Bridge over Richmond River

Prepared for

Roads & Maritime

PACIFIC COMPLETE

lendlease

SMEC
Local People. Global Experience.

HASSELL

Bridge over Richmond River UDLP Document Number Revision

REV	DATE	REASON FOR ISSUE
0.1	17.05.17	DCD–CDR
01	31.05.17	DCD
0.2	21.06.17	SDD–CDR
02	30.06.17	SDD
03	31.07.17	SDD-RMS review
04	10.08.17	SDD-Final
05	13.12.17	FDD FOR Department of Planning and Environment
06	21.12.17	FDD FOR Department of Planning and Environment
07	12.01.18	FDD FOR Department of Planning and Environment
08	29.01.18	FDD incorporating Department of Planning and Environment comments

Cover image
Artist impression of Bridge over Richmond River looking towards Broadwater. Subject to further design

Executive summary

This Urban Design and Landscape Plan (UDLP) is produced to document the urban design and landscape design specific to the Bridge over Richmond River of the Woolgoolga to Ballina Pacific Highway upgrade. This report is submitted by the applicant Roads and Maritime Services for construction approval in accordance with Minister of Planning's Conditions of Approval (MCoA) D20.

This plan was prepared in accordance with:

- Roads and Maritime Services Urban Design Visual Guidelines
- Design principles outlined in the Environmental Impact Statement (EIS) and The Submissions/Preferred Infrastructure Report (SPIR).

Project background

The Pacific Highway upgrade is one of the largest road infrastructure projects in NSW. The Pacific Highway connects Sydney and Brisbane, and is a major contributor to Australia's economic activity. The Woolgoolga to Ballina upgrade for the Pacific Highway has been subdivided into 11 sections with upgrade work to all sections except Richmond River to Ballina (section 10) under construction. The Australian and NSW Governments are committed to completing the Pacific Highway upgrade (sections 3 to 11) by 2020.

Design process

The design process is focused on the bridge design relative to the urban and landscape design which has been developed for the adjoining project sections. The urban design and landscape strategies from the Broadwater National Park to the southern embankment of the Richmond River (section 9) and the urban and landscape design strategies for the northern embankment of the Richmond River to Coolgardie Road (section 10).

The design process has employed a number of reference documents and guidelines to support the development of the bridge design strategies and outcomes. These guidelines include:

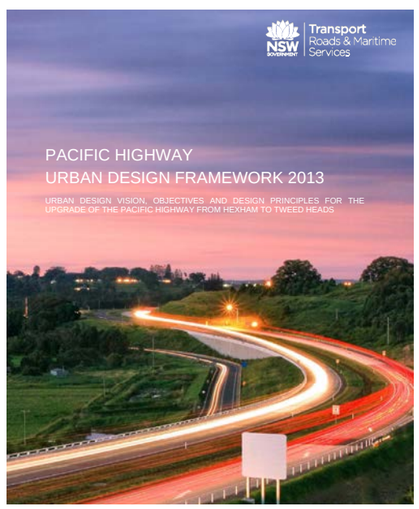
- Upgrading the Pacific Highway – Design Guidelines, Roads and Maritime Services, March 2015
- Pacific Highway Urban Design Framework Urban design guidelines for the SH10 from Hexham to Tweed Heads, Roads and Traffic Authority, 2013
- Bridge Aesthetics, Design guideline to improve the appearance of bridges in NSW, Roads and Maritime Services Centre for Urban Design, July 2012
- Beyond the Pavement, Urban Design Policy, Procedures and Design Principles, Roads and Maritime Services Centre for Urban Design 2014
- Draft Urban Design and Landscape Plan for Woolgoolga to Ballina, Devils Pulpit to Richmond River (sections 7,8 and 9)
- Draft Urban Design and Landscape Plan for Woolgoolga to Ballina, Richmond River to Ballina (sections 10 and 11)

An integrated multidisciplinary design approach is instilled throughout this design process. This process aims to achieve the urban design and landscape objectives to provide a holistic, yet varied and consistent design strategy across the wider Woolgoolga to Ballina upgrade.

The multidisciplinary design approach will facilitate the delivery of Roads and Maritime Services vision for the Pacific Highway as stated in the Pacific Highway Urban Design Framework and repeated below:

'The upgrade should be a sweeping, green highway providing panoramic views to the Great Dividing Range and the forests, farmlands and coastline of the Pacific Ocean; sensitively designed to fit into the landscape and be unobtrusive; and characterised by simple and refined road infrastructure'.

Figure i Excerpt of Pacific Highway staging map (Source: Roads and Maritime Services)



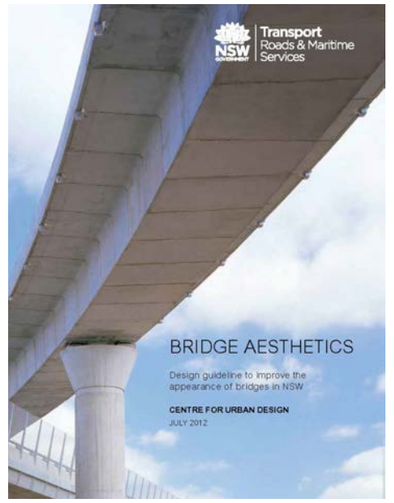


Figure ii Roads and Maritime Services design reference and guideline documents

Figure iii Artist impression of view of bridge looking east, subject to further design

Design objectives and strategies
In fulfilling Roads and Maritime Services vision and the Minister's Conditions of Approval, six project objectives have been developed to define the nature and parameters of this design response. Of these six objectives, two are applicable to the bridge design. They are:

- Provide a flowing road alignment which is responsive and integrated with the landscape
- Provide consistency with variety in road elements.

In response to the urban and landscape design objectives strategies were employed to ensure these objectives were achieved.

- Consistently connect
- Safely and sensitively structure.

The design strategies (example strategy plan shown in Figure iv) provide the framework for the design of the detailed construction documentation which is being developed concurrently to this report.

Consultation with communities, councils agencies and stakeholders is completed for the design development phase of this project in accordance with the Roads and Maritime Services Woolgoolga to Ballina Pacific Highway Communications and Stakeholder Engagement Strategy. Refer to Appendix A and B.

Design response
The design is developing through rigorous analysis of local conditions and development of design strategies which respond to the design strategies for the adjoining Woolgoolga to Ballina upgrade work (Devils Pulpit to Richmond River and Richmond River to Ballina).

The existing landscape character of the Richmond River is largely determined by the vegetative characteristics seen in the adjacent landscape.

Travelling from north to south the landscape is a transitional landscape where on the northern embankment the proposed bridge alignment will travel through the existing blackbutt eucalyptus forest. As the bridge ascends over a dense screen of mangroves the character of the landscape transitions to a riverine landscape dominated by the serpentine riparian form of the Richmond River. Again a dense screen of mangroves dominates the southern river embankment before transitioning into cane fields and grazing plains.

The descent of the bridge alignment grounds at the northern tip of the existing swamp mahogany forest.

Capitalising on the scenic quality of the environment, the bridge over Richmond River at Broadwater is being designed to be simple and unobtrusive to complement the natural landscape setting.

The bridge is designed to show a consistent aesthetic to the urban design of the bridges crossing rivers in the adjoining sections of the Pacific Highway upgrade with commonalities in superstructure and substructure elements.

The bridge is designed with a slender horizontal alignment and smooth clean lines. The individual bridge elements are designed to specifically address consistencies in form (combination of proportion, symmetry, order, rhythm, simplicity) materials and finishes across the entire Woolgoolga to Ballina upgrade.

Conclusion
The design as described in this document will achieve the environmental requirements and measures set by the project Environmental Impact Statement (EIS) and Submissions/Preferred Infrastructure Report (SPIR) and fulfils the stated requirements of the Minister's Conditions of Approval for the project (MCoA).

The bridge design will ensure the upgraded Pacific Highway will continue to service the needs of the travelling public, achieve transport efficiencies, sit comfortably within the local environment and contribute positively to the neighbouring human and environmental communities.

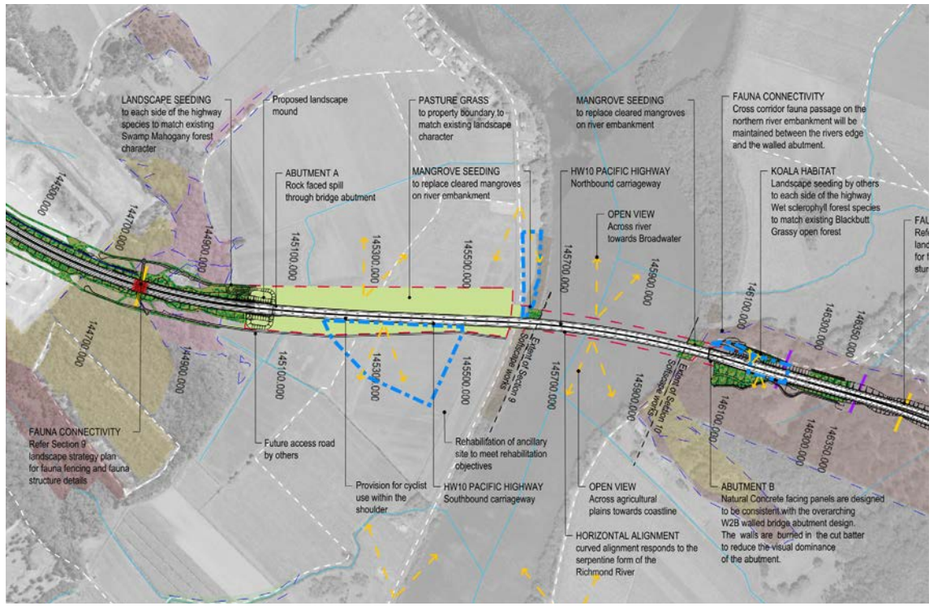


Figure iv *Example strategy plan*

Figure v *Artist impression of view of bridge from existing highway, subject to further design*

Contents

List of figures

Tables

Glossary

Terminology	Definition
Bioregion	Classification of Australia's landscape into 89 distinct bioregions based on climate, geology, landform and native vegetation and species information. The Woolgoolga to Ballina upgrade is within the NSW North Coast Bioregion (NNC) as defined by Interim Biogeographic Regionalisation of Australia mapping (IBRA).
Cover crop (short lived)	Fast growing, but short lived non-native pasture grasses with low reproduction levels (low fecundity) used to revegetate exposed batters to minimise erosion and weed infestation.
Compost blanket	Consists of high quality compost incorporating organic tackifiers, biological stimulants, wetting agents, soil ameliorants and seed mix which is applied to the batter surface with pneumatic blowers at a thickness of between 25mm and100mm depending on type of vegetation to be established.
Drill/broadcast seeding	Seeding using a mechanical disc seeder towed by a tractor. Drill seeders have metal discs which create small furrows into which seed is placed. Broadcast seeding involves the mechanical spreading of seed on the soil surface using a trailer or truck mounted spinning type or agitator type seed spreader. Following seeding, the soil is harrowed to cover the seed with a thin layer of soil.
Direct return	Stripping and replacement of site soils containing a seed bank of native indigenous species.
Fauna crossing structure	Structures which allow animals to safely cross over or under human-made barriers including highways.
Frangible	Planting which breaks under the impact of a motor vehicle (and hence helps to stop a vehicle). Generally trees and shrubs with a mature trunk diameter of less than 100 mm at 500 mm above ground are considered frangible.
Hydromulching	Various types of organic fibrous materials mixed with water and sprayed onto the soil surface in slurry form which sets to form a layer and provides temporary protection from wind and water erosion. The mix may include seed of a cover crop, legume, native ground cover, shrub or tree species.
Hydroseeding	Hydraulic application of seed, seed carrier and soil ameliorants added to a tank fitted with an agitator and pump. It is commonly followed by hydromulching or straw mulching to provide surface protection.
Indigenous species	Plant species native to the bioregion in which the project is located.
Landscape Management Plan	A defined combination of techniques and frequency of activities for the successful establishment, maintenance and ongoing management of all landscape areas developed by seeding, planting or bushland regeneration.
Landscape soil	Soil profile which is either modified from a natural soil or manufactured and installed using artificial components for the purpose of sustaining vegetation is chosen to achieve a particular landscape design outcome or revegetation.

