> </ul> </li> </ul>		

## 6.5 Noise and vibration

A Noise and Vibration Assessment was prepared by Renzo Tonin and Associates to assess the construction and operational noise and vibration impacts of the proposal. The assessment quantifies the potential noise impact on sensitive receivers from road traffic and construction activity associated with the proposed replacement of the existing bridge and causeway and associated approaches to the east and west of the bridge (Renzo Tonin and Associates 2013). It is summarised in this chapter and appended in full, Appendix G.

### 6.5.1 Methodology

The Noise and Vibration Assessment identifies sensitive locations and assesses potential noise and vibration impacts against noise and vibration criteria presented in the NSW Environment Protection Authority's (EPA) 'Road Noise Policy' (RNP), 'Interim Construction Noise Guideline' (ICNG), 'Assessing Vibration: A Technical Guideline' and the NSW Roads & Maritime Service's (Roads and Maritime) 'Environmental Noise Management Manual' (ENMM). The methodology included the following:

1. Determine representative Noise Catchment Areas (NCAs) for the study area.
2. Conduct long-term noise monitoring at key residential receiver locations.
3. Unattended noise monitoring was conducted over fourteen days, between Tuesday 3rd September and Monday 16th September 2013. Appendix D of the Noise and Vibration Assessment details the noise monitoring methodology.
4. Calculate predicted noise and vibration from the upgrade at the most affected neighbouring residences, for both the construction and operational stages of the proposal.
5. Noise modelling was undertaken using the Road Traffic Noise Module in the SoundPLAN noise modelling software. Inputs and assumptions used in the traffic noise prediction model are provided in the Noise and Vibration Assessment.
6. Recommend treatments, where required to address noise and vibration impacts.

## Relevant guidelines and criteria

### Construction noise

The NSW 'Interim Construction Noise Guideline' (ICNG, DECC 2009) sets out the noise management levels for residences, businesses and recreational areas (refer Table 6-13). The Rating Background Level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period. Residential receivers are considered 'noise affected' where construction noise levels are greater than the noise management levels identified below.

Table 6-13 – Noise management levels at residential receivers.

Time of Day	Management Level
	$L_{Aeq} (15 \text{ min})^*$
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10dB(A)
	Highly noise affected 75dB(A)
Outside recommended standard hours	Noise affected RBL + 5dB(A)

Standard work hours are defined as 7am to 6pm Monday to Friday; 8am to 1pm Saturdays; no works on Sunday and public holidays.

### Construction vibration

For disturbance to human occupants of buildings, NSW EPA's 'Assessing Vibration; a technical guideline' (DECC 2006) provides the relevant criteria. It is based on the British Standard BS 6472-1992, 'Evaluation of human exposure to vibration in buildings (1-80Hz)'.

Safe limits for construction generated vibration have been determined using the vibration limits set out in the German Standard DIN 4150 Part 3-1999 'Structural Vibration in Buildings – Effects on Structures'.

### Operational noise

#### Residential receivers

The Burrill Lake crossing and Princes Highway upgrade would constitute road 'redevelopments' as defined in the NSW RNP and the Roads and Maritime's ENMM, as they are expansions of existing arterial road corridors to change the road alignments through design or engineering changes.

The 'redevelopment' criteria for residential type receivers, as set out in the RNP apply and are presented below. Where feasible and reasonable, noise levels from existing roads should be reduced to meet the noise criteria.

Table 6-14 Road traffic noise assessment criteria for residential land uses.

Road Category	Type of Development	Assessment Criteria, dB(A)	
		Day (7am – 10pm)	Night (10pm – 7am)
Freeway/ arterial/ sub-arterial roads	Existing residences affected by noise from redevelopment of existing freeway / arterial / sub-arterial roads	$L_{Aeq,15 \text{ hour}}$ 60 (external)	$L_{Aeq,9 \text{ hour}}$ 55 (external)

### Sensitive land use

Lions Park is located on the south western side of the bridge. It is a passive recreation area and considered to be a sensitive land use. The applicable road traffic noise criterion for Lions Park is presented below.

Table 6-15 – Road traffic noise assessment criteria for sensitive land uses.

Existing Sensitive Land Use	Assessment Criteria, dB(A)	
	Day (7am-10pm)	Night (10pm-7am)
Open space (passive use)	L <sub>Aeq,(15 hour)</sub> 55 (external) when in use	–

### 6.5.2 Existing environment

#### Noise Catchment Areas (NCAs) for the study area

Suburban residential properties are located near the Princes Highway and the Burrill Lake crossing. Commercial businesses are also located along the Princes Highway on the northern and southern approaches to the bridge. A site inspection indicated that the majority of dwellings in the study area are typically of single storey construction with some double storey dwellings. A recreational area, Lions Park, is located on the southern foreshore of the Burrill Lake and southwest of the bridge.

Four representative residential NCAs were defined, mapped on Table 6-16.

Table 6-16 Sensitive receivers in Noise Catchment Areas.

Noise catchment areas	Sensitive receivers
<b>NCA 1</b>	Suburban residential and commercial area on the northern side of the Princes Highway, bordered by the northern extent of the upgrade and the northern approach of the Burrill Lake bridge.
<b>NCA 2</b>	Suburban residential area which includes a motel and caravan park on the southern side of the Princes Highway, bordered by Princess Avenue South to the east and the northern approach of the Burrill Lake bridge.
<b>NCA 3</b>	Suburban residential and commercial area on the northern side of the Princes Highway, bordered by the southern extent of the upgrade and the southern approach of the Burrill Lake bridge.
<b>NCA 4</b>	Single residence and a recreational area on the southern side of the Princes Highway, bordered by the southern extent of the upgrade and the southern approach of the Burrill Lake bridge.

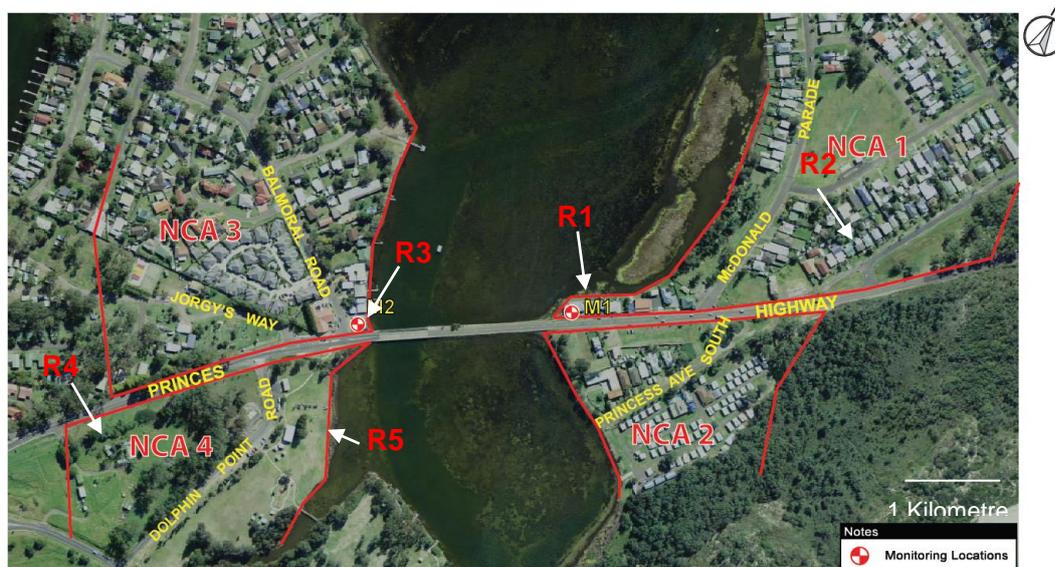


Figure 6-9 Noise catchment areas (NCAs) and monitoring locations (M1 and M2) (Renzo Tonin 2013).

Construction noise impacts were predicted at the following locations: R1 – R5 (Table 6-17). Noise monitoring (M1 – M2) was used to measure the background and ambient noise environment in the vicinity of the proposal, providing a basis for the development of noise criteria (refer to Figure 6-9).

Table 6-17 Construction noise impact monitoring locations.

Location	Location description
Location R1	<b>113 Princes Highway</b> Residential receiver facing the Princes Highway and approximately 10 metres from the proposed construction works. This receiver is considered to be representative of residential and commercial receivers in NCA 1.
Location R2	<b>15 Princess Avenue South</b> Residential receiver backing onto the proposed northern approach to the new bridge, approximately 10 metres from the proposed construction works for the southern approach. This receiver is considered to be representative of residential and commercial receivers in NCA 2.
Location R3	<b>39 Balmoral Road</b> Residential receiver facing the Princes Highway and approximately 10 metres from the proposed construction works. This receiver is considered to be representative of residential and commercial receivers in NCA 3.
Location R4	<b>Lot 7 Dolphin Point Road</b> Residential receiver facing Princes Highway and approximately 40 metres from the proposed construction works. This is the only residential receiver in NCA 4.
Location R5	<b>Lions Park</b> Passive recreation area, with the assessment point approximately 50 metres from the proposed construction works.

### Existing traffic and background noise levels

The main source of noise in the study area is generally traffic noise from the Princes Highway. Existing road traffic and background noise levels are shown below.

Table 6-18 – Measured existing traffic ( $L_{eq}$ ) and background ( $L_{90}$ ) noise levels, dB(A).

Location	$L_{Aeq}$ Traffic Noise Levels		$L_{A90}$ Background Noise Levels		
	Day	Night	Day	Evening	Night
M1, 113 Princes Highway	64	59	48	37	32
M2, 14 Bringelly Road	68	62	53	41	36

A traffic classification survey was undertaken to validate the noise modelling program. The existing 15 hour and 9 hour volumes, compositions and vehicle speeds used for validation of the noise model are presented in Table 6-19 below.

Table 6-19 – Existing 2013 traffic volumes, compositions and speeds.

Traffic Monitoring Location	7am – 10pm (15 hour)			10pm – 7am (9 hour)		
	Total Vehicles	% Heavy Vehicles	Speed (km/h) <sup>1</sup>	Total Vehicles	% Heavy Vehicles	Speed (km/h) <sup>1</sup>
Princes Highway	7,416	8%	62	484	21%	71

### 6.5.3 Potential impacts

#### Construction and demolition

##### Construction noise goals

Based on the recorded background noise levels and in accordance with the NSW 'Interim Construction Noise Guideline', the adopted construction noise management levels for residential receivers within each NCA, Lions Park (identified as a sensitive receiver) and commercial premises are shown below.

Table 6-20 – Summary of construction noise management levels.

Time of Day	Management Level $L_{Aeq(15min)}$	Base Management Level $L_{Aeq(15min)}$			
		NCA 1 <sup>1</sup>	NCA 2 <sup>1</sup>	NCA 3 <sup>2</sup>	NCA 4 <sup>2</sup>
During recommended standard hours (day)	RBL + 10dB(A)	58	58	63	63
Outside recommended standard hours (evening)	RBL + 5dB(A)	42	42	46	46
Outside recommended standard hours (night)		37	37	41	41

Land use	Where Objective Applies	Management level $L_{Aeq(15min)}$
Passive recreation areas	External noise level	60 dB(A)
Commercial premises	External noise level	70 dB(A)

The sound power levels for the proposed plant and equipment are presented in the following table.

Table 6-21 – Typical construction equipment & sound power levels, dB(A).

Plant description	Sound power levels, dB(A) re 1pW	
	$L_{Aeq}$	$L_{Amax}$
Concrete Saw	115	118
Bored Piling Rig	111	124
Rock Crusher	110	140
Compactor	110	116
Jackhammer	110	115
Crane	110	115
Bobcat	110	115
Powered Hand Tools	110	115
Pavement Laying Machine	109	118
Road Profiler	108	111
Tracked Excavator	107	115
Grader	107	115
Mulcher	106	110
Vibratory Roller	106	110
Road Truck	105	113
Sweeper	104	110
Chainsaw	103	118
Backhoe	101	108
Generator	100	106
Compressor	95	105

#### *Construction noise impacts*

Noise emissions were determined by modelling the noise sources, receiver locations, and use of construction equipment as outlined above. Predicted noise levels assume all listed equipment for individual tasks are operating concurrently. This approach is conservative, a worst-case. Actual noise generated during construction works would generally be below the predictions presented below.

Table 6-22 presents a summary of the predicted  $L_{Aeq}$  noise levels for each activity associated with the construction stage. Only the road profiler and pavement laying machine are assessed for the evening and night periods.

Table 6-22 – Predicted  $L_{Aeq}$  Construction Noise Levels, dB(A).

Activity		Assessment Locations				
		R1	R2	R3	R4	R5
Noise Management Levels	Day <sup>1</sup>	58 / 70	58 / 70	63 / 70	63 / 70	60
	Evening	42	42	46	46	
	Night	37	37	41	41	
Site Establishment		<b>88</b>	<b>88</b>	<b>88</b>	<b>76</b>	<b>74</b>
Earthworks		<b>88</b>	<b>88</b>	<b>88</b>	<b>76</b>	<b>74</b>
Bridgeworks		<b>85</b>	<b>85</b>	<b>85</b>	<b>73</b>	<b>71</b>
Paving		<b>91</b>	<b>91</b>	<b>91</b>	<b>79</b>	<b>77</b>
Milling & Asphaltting <sup>2</sup>		<b>84</b>	<b>84</b>	<b>84</b>	<b>72</b>	<b>70</b>

1. Represents criterion for residences / criterion for commercial premises
2. Representative of receivers in NCA 1 nearest to the construction works
3. Applicable for night time activities only
4. **Black Bold** font represents exceedance of greater than 10dB(A) above the daytime NML (20dB(A) above daytime RBL).
5. **Black Bold underline** font represents exceedance of the 75dB(A) highly affected noise objective and only assessed for during standard hours only; i.e. day time period.

Table 6-23 presents a summary of the predicted  $L_{Amax}$  noise levels at residential receivers during potential night time milling and asphaltting works.

Table 6-23 – Predicted  $L_{Amax}$  Construction Noise Levels for Night Works, dB(A).

Activity		Assessment Locations			
		Receiver R1	Receiver R2	Receiver R3	Receiver R4
Sleep Disturbance Upper Limit	Night	65	65	65	65
Milling & Asphaltting		<b>88</b>	<b>88</b>	<b>88</b>	<b>76</b>

Construction noise is likely to exceed the construction noise management levels during all periods of the day for the majority of receivers within the vicinity of the construction works. Impacts during the proposed night time milling and asphaltting work are also predicted to exceed the construction noise management levels and the sleep disturbance criteria. These would occur for up to three weeks. All reasonable and feasible noise mitigation should be applied during the construction stage (refer Appendix G).

#### Vibration

The vibration levels during construction would vary depending on the type of activity being carried out. Construction equipment most likely to cause significant vibration includes:

- Bored piling
- Jackhammers
- Excavators / graders
- Compactors
- Vibratory rollers
- Truck traffic

Unlike noise, vibration cannot be 'predicted'. There are many variables from site to site. Potential vibration impacts are summarised in Table 6-24 below for each noise catchment area.

Table 6-24 – Potential Vibration Impact Assessment.

NCA	Approximate distance to nearest buildings	Assessment on Potential Vibration Impacts		
		Structural Damage Risk	Human Disturbance	Vibration Monitoring
1	10m to 20m	<b>Medium</b> risk of structural damage from vibratory rolling. <b>Low</b> risk of structural damage from other activities.	<b>High</b> risk of adverse comment as a result of compacting, truck traffic and/ or vibratory rolling.	Vibration monitoring would be conducted.
2	10m to 20m	<b>Medium</b> risk of structural damage from vibratory rolling. <b>Low</b> risk of structural damage from other activities.	<b>High</b> risk of adverse comment as a result of compacting, truck traffic and/ or vibratory rolling.	Vibration monitoring would be conducted.
3	10m to 20m	<b>Medium</b> risk of structural damage from vibratory rolling. <b>Low</b> risk of structural damage from other activities.	<b>High</b> risk of adverse comment as a result of compacting, truck traffic and/ or vibratory rolling.	Vibration monitoring would be conducted.
4	>40m	<b>Very Low</b> risk of structural damage.	<b>Low</b> risk of adverse comment.	Not required

The risk of structural damage during construction is generally assessed as being very low to medium risk. For human response to construction vibration, the risks of adverse comment from the nearest receivers were determined to be low to high. Control of vibration impacts would require minimum working distances for construction plant.

### Operation

Operational noise modelling predicted traffic noise for two scenarios:

- 2016 (opening year)
- 2026 (design year)

Noise modelling was completed at residential assessment locations potentially worst affected by the proposed upgrade. These residences are typically within the first two rows of properties nearest to the road upgrade. The modelling assumes no mitigation is employed.

Traffic noise levels in 2016 were predicted to be within 2dB(A) of the 'no build' option (if the upgrade was not constructed) at most receivers. Increases within 2dB(A) of the no build option are considered acceptable. Traffic noise levels in 2016 exceeded a 2dB(A) increase for five receivers within NCA 2 where noise levels are predicted to increase by up to 3.7dB(A) (the Noise and Vibration Assessment discusses a range of mitigation options to further reduce noise levels). Acute noise levels are defined as road traffic noise levels that are equal to or exceed  $L_{Aeq(15 \text{ hour})}$  65 dB(A) (day) or  $L_{Aeq(9 \text{ hour})}$  60 dB(A) (night). According to Roads and Maritime assessment procedures, properties calculated to have acute noise levels must be considered for noise mitigation. The assessment identified one residence in NCA 2 predicted to have an acute noise level during the day period in 2026, refer to Table 6-25Table 6-24.

Table 6-25 – Number of residences impacted due to the build option 2026

NCA	Residences in NCA	Day Period – Number of Residences				Night Period - Number of Residences			
		Exceed RNP noise level <sup>1</sup>	>2dB (A) <sup>2</sup>	Acute Noise	Further Treatment	Exceed RNP Noise Level <sup>1</sup>	>2dB (A) <sup>2</sup>	Acute noise	Further Treatment
1	85	4	0	0	0	1	0	0	0
2	7	5	5	1	5	2	1	0	1
3	81	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0
Total	174	9	5	1	5	3	1	0	1

Notes 1. RNP noise level for the day period is  $L_{Aeq(15\text{ hour})}$  60dB(A) and for the night period is  $L_{Aeq(9\text{ hour})}$  55dB(A)

2. > 2dB(A) increase based on comparison between 'build option' and 'no build option'

#### 6.5.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Construction noise	<ul style="list-style-type: none"> <li>Any work that is performed outside normal work hours or on Sundays or public holidays is to minimise noise impacts in accordance with the RMS Noise Management Manual and the NSW Interim construction noise guidelines.</li> </ul>	Construction Contractor	Construction
Construction noise	<ul style="list-style-type: none"> <li>As part of the construction environmental management plan, a construction noise and vibration management plan would be developed and implemented in accordance with OEH/EPA's ICNG.</li> </ul>	Construction Contractor	Construction
Construction noise	<ul style="list-style-type: none"> <li>Noise impacts are to be minimised in accordance with Practice Note 7 in the Roads and Maritime's Environmental Noise Management Manual and Roads and Maritime's Environmental fact sheet No. 2- Noise management and Night Works.</li> </ul>	Construction Contractor	Construction
Construction noise	<ul style="list-style-type: none"> <li>All reasonable and feasible noise control measures would be implemented prior to the commencement of construction works.</li> </ul>	Construction Contractor	Construction
Construction noise - monitoring	<ul style="list-style-type: none"> <li>Noise monitoring would be undertaken in the following cases:                             <ul style="list-style-type: none"> <li>Where potential noise impacts are predicted to be within 10 to 15dB(A) of the noise management level, to confirm predicted noise impacts within two weeks of commencement of</li> </ul> </li> </ul>	Construction Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>construction.</p> <ul style="list-style-type: none"> <li>○ Where potential noise impacts are predicted to be more than 15dB(A) above the noise management levels.</li> <li>● Noise compliance monitoring for all major equipment and activities on the sites would be undertaken prior to their commencement of work on site.</li> <li>● Further noise reduction measures (where reasonable and feasible) would be implemented (e.g. restrict working hours, use silencing equipment) where noise management levels are exceeded.</li> </ul>		
Construction vibration	<ul style="list-style-type: none"> <li>● Where construction activity occurs in close proximity to sensitive receivers, vibration testing of actual equipment on site would be carried out prior to site operation to determine acceptable buffer distances to the nearest affected receiver locations.</li> </ul>	Construction Contractor	Construction
Construction vibration	<ul style="list-style-type: none"> <li>● Building dilapidation surveys would be conducted specific to equipment and distances identified in the last column of table 6-6 in Burrill Lake Noise Assessment (Renzo Tonin 2013). This is to address potential community concerns (equipment identified includes vibratory rollers, pile boring, jackhammers, compactors, graders, excavators and truck movements).</li> </ul>	Construction Contractor	Construction
Construction noise and vibration complaints	<ul style="list-style-type: none"> <li>● A noise and vibration complaints procedure would be developed and implemented. This would include the following: <ul style="list-style-type: none"> <li>○ Each complaint would be investigated.</li> <li>○ Appropriate noise / vibration amelioration measures would be put in place to mitigate future occurrences, where construction noise / vibration is in excess of allowable limits.</li> </ul> </li> </ul>	Construction Contractor	Construction
Construction vibration	<ul style="list-style-type: none"> <li>● Where vibration is found to be excessive, management measures would be implemented</li> </ul>	Construction Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	<p>to ensure vibration compliance is achieved.</p> <ul style="list-style-type: none"> <li>• Burrill Lake Noise Assessment (Renzo Tonin 2013) provides a range of management measures and buffer distances to be considered and implemented as required.</li> </ul>		
Construction vibration monitoring	<ul style="list-style-type: none"> <li>• Attended vibration monitoring is to be undertaken in the following cases: <ul style="list-style-type: none"> <li>○ At the commencement of operation for each plant or activity on site, which has the potential to generate significant vibration levels, in order to provide site-specific minimum working distances.</li> <li>○ Where it is not feasible to modify construction methodology to reduce vibration within the safe working distances for cosmetic damage.</li> <li>○ For short periods of potential risk for cosmetic damage to buildings and structures.</li> <li>○ Where deemed to be relevant in response to a vibration related complaint.</li> <li>○ Where attended vibration monitoring is not feasible, a permanent vibration monitoring system is to be installed to warn plant operators (via flashing light, audible alarm, etc.) that there is potential for cosmetic damage to buildings and structures.</li> </ul> </li> </ul>	Construction Contractor	Construction
Operational traffic noise	<ul style="list-style-type: none"> <li>• Properties calculated to have acute noise levels would be considered for noise mitigation:</li> <li>• A 1.2 metre high barrier at the top of the northern approach embankment at a length of 104 metres would be provided to attenuate noise to residential receivers within NCA 2 as identified in Renzo Tonin 2013.</li> </ul>	Roads and Maritime	Detailed design
Operational traffic noise monitoring	<ul style="list-style-type: none"> <li>• Operational noise monitoring would: <ul style="list-style-type: none"> <li>○ Be undertaken in</li> </ul> </li> </ul>	Roads and Maritime	Operation

Impact	Environmental safeguards	Responsibility	Timing
	<p>accordance with Practice Note VIII of Roads and Maritime's ENMM.</p> <ul style="list-style-type: none"> <li>○ Would assess the adequacy of the traffic noise mitigation measures determined during the detailed design stage.</li> <li>○ Be conducted within two to twelve months of project completion, at selected representative locations to give a minimum of seven days of data (excluding adverse weather).</li> <li>○ Locations would be selected to represent the potentially most affected noise-sensitive receptors in each NCA, and to correlate with noise monitoring locations selected prior to the construction of the upgrade.</li> <li>● Classified traffic monitoring would be conducted simultaneously with the noise monitoring to identify traffic flows and compositions.</li> <li>● Further noise mitigation measures would be investigated where a clear trend in higher than predicted traffic noise levels in excess of the noise goals is found.</li> </ul>		
Operational traffic noise management	<ul style="list-style-type: none"> <li>● If post construction noise monitoring indicates operational noise levels exceed the design noise level for year 1, then: <ul style="list-style-type: none"> <li>○ If exceeded by 2 dB(A) or less, the noise data would be examined, the prediction methodology and suitability of mitigation measures would be reassessed and the reasons for the marginal exceedance(s) be identified and reported.</li> <li>○ If exceeded by more than 2 dB(A), the adequacy of the noise mitigation needs to be reviewed, and if problems are identified steps need to be taken to rectify the situation. Additional noise treatments may be required to achieve the design noise</li> </ul> </li> </ul>	Roads and Maritime	Operation

Impact	Environmental safeguards	Responsibility	Timing
	level, where this is feasible and reasonable.		

## 6.6 Landscape character and visual amenity

An Urban Design Report and Visual Impact Assessment was prepared by Jackson Teece (2013). It is summarised in this chapter and appended in full, Appendix H.

The report describes the concept urban and landscape design for the project, designed in accordance with the Roads and Maritime urban design policy *Beyond the Pavement - RTA Urban Design Policy, Procedures and Design Principles* (August 2009, Roads and Traffic Authority). A landscape character and visual impact assessment is also undertaken. The assessment was carried out in accordance with the *Environmental Impact Assessment Practice Note: Guidelines for Landscape Character and Visual Impact Assessment* (“EIA No4 Guidelines”, March 2013, Roads and Maritime).

The urban design assessment was undertaken to inform the development of the concept design. Key elements have been incorporated into the proposal description. The summary below is relevant to the landscape character and visual impact assessment components of the Jackson Teece (2013) report only.

### 6.6.1 Methodology

Landscape character is the combined quality of built, natural and cultural aspects that make up an area and provide it's unique sense of place. The study area is divided into zones based on spatial or character properties. These are referred to as landscape character zones. They are areas of landscape with similar properties.

Visual impact assessment considers the visibility of the proposal, the key view points and their sensitivity. The visual impact is based on the:

- Visibility of the receptor
- Type of receptor

For example, the visibility of a road corridor is based on static (generally long term) and mobile (generally short term) receptors. The impact varies based on the type of receptor. Static receptors are generally people with views of the proposal from their dwellings and places of work. Mobile receptors include commuters, shoppers, pedestrians and people using the lake or the park for recreation.

The determination of the impacts is based on two criteria:

- Sensitivity of the impact
- Magnitude of the impact

Sensitivity refers to the capacity of a landscape character zone or view to absorb change. In the case of visual impact this also relates to the type of viewer and number of viewers. The magnitude is the scale, form and character of the proposed development, when compared to the existing condition. In the case of visual assessment this also relates to how far the proposal is from the viewer. The combined assessment of sensitivity and magnitude provides the visual impact ratings (Table 6-26).

Table 6-26 Visual impact: sensitivity versus magnitude.

Sensitivity	Magnitude				
		High	Moderate	Low	Negligible
High		High	High-Moderate	Moderate	Negligible
Moderate		High-Moderate	Moderate	Moderate-Low	Negligible
Low		Moderate	Moderate-Low	Low	Negligible
Negligible		Negligible	Negligible	Negligible	Negligible

## 6.6.2 Existing environment

### Natural and built environment

The landscape character of the South Coast region is dominated by the natural environment. Extensive areas of bushland and rural land are common. The landform is variable, generally undulating to hilly. There is a low level of urban development. The Princes Highway links small settlements and larger towns. From the highway, views of the Tasman Sea and coastal edge are integral to the regional landscape character.

Major settlements of Burrill Lake include the residential and commercial suburb along the northern approach to the crossing; the predominantly residential suburb of Dolphin Point and the suburb of Bungalow Park Village, on a peninsula that extends westwards into the lake. The village centre has developed either side of the crossing, with the crossing being the only connection between the two sides. The Burrill Lake Lions Park is located along the bank of the Burrill Inlet channel, south of the crossing and includes picnic shelters with a barbeque area and a toilet block, children's play area and cycle ways. Overall, the landscape character is dominated by the Burrill Lake water body, which can be seen from most vantage points around the lake edge and while travelling along the highway.

### Landscape character zones

Five character zones were described for the study area:

- Character Zone 1: State Forest and surrounding forested area
- Character Zones 2A and 2B: Northern and southern residential areas
- Character Zones 3A and 3B: Northern and southern village centres
- Character Zone 4: Burrill Lake
- Character Zone 5: Burrill Lake Lions Park

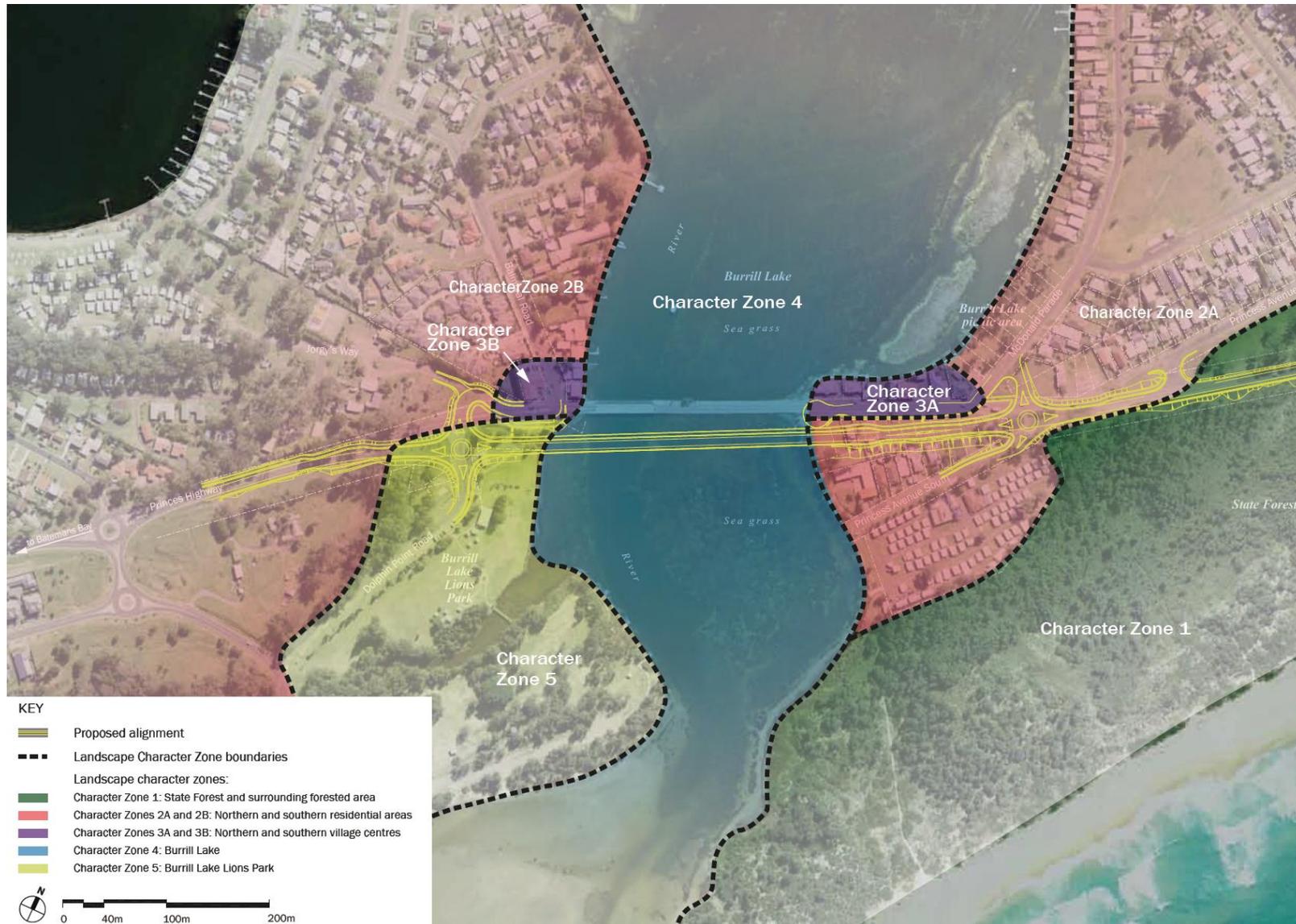


Figure 6-10 Landscape character zones.