Terminology	Definition
Local provenance seed	Seed collected from plants growing in the locality of the project site which may include the road corridor and adjoining areas within the NSW North Coast (NNC) Bioregion.
Native grasses	Grass species native to Australia.
Natural soils	Soils remaining insitu which have formed distinct horizons and typically sustaining specific plant communities.
Non-native	Plants which are not native to the bioregion in which the project site is located.
Noxious weeds	Plants declared noxious weeds which are classified into one of five control classes with specified action for each class by the Noxious Weed Act, 1993 and Weed Control Order 2014.
Pasture grass mix	Mix of grasses and legumes, predominantly grasses with a portion of legumes to provide nitrogen; typically used on areas which are not to be managed.
Plant container	Containers for plant stock in various sizes and volumes. Pots are containers with rigid walls, which are identified by their diameter in millimetres. Bags are containers with flexible or woven walls, which are identified by their volume in litres.
Reconstruction	The practice of revegetating areas where the soil profile has been disturbed by construction activity; the process involves soil treatment, which may include return of bushland soil, followed by drill seeding, hydromulching or mass planting.
Regeneration	The practice of restoring disturbed or cleared bushland areas where the soil profile remains intact by reinstating and reinforcing the natural regeneration processes in areas within or adjoining bushland, primarily through weed control weed cover should be less than 15 percent after 12 months from start of the work.
Revegetation	Re-establishing vegetation on an area by direct seeding with native species using manual or mechanical means such as hydromulching, straw mulching, or tractor seeding. A cover crop of annual grass or legume species may be required to provide surface protection in some situations.
Tubestock	Rigid plant containers with a top edge length or diameter between 40mm and 50mm or 75mm. Includes individual containers as well as trays, and may have proprietary names.

Abbreviations

Terminology	Definition
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EPBC Act	Environment Protection and Biodiversity Conservation ACt 1999
ESD	Ecologically Sustainable Development
MCoA	Minister's Conditions of Approval
PAD	Potential Archeological Deposit
Roads and Maritime	Roads and Maritime Services
SAP	Sustainability Action Plan
SPIR	Submission/Preferred Infrastructure Report
UDLP	Urban Design Landscape Plan
W2B	Woolgoolga to Ballina

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

1 Introduction

1.1 Background

The Pacific Highway upgrade is one of the largest road infrastructure projects in NSW. The highway connects Sydney and Brisbane, and is a major contributor to Australia's economic activity. The road is a vital piece of the nation's infrastructure and is a key link in the National Land Transport Network. The Australian and NSW governments have been jointly upgrading the Pacific Highway since 1996.

An upgraded Pacific Highway must continue to service the needs of the travelling public and achieve transport efficiencies, while also ensuring ecological sustainability and meeting the needs of the coastal communities which live along the highway. Upgrading new sections and carrying out safety improvements to the existing highway have brought major improvements to road conditions. These improvements support regional development and provide:

- Safer travel
- Reduced travel times with improved transport efficiency
- More consistent and reliable travel
- Improved amenity for local communities.

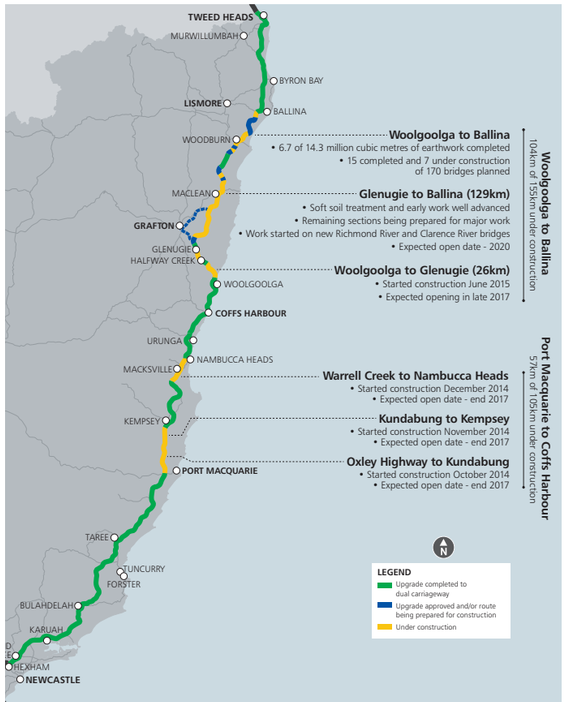


Figure 1.0 Status of Pacific Highway upgrade

1.2 Overview of the Woolgoolga to Ballina upgrade

The 155 kilometre upgrade between Woolgoolga to Ballina is the last highway link between Hexham and the Queensland border to be upgraded to four lanes. The project will duplicate the existing highway to two lanes in each direction from about six kilometres north of Woolgoolga (north of Coffs Harbour) to about six kilometres south of Ballina.

The project bypasses the towns of Grafton, South Grafton, Ulmarra, Woodburn, Broadwater and Wardell. The project will include building new lanes and realigning the road.

Key features of the upgrade include:

- Duplicating 155 kilometres of the Pacific Highway to a motorway standard (Class M) or arterial road (Class A), with two lanes in each direction, and room to add a third lane if required in the future
- Split-level (grade-separated) interchanges at Range Road, Glenugie, Tyndale, Maclean, Yamba/Harwood, Woombah (Iluka Road), Woodburn, Broadwater and Wardell
- Bypasses of Grafton, South Grafton, Ulmarra, Woodburn, Broadwater and Wardell
- More than one hundred bridges including major crossings of the Clarence and Richmond Rivers
- Bridges over and under the highway to maintain access to local roads which cross the highway
- Access roads to maintain connections to existing local roads and properties
- Structures designed to safely encourage animals over and under the upgraded highway where it crosses key animal habitat or wildlife corridors
- Rest areas conveniently located at intervals to assist with reducing driver fatigue
- Heavy vehicle checking stations near Halfway Creek
- Connections from the project to the local road network and other sections of the Pacific Highway
- Emergency stopping facilities, and U-turn bays
- Relocation of utilities and provision of roadside furniture, fencing (including wildlife exclusion fencing) and lighting.

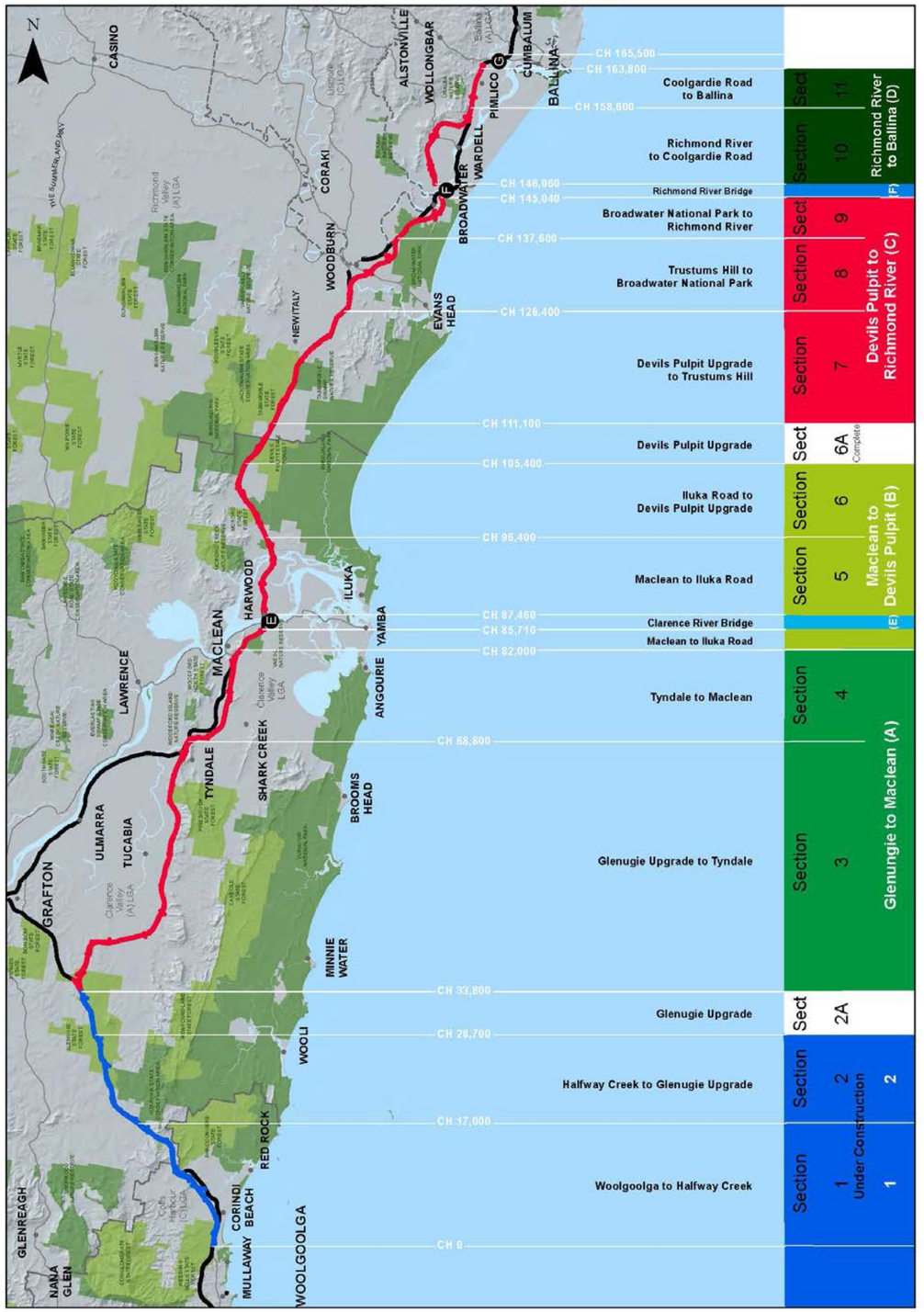


Figure 1.1 Pacific Highway staging map (Source: Roads and Maritime Services)

1.3 Project type and staging

The Pacific Highway Project Office is responsible for the 657 kilometre Pacific Highway upgrade program between Hexham and the Queensland border, and is leading the wave of major infrastructure projects in NSW with an equally strong focus on delivery and leaving a positive legacy. A clear benefit of the project office is it provides a single point of contact for the general public and key stakeholders while also offering an integrated and collaborative office tasked with developing and delivering the upgrade program.

In order to realise Roads and Maritime's vision of 'driving a better highway upgrade' the project office has adopted a delivery partner model for the Woolgoolga to Ballina upgrade.

The delivery partner model is based on the approach used to oversee construction of the London Olympic Games and supports collaboration and innovation by bringing business, workers, consumers and suppliers together. It encourages the best ideas and solutions from the private sector while also drawing on Roads and Maritime's knowledge to ensure better engineering and design, customer outcomes and public value including:

- Greater access to resources and optimising resources from within the public and private sector
- Greater flexibility in resource use to better respond to delays and disruptive events
- Better customer outcomes through a consistent and coordinated approach
- Economies of scale and better access to competitive suppliers and subcontractors
- Direct engagement of design, management and construction skills to fast track the upgrade.