## Viewpoints

Nine viewpoints were identified for the study area, taking into account views that assess the impact of the proposal at a range of distances and views that address issues specific to a certain viewpoint:

- Viewpoint 1: The external courtyard of the retail centre.
- Viewpoint 2: The southern village centre area looking south.
- Viewpoint 3: The northern village centre looking south.
- Viewpoint 4: The fishing platform to the east located in Burrill Lake Lions Park.
- Viewpoint 5: The cul-de-sac at the end of Kendall Crescent.
- Viewpoint 6: View from private properties along Princess Avenue North
- Viewpoint 7: View from private properties along Princess Avenue South.
- Viewpoint 8: View from private properties along Balmoral Avenue.
- Viewpoint 9: View from the BIG Bungalow Caravan Park.

### 6.6.3 Potential impacts

#### Construction impacts

While outside the scope of the Landscape character and visual impact assessment, it is noted that visual impacts will also result during the construction stage. Disturbed soils, barricades, additional signage, construction vehicles and staff will create clutter and detract from the existing views, particularly around the foreshore where views are of higher importance to a greater number of people. These impacts would be temporary and can be mitigated to some extent, by the maintenance of a tidy work site and completing the works as rapidly as possible as well as undertaking works during periods that do not coincide with peak visitor use, where possible.

#### Proposed landscape design

The landscape design has been influenced by the informal, coastal character of the settlement of Burrill Lake and the natural environment of the lake itself. The design seeks to complement and enhance this existing landscape character rather than substantially alter it.

The landscape design reflects the relatively low-speed environment, and has been designed so that motorists recognise the surrounding urban community. This is reinforced by pedestrian-scale landscape planting and street trees. The roundabouts provided at either end link the highway to the surrounding local road network and serve to reinforce the desired speed environment of the road.

The landscape design enhances the public spaces and settings of the two village areas of Burrill Lake, with street trees located to highlight and draw visitors towards these key areas. Landscaping enhances the pedestrian environment and creates attractive areas to sit and walk, with clear views of the lake ever present. Lion's Park would include new landscape works, a pedestrian pathway under the bridge and a new amenities building. Other areas have been landscaped to increase the overall tree cover, ensure disturbed areas are stabilised and made attractive and reduce visual impacts to residents. Refer to Appendix H for more detailed explanation of the design, including proposed treatments of built elements and plantings.

#### Landscape character and visual impact assessment

The landscape character and visual impact assessment highlight the substantial impacts of the proposal on the surrounding visual environment (Jackson Teece 2013) (refer to Table 6-27 and Table 6-28 below). In terms of landscape character, the overall magnitude of the proposed change is considered to be moderate. The combination of the sensitivity of the character zone and the magnitude of the proposed change provide a landscape character impact of moderate. The visual impact varies from low to high, depending on the location of the viewpoints (1-9).

Table 6-27 Summary of character zone impacts.

<b>Viewpoint</b>	<b>Description</b>	<b>Sensitivity</b>	<b>Magnitude</b>	<b>Impact rating</b>
1	State Forest	Moderate	Low	<b>Moderate - low</b>
2	Northern and southern residential areas	Moderate	Moderate	<b>Moderate</b>
3	Northern and southern village centre	Moderate	High	<b>High-Moderate</b>
4	Burrill Lake	Moderate	High	<b>High-Moderate</b>
5	Lions Park	Moderate	Moderate	<b>Moderate</b>

Photomontages were prepared to compare the existing view to the view after development for Viewpoints 1-5. These are provided in Appendix H to illustrate how the proposal would change local views.

Table 6-28 Impact at key viewpoints.

<b>Viewpoint</b>	<b>Description</b>	<b>Sensitivity</b>	<b>Magnitude</b>	<b>Impact rating</b>
1	The external courtyard of the retail centre (south side)	Moderate	High	<b>High-Moderate</b>
2	The southern village centre area looking south	Moderate	Moderate	<b>Moderate</b>
3	The northern village centre looking south	High	Moderate	<b>Moderate</b>
4	The fishing platform to the east located in Burrill Lake Lions Park	High	Moderate	<b>High-Moderate</b>
5	The cul-de-sac at the end of Kendall Crescent	Moderate	Negligible	<b>Negligible</b>
6	View from private properties to the north-west of the alignment along Princess Avenue North	Low	Low	<b>Low</b>
7	View from the backyards of private properties to the north-east of the alignment along Princess Avenue South	High	High	<b>High</b>
8	View from the backyards of private properties facing the lake on the south-west of the alignment along Balmoral Avenue	High	Moderate	<b>High-Moderate</b>
9	View from the BIG Bungalow Caravan Park	Low	Low	<b>Low</b>

Throughout the development of the concept design for the project, the design team identified design measures that could mitigate impacts. A number of design changes were made to reduce impacts and are included in the concept design, as follows:

- Minimising the height of the new bridge and its approach embankments as far as possible so the structure does not overwhelm the small settlement. This also reduces the visibility of the bridge and improves the level of accessibility and connectivity with the surrounding areas.
- Responding to the aesthetic character of the Lions Park; replacement of lost trees and facilities, provision of a pedestrian connection to the nearby shopping area.
- Creating new public open spaces and attractive landscaping around the two village shopping areas.

- Ensuring adequate space is provided to screen the residential and motel facility at the northern end of the bridge (northern approach).

The detailed design would need to pay attention to the detailing, the convenience of use, the materials and finishes of the proposal. Specific points are detailed in the report in full (Appendix H) and summarised in the recommended mitigation measures below.

#### 6.6.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Visual impact - construction	<ul style="list-style-type: none"> <li>• Maintain a tidy worksite.</li> <li>• Schedule construction activities that would have a high visual impact such as demolition works to outside peak holiday periods.</li> </ul>	Construction contractor	Construction
Visual impact - operation	<ul style="list-style-type: none"> <li>• Finalise the detailed design of the proposal in consideration of:               <ul style="list-style-type: none"> <li>○ The design and detailing of the visual elements of the bridge, in particular its superstructure elements, piers and headstocks, barriers and handrail, shared path connections and depth of structure.</li> <li>○ Landscape screening where appropriate in consideration with other design principles including maintaining views and safety considerations.</li> <li>○ The design of public elements (such as the shared/foot path, stairs and handrails, screening fence and its associated landscape zone, roundabouts, the detailing and finishes of the new public spaces).</li> <li>○ The provision of landscape and street trees to improve the overall amenity within the two village shopping areas affected by the proposal.</li> <li>○ New signage to signify the location of the village centre and connecting local roads. Directional signage for pedestrians may also be required.</li> <li>○ Creation of two public spaces at either end of the old crossing, providing opportunities to enjoy the</li> </ul> </li> </ul>	Roads and Maritime	Detailed design stage.

Impact	Environmental safeguards	Responsibility	Timing
	<p>water front close to the shopping areas.</p> <ul style="list-style-type: none"> <li>○ Improved pedestrian facilities and a greater level of connectivity in general in the areas affected by the proposal.</li> <li>○ Stabilisation of new embankments and cuttings with native plants, blended into bushland where adjacent to it.</li> <li>○ At locations where greater visual impacts have been identified, larger sized trees may be planted to help reduce the visual impact in the short to medium term.</li> <li>○ Avoiding 2:1 or greater batter slopes, as far as practical.</li> <li>○ Additional landscaping works in Lions Park.</li> </ul>		

## 6.7 Waste and resources

### 6.7.1 Policy setting

Roads and Maritime are committed to ensuring responsible management of unavoidable waste and to promoting the reuse of such waste through appropriate measures in accordance with the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act 2001* (WARR Act).

The resource management hierarchy principles in order of priority as outlined in the WARR Act are:

1. Avoidance of unnecessary resource consumption.
2. Resource recovery (including reuse, reprocessing, recycling and energy recovery).
3. Disposal.

By adopting the above principles, Roads and Maritime encourage the most efficient use of resources and reduces cost and environmental harm in accordance with the principles of ecologically sustainable development, as outlined in chapter 8 of this REF.

### 6.7.2 Potential impacts

Potential waste streams generated during the construction stage include:

- Materials from new bridge (concrete, steel).
- Materials from demolition of bridge and causeway (concrete, steel).
- Contaminated materials (asbestos, acid sulfate soils).
- Excavated soil and rock.
- Green waste (from vegetation removal).
- Road surface material (asphalt, gravel cement).
- Roadside materials (guide posts, guard rails etc.).

- Paper and office waste from project management.
- General waste from staff (lunch packaging, portable toilets etc.).

The demolition works would contribute to most of the total waste generated, including the materials that require special handling, transport and disposal. These materials are asbestos in the bridge and contaminated materials of the causeway. These materials pose a risk to health and safety of workers and locals.

Excess spoil would require removal from site but there may be opportunity for its reuse in other road works. Vegetation may be reused for mulch if it is suitably weed free.

All other waste would require removal from site. This should be transported to the nearest licensed waste disposal facility.

Minimal, if any, waste is expected to be generated from maintenance activities during the operation stage.

The activities proposed require the use of a number resources, including

- Resources associated with the operation of construction machinery, and motor vehicles (this includes a variety of resources, the major one being fossil fuels).
- Material required for road surface and bridge construction (road base, concrete, asphalt, spray seal, sand, aggregate, steel etc.).
- Fill required to meet design levels.
- Construction water (for concrete and dust suppression).
- Rock and other material for the temporary working platforms.

Final quantities of materials would be determined after the completion of the detailed design and specifications.

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.

The majority of the gravel and aggregate for the pavement construction would be sourced from local quarries. The nearest is about 100 kilometres from the site.

All of the new and purchased materials to be used would be sourced from commercial suppliers as close to the work site as possible to reduce transport costs, including fuel usage.

There is potential to reuse rock required for the temporary working platforms for other projects. Identification of opportunities for reuse of materials would be required as part of this project.

### 6.7.3 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Waste	<ul style="list-style-type: none"> <li>• A Waste Management Plan would be prepared for construction and operation which would include the following:               <ul style="list-style-type: none"> <li>○ Identify all potential waste streams associated with the works.</li> </ul> </li> </ul>	Construction Contractor	Pre-construction

Impact	Environmental safeguards	Responsibility	Timing
	<ul style="list-style-type: none"> <li>○ Identify opportunities to minimise the use of resources, and to reuse and recycle materials.</li> <li>○ 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.</li> <li>○ Outline methods to keep the facility free of litter during operation</li> </ul>		
Waste	<ul style="list-style-type: none"> <li>• Cleared vegetation would not be burnt at the site. If suitably weed free, the vegetation can be mulched and used in stabilising the disturbed areas in rehabilitation.</li> <li>• Garbage receptacles would be provided and recycling of materials encouraged. Rubbish would be transported to an appropriate waste disposal facility.</li> <li>• Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working shift</li> <li>• All waste would be managed in accordance with the Protection of the Environment Operations Act 1997 (POEO Act).</li> <li>• Toilets (e.g. portable toilets) would be provided for construction workers.</li> </ul>	Construction Contractor	During Construction
Waste disposal: Asbestos and contaminated soils	<ul style="list-style-type: none"> <li>• All waste would be disposed of at facilities able to accept the materials.</li> </ul>	Construction Contractor	During Construction

## 6.8 Aboriginal Heritage

A Cultural Heritage Assessment Report (CHAR) was prepared by Artefact Heritage in accordance with Stage 3 of the Roads and Maritime *Procedure for Aboriginal Cultural Heritage Consultation and Investigation 2011* (PACHCI). It is summarised in this chapter and appended in full, Appendix I.

### 6.8.1 Methodology

The objectives of the CHAR were to comply with the Roads and Maritime PACHCI and Office of Environment and Heritage (OEH) regulations, including the *Code of Practice for*

*Archaeological Investigation of Aboriginal Objects in New South Wales 2010, the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales 2010 and the Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.*

Specific to the proposed upgrade of the Burrill Lake crossing, the CHAR (Artefact Heritage 2013) provides:

- A significance assessment of the study area including cultural and archaeological values.
- A description of statutory requirements for the protection of Aboriginal heritage.
- An impact assessment for the recorded Aboriginal sites.
- Provision of recommendations for management and mitigation measures for Aboriginal sites.

The investigation included consultation and examination of existing reports relevant to the study area. A field inspection was carried out with representative of the Ulladulla Local Aboriginal Land Council.

### 6.8.2 Existing environment

The country and landscape as a whole is culturally significant to Aboriginal people. Burrill Lake is also seen as significant for its archaeological and cultural values.

The landscape around Burrill Lake has changed significantly over time, primarily in response to changing sea levels. The sea level surpassed its present level at around 7000 years ago and remained about 1 – 2 metres above the present level for around 3000 years causing river valleys to be inundated. During this period the study area was significantly transformed. Burrill Lake would initially have been an open bay, becoming more sheltered as a barrier beach formed. When sea levels fell, the western portion of the basin was disconnected from the rest of the Burrill Lake estuary, possibly transforming the area into saltmarsh or sand flats.

Aboriginal people have lived in the Shoalhaven area for more than 20,000 years. The primary groups occupying the study area are thought to have been the Wandandian and the Murramarang. The South Coast is thought to have been one of the most densely populated regions prior to colonisation. Estimates in the order of about 200 people per square kilometre (Organ & Speechley 1997:1) have been made. This may be related to the availability of many and varied food resources the coastal locality provided.

Many activities have occurred that have caused changes to the Burrill Lake environment since colonisation. These include dredging sand from Burrill Lake, excavating drainage channels, the removal of native vegetation. The Burrill Lake area has been primarily agricultural, with a number of dairies operating in the region. The harvesting of wheat and grazing of horses and beef cattle have also been important activities in the area.

### **Aboriginal Heritage Information Management System (AHIMS)**

A search of the Aboriginal Heritage Information Management System (AHIMS) was conducted on 8 May 2012. The search took in a five kilometre radius of the study area. Seventy (70) Aboriginal sites were located in the vicinity of the study area. No previously recorded Aboriginal sites were located within the study area, but sites such as middens and Potential Archaeological Deposits (PADs) have been found in the close vicinity.

### **Predictive models**

Considering where the most likely areas of archaeological potential within the study area are located:

- There is a high potential for middens to occur within the study area.
- Middens are most likely to occur adjacent to or well above the shoreline on raised areas.
- Stone artefacts may be present in association with midden material.
- Stone artefacts are most likely to occur in a low density.
- Existing intact archaeological deposits would be located in areas of least ground disturbance.
- Other Aboriginal site types such as scarred trees and stone arrangements are unlikely to occur.

### Results of field survey

A field survey was conducted on the 17 May 2012 by Artefact Heritage, RMS Aboriginal Cultural Heritage Advisor and representatives from Ulladulla Local Aboriginal Land Council. No Aboriginal sites were located during the site survey. However, two areas of PAD were identified within the study area. Test excavations were undertaken to assess the archaeological significance of these areas (PAD1, comprised of Areas A, B and C; PAD2 comprised of a single area).

#### 6.8.3 Potential impacts

Ground disturbance (including activities such as clearing and excavation) have potential to damage or destroy artefacts that occur in the soil profile. The proposed works would directly impact two areas of PAD.

The significance of potential impacts was assessed following test excavations of PAD1 and PAD2. Based on the number, type and distribution of artefacts recorded and their assessed significance, it was determined that:

- PAD1 Areas A and B were assessed as having a low archaeological significance.
- PAD1 Area C was assessed as having moderate archaeological significance.
- PAD2 was assessed as having a low archaeological significance.

Further sub-surface investigation of Area C would not represent a beneficial increase in knowledge of the archaeological context to what has already been documented and no further archaeological work is required prior to impacts.

To change the status from PAD to Aboriginal site, PAD1 and PAD2 were registered in 2013 and an Aboriginal Heritage Impact Permit (AHIP) is required prior to any impacts on these areas.

No additional constraints regarding cultural significance of the study area are considered to apply.

#### 6.8.4 Safeguards and management measures

Management measures have been developed specific to the archaeological significance of the Aboriginal sites that would be impacted.

Impact	Environmental safeguards	Responsibility	Timing
Damage to known sites	<ul style="list-style-type: none"> <li>• Obtain an Aboriginal Heritage Impact Permit (AHIP) in respect of PAD1 Area C and PAD2, prior to impacts. This would be an area based permit to cover impacts to objects located in the proposal</li> </ul>	Roads and Maritime Project Manager.	Prior to construction

Impact	Environmental safeguards	Responsibility	Timing
	area as well as the specified sites.		
Unexpected finds – Aboriginal heritage	<ul style="list-style-type: none"> <li>Should an unexpected Aboriginal find be unidentified during construction, all works in the vicinity of the find must cease and the Roads and Maritime 'unexpected archaeological finds procedure' must be followed.</li> </ul>	Construction contractor	Construction

## 6.9 Non-Aboriginal heritage

A preliminary environmental investigation (PEI) of the study area, including the existing bridge and causeway, concluded it has low non-Aboriginal archaeological potential (GHD 2013). The GHD field investigation revealed remnants of the former bridge pylons or supports beneath the existing bridge. The remains did not appear to be extensive, but as there may be impacts to these remnants during the removal of the existing bridge, further assessment was required to determine the significance of these impacts. An assessment of heritage significance for the causeway and bridge remains was prepared as part of the PEI (Artefact Heritage 2012).

The causeway and remains of the former bridge are of local significance for their association with the early development of Burrill Lake and as elements of the first crossing of the Burrill Lake inlet. As the causeway is to be removed, and the remains of the former wooden bridge may be impacted, a Statement of Heritage Impacts (SoHI) was required to assess the impacts of the proposal on built heritage values (provided in full, Appendix J). This chapter summarises the SoHI, prepared by **ngh**environmental (2013).

### 6.9.1 Approach

A desktop assessment was undertaken to determine the heritage values of any objects or places within the proposal area, with a particular focus on the area of the proposed works.

A site visit on 14 August 2013 determined the potential presence of any additional unlisted items that may be of potential heritage significance, and therefore protected under the Heritage Act 1977.

The area searched for the desktop study was restricted to the study area. Heritage database searches were conducted on the 12 August 2013, of the study area included:

- The NSW State Heritage Inventory (for items on the State Heritage Register and Section 170 Heritage and Conservation Registers of State Government agencies).
- The National and Commonwealth Heritage Lists.
- The World Heritage List.
- Heritage items listed by the Shoalhaven City Council LEP.

### 6.9.2 Existing environment

Desktop searches identified one listed heritage item within or close to the proposed project site; Burrill Lake Community Hall, listed on the Shoalhaven LEP.

Table 6-29 Heritage database searches.

Heritage Register	Number of Items
World Heritage	0
National Heritage List	0
Commonwealth Heritage List	0
NSW State Heritage Register	0
NSW State Agency Heritage Registers	0
Shoalhaven LEP Heritage Schedule	1

### 6.9.3 Potential impacts

#### Listed items

The Burrill Lake Community Hall is located about 70 metres from the closest point of the works footprint. The hall is accessed from a minor road in Burrill Lake located off the highway. No direct or indirect impacts as a result of the works would affect the hall and no further assessment is required for this listing.

#### Unlisted items

It is important to note that while many heritage items have been identified and listed on heritage registers at National, State and local levels, some have not. Penalties under the Heritage Act also apply to items destroyed without investigation.

Although not heritage listed, the existing causeway and timber remains of the original Burrill Lake bridge (Figure 6-11 and Figure 6-12) have been assessed previously to be of local heritage significance (Artefact Heritage 2012). The proposal is to remove the existing causeway. Therefore a Statement of Heritage Impact (SoHI) was prepared to assess the impacts of the works on the heritage significance of the causeway and former bridge remains (Appendix J).



Figure 6-11. The south western side of the causeway with sandstone blocks and 1950s bridge.



Figure 6-12. Timber piles below water level under the existing bridge (photo supplied by GHD).

The SOHI determined that the causeway and remains of the former bridge are historically significant as elements of the first crossing of the Burrill Lake inlet. The stone causeway represented a degree of technical achievement in the local context. However, the individual elements of the bridge and causeway do not have considerable significance that would require their retention.

Although the causeway is associated with the original crossing of Burrill Lake it is not considered to have a high enough level of significance as an element of the overall structure to warrant retention. The causeway, originally constructed of sandstone blocks, has in more recent times been stabilised with concrete and the remaining sections that consist only of sandstone is generally not in good condition.

Demolition of the existing bridge and causeway at Burrill Lake, as described by this REF, is not considered likely to lead to a significant impact in accordance with the *NSW Heritage Act 1977*, *Environmental Planning and Conservation Act 1979* or *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*, in terms of heritage.

#### 6.9.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Removal of causeway and bridge	<ul style="list-style-type: none"> <li>Prior to construction works, an archival recording should be prepared for the existing bridge and causeway. This should also include the remains of the original timber piers from the 1880s bridge and follow the guidelines for Items of Local Heritage Significance as outlined in the NSW Heritage Division publication <i>How to Prepare Archival Records of Heritage Items</i>.</li> </ul>	Roads and Maritime	Pre-construction
Discovery of other heritage	<ul style="list-style-type: none"> <li>If unexpected archaeological remains are uncovered during the works, all works must cease in the</li> </ul>	Construction contractor and	Construction

Impact	Environmental safeguards	Responsibility	Timing
items	<p>vicinity of the material/find and the steps in the Roads and Maritime Standard Management Procedure: Unexpected Archaeological Finds must be followed. Roads and Maritime Environment Manager, Southern must be contacted immediately.</p> <ul style="list-style-type: none"> <li>If any items defined as relics under the NSW Heritage Act 1977 are uncovered during the works, all works must cease in the vicinity of the find and the Roads and Maritime Services Environment Manager, Southern contacted immediately.</li> </ul>		

## 6.10 Air quality

### 6.10.1 Existing environment

In general, the air quality in the Shoalhaven City area is considered to be very good (Shoalhaven City Council 2012a). It has comparatively little heavy industry. During summer, vehicle emissions and smoke from bush fires are likely air contaminants. During winter, temporary and relatively minor smoke emissions from solid fuel heaters and fire management burns adversely affect air quality.

Burrill Lake is a small coastal township within the Shoalhaven LGA. No manufacturing is undertaken in the Burrill Lake Township. It had a population of 1328 in 2011. Surrounding features include recreational parks and facilities. Local businesses include caravan parks and retail outlets. Meroo National Park is located south and south-west of Burrill Lake. In general, the absence of large scale industries that emit atmospheric pollutants and the low population density within the area ensures that the air is of a relatively high quality.

A search of the National Pollutant Inventory for the 2011-2012 (Commonwealth Department of Sustainability, Environment, Water, Population and Communities 2012, postcode 2539) for Burrill Lake identified two air pollutant substances from one source. The source is the Ulladulla Sewage Treatment Plant located about 4.5 kilometres northeast of the proposal area.

The main source of emissions for the study area is from vehicles using the Princes Highway.

Receivers within the study area include residential receivers, recreational areas and commercial premises. Some of these are located very close to the proposed construction activities and associated stockpile and compound sites.

### 6.10.2 Criteria

The *Protection of the Environment Operations Act 1997* (POEO Act) requires that no vehicle shall have continuous smoky emissions for more than ten seconds. Limits on dust emission of less than 4mg/m/m<sup>2</sup> are also specified.

### 6.10.3 Potential impacts

#### **Construction and demolition**

During the construction stage, the following activities are likely to temporarily affect local air quality.

- Clearing of vegetation.
- Earthworks.
- Milling of concrete causeway during removal.
- Concrete saw cutting associated with bridge and causeway demolition.
- Stockpiles.
- Road sub-grade preparation and road pavement works.
- Transport and handling of soils and materials.
- Use of construction vehicles leading to the creation of exhaust fumes.

These activities are likely to generate dust and debris as well as exhaust emissions. Impacts are expected to be minimal at distance from the works, as these impact attenuate with distance. However, for residences and businesses fronting the works areas, these are likely to be moderate. Dust and debris would be limited to the construction and demolition works. Exhaust emissions would be present during the works and operation of the new crossing. However, the operation of the new crossing is not expected to have higher emissions than currently produced by the use of the existing crossing.

Impacts on air quality can impact on health, visual amenity, reduce visibility and add sediments to Burrill Lake. Controls would be required to manage impacts to air quality.

### Operation

No additional operational impacts are anticipated.

#### 6.10.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing
Exhaust emissions	<ul style="list-style-type: none"> <li>• Vehicles would be maintained to manufacturer's standards and regular checks would be made to ensure there are no continuous exhaust emissions of 10 seconds or longer.</li> <li>• Vehicles would not be left running idle.</li> </ul>	Contractor	Construction
Air pollution – dust and debris	<ul style="list-style-type: none"> <li>• Measures including watering/ progressive stabilisation of disturbed areas, or wrapping of bridge sections would be used to minimise air pollution.</li> <li>• Surveillance for visible dust generation would occur at all times. Work would cease when levels of airborne dust cannot be controlled.</li> <li>• Works that disturb vegetation, soil or stockpiles would not be carried out during strong winds (over 40km/hour) when this may affect receivers (visibility on roads, dust and debris near recreational areas, residences and commercial premises).</li> <li>• Trucks transporting material to and from the proposal site would</li> </ul>	Contractor	Construction

Impact	Environmental safeguards	Responsibility	Timing
	be covered at all times.		

## 6.11 Socio-economic

### 6.11.1 Existing environment

#### Population demographics

In 2011, the population of Burrill Lake suburb was 1328 people (Australian Bureau of Statistics 2013). The growth rate, over a 25 year period is 1.17 per cent per annum, which is lightly lower than the growth rate for the Shoalhaven LGA. Burrill Lake is characterised by an older population, with almost half the population aged 50 years and over. This reflects the trend of many retirees making a 'sea change' to the area.

#### Economic drivers

The major economic driver for Burrill Lake is tourism, consistent with the broader Shoalhaven LGA. The highest proportions of employed persons work in retail, accommodation and food services (GHD 2013). Census data for Burrill Lake indicates that 29.2 per cent of private dwellings are unoccupied. This is higher than the average for the LGA (27.5 per cent) and over double that for the state (9.7 per cent). It is likely to reflect the high number of dwellings used for holiday rental purposes and underscore the importance of the tourism economy for Burrill Lake. Other important industries for Burrill Lake include health care, social assistance and construction.

Most businesses in Burrill Lake rely strongly on tourist trade. Most Burrill Lake shops front the Princes Highway in a small retail district at either end of the existing crossing. The convenient location of these shops to the highway is likely to be important to securing ongoing trade for these businesses. Refer to Figure 6-8 for the distribution and make-up of the retail district.

#### Role of the transport network

The safety and the efficiency of the road network in Burrill Lake affects private residents, tourists and local business. The majority of employed residents in Burrill Lake (71.2 per cent) are highly dependent on private motor vehicles to travel to work (GHD 2013). It is likely that most people who travel to work by private car would travel via the Princes Highway on a daily basis, with many crossing Burrill Lake Bridge. As the Princes Highway is the major coastal transport link connecting Sydney to Melbourne, Burrill Lake often experiences heavy traffic volumes, leading to traffic congestion at times. This is exacerbated in holiday periods. Shoalhaven City Council notes that the Burrill Lake Bridge plays a vital role in the local transport network, with a variety of road users such as freight companies, large supermarkets, significant services, or workers crossing the bridge on a daily basis. Roads and Maritime is responsible for assisting to maintain vehicular access throughout NSW.

#### Public access and use

Public spaces, mostly associated with the lake and the foreshore area, provide recreational areas to local residents and tourists. Burrill Lake is navigable and boats, kayaks and other recreational devices are used within the lake. Burrill Inlet provides the easiest access to small water craft. Lions Park and foreshore area currently accommodate disabled access. An ablutions block, shelter and seating are provided, in addition to parking. At the eastern end of the study area, an informal track winds alongside the forest (zone 6 (a) Open Space Recreation existing) and provides access south of the highway to the Burrill Lake Tourist Park and foreshore.