The delivery partner Pacific Complete, comprising Laing O'Rourke and WSP is working closely with the Pacific Highway Project Office to oversee the upgrade and handle multiple contracts for professional services and building of the $4.36 billion upgrade.

The project was divided into 11 sections in the Environmental Impact Statement (EIS) for assessment purposes (Figure 1.1). Upgrade work to all sections except Richmond River to Ballina (section 10) are under construction.

- Glenugie to Maclean (sections 3 and 4)
- Clarence River Bridge
- Maclean to Devils Pulpit (sections 5 and 6)
- Devils Pulpit to Richmond River (sections 7, 8 and 9)
- Bridge over Richmond River
- Richmond River to Ballina (sections 10 and 11).

1.4 Purpose of this plan

This plan has been developed to address the requirements of the Minister's Conditions of Approval (MCoA) D20 and present an integrated urban design for the Woolgoolga to Ballina upgrade. This plan specifically addresses the Bridge over Richmond River Crossing at Broadwater and demonstrates commitment to the mitigation and management measures identified in the Woolgoolga to Ballina Environmental Impact Statement (EIS), the Submissions/Preferred Infrastructure Report (SPIR, and other approved environmental management documentation).

1.5 Urban and landscape design methodology

The urban and landscape design methodology will be refined at each design stage. As the project progresses through detailed design an integrated multidisciplinary design approach has been instilled to achieve urban design and landscape objectives which provide a holistic, yet varied and consistent design strategy. The design process is shown in Figure 1.2.

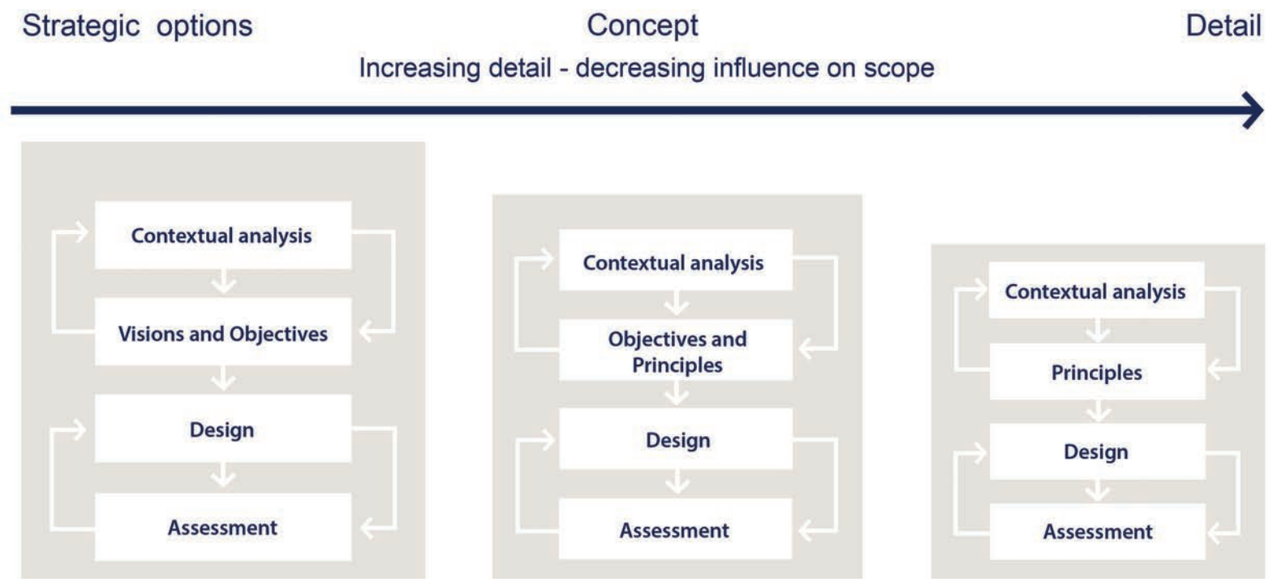


Figure 1.2 Design Process (Image source: Beyond the Pavement 2014)

1.6 Reference documents, standards and guidelines

Urban design for the project is guided by five key documents:

- The overarching best practice urban design principles as set out in Beyond the Pavement – Urban Design Policy Procedures and Design Principles by Roads and Maritime Services' Centre for Urban Design, 2014
- The Pacific Highway Upgrade Urban Design Framework – Urban Design Vision, Objectives and Design Principles for the Upgrade of the Pacific Highway from Hexham to Tweed Heads, Roads and Maritime Services, 2013
- The urban design report prepared as part of the EIS for the Woolgoolga to Ballina upgrade – Pacific Highway Upgrade Woolgoolga to Ballina Urban Design Report Landscape Character and Visual Impact Assessment, HASSELL, September 2012
- Draft Urban Design and Landscape Plan for Woolgoolga to Ballina, Devils Pulpit to Richmond River (sections 7,8 and 9)
- Draft Urban Design and Landscape Plan for – Richmond River to Ballina (sections 10 and 11).

In addition, the UDLP has been prepared with reference to the following approval and policy guideline documents.

Approval documents:

- *Project Approval Notice* dated 14 August 2014, and Modifications to the Project Approval is dated 15 January 2015 and 7 October 2015
- *The Woolgoolga to Ballina – Pacific Highway Upgrade – Environmental Impact Statement (EIS), Roads and Maritime Services 2012*
- *Woolgoolga to Ballina Urban Design Report Landscape Character and Visual Impact Assessment, Roads and Maritime Services, 2012*
- *The Woolgoolga to Ballina – Pacific Highway Upgrade – EIS Working Paper – Biodiversity Assessment, Roads and Maritime Services, 2012*
- *Upgrading the Pacific Highway – Design Guidelines, March 2015.*

Guidelines documents:

- *Guideline for Batter Surface Stabilisation using vegetation. Roads and Maritime Services , April 2015*
- *Environmental Impact Assessment Practice Note: Guidelines for Landscape Character and Visual Impact Assessment ("EIA No4 Guidelines"), Roads and Maritime Services, March 2013*
- *Beyond the Pavement – Urban Design Policy, Procedures and Design Principles, Roads and Maritime Services, 2014*
- *Bridge Aesthetics – design guideline to improve the appearance of bridges in NSW, Roads and Maritime Services, July 2012*
- *Landscape Guidelines, Roads and Maritime Services, April 2008*
- *Biodiversity Guidelines – Protecting and Managing Biodiversity, Roads and Transport Authority, September 2011.*

Figure 1.3 Reference documents

1.7___Document structure

The structure and content of this Urban Design and Landscape Plan is presented in Table 1.0.

1.8___Design development and representations

The visualisations, artists' impressions, design drawings, figures and images shown in this report accurately represent the detailed design at the time of publication. Design developments which occur during construction will be addressed in supplementary reports. Future design development may occur which is not represented in the report. Artists' impressions are intended to be indicative ideas of a possible future landscape at maturity.

Table 1.0 Document structure

Title		Description
Executive summary		Provides a summary of the Urban Design and Landscape Plan
Chapter 1	Introduction	Provides a broad overview of the project and identifies the purpose and structure of the Urban Design and Landscape Plan
Chapter 2	Overview of the Pacific Highway upgrade	Provides a broad overview of the Pacific Highway upgrade
Chapter 3	Consultation	Describes the consultation that has occurred.
Chapter 4	Project wide urban design and landscape objectives and principles	Describes the project wide urban design and landscape objectives and principles
Chapter 5	Contextual analysis	Describes contextual analysis and associated landscape and urban design principles specific to the Bridge over Richmond River
Chapter 6	Design Principles	Provides an overview of the Bridge over Richmond River design and describes the urban design principles and strategies specific to the Bridge over Richmond River at Broadwater.
Chapter 7	Urban design and landscape design	Describes the landscape and urban design concept specific to the Bridge over Richmond River at Broadwater. This chapter includes urban design and landscape drawings which present the integrated landscape and urban design solution.
Chapter 8	Detailed response for urban and landscape design	Detailed descriptions of all urban design elements for the Bridge over Richmond River at Broadwater
Chapter 9	Drainage and water quality	Describes the drainage design and water quality management
Chapter 10	Conclusion	Summary of design outcomes
Chapter 11	Bibliography	Catalogue of referenced documents and document appendices

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

2 Compliance with project planning approvals

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

2.1 Minister's conditions of approval

The Woolgoolga to Ballina upgrade has been approved as State Significant Infrastructure under Part 5.1 of the NSW Environmental Planning and Assessment Act 1979 (SSI–4963, approval dated 24 June 2014). The project is also approved under the Commonwealth Environment Protection and Biodiversity Act 1999 (012/6394 approval dated 14 August 2014).
MCoA D20 relates to the preparation of an UDLP to be implemented before the start of permanent built work and/or landscaping. The specific requirements of MCoA D20 and where they are addressed in this plan are outlined in Table 2.0

Table 2.0 MCoA D20 Conditions

C0A No.	Condition Requirements	Document Reference
D20	The applicant shall prepare and implement an Urban Design and Landscaping Plan prior to the commencement of permanent built work and/or landscaping, unless otherwise agreed by the Secretary, to present an integrated landscape design for the SSI. The plan shall be prepared in accordance with the Roads and Maritime Services urban design and visual guidelines, the design principles outlined in the EIS, and the revegetation principles outlined in the EIS Working Paper – Biodiversity. The Plan shall be prepared by an appropriately qualified expert in consultation with the relevant council and community, to the satisfaction of the secretary.	This report
(a)	The plan shall include but not necessarily be limited to: Identification of design principles and standards based on: (i) Local environmental values (ii) Heritage values (iii) Urban design context (iv) Sustainable design and maintenance (v) Community amenity and privacy (vi) Relevant design standards and guidelines (vii) The urban design objectives outlined in section 4.2 of the EIS Working Paper Urban Design Landscape Character and Visual Impact.	Chapter 6.4 Chapter 6.5 Chapter 6.2 Chapter 6.6 Chapter 6.8 Chapter 1 Chapter 4
(b)	The location of existing vegetation and proposed landscaping (including use of indigenous and endemic species where possible). Details of species to be replanted/ revegetated shall be provided, including their appropriateness to the area and habitat for threatened species.	Chapter 7
(c)	A description of locations along the corridor directly or indirectly impacted by the construction for the SSI (eg Temporary ancillary facilities, access tracks, watercourse crossings, etc) and details of the strategies to progressively rehabilitate regenerate and/or revegetate the locations with the objective of promoting biodiversity outcomes and visual integration.	Chapter 7
(d)	Take into account appropriate roadside plantings and landscaping in the vicinity of heritage items and ensure no additional heritage impacts.	Chapter 6.5 and 7.3
(e)	A description of disturbed areas (including borrow sites) and details of the strategies to progressively rehabilitate, regenerate and/or revegetate these areas, including clear objectives and time frames for rehabilitation work, procedures for monitoring success of regeneration or revegetation, and corrective actions should regeneration or revegetation not conform to the objectives adopted.	Chapter 7.9
(f)	Location and design treatments for any associated footpaths and cyclist elements, and other features such as seating, lighting (in accordance with AS4282–1997 Control of the Obtrusive Effect of Outdoor Lighting), fencing, materials and signs.	Chapter 8
(g)	An assessment of the visual screening effects of existing vegetation and the proposed landscaping and built elements. Where properties have been identified as likely to experience high visual impact as a result of the SSI and high residual impacts are likely to remain, the Applicant shall, in consultation with affected landowners, identify opportunities for providing at property landscaping to further screen views of the SSI. Where agreed with the landowner, these measures shall be implemented during the construction of the SSI.	Chapter 5.9
(h)	Graphics such as sections, perspective views and sketches for key elements of the SSI, including, but not limited to built elements of the SSI.	Chapters 7 and 8
(i)	Strategies for progressive landscaping and other environmental controls such as erosion and sedimentation controls, drainage and noise mitigation.	Chapter 7
(j)	Monitoring and maintenance procedures for the built elements, rehabilitated vegetation and landscaping (including weed control) including performance indicators, responsibilities, timing and duration and contingencies where rehabilitation of vegetation and landscaping measures fail.	Chapter 7
(k)	Evidence of consultation with the relevant council and community on the proposed urban design and landscape measures prior to its finalisation.	Chapter 3

2.2 Compliance with EIS and SPIR environmental mitigation measures and landscape strategies

In the EIS a range of environmental outcomes and management measures were identified to avoid or reduce the impact the project has on the environment. These measures were further refined during the SPIR. Additional commitments were identified and conditions which had already been fulfilled were removed.

Table 2.1 outlines compliance with relevant environmental mitigation measures related to landscape and urban design specific to the Bridge over Richmond River at Broadwater.

SPIR mitigation measures relating to landscaping strategies within this project boundary have been responded to in the UDLP reports for Devils Pulpit to Richmond River (sections 7,8 and 9) and Richmond River to Ballina (sections 10 and 11).

The EIS identified a range of strategies and management measures to minimise the visual impact and adverse changes to the landscape character by the project. This Urban Design and Landscape Plan has been developed based on the landscape character and visual assessment and landscape strategy prepared as part of the EIS and revised in the SPIR.

Table 2.1 SPIR Mitigation measures

Mitigation measures	Document Reference
UD4 – Design of urban design features and road furniture. The built form of the project, including consideration of the height, bulk, scale, materials and finishes for: • Bridges • Retaining walls • Cuttings and embankments • Fences • Road barriers. The project will be designed in accordance with the design principles identified in Working Paper – Urban Design, Landscape Character and Visual Impact, and relevant Roads and Maritime Services guidelines.	Chapter 8
UD11 – Visual impact of borrow sites – The extent of excavation and the landscaping strategy at borrow sites will be reviewed considering material requirements on the project and the visual impact on the resultant cuttings.	N/A

2.3 Urban Design and landscape compliance with EIS

Chapter 11 of the *EIS – Urban Design, Landscape Character and Visual Impact Assessment* presented a summary of the landscape character and visual impact assessment carried out to assess the direct and indirect impact of the project. Overall, it was identified the project was expected to have a low to moderate impact on landscape character. Table 2.2 identifies EIS landscape strategies related to landscape and urban design specific to the Bridge over Richmond River at Broadwater.

Table 2.2 Compliance with the EIS urban design and landscape requirements

EIS compliance measure	Document reference
Viewpoint mitigation measures	
Viewpoint 46 – Pacific Highway, North Broadwater Minimise the loss of existing riparian vegetation	Chapter 5.7
Viewpoint 47 – Pacific Highway, Opposite Goat Island Minimise the loss of existing riparian vegetation	Chapter 5.7
Viewpoint 48A – Pacific Highway, Broadwater Maintain an agricultural setting for the elevated bridge and embankments in this location over pastoral land Minimise the loss of existing riparian vegetation as much as possible	Chapter 5.7

2.4 Urban design and landscape compliance with the EIS working paper – Biodiversity

The Woolgoolga to Ballina upgrade EIS Working Paper: Biodiversity (W2BPA 2012b) identified the potential biodiversity impacts of the project to be:

- Loss of vegetation, threatened species and wildlife habitat
- Wildlife mortality during construction
- Edge effects and weeds
- Habitat fragmentation, barrier effects and wildlife mortality during operation
- Impacts on aquatic habitats, changed hydrology and fish passage.

To ensure a consistent approach to the mitigation, management and offsetting of biodiversity for the project, an overarching management strategy was developed as part of the EIS. This is comprised of a Mitigation Strategy, a Monitoring Strategy and an Offset Strategy. The vegetation and landscape design principles for connectivity measures as outlined in the EIS Biodiversity Connectivity Strategy has been addressed as part of the UDLP reports for Devils Pulpit to Richmond River (sections 7,8 and 9) and Richmond River to Ballina (sections 10 and 11).

2.5 Urban design and landscape compliance with threatened species management plans

Threatened species management plans outline specific mitigation measures and monitoring identified for target threatened species before work, during major work and operation of the project.

The Threatened Species Management Plans for the Woolgoolga to Ballina upgrade, and their applicability to the section, are outlined in Table 2.3

This UDLP addresses the mitigation measures related to landscape and urban design stipulated in the threatened species management plans which are applicable to the Bridge over Richmond River at Broadwater. Appendix A provides further details about compliance with specific urban design and landscape requirements which are included in these management plans.

Table 2.3 Threatened species management plans relevant to the Bridge over Richmond River at Broadwater.

Threatened species management plans	Bridge over Richmond River
Coastal emu management plan (Roads and Maritime Services, 2015)	NO
Koala management plan (Roads and Maritime Services, 2016)	YES
Rainforest communities and threatened rainforest plants management plan (Roads and Maritime Services, 2016)	NO
Threatened flora management plan (Roads and Maritime Services, 2015)	NO
Flora Translocation Strategy Roads and Maritime Services, 2016)	NO
Threatened fish management plan (Roads and Maritime Services, 2015)	NO
Threatened frog management plan Roads and Maritime Services, 2015)	NO
Threatened glider management plan (Roads and Maritime Services, 2015)	NO
Threatened invertebrate management plan (Roads and Maritime Services, 2015)	YES
Threatened mammal management plan (Roads and Maritime Services, 2015)	YES
Wallum management plan	NO

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

3 Consultation

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

3.1___Consultation

Community and stakeholder consultation for the project was carried out in line with the Woolgoolga to Ballina Pacific Highway upgrade Communications and Stakeholder Engagement Strategy. The strategy identified the key stakeholders and communities, and the methods by which they would be consulted.

The strategy outlined the following communication and engagement objectives for the project:

- Provide clear, consistent and timely information about the project to local communities, road users and stakeholder groups
- Raise awareness of the project and develop relationships with communities and key stakeholders
- Provide a single point of contact for communities
- Anticipate and manage local issues
- Manage community feedback and complaints in a timely fashion
- Identify opportunities for local and regional communities and stakeholder groups to be involved in the project
- Inform government and other major stakeholders, including emergency services of project progress
- Monitor and evaluate feedback to measure success and review overarching communications and community involvement strategy and action plans as required.

The key consultation activities for the project were:

- Project notifications and community updates
- Variable electronic message signage
- Community information sessions
- Staffed information displays
- Stakeholder briefings
- Face-to-face meetings
- Woolgoolga to Ballina information centre
- Community focus groups
- 1800 information line
- Email
- Collaborative map
- Community contact database and complaints handling procedure.

3.2___Community consultation

The UDLP was placed on public exhibition in August 2017 for the community to provide input.

Key matters raised included bridge lighting, fauna crossings, cycle ways and operational noise.

One matter raised was considered outside the scope of the urban design and landscape plan and will be addressed with the stakeholders individually.

Further details of the issues raised and responses are included in Appendix A of this report.

3.3___Stakeholder consultation

Stakeholders that were provided the UDLP for review include:

- NSW Environment Protection Authority
- NSW Department of Primary Industries – Fisheries
- NSW Maritime
- Richmond Valley Council
- Ballina Shire Council
- Lismore City Council.

Following agency review, all stakeholder comments were collated and are included in Appendix B of this report.

The UDLP did not require amendment based on comments received by both the community and stakeholder consultation.

The community and stakeholders were consulted on the project alignment, the environment, project staging and noise attenuation

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

4

Project wide urban design and landscape objectives and principles

4.1 Project wide vision

The Pacific Highway Urban Design Framework (Roads and Maritime Services, 2013) has established a vision for the Pacific Highway which is:

“The upgrade should be a sweeping, green highway providing panoramic views to the Great Dividing Range and the forests, farmlands and coastline of the Pacific Ocean; sensitively designed to fit into the landscape and be unobtrusive; and characterised by simple and refined road infrastructure.”

4.2 Pacific Highway design objectives

In fulfilling this vision a number of key objectives have been developed by Roads and Maritime:

- Provide a flowing road alignment which is responsive and integrated with the landscape
- Provide a well vegetated, natural road reserve
- Provide an enjoyable, interesting highway
- Value the communities and towns along the road
- Provide consistency-with-variety in road elements
- Provide a simplified and unobtrusive road design.

4.3 Urban design and landscape principles

Four key landscape and urban design principles were outlined in the project EIS:

- Retain the strong contrasting experience of driving through forest and open agricultural land as a feature of the Pacific Highway experience
- Acknowledge and celebrate the small and medium sized coastal towns which mark progress along the coastal Pacific Highway journey
- Highlight and celebrate the numerous minor and major creek and river crossings which punctuate the Pacific Highway journey across the coastal floodplains
- Acknowledge and preserve the natural and cultural landscapes and landmarks identified along the full length of the Pacific Highway journey.

These are shown graphically (Figure 4.0). To achieve these strategies, the project will incorporate urban design and landscape key objectives and design principles which are consistent with the key Roads and Maritime guiding documents – *Beyond the Pavement, 2014* and *Pacific Highway Urban Design Framework, 2013.*

4.4 Urban design and landscape strategy

The project EIS Working Paper *Urban design report, landscape character and visual impact assessment* (HASSELL, 2012) outlined typical landscape and urban design strategies to be adopted for the length of the project.

The strategies were incorporated into the concept design and recommended mitigation strategies for the project at EIS stage have been carried through the detailed design for this UDLP.

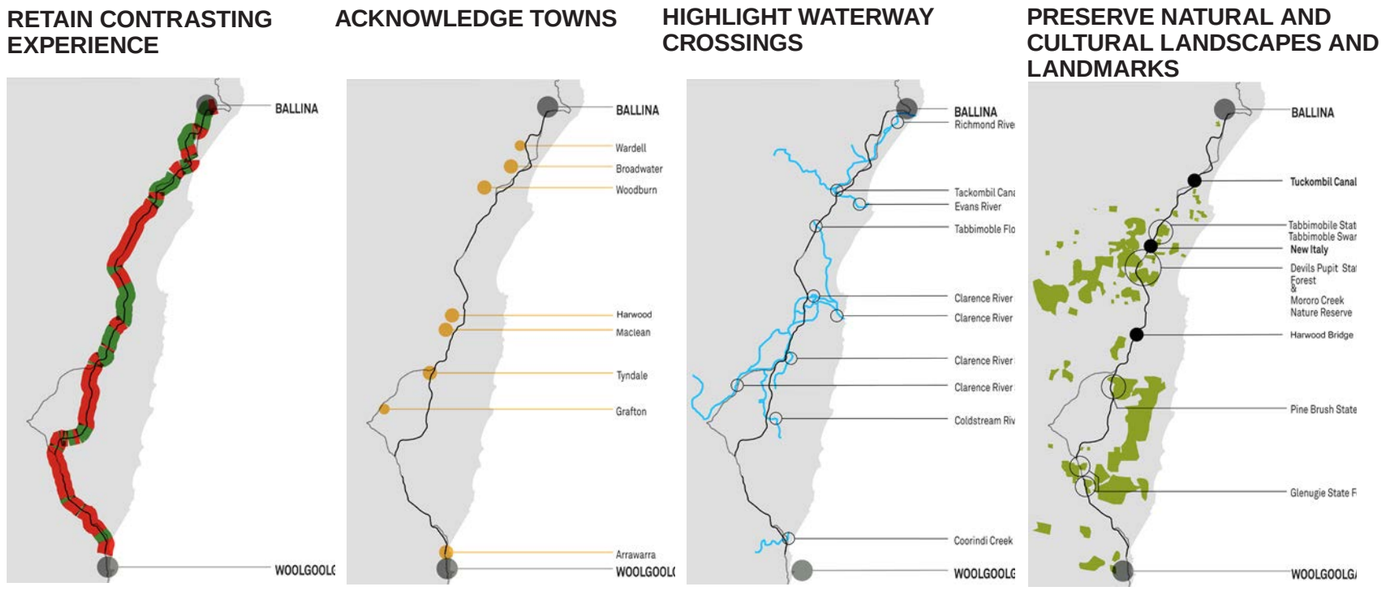


Figure 4.0 Project wide principles developed during the EIS

4.5___Project wide urban design and landscape strategies

The project wide landscape and urban design strategies outlined in the project EIS working paper urban design report, landscape character and visual impact assessment (HASSELL, 2012) are:

- Built environment, landscape character and land use
- Highlight major towns enroute with distinctive landscape treatments
- Highlight creek and river crossings.