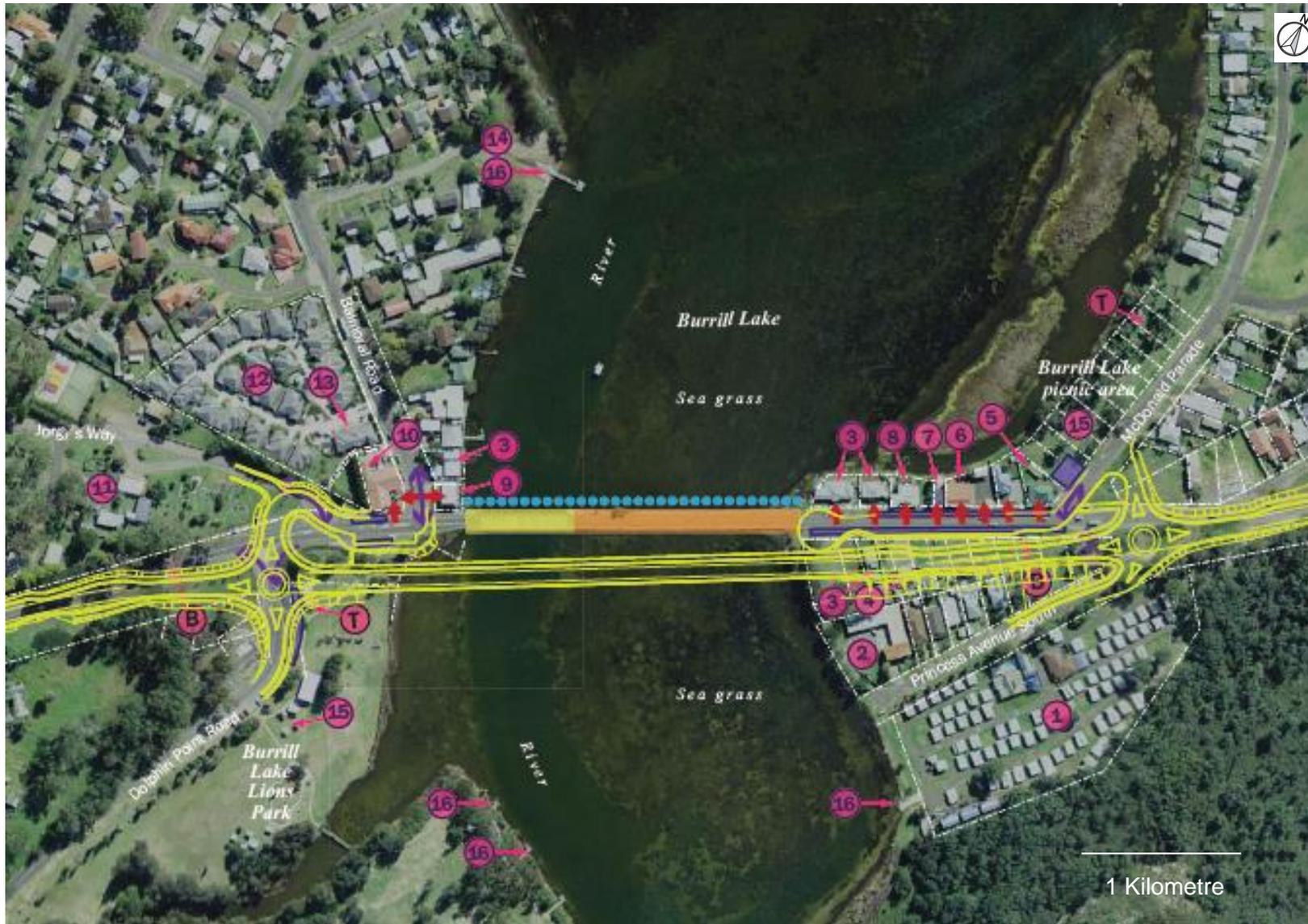


Figure 6-13 Retail district either side of the existing crossing (Source: *Urban design and visual assessment, provided in full, Appendix H*).

### 6.11.2 Potential impacts

#### **Construction and demolition works**

During construction works and the demolition of the existing crossing, potential impacts to the local economy and community are likely to include:

##### *Amenity impacts*

Private residents, tourists and local businesses may be adversely affected where generation of traffic, noise, air emissions and visual impacts occurs in close proximity to receivers (houses, recreational areas, shops). These impacts are discussed individually in other sections of this REF (Noise impacts, section 6.5; Air emissions, section 6.10; Visual impacts, section 6.6). It is noted, however, that older age groups, tourists and businesses may be more sensitive to these impacts. These groups would not obtain respite while at work, away from the site. Some areas, for example foreshore areas adjacent to the works including Lions Park, are likely to be avoided during the height of works. These impacts would also have a higher impact on socio-economics during peak holiday periods due to the increase in people and business. This specifically affects caravan parks and retail outlets that rely on tourism. It is noted that no permanent caravan sites are maintained at either of the caravan parks in Burrill Lake.

##### *Aquaculture*

Water quality and biodiversity impacts that may affect aquaculture businesses in Burrill Lake are discussed in section 6.2 and 6.3. There are no oyster leases in the immediate areas surrounding the existing causeway that may be affected by changed lake bed conditions after the removal of the causeway, as discussed in section 6.2.

##### *Changed traffic conditions*

Traffic impacts are discussed further in Traffic and access, section 6.4. It is noted however that in older age groups, a larger number of pedestrians and greater dependence on public transport may be present. Tourists are unlikely to rely on familiarity with local conditions and may be less affected by traffic changes, provided safety controls (such as adequate signage) and visibility of local features (such as tourist accommodation and retail areas) remains clear.

The existing highway would remain open (at least one lane at all times) as the construction commences, with the existing causeway, bridge and highway decommissioned in the final stage of works. This would ensure that access to retail areas and caravan parks remains open during construction. Speed limits and delays from lane closures however, are likely to increase travel times and reduce the overall level of accessibility for extended periods during construction. Access to all streets intersecting with the Princes Highway would be maintained for the entire duration of the construction period ensuring that no streets (particularly Princes Avenue South) become isolated during works.

Construction works would also generate positive, short term local economic impacts, including:

- Employment for local workers.
- Business for local construction and building supply companies.
- Increased demand for accommodation, fuels and retail facilities

Early and ongoing consultation with local community would be required to minimise adverse local economic impacts and maximise benefits of the proposal, specifically

addressing the issues discussed above:

- Timing of specific works stages, particularly:
  - Haulage of causeway materials which would generate noise, dust and increase traffic volumes. These would affect the businesses on either approach fronting the highway.
  - Tie in works, where the old highway is decommissioned and the new alignment becomes accessible to through traffic. Similarly, this would affect the way consumers access retail facilities fronting the highway and also tourist and recreational facilities (caravan parks on either side of the lake and Lions Park).
- Expected delays (timing and duration of delays).
- Changes to access (particularly, alternative access to Lions Park, but also other local access ways).

These issues are discussed and mitigated in Traffic and access, section 6.4, and are therefore not included in the safeguards below. Additionally, boat traffic would be affected. Consultation regarding changes to boat access has been included as a safeguard below.

## **Operation**

### *Access and amenity*

The proposed works have a number of advantages in the medium to long-term, for the local community and economy. Generally, improved travel safety and efficiency would result from features including improved flood immunity of the crossing, improved cycle and pedestrian access, improved public and emergency service access. This would have benefits for local residents, tourists and local businesses. Regarding pedestrian access, five pedestrian crossing opportunities, including a crossing underneath the highway on the northern approach of the proposed bridge near Princess Avenue South, as well as a crossing between Princess Avenue south and the shops are proposed. Additional fishing areas will be created where the existing highway will be decommissioned and replaced by a fishing platform (southern approach) and cul de sac (northern approach).

Associated landscaping works, discussed in section 6.6, would improve the visual amenity of several recreational areas as well as areas adjacent to the existing retail areas either side of the crossing. The more eastern highway alignment would, however, result in a greater distance between existing retail facilities and the Princes Highway. Parking opportunities directly on the highway to access these shops and visibility from the highway of these shops is likely to be reduced. Furthermore, the relocation of bus stops, Lions Park amenities and parking, may result in longer or less convenient access for some users. This impact is expected to be minor. The upgrade is being undertaken with urban design features that would enhance the overall appearance as well as the safety and efficiency of the transport network and adjacent areas. Traffic changes including the addition of roundabouts which would slow traffic, formalised pedestrian crossings and the retention of the old highway alignment in front of these two retail areas may all act to enhance retail and recreational access and experience, offsetting this impact.

The raised bridge deck and approach height would not adversely affect boat traffic or pedestrian foreshore access. Disabled access is required to be considered further in the detailed proposal design. A specific section under the northern approach may need to be fenced off, being of inadequate height for safe pedestrian access. Security lighting and fencing would be required.

Roundabouts would affect the way local residents travel on the local road network. Some residents would find increased travel distances during operation. This is discussed in detail in section 6.4. The proposed design increases existing transport routes and is not expected to isolate any areas. Improved safety and convenience of access is expected to offset small travel time increases.

Impacts to retail and recreational areas have also been discussed within section 6.11. Impacts to businesses along the existing highway alignment have also been discussed in section 6.4.

### 6.11.3 Safeguards and management measures

Management measures to address construction related amenity impacts are included in sections 6.5, 6.6 and 6.10. These include restricting works during peak tourist periods.

Management measures to address operational impacts including maintaining the visibility of businesses and the enhancement of changes to recreational and retail areas are included in section 6.6. Only additional measures are included below.

Impact	Environmental safeguards	Responsibility	Timing
Operational impacts to community	<ul style="list-style-type: none"> <li>Retain disabled access to relocated bus stops.</li> </ul>	Roads and Maritime	Detailed design
Operational impacts to community	<ul style="list-style-type: none"> <li>Retain disabled access for foreshore areas and pedestrian access to retail areas.</li> </ul>	Roads and Maritime	Detailed design
Operational impacts to community	<ul style="list-style-type: none"> <li>Security lighting and fencing would be required for fenced sections under the northern approach.</li> </ul>	Roads and Maritime	Detailed design
Construction impacts to community	<ul style="list-style-type: none"> <li>Consultation with Roads and Maritime Services (Maritime division) on changes to boat access and use on Burrill Lake would be undertaken prior to construction. Any conditions provided by the Maritime division would be implemented.</li> </ul>	Roads and Maritime	Pre-construction and Construction
Construction impacts to community	<ul style="list-style-type: none"> <li>Community consultation would be implemented to ensure the local community is aware of: <ul style="list-style-type: none"> <li>The construction program and activities.</li> <li>Any employment opportunities for local contractors during construction.</li> <li>Changes to local access, amenities and retail areas.</li> <li>Changes to boat access.</li> </ul> </li> <li>Consultation would continue throughout construction in accordance with a community consultation and liaison plan and</li> </ul>	Roads and Maritime	Pre-construction and Construction

Impact	Environmental safeguards	Responsibility	Timing
	provide mechanisms to record and respond to complaints.		

## 6.12 Land use

### 6.12.1 Existing environment

Land zoning under the current Shoalhaven Local Environment Plan relevant to the proposal include 5(d) Special Uses (Proposed Arterial Roads Reservation and Widening of existing arterial roads reservation) zone. Two property acquisitions are required, also falling with this zone. These properties currently contain residential dwellings fronting the Princes Highway. Adjacent areas are zoned 2(a1) Residential zone, 2(d) Residential Zone, 3(f) Business (Village), 3(g) Business (Development Area), 5(a) Special Use (Sewer pump), 6 (a) Open Space Recreation (existing) and 7(a) Environment Protection (ecology).



Figure 6-14 Land zoning of the proposal area (black rectangle) (Shoalhaven City Council, 2013).

Land uses at the proposal site include:

- Low density residential properties on either side of the lake.
- Tourism including caravan parks on both approaches, recreation open areas including Lions Park on the southern approach and Burrill Lake and holiday rentals.
- Businesses and community services along the existing highway alignment including cafes, fish and chip shop, stand up paddle hire shop, glass gallery, fishing retail, General Practice, newsagent, post office, hairdressers, real estate agent and supermarket.
- Aquaculture licences in Burrill Lake upstream of proposal site but these are not currently being used.

Additionally, National Park is located adjacent to the northern section of the proposal. Low density settlement, farm land, state forests and national parks are present in the broader area.

### 6.12.2 Potential impacts

Traffic impacts would result in changes for local residential traffic as discussed in section 6.4. The changes are appropriate to the traffic conditions and land use in residential areas and no substantive impacts on residential land use are anticipated.

#### *Businesses, tourism, community services*

Impacts of changed traffic conditions are expected to affect businesses currently fronting the highway most. Reduced direct access for vehicles and pedestrian traffic has been addressed in the concept design; parking and pedestrian access would be available in the old highway, provided as cul de sacs, adjacent to the proposed northern and southern approach. Landscaping and material selection is recommended in section 6.6 to offset the changes. The medium to long-term impact is expected to be positive as the cul de sacs would provide a safer more attractive area to access the retail areas. The raised height of the bridge (3 metres) would affect the visibility of this retail area but is intended to provide greater flood immunity for the town and would therefore have a positive impact access to local businesses in these conditions.

Changes further from the approaches would not be as great. The changes are appropriate to the traffic conditions expected into caravan parks and community services. The formalisation of gutter and kerbs, provision of roundabouts and cycles lanes and pedestrian refuges is expected to enhance access to these areas. A vehicle size limit is required on the roundabout to access the eastern caravan park. Signage would be required to direct traffic in this instance.

#### **Operation**

Impacts to retail and recreational areas have also been discussed within section 6.11. Impacts to businesses along the existing highway alignment have also been discussed in section 6.4 and 6.11.

The land on which the proposal would be constructed is zoned for the development of road infrastructure. On the southern approach land would be acquired from the Lions Park and on the northern approach, four blocks of land including houses would be acquired.

The acquiring of a small section of land from the Lions Park would result in the loss of open space and public utilities for tourists and the community. This would be addressed as part of the proposal design, as detailed in section 6.6. The overall improvement in foreshore access and public space is considered to offset this loss.

### 6.12.3 Safeguards and management measures

<b>Impact</b>	<b>Environmental safeguards</b>	<b>Responsibility</b>	<b>Timing</b>
Land acquisition	<ul style="list-style-type: none"> <li>All property acquisition would be undertaken in accordance with the Roads and Maritime land acquisition policy.</li> <li>Compensation would be negotiated in accordance with the Land Acquisition (Just Terms Compensation) Act 1991.</li> <li>Roads and Maritime would consult with the landholders of properties where land is to be acquired.</li> </ul>	Roads and Maritime	Pre-construction

## 6.13 Climate change (and greenhouse gas emissions)

### 6.13.1 Policy setting

The NSW state government has the following targets with regard to greenhouse gas emissions:

- Clean air target – to meet the national air quality goals as identified in the National Environment Protection Measure for Ambient Air Quality.
- Greenhouse gas target – to achieve a 60 per cent cut in greenhouse emissions by 2050 and a return to year 2000 greenhouse gas emission levels by 2025.

### 6.13.2 Methodology

A greenhouse gas assessment was undertaken to assess the greenhouse emissions of the proposal. The assessment was undertaken and prepared in accordance with the following:

- The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard developed by the World Business Council for Sustainable Development.
- Greenhouse Gas Assessment Workbook for Road Projects (Transport Authorities Greenhouse Group 2013).
- Carbon gauge excel spreadsheet (provided by Roads and Maritime).

The emissions for the project were categorised in accordance with the Greenhouse Gas Protocol, as follows:

*Scope one emissions:* Direct greenhouse gas emissions produced by activities of the proposal. This includes combustion of fuels through the use of construction equipment and site vehicles and the clearing of vegetation.

*Scope two emissions:* Indirect greenhouse gas emissions from the purchase of electricity such as for lighting and site offices.

*Scope three emissions:* Indirect greenhouse gas emissions not covered by scope two, including purchased materials / disposal of wastes used for the project.

Carbon gauge excel spreadsheet was then used to determine the amount of greenhouse gas emissions expected to be generated during the construction and operational stage of the proposal.

### 6.13.3 Existing environment

Climate change refers to the warming temperatures and altered climate conditions associated with the increased concentration of greenhouse gases in the atmosphere.

It is now generally accepted that the release of certain gases including, most notably carbon dioxide, contribute to global climate change. These gases are collectively referred to as 'greenhouse gases'. Construction activities where plant and equipment uses diesel, gasoline and other hydrocarbons, result in greenhouse gas emissions and are likely to contribute to climate change.

In 2008, the NSW Government published refined climate change projections for each region in NSW. The projected regional climatic changes by 2050 for NSW Illawarra region predicted the region would become warmer with slightly higher rainfall (DECCW, 2008). Sea level is projected to rise up to 40 centimetres above the 1990

mean sea level by 2050 and by 90 centimetres by 2100 (DECCW, 2008). This may result in changes to the regions flood patterns including localised flooding impacts at river and coastal locations.