These are illustrated on the Project wide strategy plan (Figure 4.1).

Views

- Ensure open or filtered views to pastureland are retained
- Provide screen planting on batters to specifically mitigate the visual impact of the project to nearby residences.

Ecology

- Reinstate disturbed areas of riparian vegetation where possible and comply with core riparian zone requirements
- Maximise riparian vegetation under creek crossings to encourage wildlife connectivity along creek lines
- Use local and endemic species on batters to complement existing vegetation patterns and reduce the visual impact of earthwork. This is particularly important for disturbed areas on prominent ridge lines
- Adhere also to ecological requirements outlined in specialist reporting.

Landscape treatment

- Install large size plant stock at interchanges and near townships to maximise impact and mitigation at project outset
- Lay back the top batter of cuttings and tie back into the existing landform. Revegetate the top of the profile to blend with the existing landscape.
- Where competent rock is encountered, steepen batter grades (0.25H: 1V) and expose rock faces
- Avoid use of shotcrete at all cutting locations. If shotcrete is to be used at cutting locations then any treatments and pigmentation must blend with the surrounding vegetation and rock setting
- Provide frangible planting within clear zones
- Where possible reinstate agricultural land uses
- Provide functional and safe rest areas with high landscape amenity
- Provide planting in the medians to reduce headlight glare.

Built elements

- Minimising both the use and scale of noise walls and ensuring they are recessive in the landscape, or transparent, where they are required
- Minimise the road furniture which is required in the project and ensure the road furniture proposed is an integrated and cohesive set of elements
- All materials and finishes of the built infrastructure are to be of high quality for durability and appearance.

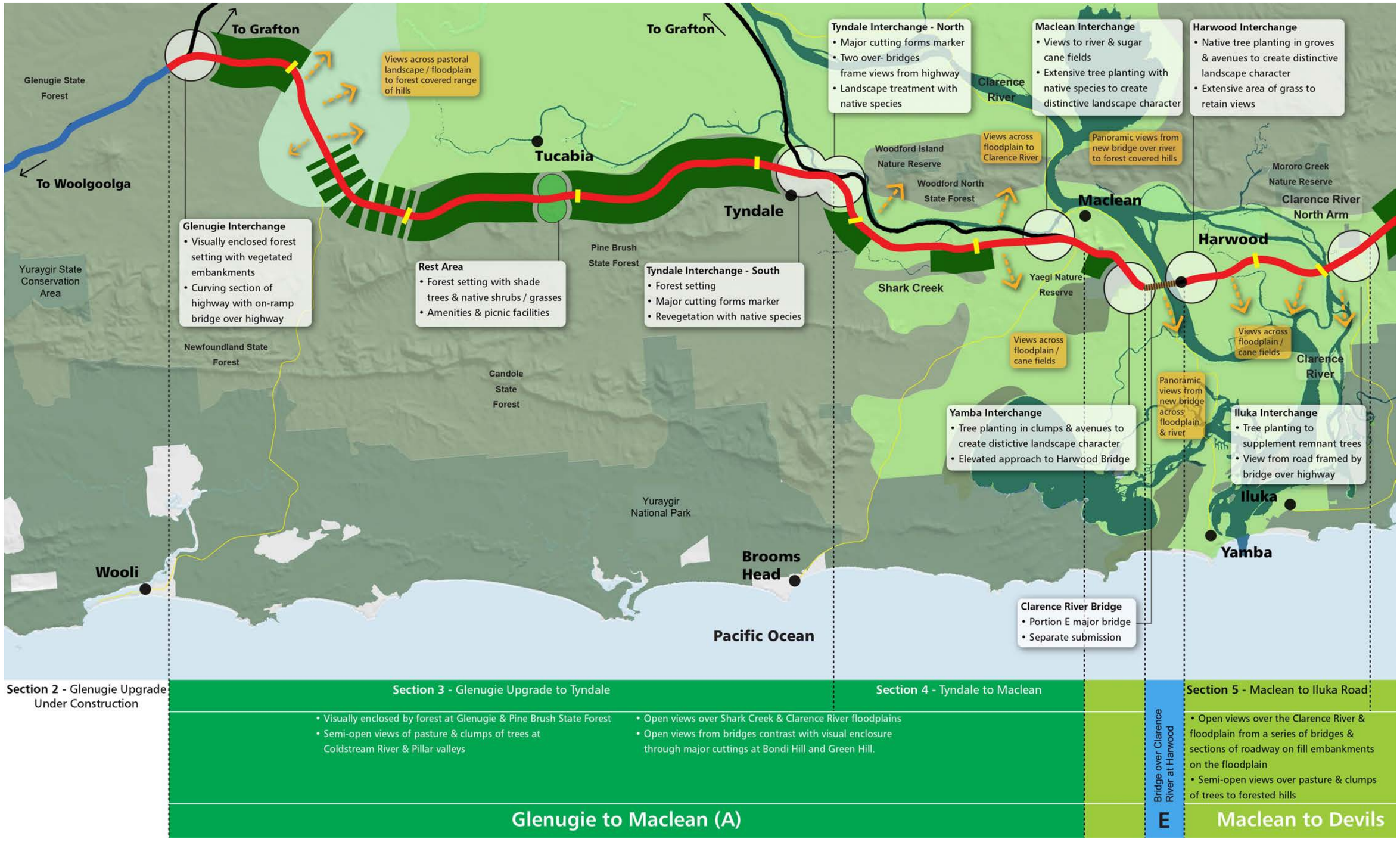


Figure 4.1 Strategy diagram for the Woolgoolga to Ballina upgrade

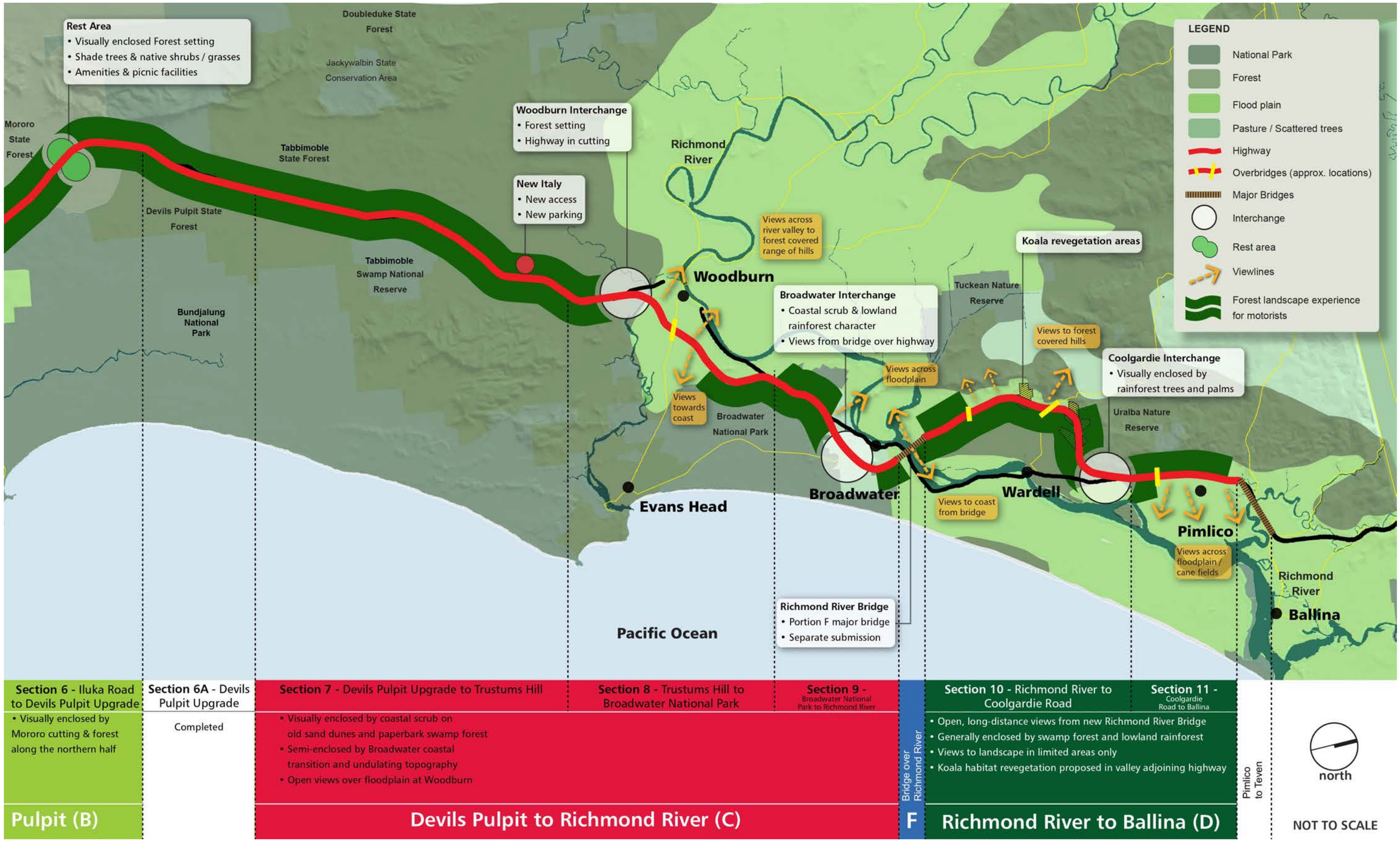

Rest Area
• Visually enclosed Forest setting
• Shade trees & native shrubs / grasses
• Amenities & picnic facilities
Doubleduke State Forest
Jackywalbin State Conservation Area
Mororo State Forest
Tabbimoble State Forest
Devils Pulpit State Forest
Tabbimoble Swamp National Reserve
Bundjalung National Park
Woodburn Interchange
• Forest setting
• Highway in cutting
New Italy
• New access
• New parking
Richmond River
Views across river valley to forest covered range of hills
Woodburn
Broadwater Interchange
• Coastal scrub & lowland rainforest character
• Views from bridge over highway
Koala revegetation areas
Tuckean Nature Reserve
Views to forest covered hills
Coolgardie Interchange
• Visually enclosed by rainforest trees and palms
Views across floodplain
Views towards coast
Broadwater National Park
Uralba Nature Reserve
Evans Head
Broadwater
Wardell
Views to coast from bridge
Pimlico
Views across floodplain / cane fields
Richmond River
Ballina
Richmond River Bridge
• Portion F major bridge
• Separate submission
Pacific Ocean
LEGEND
National Park
Forest
Flood plain
Pasture / Scattered trees
Highway
Overbridges (approx. locations)
Major Bridges
Interchange
Rest area
Viewlines
Forest landscape experience for motorists
Section 6 - Iluka Road to Devils Pulpit Upgrade
• Visually enclosed by Mororo cutting & forest along the northern half
Section 6A - Devils Pulpit Upgrade
Completed
Section 7 - Devils Pulpit Upgrade to Trustums Hill
Section 8 - Trustums Hill to Broadwater National Park
Section 9 - Broadwater National Park to Richmond River
• Visually enclosed by coastal scrub on old sand dunes and paperbark swamp forest
• Semi-enclosed by Broadwater coastal transition and undulating topography
• Open views over floodplain at Woodburn
Bridge over Richmond River
Section 10 - Richmond River to Coolgardie Road
Section 11 - Coolgardie Road to Ballina
• Open, long-distance views from new Richmond River Bridge
• Generally enclosed by swamp forest and lowland rainforest
• Views to landscape in limited areas only
• Koala habitat revegetation proposed in valley adjoining highway
Pimlico to Teven
Pulpit (B)
Devils Pulpit to Richmond River (C)
F
Richmond River to Ballina (D)
north
NOT TO SCALE

Figure 4.2 Artist impression of Bridge over Richmond River looking south, subject to further design

4.6___Urban design and landscape strategies specific to the Bridge over Richmond River

The Bridge over Richmond River, urban design and landscape strategies respond to the Pacific Highway Urban Design Framework Objectives as described in Chapter 6 of this report.

OBJECTIVE: Provide a flowing road alignment which is responsive and integrated with the landscape.

Design Principles
The proposed bridge design will use context sensitive design which fits the built components of the bridge sensitively within the landform. This will ensure the bridge structure is placed in harmony with the site maintaining the community's connection with its river identity. Context sensitive design will be achieved through:

- Minimising visual dominance of approach roads
- Proportion and scale of new bridge elements.

Creating a visually slender bridge structure which visually recedes into the landscape.

OBJECTIVE: Provide Consistency-with-variety in road elements

Design Principles
The urban design respects and reinforces the existing urban design intent developed through the wider Woolgoolga to Ballina upgrade. Consistency with variety in bridge elements will be achieved through:

- Designing individual bridge elements in accordance to the bridge aesthetics guidelines
- Specifically addressing consistencies in form (combination of proportion, symmetry, order, rhythm, simplicity), materials and finishes.

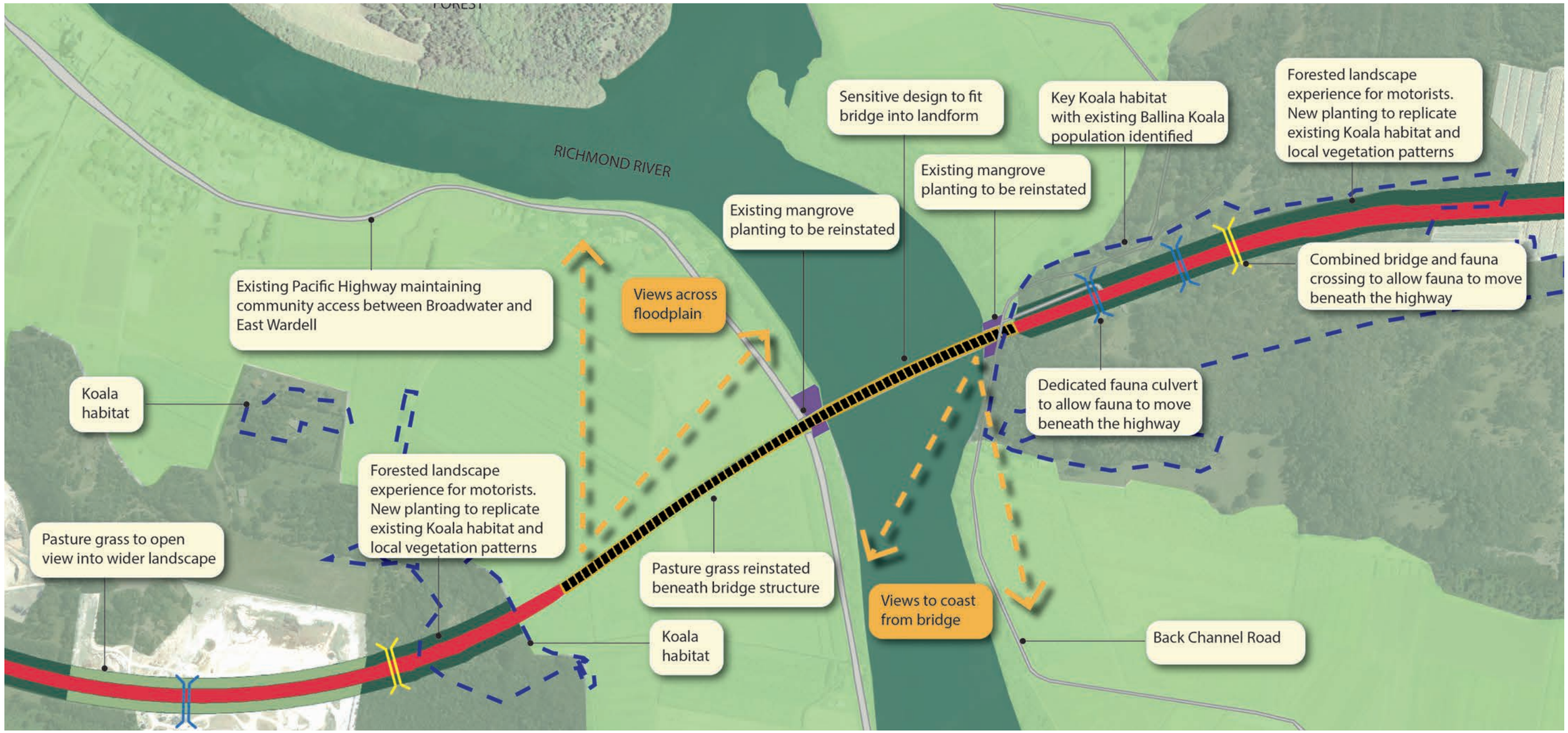


Figure 4.3 Strategy diagram for the Bridge over Richmond River

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

5 Contextual analysis

'The combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place' (Roads and Maritime, 2013).

Figure 5.0 Landscape character precincts, Data Source (EIS/SPIR 2012)

LEGEND

Precinct 45	East Broadwater and Cooks Hill	Precinct 48	Cabbage Tree Island and floodplain
Precinct 46	Broadwater township	Precinct 50	Bingal Creek
Precinct 47	Tuckean Broadwater		

5.1___Character zones

The existing landscape character of the Richmond River is largely determined by the vegetative characteristics seen in the nearby landscape.

Travelling from north to south the landscape is transitional where on the northern embankment the proposed bridge alignment will travel through the existing blackbutt eucalyptus forest.

As the bridge ascends over a dense screen of mangroves the character of the landscape transitions to a riverine landscape dominated by the serpentine riparian form of the Richmond River. Again a dense screen of mangroves dominates the southern river embankment before transitioning into cane fields and grazing plains. The descent of the bridge alignment grounds at the northern tip of the existing swamp mahogany forest. Landscape character is the aggregate of built, natural and cultural aspects which make up an area and provide its unique sense of place. Landscape in this context is taken to include all aspects of a tract of land – the built, planted and natural topographical and ecological features.

This landscape character and visual impact assessment undertaken during the EIS phase of the project followed the Roads and Maritime Services Guideline for Landscape Character and Visual Impact Assessment, 2013 to determine landscape precinct types based on identifiable landscape elements.

This process identified two landscape character precincts within this project boundary

- Precinct 46 – Broadwater Township
- Precinct 50 – Bingal Creek.

These are illustrated on Figure 5.0.

Using a visual impact grading matrix each character precinct was then assessed to identify the ability which each precinct type had to absorb character change and also the visual impact which the project may have to the existing landscape character.

5.2___Precinct 46 – Broadwater Township

This precinct of Broadwater township lies between the Richmond River and the western slopes of Cooks Hill. The Broadwater Sugar Mill lies at the centre of the township. Most of the residential lots are to the east between the existing Pacific Highway and Cooks Hill with some housing along the edge of the Richmond River.

The ability to visually absorb change is considered high due to heavily influenced and managed landscape.

5.3___Precinct 50 – Bingal Creek

Bordering the Tuckean Broadwater precinct, this precinct is predominantly dense mature forest and banksia heath forest with limited disturbance. There is consistency/ uniformity in the robust growth of the plants, which is highly sensitive to visual intrusion.

The ability to visually absorb change is considered low – moderate due to the scenic undulating landform and enclosed landscape character.

Landscape character design response
Fundamental to the way people read the journey, the road edge treatments approaching the bridge will focus on the experience of movement through the transitional landscape characters.

The landscape design will complement the open panoramic views to the south or the closed forested views to the north, tying each bridge approach seamlessly to the landscape beyond and grounding the experience before the journey ascends to reveal the impressive wide sweeping form of the river below.

5.4___Land-use and communities

The proposed Bridge over Richmond River crossing will span the river creating a new connection between the Richmond Valley and Ballina Shire Local Government Areas.

There are two communities located near the proposed bridge alignment. These are:

- Broadwater, identified as the sweet place to stop, is a small community, which is supported by the sugar industry. Crossing the north eastern boundary the bridge will pass near agricultural land
- Wardell, a village community in the Northern Rivers region of NSW. Here, the northern bridge abutment will be formed within the existing blackbutt forest.

Design response
The bridge crossing itself will become part of the suite of interactive experiences seen along the journey which includes interchanges, overbridges and underpasses. As a new landmark along the new and existing Pacific Highway routes, the bridge will be designed to sensitively fit within its riparian environment and will present as an elegant bridge crossing which reinforces the presence and place making qualities the river has for the Broadwater and Wardell communities.

Figure 5.1 Existing lowland topography, Image source: Pacific Complete

5.5 Landform and hydrology

Located in the Northern Rivers catchment area, the work will cross the Richmond River and its floodplain.

The Richmond River is subject to frequent and extensive flooding with seven major floods recorded since 1857, with the two largest occurring in 1954 and 1974. Flooding is generally concentrated on and around the coastal floodplains and inundation in these areas can extend throughout a number of weeks.

Landform and hydrology design response

The existing gentle transition between floodplains and ridges will be generally maintained through:

- Aligning the new bridge approach road closely with the existing landform
- Using minimal fill within floodplains to reduce impacts of the road on regional flooding and to improve views into the wider landscape
- Softening transitions into existing landscape with planting.

The design of the bridge crossing has considered the impact of the bridge on flood water levels, fauna crossing potential at embankments, and local and agricultural access.

The bridge has been designed to minimise the impact the bridge crossing will have on future flood events. This was achieved by improving the structural design of the bridge piers and pier struts, removing an intermediate road embankment in favour of a longer bridge and locating the southern bridge embankment as far away from the flood plain as possible to minimise the flood height, flood duration, flood velocity and the direction of flood water flow.

The design of the bridge piers takes into account flow velocities identified in the preliminary hydrology modelling.

The drainage system on the bridge has been developed in coordination with the hydrology modelling and hydraulic design and is designed to capture and convey the runoff from the bridge surface into drainage pipes which will direct the run off to water quality treatment channels or water quality basins located near the bridge abutments.

The bridge span of 980 m ensures obstruction of water flow on the floodplain is minimised to only occur at land piers and embankment. Preliminary hydrology modelling of the proposed bridge alignment has shown the bridge design will not affect the duration of flood events or flood extent and will only result in minor changes to peak water levels.

The Bridge over Richmond River is located in the NSW North Coast bioregion. This bioregion is one of the most ecologically diverse bioregions in NSW. The variety of ecosystems within the bioregion includes subtropical and warm temperate rainforests, a wide variety of wet and dry sclerophyll eucalypt forests, heathland, paperbark swamps, freshwater and estuarine wetlands, and waterways.