The existing crossing of Burrill Lake is already prone to inundation during moderate frequency flood events (currently estimated at between 1 in 10 and 1 in 20 ARI) with recent known inundations in 2007 and 1991. The flooding has ramifications for the integrity of the state road infrastructure as well as to residents for whom the existing crossing provides a flood evacuation route.

#### 6.13.4 Potential impacts

The relevance of climate change to this proposal is twofold:

- Greenhouse gas emissions: During construction and operation, greenhouse gas emissions would be generated. These emissions would contribute to climate change and should therefore be justified and reduced as much as practical.
- The context of climate change has relevance to local flooding and therefore to the design of the crossing.

#### **Construction and decommissioning**

The construction stage of the proposal would generate about 6,896 tonnes of carbon dioxide equivalent (tCO<sub>2</sub>-e) emissions. This can be broken down as follows:

- Scope one emissions: 1,298 tCO<sub>2</sub>-e
- Scope two emissions: 0 tCO<sub>2</sub>-e
- Scope three emissions: 5,598 tCO<sub>2</sub>-e

The use of materials during construction including bridge structures, drainage and pavements would be the major sources of greenhouse gas emissions, accounting for about 91 per cent of the total emissions. Earthworks account for about 9% per cent and the remaining emissions.

The materials selected for the project, primarily steel reinforced concrete, have been selected for their longevity. In maximising the operational life of the crossing and realignment, minimising the need for ongoing maintenance, these materials and their associated emissions are considered to be justified.

The location of the revised alignment is constrained by existing infrastructure and topography, as discussed in section 2.4. Therefore, it is considered that clearing impacts and earthworks have been minimised as much as possible for the project.

#### **Operation**

Considering the operational (long-term) generation of greenhouse gas emissions, over a 50 year period, the most significant contributors were calculated as follows:

- Street lighting: 136 tCO<sub>2</sub>-e.
- Road maintenance: 641 tCO<sub>2</sub>-e.

Street lighting is required for safety. As discussed above, the materials selected for the proposal have been selected for their longevity and are thereby considered to be justified in terms of their associated emissions.

The proposal works have considered the predicted climate change impacts for the

region. The new crossing would be trafficable in a current 1:100 year flood event. This has positive impacts for the community and emergency services access.

### 6.13.5 Safeguards and management measures

Controls relevant to minimising emissions (efficient operation of plant, minimising areas disturbed by the works including clearing) and preparedness for flooding during construction and operation are addressed in sections 6.2 and 6.10 and are not duplicated here.

Impact	Environmental safeguards	Responsibility	Timing
Greenhouse gas emissions	<ul style="list-style-type: none"> <li>Consider the use of renewable energy to power the site compound (e.g. solar panels) or the contribution to green energy programs.</li> </ul>	Construction Contractor	Pre-construction and during construction
Greenhouse gas emissions	<ul style="list-style-type: none"> <li>Where feasible and reasonable, procure recycled content road construction and maintenance materials such as recycled aggregates in road pavement and surfacing.</li> </ul>	Construction contractor	Pre-construction and construction
Greenhouse gas emissions	<ul style="list-style-type: none"> <li>Where feasible and reasonable select the most fuel efficient plant, equipment and vehicles available through consultation with subcontractors and suppliers.</li> <li>Maintain all plant and vehicles regularly to maintain fuel efficiency.</li> <li>Procure locally produced goods and services where feasible, reasonable and cost effective to reduce transport fuel emissions.</li> <li>Alternative fuel and power sources (such as biodiesels and ethanol blends) would be used wherever practicable.</li> </ul>	Construction contractor	Construction

## 6.14 Cumulative impacts

Cumulative environmental 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.

### 6.14.1 Existing environment

One additional highway upgrade project was identified as potentially relevant to the proposed works. This involves upgrades to the Princes Highway at Termeil Creek, south of Burrill Lake.

### 6.14.2 Potential impacts

#### **Construction and decommissioning**

Cumulative adverse impacts could result from the combined noise, air quality, traffic and other impacts, for receivers located near to the construction activities. These impacts are considered best managed on an individual basis and have been addressed separately in this REF.

Where construction of other road upgrades or large infrastructure projects may occur concurrent with the proposal, haulage traffic may create additional delays and traffic hazards. Measures to address this issue have been included in section 6.4.

### **Operation**

Combined with other road upgrades in the region, the implementation of the proposal would improve the local and regional transport network. Positive cumulative traffic impacts would result, including:

- Safer travelling conditions, including for cyclists and pedestrians.
- Improved flood immunity for local and regional motorists.
- Provide new infrastructure that is consistent with the future provision of a Milton Ulladulla Bypass.

#### **6.14.3 Safeguards and management measures**

It is considered that the potential for adverse cumulative impact is most effectively addressed by the application of the individual impact area safeguards recommended in this REF. No additional measures are considered warranted.

## 7 Environmental management

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### 7.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Project Environmental Management Plan (PEMP) and a Contractors Environmental Management Plan (CEMP) would be prepared to describe safeguards and management measures identified. These plans would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The plans would be prepared prior to construction of the proposal and must be reviewed and certified by the Roads and Maritime Services Environmental Officer, Southern Region, prior to the commencement of any on-site works. The CEMP would be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP and PEMP would be developed in accordance with the specifications set out in the QA Specification G36 – Environmental Protection (Management System), QA Specification G38 – Soil and Water Management (Soil and Water Plan) and the QA Specification G40 – Clearing and Grubbing.

### 7.2 Summary of safeguards and management measures

Environmental safeguards outlined in this document would be incorporated into the detailed design stage of the proposal and during construction and operation of the proposal, should it proceed. These safeguards would minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7.1.

Table 7.1: Summary of site specific environmental safeguards.

No.	Impact	Environmental safeguards	Responsibility	Timing
1	General	<ul style="list-style-type: none"> <li>• All environmental safeguards must be incorporated within the following documents:                             <ul style="list-style-type: none"> <li>○ Project Environmental Management Plan</li> <li>○ Detailed design stage</li> <li>○ Contract specifications for the proposal</li> <li>○ Contractor's Environmental Management Plan</li> </ul> </li> </ul>	Project manager	Pre-construction
2	General	<ul style="list-style-type: none"> <li>• A risk assessment has been/ must be carried out on the Proposal in accordance with the Roads and Maritime Services Audit Pack and Operations and Services (OSD) risk assessment procedures to determine an audit and inspection program for the works. The recommendations of the risk assessment are to be implemented.</li> <li>• A review of the risk assessment must be undertaken after the initial audit or inspection to evaluate is the level of risk chosen for the project is appropriate.</li> <li>• Any works resulting from the proposal and as covered by the REF may be subject to environmental audit(s) and/or inspection(s) at any time during their duration.</li> </ul>	Project manager and regional environmental staff	Pre-construction  After first audit
3	General	<ul style="list-style-type: none"> <li>• The environmental contract specification [insert name] must be forwarded to the Roads and Maritime Services Environment Manager, Southern for review at least 10 working days prior to the tender stage.</li> <li>• A contractual hold point must be maintained until the CEMP is reviewed by the Roads and Maritime Services Environment Manager, Southern.</li> </ul>	Project manager	Pre-construction
4	General	<ul style="list-style-type: none"> <li>• The Roads and Maritime Services Project Manager must notify the Roads and Maritime Services Environment Manager, Southern at least 5 days prior to work commencing.</li> </ul>	Project manager	Pre-construction

5	General	<ul style="list-style-type: none"> <li>All businesses and residences likely to be affected by the proposed works must be notified at least 5 working days prior to the commencement of the proposed activities.</li> </ul>	Project manager	Pre-construction
6	General	<ul style="list-style-type: none"> <li>Environmental awareness training must be provided, by the contractor, to all field personnel and subcontractors.</li> </ul>	Contractor	Pre-construction and during construction as required.
7	Soil management	<ul style="list-style-type: none"> <li>Construction would be managed in accordance with the Blue Books 1 and 2D; Managing Urban Stormwater, Soils &amp; Construction, Volume 1 (Landcom 2004) and Managing Urban Stormwater, Soils and Construction, Volume 2D, Main Road Construction (DECC 2008).</li> <li>As the disturbance area is in excess of 2.5 hectares, a soil and water management plan would be prepared as part of the construction environmental management plan.</li> <li>Environmental Work Method Statements (EWMS) would be developed and implemented for high risk activities including abutment removal, construction of working platform and causeway removal.</li> <li>Site-specific erosion and sediment control plan/s would include the following: <ul style="list-style-type: none"> <li>Measures to ensure that the site is adequately protected when rain is forecast.</li> <li>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.</li> <li>Measures to minimise the area of disturbance and the amount of disturbance (traffic or compaction from material laydown) over areas that would, on completion, be retained as vegetated areas.</li> <li>Measures to protect drainage lines from disturbance or the entry of polluted run-off.</li> </ul> </li> </ul>	Construction contractor	Construction

		<ul style="list-style-type: none"> <li>○ Measures to contain sediments during works near water sources (silt curtain).</li> <li>● Stockpiles would be managed in accordance with the Stockpile Site Management Guideline (RTA 2011a).</li> </ul>		
8	Contamination: Acid Sulfate Soils	<ul style="list-style-type: none"> <li>● The soil and water management plan would include management measures for excavation near and within Potential Acid Sulfate Soils (PASS) (Fill 2 and Alluvial sediments).</li> <li>● The 'Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze' (RTA, 2005) would be used as a guide for management of ASS.</li> <li>● Additional testing of the stockpiled soil arising from construction to ascertain the correct liming rate for the stockpile would be undertaken.</li> </ul>	Construction contractor	Construction
9	Contamination: Asbestos	<ul style="list-style-type: none"> <li>● Known areas of asbestos within the works footprint would be removed prior to earth works. This includes scupper pipes from the existing bridge as well as two additional locations (near the proposed southern roundabout and near the proposed northern bridge abutment) where asbestos fibres were identified in fill material.</li> <li>● Asbestos removal and disposal shall be undertaken by a Class A licensed asbestos remover. Removal would be undertaken in accordance with the Safe Work Australia How To Safely Remove Asbestos Code of Practice (December 2011). This would include the preparation and compliance with an approved Asbestos Removal Control Plan.</li> <li>● The transport and disposal of asbestos would be undertaken under a license obtained in accordance with Clause 42 of Protection of the Environment Operations (Waste) Regulation 2005.</li> </ul>	Construction contractor	Construction

10	Contamination: Other	<ul style="list-style-type: none"> <li>If signs of contaminated soils are discovered (e.g. smell, discolouration, suspect rubbish), the site would be marked and the soil replaced to cover the contamination. The soil would be analysed without delay to determine the type of contamination and an appropriate management plan would then be developed and followed.</li> </ul>	Construction contractor	Construction
11	Pollution	<ul style="list-style-type: none"> <li>Materials that could be pollutants in soil (including fuels, cement) would be stored and handled in accordance with their material safety data sheets.</li> </ul>	Roads and Maritime	Construction
12	Pollution	<ul style="list-style-type: none"> <li>Drainage systems would be checked at regular intervals and maintained to ensure they are operating at full capacity (e.g. clearance of debris from drainage lines).</li> </ul>	Roads and Maritime	Operation
13	Disturbance to lake bed	<ul style="list-style-type: none"> <li>Temporary rock platforms would be designed and constructed in accordance with the technical criteria example, Appendix C.</li> </ul>	Roads and Maritime	Pre-construction
14	Water pollution	<ul style="list-style-type: none"> <li>As part of the construction environmental management plan, EWMS would be prepared and implemented for pile driving works and the demolition of the existing bridge and causeway. The content of the EWMS would include but not be limited to: <ul style="list-style-type: none"> <li>Description of the works/activities including machinery to be used.</li> <li>Outline of the sequence of the work/activities, including interfaces with other construction activities.</li> <li>Identification of potential environmental risks/impacts due to the works/activities <i>and</i> associated with wet weather events.</li> <li>Evaluation of methods to eliminate/reduce the environmental risk.</li> <li>Mitigation measures to reduce environmental risk.</li> <li>Any safeguards resulting from consultation with public authorities and other stakeholders, when appropriate.</li> <li>A map indicating the locations of sensitive locations (such as threatened species or heritage items), likely potential environmental impacts, and work areas.</li> </ul> </li> </ul>	Construction contractor	Pre-construction & construction

		<ul style="list-style-type: none"> <li>○ Identification of work area and exclusion areas.</li> <li>○ A process for progressive review, eg monitoring processes and methods to eliminate/reduce environmental risks/impacts.</li> </ul>		
15	Flooding	<ul style="list-style-type: none"> <li>● As part of the construction environmental management plan, a procedure would be prepared to identify potential flood threats and an evacuation procedure for dispersible materials, hazardous materials and equipment containing such materials. The procedure would include: <ul style="list-style-type: none"> <li>○ Regular consultation of the Bureau of Meteorology website for weather forecasts and flood warnings</li> <li>○ Scheduling of activities on land subject to flooding to avoid high flow periods.</li> <li>○ A process for removing equipment and materials off site and out of flood risk areas quickly.</li> <li>○ Storing and use of fuels and chemicals away from the flood zone, in bunded areas.</li> </ul> </li> </ul>	Construction contractor	Construction
16	Pollution (water and soil)	<ul style="list-style-type: none"> <li>● Concrete wash areas would be clearly sign posted and would allow for the chute only to be cleaned on site.</li> </ul>	Construction contractor	Construction
17	Pollution (water and soil)	<ul style="list-style-type: none"> <li>● As part of the construction environmental management plan, a spill management plan would be developed and implemented and would include measures for refuelling, maintenance of machinery and response and notification procedures. It would also include storage of potential pollutants: <ul style="list-style-type: none"> <li>○ All fuels, chemicals, and liquids would be stored at least 50 metres away from any waterways or drainage lines and would be stored in an impervious bunded area. If this is not possible, storage would be undertaken as far from waterways as possible on flat ground in an impervious double bund.</li> <li>○ Refuelling of plant and maintenance of machinery would</li> </ul> </li> </ul>	Construction contractor	Pre-construction & construction

		<p>be undertaken in impervious bunded areas at least 50 metres away from any waterways or drainage lines. If this is not possible, refuelling would be undertaken as far from waterways as possible on flat ground in an impervious double bund.</p> <ul style="list-style-type: none"> <li>○ Vehicle wash downs would be undertaken within a designated impervious bunded area or undertaken off-site.</li> <li>○ Machinery would be regularly checked to ensure there is no oil, fuel or other liquids leaking from the machinery, including daily checks of machinery and equipment to be used for bridge works.</li> </ul>		
18	Pollution (water and soil)	<ul style="list-style-type: none"> <li>● If a spill occurs: <ul style="list-style-type: none"> <li>○ The Roads and Maritime's Environmental Incident Classification and Management Procedure would be followed and the Roads and Maritime Contract Manager notified as soon as practicable.</li> <li>○ EPA would be informed of all notifiable spills.</li> </ul> </li> </ul>	Construction contractor	During construction
19	Pollution (water)	<ul style="list-style-type: none"> <li>● The requirement for permanent detention basins would be investigated during detailed design and, if required, may be subject to a separate environmental impact assessment.</li> </ul>	Roads and Maritime	Pre-construction
20	Clearing	<ul style="list-style-type: none"> <li>● 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.</li> <li>● Trees designated for clearing would be removed in such a way as not to cause damage to surrounding vegetation. This would ensure groundcover disturbance would be kept to a minimum.</li> <li>● 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).</li> </ul>	Contractor	Pre-construction and construction