5.6___Flora

Existing vegetation types for the whole Woolgoolga to Ballina upgrade corridor were mapped for the EIS (SKM 2012). These were checked and refined by Roads and Maritime Services in 2015. Three ecological communities are present beneath the Bridge over Richmond River alignment as shown in Figure 5.2.
Of those, one community the Swamp Oak Floodplain Forest on Coastal Floodplains is classified as an endangered ecological community (EEC) listed under the NSW Threatened Species Conservation Act 1995 (TSC Act).

Existing vegetation types

The existing vegetation types are grouped into vegetation communities which vary due to changes in topography, soil type, rainfall and proximity to the coastal environment.

The vegetation community types seen in the area are:

- Wet sclerophyll forests
- Swamp forests
- Mangrove forests
- Floodplain forests.

Threatened flora

Investigative work carried out during the EIS identified threatened flora species and communities next to or near the road. No threatened ecological communities listed under the EPBC Act occur within this project's boundaries.

Endangered Ecological Communities

Several Endangered Ecological Communities (EECs) listed under the NSW TSC Act have been identified as being located in the study area for the Woolgoolga to Ballina upgrade. A single EEC (Swamp Oak Floodplain Forest of the NSW North Coast) occurs on both river embankments. This community includes the Grey Mangrove which is protected under the Fisheries Management Act.

Flora design response

The soft landscape work will be documented as part of the two adjoining Woolgoolga to Ballina packages (sections 9 and 10). For each of these sections the existing vegetation types identified on site have been incorporated into each areas planting design to produce community specific seed mixes suitable for use in the modified conditions. This highly contextual revegetation strategy has ensured the upgrade work responds to and appropriately strengthens the existing vegetative character of the area.

Bridge piers have been located to minimise clearing of mangroves. A permit will be obtained to remove about 1250 square metres of mangroves before the construction of the Bridge over Richmond River.

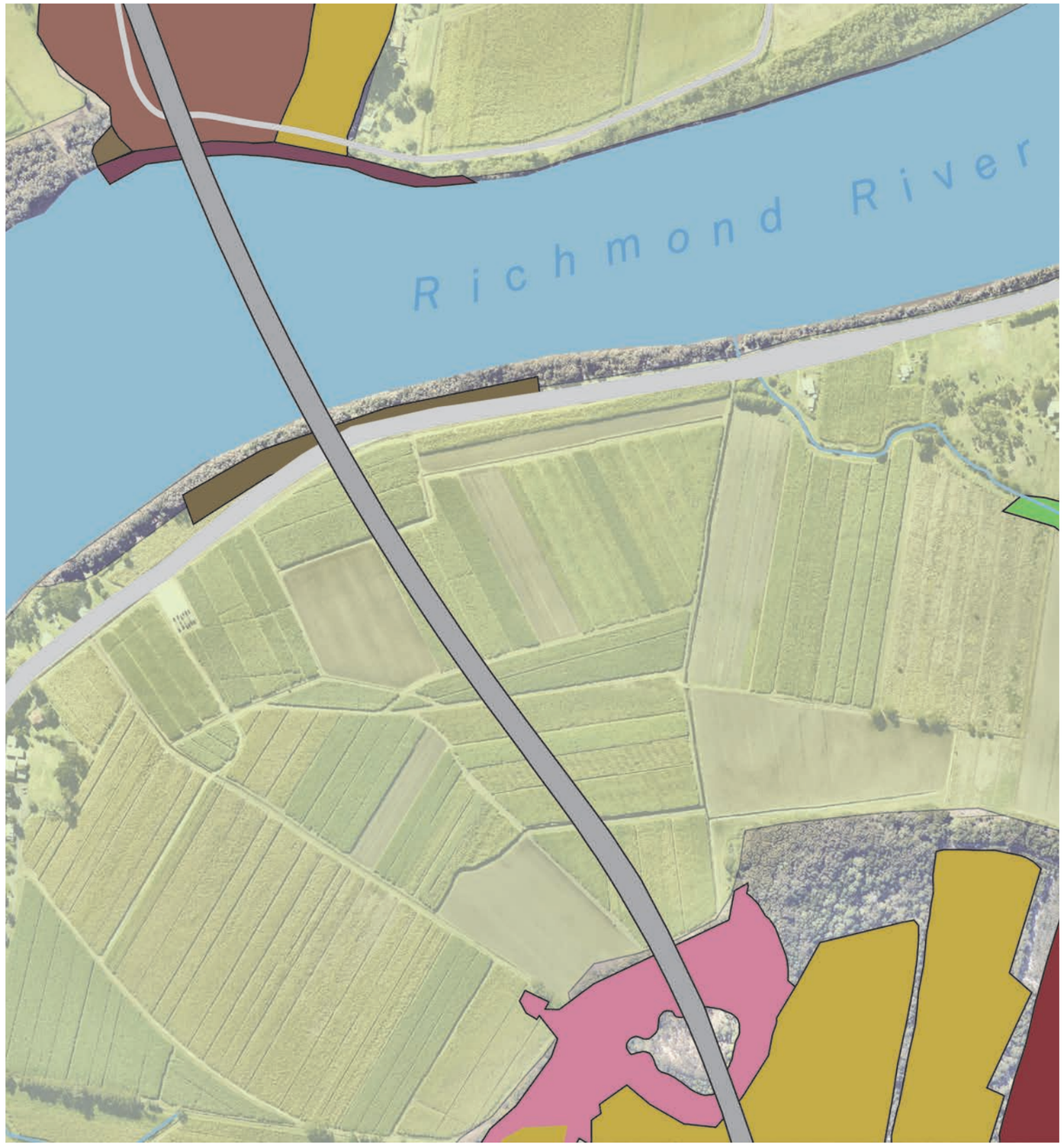


Figure 5.2 Existing vegetation map, Data source Pacific Complete (EIS/SPIR 2012)

5.7 Fauna

The EIS identified 350 fauna species (including fish and decapods) across the whole Woolgoolga to Ballina upgrade corridor, comprising of 335 native species and 15 introduced fauna species.

Fauna species include 190 bird species, 66 mammal species, 31 frog species, 31 reptile species, 24 freshwater and estuarine fish species, six species of decapods (crabs, prawns and shrimp) and two terrestrial invertebrates.

Fauna populations present next to the Richmond River include:

- Koala
- Pink underwing moth
- Brolga
- Eastern Grass and Powerful Owls
- Rose-crowned fruit dove
- Yellow-bellied sheathtail-bat
- Squirrel glider
- Long-nosed potoroo
- Coastal petaltail dragonfly.

The Richmond River is classified as a Class 1 waterway and is considered as a major permanently or intermittently flowing waterway (for example river or major creek), habitat of a threatened fish species. This aquatic habitat has the potential to support the Eastern (Freshwater) Cod.

Threatened fauna species
Targeted field studies carried out during the EIS identified the presence of Koala and Pink Underwing moth in close proximity to the project boundary. Both of these species are listed as threatened.

In addition 25 species identified in the project work from Richmond River to Ballina are listed as vulnerable and are likely to occur within or in close proximity to this project.

Migratory species
Targeted field studies carried out during the EIS confirmed the presence of ten migratory species within the project boundary. Two additional migratory species have also been identified as having a high likelihood of occurrence within the project boundary.

These species include:

- Australian Painted Snipe
- Spectacled Monarch
- Eastern Osprey
- Cattle Egret.

Fauna connectivity
The road alignment traverses land which is identified as key habitat and wildlife corridors. The key habitat areas comprise areas of predicted high conservation value for forest fauna, and include large areas of vegetated lands and important vegetation remnants. The habitat corridors facilitate important ecological processes including:

- Migration
- Colonisation
- Interbreeding of animals between two or more larger areas of habitat.

Fauna design response
Four fauna connectivity structures will be designed and documented as part of the two adjoining Woolgoolga to Ballina packages (sections 9 and 10) shown in Figure 4.3. Cross corridor fauna passage on the northern river emankment will be maintained between the rivers edge and the walled abutment. Fauna fencing will prevent fauna from accessing the highway at this location.

The design has been composed to meet the environmental objective for the upgrade of 'protecting the long-term viability of local fauna populations' by:

- Providing fauna connectivity structures to facilitate population movement between existing habitats for all species. Existing habitat for Koala is mapped in Figure 5.3 and
- Providing fauna protection fencing to protect from movement onto the highway and to direct fauna to key crossing locations
- Providing strategic planting next to fauna connectivity structures to replicate the surrounding habitat and provide protective cover for at risk fauna while minimising concealment opportunities for predators.
- Providing strategic habitat planting for koalas in areas which will adjoin sections of the road corridor described in Chapter 7.

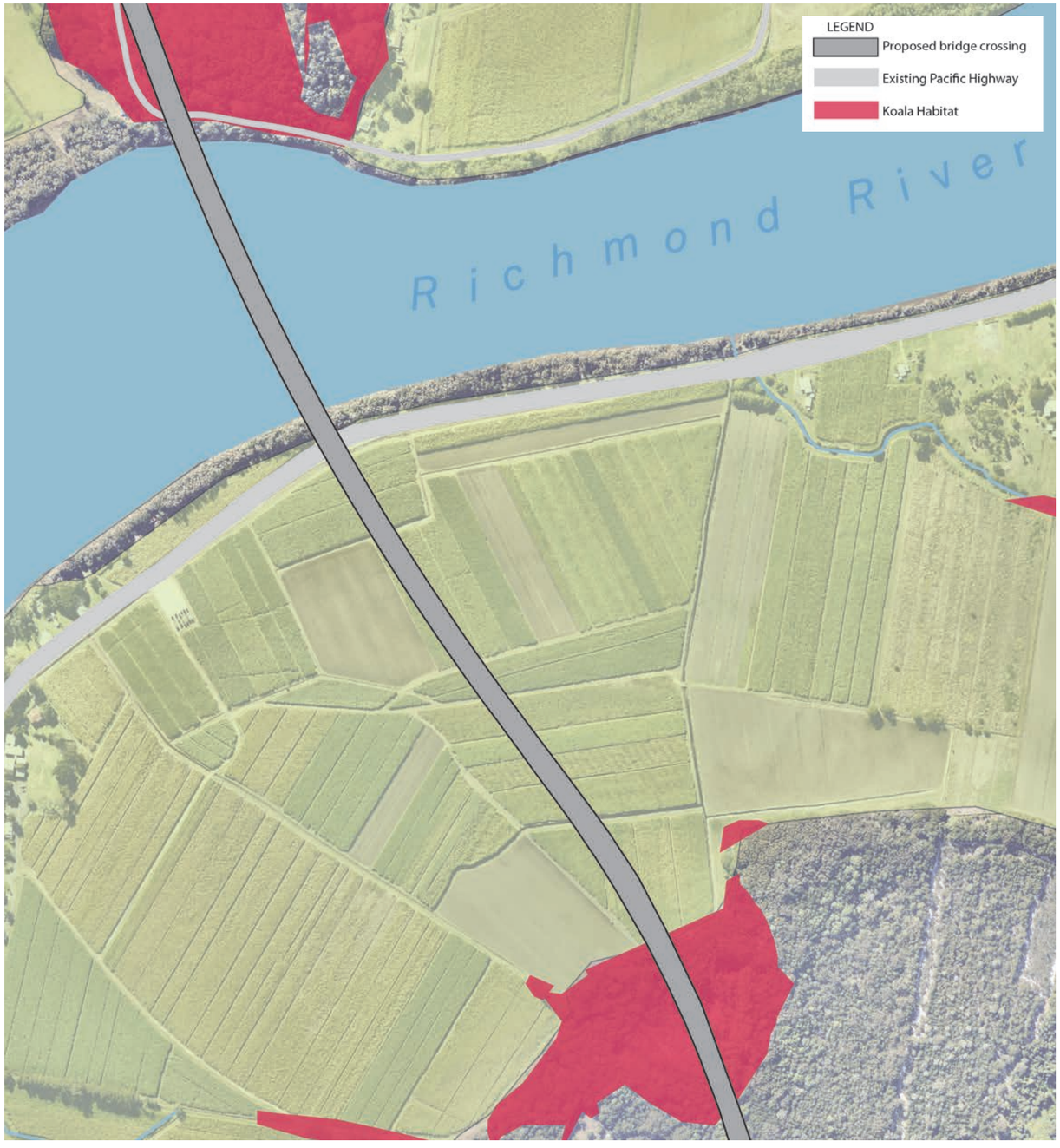


Figure 5.3 Existing Koala habitat map, Data source Pacific Complete (EIS/SPIR 2012)

The traditional owners of the land in Richmond Valley are a part of the Bundjalung Nation. The Bundjalung people are a large Aboriginal Nation, a federation of a number of groups of clans which inhabit the region north of the Clarence River to the Logan River in south-east Queensland.