		<ul style="list-style-type: none"> <li>• Where possible, work would not encroach into dripline of trees to be retained. This zone is defined as the Tree Protection Zone (TPZ) and is ordinarily around 5m from the base of the tree.</li> <li>• All vegetation removal would be in accordance with the Roads and Maritime Biodiversity Guidelines – Protecting and Managing Biodiversity on RTA Projects (RTA 2011).</li> <li>• A permit under Part 7 of the Fisheries Management Act to harm saltmarsh would be required.</li> </ul>		
21	Erosion and/or disturbance to Burrill Lake and lake margins	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Erosion control would include: <ul style="list-style-type: none"> <li>○ Measures to ensure that the site is adequately protected when rain is forecast.</li> <li>○ 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.</li> <li>○ 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.</li> </ul> </li> </ul>	Roads and Maritime, contractor	Pre-construction and construction
22	Damage to native vegetation outside of impact zone	<ul style="list-style-type: none"> <li>• Stockpiling materials and equipment and parking vehicles would be avoided within the dripline of any tree.</li> </ul>	Contractor	Construction
23	Introduction and spread of noxious weeds and pathogens	<ul style="list-style-type: none"> <li>• A Weed Management Plan would be developed for the sites to prevent/minimise the spread of weeds in and between sites, in accordance with Guide 6 (Weed Management) in the Roads and Maritime Biodiversity Guidelines (RTA 2011) and Shoalhaven City Council control plan for each noxious weed.</li> <li>• Declared noxious weeds would be managed according to the</li> </ul>	Contractor	Construction

		<p>requirements stipulated by the Noxious Weeds Act 1993, and any weed removal activities would be in accordance with Guide 6 (Weed Management) in the Roads and Maritime Biodiversity Guidelines (RTA 2011).</p> <ul style="list-style-type: none"> <li>• Regular targeted control of noxious and environmental weeds would take place during construction to manage noxious weeds. <ul style="list-style-type: none"> <li>○ 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 to prevent spread of potential pathogens and weeds. Vehicle wash downs would be undertaken within a designated impervious bunded area.</li> </ul> </li> <li>• All plant material containing seed heads, weeds that have allopathic properties, and weeds that are able to reproduce vegetatively (e.g. Wandering Jew and Willows), including topsoil containing weed propagules, would be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth.</li> <li>• Weed-free fill would be used for on-site earthworks.</li> <li>• All 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.</li> <li>• Any occurrences of pathogens such as Myrtle Rust and Phytophthora will be monitored and treated as per Guide 7 (Pathogen Management) of the Roads and Maritime Biodiversity Guidelines (RTA 2011).</li> </ul>		
24	Disturbance to	<ul style="list-style-type: none"> <li>• A permit under Part 7 of the Fisheries Management Act to harm</li> </ul>	Roads and Maritime,	Construction,

	seagrass meadows	<p>seagrass would be required.</p> <ul style="list-style-type: none"> <li>• 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).</li> <li>• The use of boats and barges in seagrass beds would be minimised where possible.</li> <li>• 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).</li> <li>• Anchoring would not occur within seagrass beds. Support vessels would be moored to the barge to prevent any damage to seagrass beds.</li> <li>• A seagrass monitoring design following a Before After Control Impact (BACI) shall be prepared and implemented prior to the commencement of construction to determine the degree of impact to seagrass.</li> </ul>	contractor	Post-construction
25	Disturbance to fallen timber, dead wood and bush rock	<ul style="list-style-type: none"> <li>• 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 (refer to Guide 5 Re-use of woody debris and bushrock of the Roads and Maritime Biodiversity Guidelines (RTA 2011) for guidance).</li> </ul>	Contractor	Construction
26	Removal and replacement of native vegetation and/or fauna habitat	<ul style="list-style-type: none"> <li>• A 'Clearing and Grubbing Plan' would be developed in accordance with Guide 4 (clearing of vegetation) of the Roads and Maritime Biodiversity Guidelines (RTA 2011). This will include best practice methods for the removal of woody vegetation and non-woody vegetation.</li> <li>• A pre-clearing process and unexpected threatened species finds procedure would be implemented before clearing begins</li> </ul>	Roads and Maritime, contractor	Construction and post-construction

		<p>according to Guide 1 of the Roads and Maritime Biodiversity Guidelines (RTA 2011). This would include checking bridge piers and infrastructure for microbats prior to any construction works.</p> <ul style="list-style-type: none"> <li>• Revegetation of any bare soil or cleared areas with locally-occurring native flora species typical of the original habitat types should occur (refer to flora species list in Appendix B of the Biodiversity Assessment for guidance).</li> </ul>		
27	Traffic safety during construction	<ul style="list-style-type: none"> <li>• A detailed Traffic Management Plan would be prepared in accordance with the Roads and Maritime Traffic Control at Work Sites Manual Version 4 (RTA 2010), and approved by Roads and Maritime and Council prior to implementation. The Traffic Management Plan would consider other developments that may also be under construction close to proposed works and be submitted for approval prior to any works commencing. The plan would include consideration of the following items: <ul style="list-style-type: none"> <li>○ Continuing safe access during construction should be provided for pedestrians between the public rest area (Lions Park) adjacent to the southern bridge abutment and the shops near Balmoral Road. This route would also provide for shoppers and recreational walkers.</li> <li>○ Continuing safe access during construction should be provided for pedestrians Princess Avenue South and the shops on Princes Highway.</li> </ul> </li> <li>• The number of parking spaces adjacent to shops should be maintained during construction.</li> <li>• Provision for regular consultation with residents and business operators regarding changed traffic conditions.</li> <li>• Restriction of construction during NSW school holiday periods.</li> <li>• Monitoring of traffic delays and accidents.</li> <li>• Adoption of minimum delay times for control of traffic.</li> <li>• A code of conduct for the operators of delivery vehicles</li> </ul>	Construction contractor	Pre-construction

		<p>accessing the work site.</p> <ul style="list-style-type: none"> <li>• Provision for the continuing operation of all bus services during construction (allocation of alternative bus stopping bays).</li> <li>• Detailed haulage protocols to minimise the impacts of cartage (i.e. fill, spoil etc.) on adjacent properties. For example, consideration of: <ul style="list-style-type: none"> <li>○ Minimising of truck numbers and haulage distance (i.e. maximising reuse where appropriate).</li> <li>○ Provision of temporary highway access for waste removal.</li> <li>○ Covering of loads to minimise dust and odour.</li> </ul> </li> </ul>		
28	Construction noise	<ul style="list-style-type: none"> <li>• Any work that is performed outside normal work hours or on Sundays or public holidays is to minimise noise impacts in accordance with the RMS Noise Management Manual and the NSW Interim construction noise guidelines.</li> </ul>	Construction Contractor	Construction
29	Construction noise	<ul style="list-style-type: none"> <li>• As part of the construction environmental management plan, a construction noise and vibration management plan would be developed and implemented in accordance with OEH/EPA's ICNG.</li> </ul>	Construction Contractor	Construction
30	Construction noise	<ul style="list-style-type: none"> <li>• Noise impacts are to be minimised in accordance with Practice Note 7 in the Roads and Maritime's Environmental Noise Management Manual and Roads and Maritime's Environmental fact sheet No. 2- Noise management and Night Works.</li> </ul>	Construction Contractor	Construction
31	Construction noise	<ul style="list-style-type: none"> <li>• All reasonable and feasible noise control measures would be implemented prior to the commencement of construction works.</li> </ul>	Construction Contractor	Construction
32	Construction noise monitoring	<ul style="list-style-type: none"> <li>• Noise monitoring would be undertaken in the following cases: <ul style="list-style-type: none"> <li>○ Where potential noise impacts are predicted to be within 10 to 15dB(A) of the noise management level, to confirm predicted noise impacts within two weeks of commencement of construction.</li> <li>○ Where potential noise impacts are predicted to be more than 15dB(A) above the noise management levels.</li> </ul> </li> </ul>	Construction Contractor	Construction

		<ul style="list-style-type: none"> <li>Noise compliance monitoring for all major equipment and activities on the sites would be undertaken prior to their commencement of work on site.</li> <li>Further noise reduction measures (where reasonable and feasible) would be implemented (e.g. restrict working hours, use silencing equipment) where noise management levels are exceeded.</li> </ul>		
33	Construction vibration	<ul style="list-style-type: none"> <li>Where construction activity occurs in close proximity to sensitive receivers, vibration testing of actual equipment on site would be carried out prior to site operation to determine acceptable buffer distances to the nearest affected receiver locations.</li> </ul>	Construction Contractor	Construction
34	Construction vibration	<ul style="list-style-type: none"> <li>Building dilapidation surveys would be conducted specific to equipment and distances identified in the last column of table 6-6 in Burrill Lake Noise Assessment (Renzo Tonin 2013). This is to address potential community concerns (equipment identified includes vibratory rollers, pile boring, jackhammers, compactors, graders, excavators and truck movements).</li> </ul>	Construction Contractor	Construction
35	Construction noise and vibration complaints	<ul style="list-style-type: none"> <li>A noise and vibration complaints procedure would be developed and implemented. This would include the following: <ul style="list-style-type: none"> <li>Each complaint would be investigated.</li> <li>Appropriate noise / vibration amelioration measures would be put in place to mitigate future occurrences, where construction noise / vibration is in excess of allowable limits.</li> </ul> </li> </ul>	Construction Contractor	Construction
36	Construction vibration	<ul style="list-style-type: none"> <li>Where vibration is found to be excessive, management measures would be implemented to ensure vibration compliance is achieved.</li> <li>Burrill Lake Noise Assessment (Renzo Tonin 2013) provides a range of management measures and buffer distances to be considered and implemented as required.</li> </ul>	Construction Contractor	Construction
37	Construction vibration	<ul style="list-style-type: none"> <li>Attended vibration monitoring is to be undertaken in the</li> </ul>	Construction Contractor	Construction

	monitoring	<p>following cases:</p> <ul style="list-style-type: none"> <li>○ At the commencement of operation for each plant or activity on site, which has the potential to generate significant vibration levels, in order to provide site-specific minimum working distances.</li> <li>○ Where it is not feasible to modify construction methodology to reduce vibration within the safe working distances for cosmetic damage.</li> <li>○ For short periods of potential risk for cosmetic damage to buildings and structures.</li> <li>○ Where deemed to be relevant in response to a vibration related complaint.</li> <li>○ Where attended vibration monitoring is not feasible, a permanent vibration monitoring system is to be installed to warn plant operators (via flashing light, audible alarm, etc.) that there is potential for cosmetic damage to buildings and structures.</li> </ul>		
38	Operational traffic noise	<ul style="list-style-type: none"> <li>● Properties calculated to have acute noise levels would be considered for noise mitigation:</li> <li>● A 1.2 metre high barrier at the top of the northern approach embankment at a length of 104 metres would be provided to attenuate noise to residential receivers within NCA 2 as identified in Renzo Tonin 2013.</li> </ul>	Roads and Maritime	Detailed design
39	Operational traffic noise monitoring	<ul style="list-style-type: none"> <li>● Operational noise monitoring would: <ul style="list-style-type: none"> <li>○ Be undertaken in accordance with Practice Note VIII of Roads and Maritime's ENMM.</li> <li>○ Would assess the adequacy of the traffic noise mitigation measures determined during the detailed design stage.</li> <li>○ Be conducted within two to twelve months of project completion, at selected representative locations to give a minimum of seven days of data (excluding adverse weather).</li> </ul> </li> </ul>	Roads and Maritime	Operation

		<ul style="list-style-type: none"> <li>○ Locations would be selected to represent the potentially most affected noise-sensitive receptors in each NCA, and to correlate with noise monitoring locations selected prior to the construction of the upgrade.</li> <li>● Classified traffic monitoring would be conducted simultaneously with the noise monitoring to identify traffic flows and compositions.</li> <li>● Further noise mitigation measures would be investigated where a clear trend in higher than predicted traffic noise levels in excess of the noise goals is found.</li> </ul>		
40	Operational traffic noise management	<ul style="list-style-type: none"> <li>● If post construction noise monitoring indicates operational noise levels exceed the design noise level for year 1, then: <ul style="list-style-type: none"> <li>○ If exceeded by 2 dB(A) or less, the noise data would be examined, the prediction methodology and suitability of mitigation measures would be reassessed and the reasons for the marginal exceedance(s) be identified and reported.</li> <li>○ If exceeded by more than 2 dB(A), the adequacy of the noise mitigation needs to be reviewed, and if problems are identified steps need to be taken to rectify the situation. Additional noise treatments may be required to achieve the design noise level, where this is feasible and reasonable.</li> </ul> </li> </ul>	Roads and Maritime	Operation
41	Visual impact - construction	<ul style="list-style-type: none"> <li>● Maintain a tidy worksite.</li> <li>● Schedule construction activities that would have a high visual impact such as demolition works to outside peak holiday periods.</li> </ul>	Construction contractor	Construction
42	Visual impact - operation	<ul style="list-style-type: none"> <li>● Finalise the detailed design of the proposal in consideration of: <ul style="list-style-type: none"> <li>○ The design and detailing of the visual elements of the bridge, in particular its superstructure elements, piers and headstocks, barriers and handrail, shared path connections and depth of structure.</li> </ul> </li> </ul>	Roads and Maritime	Detailed design stage.

		<ul style="list-style-type: none"> <li>○ Landscape screening where appropriate in consideration with other design principles including maintaining views and safety considerations.</li> <li>○ The design of public elements (such as the shared/foot path, stairs and handrails, screening fence and its associated landscape zone, roundabouts, the detailing and finishes of the new public spaces).</li> <li>○ The provision of landscape and street trees to improve the overall amenity within the two village shopping areas affected by the proposal.</li> <li>○ New signage to signify the location of the village centre and connecting local roads. Directional signage for pedestrians may also be required.</li> <li>○ Creation of two public spaces at either end of the old crossing, providing opportunities to enjoy the water front close to the shopping areas.</li> <li>○ Improved pedestrian facilities and a greater level of connectivity in general in the areas affected by the proposal.</li> <li>○ Stabilisation of new embankments and cuttings with native plants, blended into bushland where adjacent to it.</li> <li>○ At locations where greater visual impacts have been identified, larger sized trees may be planted to help reduce the visual impact in the short to medium term.</li> <li>○ Avoiding 2:1 or greater batter slopes, as far as practical.</li> <li>○ Additional landscaping works in Lions Park.</li> </ul>		
43	Waste	<ul style="list-style-type: none"> <li>● A Waste Management Plan would be prepared for construction and operation which would include the following: <ul style="list-style-type: none"> <li>○ Identify all potential waste streams associated with the works.</li> <li>○ Identify opportunities to minimise the use of resources, and to reuse and recycle materials.</li> </ul> </li> </ul>	Construction Contractor	Pre-construction

		<ul style="list-style-type: none"> <li>○ 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.</li> <li>○ Outline methods to keep the facility free of litter during operation</li> </ul>		
44	Waste	<ul style="list-style-type: none"> <li>● Cleared vegetation would not be burnt at the site. If suitably weed free, the vegetation can be mulched and used in stabilising the disturbed areas in rehabilitation.</li> <li>● Garbage receptacles would be provided and recycling of materials encouraged. Rubbish would be transported to an appropriate waste disposal facility.</li> <li>● Working areas are to be maintained, kept free of rubbish and cleaned up at the end of each working shift</li> <li>● All waste would be managed in accordance with the Protection of the Environment Operations Act 1997 (POEO Act).</li> <li>● Toilets (e.g. portable toilets) would be provided for construction workers.</li> </ul>	Construction Contractor	During Construction
45	Waste disposal: Asbestos and contaminated soils	<ul style="list-style-type: none"> <li>● All waste would be disposed of at facilities able to accept the materials.</li> </ul>	Construction Contractor	During Construction
46	Damage to known sites	<ul style="list-style-type: none"> <li>● Obtain an Aboriginal Heritage Impact Permit (AHIP) in respect of PAD1 Area C and PAD2, prior to impacts. This would be an area based permit to cover impacts to objects located in the proposal area as well as the specified sites.</li> </ul>	Roads and Maritime Project Manager.	Prior to construction
47	Unexpected finds – Aboriginal heritage	<ul style="list-style-type: none"> <li>● Should an unexpected Aboriginal find be unidentified during construction, all works in the vicinity of the find must cease and the Roads and Maritime ‘unexpected archaeological finds procedure’ must be followed.</li> </ul>	Construction contractor	Construction

48	Removal of causeway and bridge	<ul style="list-style-type: none"> <li>• Prior to construction works, an archival recording should be prepared for the existing bridge and causeway. This should also include the remains of the original timber piers from the 1880s bridge and follow the guidelines for Items of Local Heritage Significance as outlined in the NSW Heritage Division publication How to Prepare Archival Records of Heritage Items.</li> </ul>	Roads and Maritime	Pre-construction
49	Discovery of other heritage items	<ul style="list-style-type: none"> <li>• If unexpected archaeological remains are uncovered during the works, all works must cease in the vicinity of the material/find and the steps in the Roads and Maritime Standard Management Procedure: Unexpected Archaeological Finds must be followed. Roads and Maritime Environment Manager, Southern must be contacted immediately.</li> <li>• If any items defined as relics under the NSW Heritage Act 1977 are uncovered during the works, all works must cease in the vicinity of the find and the Roads and Maritime Services Environment Manager, Southern contacted immediately.</li> </ul>	Construction contractor and	Construction
50	Exhaust emissions	<ul style="list-style-type: none"> <li>• Vehicles would be maintained to manufacturer's standards and regular checks would be made to ensure there are no continuous exhaust emissions of 10 seconds or longer.</li> <li>• Vehicles would not be left running idle.</li> </ul>	Contractor	Construction
51	Air pollution – dust and debris	<ul style="list-style-type: none"> <li>• Measures including watering/ progressive stabilisation of disturbed areas, or wrapping of bridge sections would be used to minimise air pollution.</li> <li>• Surveillance for visible dust generation would occur at all times. Work would cease when levels of airborne dust cannot be controlled.</li> <li>• Works that disturb vegetation, soil or stockpiles would not be carried out during strong winds (over 40km/hour) when this may affect receivers (visibility on roads, dust and debris near recreational areas, residences and commercial premises).</li> <li>• Trucks transporting material to and from the proposal site would be covered at all times.</li> </ul>	Contractor	Construction

52	Operational impacts to community	<ul style="list-style-type: none"> <li>Retain disabled access to relocated bus stops.</li> </ul>	Roads and Maritime	Detailed design
53	Operational impacts to community	<ul style="list-style-type: none"> <li>Retain disabled access for foreshore areas and pedestrian access to retail areas.</li> </ul>	Roads and Maritime	Detailed design
54	Operational impacts to community	<ul style="list-style-type: none"> <li>Security lighting and fencing would be required for fenced sections under the northern approach.</li> </ul>	Roads and Maritime	Detailed design
55	Construction impacts to community	<ul style="list-style-type: none"> <li>Consultation with Roads and Maritime Services (Maritime division) on changes to boat access and use on Burrill Lake would be undertaken prior to construction. Any conditions provided by the Maritime division would be implemented.</li> </ul>	Roads and Maritime	Pre-construction and Construction
56	Construction impacts to community	<ul style="list-style-type: none"> <li>Community consultation would be implemented to ensure the local community is aware of: <ul style="list-style-type: none"> <li>The construction program and activities.</li> <li>Any employment opportunities for local contractors during construction.</li> <li>Changes to local access, amenities and retail areas.</li> <li>Changes to boat access.</li> </ul> </li> <li>Consultation would continue throughout construction in accordance with a community consultation and liaison plan and provide mechanisms to record and respond to complaints.</li> </ul>	Roads and Maritime	Pre-construction and Construction
57	Land acquisition	<ul style="list-style-type: none"> <li>All property acquisition would be undertaken in accordance with the Roads and Maritime land acquisition policy.</li> <li>Compensation would be negotiated in accordance with the Land Acquisition (Just Terms Compensation) Act 1991.</li> <li>Roads and Maritime would consult with the landholders of properties where land is to be acquired.</li> </ul>	Roads and Maritime	Pre-construction
58	Greenhouse gas emissions	<ul style="list-style-type: none"> <li>Consider the use of renewable energy to power the site compound (e.g. solar panels) or the contribution to green</li> </ul>	Construction Contractor	Pre-construction and during construction

		energy programs.		
59	Greenhouse gas emissions	<ul style="list-style-type: none"> <li>Where feasible and reasonable, procure recycled content road construction and maintenance materials such as recycled aggregates in road pavement and surfacing.</li> </ul>	Construction contractor	Pre-construction and construction
60	Greenhouse gas emissions	<ul style="list-style-type: none"> <li>Where feasible and reasonable select the most fuel efficient plant, equipment and vehicles available through consultation with subcontractors and suppliers.</li> <li>Maintain all plant and vehicles regularly to maintain fuel efficiency.</li> <li>Procure locally produced goods and services where feasible, reasonable and cost effective to reduce transport fuel emissions.</li> <li>Alternative fuel and power sources (such as biodiesels and ethanol blends) would be used wherever practicable.</li> </ul>	Construction contractor	Construction

### 7.3 Licensing and approvals

Table 7-1 Summary of licensing and approval required.

Requirement	Timing
Minister for Primary Industries must be notified of any dredging or reclamation works prior to the undertaking of such works.	A minimum of 28 days prior to the commencement of the works.
A Part 7 Fisheries Permit would be obtained, under the <i>Fisheries Management Act</i> , for works that harm marine vegetation.	Prior to works.
Under the State Environmental Planning Policy (Infrastructure) 2007, consultation is required with Shoalhaven City Council, with regard to impacts on specific council assets (public space, flood liable land).	Prior to works.
Under the State Environmental Planning Policy (Infrastructure) 2007, consultation is required with Office of Environment and Heritage (a stockpile site would be located adjacent to National Park).	Prior to works.
Under the State Environmental Planning Policy (Infrastructure) 2007, consultation is required with Maritime Authority of NSW (a permanent structure would be constructed in navigable waters).	Prior to works.
Obtain an Aboriginal Heritage Impact Permit (AHIP) for works that would directly impact two Aboriginal sites.	Prior to works.

## 8 Conclusion

### 8.1 Justification

The proposal is consistent with:

- The NSW State Plan - NSW 2012.
- NSW Long Term Transport Master Plan.
- State Infrastructure Strategy 2012-2032.
- South Coast Regional Strategy 2006-2031.

At Burrill Lake, the Princes Highway carries local, commercial and freight traffic with seasonal increases in recreational and tourist traffic. The proposal would be a regionally significant infrastructure upgrade. Works are required to address deterioration of the existing crossing and provide a safe reliable crossing. Additionally, the upgrade would provide flood immunity in a 1:100 year flood event and enhance connectivity between south coast communities and neighbouring regions. By improving transport infrastructure, the proposal would support economic development in the region. Environmental impacts addressed in this REF are considered manageable and justified.

### 8.2 Objects of the EP&A Act

This section demonstrates how the proposal is consistent with the objectives of the EP&A Act. The below table summaries how the proposal performs against the objects of the Act, and references earlier sections of the RED where greater detail is provided.

Object	Comment
5(a)(i) To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The proposal has been designed to minimise impacts on natural and artificial resources, including natural areas and the town of Burrill Lake. The proposal would have clear social benefits, including improved connectivity to surrounding regions and improved access during floods for emergency services.
5(a)(ii) To encourage the promotion and co-ordination of the orderly economic use and development of land.	The proposal is restricted to land zone for highway widening. Benefits of the proposal would include short and long-term economic benefits, through construction employment and an improved transport network.
5(a)(iii) To encourage the protection, provision and co-ordination of communication and utility services.	The proposal would require utility adjustments. This would be undertaken in consultation with the asset managers (refer to section 3.5).
5(a)(iv) To encourage the provision of land for public purposes.	The highway would be available for use by the public. Impacts to adjacent recreational areas would be addressed in the detailed design though improved landscaping.
5(a)(v) To encourage the provision and co-ordination of community services and	The proposal would improve the road network in the proposal location.

Object	Comment
facilities.	Impacts to community services including bus stops and pedestrian access are addressed in the proposal.
5(a)(vi) To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	The proposal has been designed to minimise impacts to the environment, including protected and threatened flora and fauna, and this REF includes safeguards to further minimise impacts to such entities (see section 7.2)
5(a)(vii) To encourage ecologically sustainable development.	Ecologically sustainable development is considered in sections 8.2.1 – 8.2.4 below.
5(a)(viii) To encourage the provision and maintenance of affordable housing.	Not relevant to the project.
5(b) To promote the sharing of the responsibility for environmental planning between different levels of government in the State.	Not relevant to the project.
5(c) To provide increased opportunity for public involvement and participation in environmental planning and assessment.	Roads and Maritime has undertaken and would continue to undertake stakeholder and community consultation in relation to the project. Ongoing consultation will centre around obtaining community comments, feedback and suggestions on the proposal, particularly during the public exhibition of the REF.

### 8.2.1 The precautionary principle

The precautionary principle requires evaluation of the threats of serious or irreversible environmental damage. Lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

This REF has been prepared utilising the precautionary principle. Options have been considered and assessed with the purpose of reducing risk of serious and permanent impacts on the environment. Specialist studies were undertaken to provide accurate and impartial information to assist in the evaluation of the options and the development of the proposal. The detailed assessment is located chapter 6 of the REF and recommendations for environmental management are described in chapter 7.

### 8.2.2 Intergenerational equity

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

The proposed works would potentially remove less than one hectare of native vegetation including vegetation listed as an EEC and seagrass. However, the REF has determined that the proposed works would not impact on natural features to a level that would compromise the health, diversity or productivity of the environment to a level that would impact on future generations.

Should the proposal not proceed, the principle of intergenerational equity may be compromised as future generations would inherit a lower level of service on the road

transport network. The proposal would benefit future generations of road users by improving the condition of the existing crossing and provide a safe reliable crossing. Additionally, the upgrade would provide flood immunity in a 1:100 year flood event and enhance connectivity between south coast communities and neighbouring regions.

### 8.2.3 Conservation of biological diversity and ecological integrity

The proposed works would require vegetation removal of exotic and native plants and disturb terrestrial foraging and aquatic habitat (around 0.94 hectares of native vegetation and 1.70 hectares of exotic vegetation). The disturbance is not considered to be significant. The assessment has identified that the works would be unlikely to impact on the biological diversity and ecological integrity of the locality, with the effective implementation of the management measures specified in this REF.

### 8.2.4 Improved valuation, pricing and incentive mechanisms

This principle requires that costs to the environment are incorporated or internalised in terms of the overall project costs.

The environmental consequences of the proposal have been assessed in this REF and mitigation measures identified for factors with potential for adverse impact. Implementing the mitigation measures would impose an economic cost on Roads and Maritime, increasing both the capital and operating costs of the proposal. This indicates that environmental resources have been valued.

The proposal has been designed with the objective of minimising potential impacts on the surrounding environment, thereby minimising costs to the environment.

## 8.3 Conclusion

The proposal to replace the existing Burrill Lake crossing would include the construction of a new bridge, changes to bridge approaches and local traffic conditions and the demolition of the existing crossing. The proposal is subject to assessment under Part 5 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity. This has included consideration of conservation agreements and plans of management under the NPW Act, joint management and biobanking agreements under the TSC Act, wilderness areas, critical habitat, impacts on threatened species, populations and ecological communities and their habitats and other protected fauna and native plants.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the project objectives but would still result in some impacts on the surrounding environment. Impacts that would be more than minor include:

- Soil and water impacts
- Biodiversity impacts
- Traffic and access
- Noise and vibration
- Landscape and visual character

Mitigation measures as detailed in this REF would ameliorate or minimise these expected impacts. They have been developed with reference to specialist investigations in these areas. The proposal is required to provide a safe and reliable

crossing over Burrill Lake. Additionally, it would improve maintenance requirements and provide for improved flood immunity and connectivity between south coast communities and neighbouring regions. On balance the proposal is considered justified.

The environmental impacts of the proposal are not likely to be significant and therefore it is not necessary for an environmental impact statement to be prepared and approval to be sought for the proposal from the Minister for Planning under Part 5.1 of the EP&A Act. The proposal is unlikely to significantly affect threatened species, populations or ecological communities or their habitats, within the meaning of the *Threatened Species Conservation Act 1995* or *Fisheries Management Act 1994* and therefore a Species Impact Statement is not required. The proposal is also unlikely to affect Commonwealth land or have an impact on any matters of national environmental significance.

## 9 Certification

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This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.



Brooke Marshall  
Senior environmental consultant and manager, South Coast & Snowy Mountains  
nghenvironmental  
Date: 21/01/2014

I have examined this review of environmental factors and the certification by Brooke Marshall of nghenvironmental and accept the review of environmental factors on behalf of Roads and Maritime Services.



Peter Townsend  
Project Manager  
Roads and Maritime Services Southern Region  
Date: 26/02/2014

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## Terms and acronyms used in this REF

AADT	Average Annual Daily Traffic
AFG	Aboriginal Focus Group
ARI	Average Recurrence Interval
AS	Australian Standard
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
CEMP	Construction environmental management plan
CHAR	Cultural Heritage Assessment Report
DECC	Department of Environment and Climate Change (refer to OEH)
DPI	Department of Primary Industries
EEC	Endangered ecological community
EIA	Environmental Impact assessment
EIS	Environmental Impact Statement
ENMM	Environmental Noise Management Manual
EPA	Environmental Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW). Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth). Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process.
EMWS	Environmental Work Method Statements
FM Act	<i>Fisheries Management Act 1994</i> (NSW)
Heritage Act	<i>Heritage Act 1977</i> (NSW)
HML	Higher Mass Limit
KFH	Key Fish Habitat
ICNG	Interim Construction Noise Guideline
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local Government Area
NCA	Noise Catchment Areas
NSW	New South Wales
Noxious Weeds Act	<i>Noxious Weeds Act 1993</i> (NSW)
NPW Act	<i>National Parks and Wildlife Act 1974</i> (NSW)
OEH	Office of Environment and Heritage
PACHCI	<i>Procedure for Aboriginal Cultural Heritage Consultation and Investigation</i>
PADs	Potential Archaeological Deposits
PASS	Possible Acid Sulfate Soils
PEI	Preliminary Environmental Investigation
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
RBL	Rating Background Level
REF	Review of Environmental Factors
RNP	Roads Noise Policy
RTA	Roads and Traffic Authority (now Roads and Maritime Services)
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SEPP 14	<i>State Environmental Planning Policy No.14 – Coastal Wetlands</i>
SHR	State Heritage Register
SoHI	Statement of Heritage Impacts
TSC Act	<i>Threatened Species Conservation Act 1995</i> (NSW)
QA Specifications	Specifications developed by Roads and Maritime Services for use with roadworks and bridgeworks contracts let by Roads and Maritime Services
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2001</i>
WM Act	<i>Water Management Act 2000</i>