5.8___Heritage

Aboriginal heritage
Existing Aboriginal cultural heritage values surrounding the proposed Bridge over Richmond River alignment were identified during both the EIS and SPIR phases through consultation with the Bundjalung people.

The investigations identified nine sites between Devils Pulpit and the Richmond River, and 11 sites between the northern embankment of the Richmond River and Ballina which are listed in the NSW Aboriginal Heritage Information Management System (AHIMS). Of particular significance to this project is an artefact scatter site of shell midden (13-1-0189, Site 11) located between 1.6 km and 1 km east of the project boundary.

As part of the section's 7, 8 and 9 work the aboriginal artefacts at Site 11 have been salvaged through a mixture of surface recovery and subsurface excavation. These artefacts were catalogued and re-buried. The location of a significant stone feature has been recorded and conserved in situ, at depth, in accordance with the wishes of Aboriginal stakeholders. This area will also be fenced with an access path from the existing Pacific Highway installed.

Design Response.
Access to the Aboriginal heritage Site 11 will be incorporated in the design.

Figure 5.4 Bundjalung nation clan map, Data Source Pacific Complete (EIS/SPIR 2012)

5.9___Landscape character and visual impact

As described in sub chapter 5.1 the landscape character assessment relates to the built, natural and cultural aspects which makes a place unique. The Visual Impact Assessment of the project involves the assessment of the visibility of the proposed bridge and the impact of the bridge to the visual character seen at each viewpoint.

This chapter summarises and compares the landscape character and visual impact assessment for the Bridge over Richmond River based on the methodology used during the EIS phase of the whole Woolgoolga to Ballina upgrade. The comparison is based on the impact assessment grading matrix shown in Figure 5.5 where magnitude is a measure of the scale, character, and distance of the proposal on the area or view. Sensitivity refers to the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed change.

5.9.1__Landscape character impacts

The following landscape character ratings were determined in the EIS. A comparison between the EIS and the current design is included in table 5.0.

Broadwater National Park to Richmond River
In Broadwater National Park to Richmond River (section 9), the project will introduce new bridge infrastructure in the landscape, with the bridge height ranging from 3–14 m above ground level. The impact would be greatest where the bridge spans the existing Pacific Highway on the southern river embankment.

Richmond River to Coolgardie Road
In Richmond River to Coolgardie Road (section 10), the project will introduce new bridge infrastructure in the landscape with the northern bridge embankment located within high quality bush land. The impact is greatest in this area as the infrastructure will physically dissect the existing landscape.

MAGNITUDE

SENSITIVITY	High	High to Moderate	Moderate	Moderate to low	Low	Negligible
High	High impact	High impact	Moderate - high	Moderate - high	Moderate	Negligible
High to Moderate	High impact	Moderate - high	Moderate - high	Moderate	Moderate	Negligible
Moderate	Moderate - high	Moderate - high	Moderate	Moderate	Moderate - low	Negligible
Moderate to low	Moderate - high	Moderate	Moderate	Moderate - low	Moderate - low	Negligible
Low	Moderate	Moderate	Moderate - low	Moderate - low	Low impact	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Figure 5.5 Landscape character and visual impact grading matrix

Table 5.0 Visual impact mitigation measures

Landscape Character Precinct	Magnitude	Sensitivity	Impact EIS	Impact UDLP
Precinct 46 – Broadwater Township	High New bridge across the Richmond River with associated embankments.	High Limited residences.	High	The current design will not change the magnitude and sensitivity identified in the EIS, as there is no change in the location of this character precinct and so the overall impact will remain the same.
Precinct 50 – Bingal Creek	Moderate–High New bridge across the Richmond River with associated embankments.	Moderate–High Limited residences. Northern side of bridge located within high quality bush land.	High	The current design will not change the magnitude and sensitivity identified in the EIS, as there is no change in the location of this character precinct and so the overall impact will remain the same.

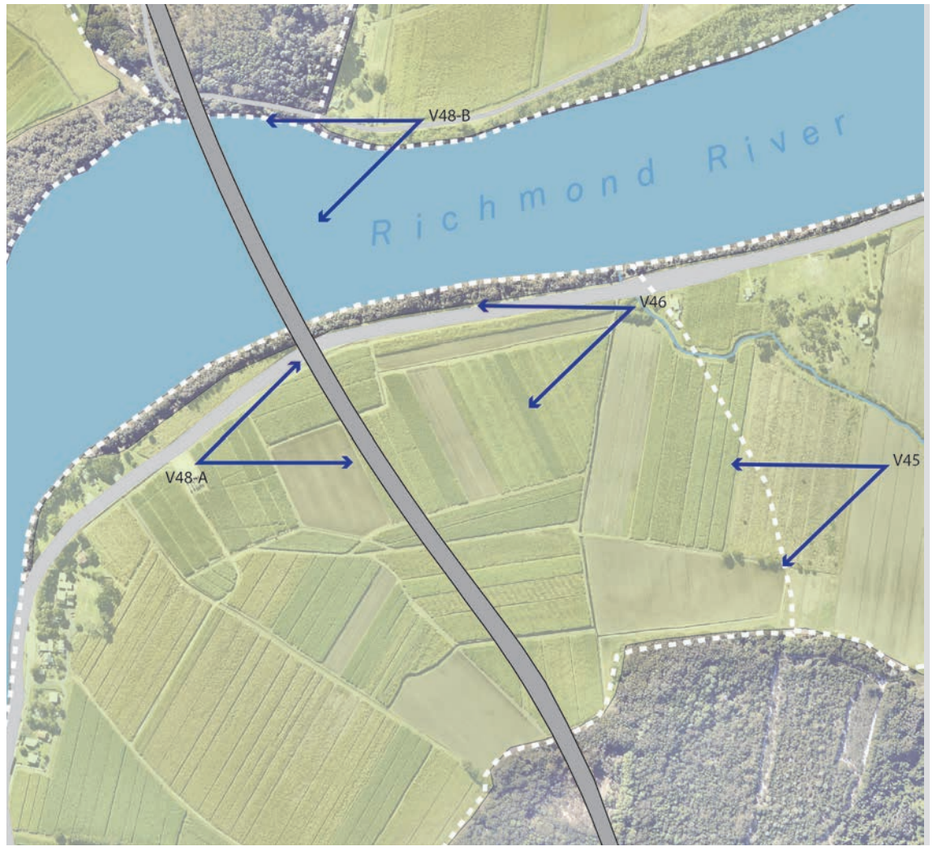


Figure 5.6 Viewpoint locations

5.9.2__Impacts on key views

Site description
An elevated bridge crossing over the Richmond River is proposed. The project deviates from the existing highway alignment around Cook's Hill on the south side of the river to the low ridge on the north side of the river. The new alignment typically traverses sugar cane farm lands and forested slopes associated with Cooks Hill and the prominent ridge. Views towards the bridge would typically be experienced from the floodplain areas around the proposed new crossing area. To the north of the river the visual catchment area is limited by the topographical relief and forest vegetation. There are few existing residences in close proximity to this area.

Project description
The proposed highway traverses floodplain areas on a fill embankment rising to a high level bridge crossing nearly one kilometre in length. The proposed highway approach from the south is located on a low fill embankment. On the northern side the bridge lands on an existing elevated natural ridge line.

Vantage point selection
These vantage points were selected to address the visibility and impact of the Bridge over Richmond River. These views are considered to represent the changed views which would be experienced by local people from their residences and from the local street network and by travellers passing through the area.

The selected viewpoints are listed below and illustrated on Figure 5.6
- Viewpoint 45 – Eversons Lane, North Broadwater
- Viewpoint 46 – Pacific Highway, North Broadwater
- Viewpoint 47 – Pacific Highway, Opposite Goat Island (not shown)
- Viewpoint 48A – Pacific Highway, Broadwater
- Viewpoint 48B – Back Channel Road.

The results of the EIS assessment have been reviewed and re-assessed in the following paragraphs in accordance with Roads and Maritime impact grading matrix (refer to Figure 5.5), taking into consideration the design amendments between the EIS and concept design.

Viewpoint 45 – Eversons Lane, North Broadwater

Description
Middle ground view looking north–west from Eversons Lane.

EIS assessment
The EIS concept viewpoint was assessed to have high to moderate magnitude due to the introduction of the bridge infrastructure and fill embankments in the agricultural setting.

The viewpoint was assessed to have moderate sensitivity as a small number of residents and local road users will experience change to the middle ground view. This gave an overall visual impact of moderate.

Visual impact assessment
The magnitude rating will remain as high to moderate as the current design is similar to the EIS concept. The current design will not change the sensitivity rating assessed in the EIS, which will remain moderate. The overall visual impact will remain Moderate.

Management measures identified in the EIS
- Maintain an agricultural setting for the elevated bridge and embankments in this location where they cross sugar cane fields
- Provide new tree planting only where the upgrade passes through forested areas in accordance with the concept design.

These management measures have been adopted in the planting design.

Viewpoint 46 – Pacific Highway, North Broadwater

Description
Foreground view looking west from the existing Pacific Highway, North Broadwater.

EIS assessment
The EIS concept viewpoint was assessed to have high to moderate magnitude due to the new bridge infrastructure over the river and Pacific Highway in a natural and agricultural setting.

The viewpoint was assessed to have low sensitivity as the changed view would be visible to a low number of local people from the local road network. This gave an overall visual impact of moderate.

Visual impact assessment
The magnitude rating will remain as moderate as the current design is similar to the EIS concept. The current design will not change the sensitivity rating assessed in the EIS, which will remain low. The overall visual impact will remain Moderate.

Management measures identified in the EIS
- Minimise the loss of existing riparian vegetation
- Minimise the depth of the bridge deck
- Avoid adding acoustic barriers above the bridge deck. If this is necessary use transparent barriers.
- Provide a high quality bridge design.

These management measure are being implemented as part of the concept design. Refer to Chapters 7 and 8 for details.

Viewpoint 47 – Pacific Highway, Opposite Goat Island

Description
Distant view looking south–west, Pacific Highway opposite Goat Island.

EIS assessment
The EIS concept viewpoint was assessed to have moderate magnitude. This was determined by the inclusion of the major new bridge infrastructure over the Richmond River in a natural scenic setting but viewed at a distance.

The viewpoint was assessed to have moderate sensitivity. The view is sensitive because of its high scenic quality but only a few people have access to the view. This gave an overall visual impact of moderate.

Visual impact assessment
The magnitude rating will remain as high to moderate as the current design is similar to the EIS concept. The current design will not change the sensitivity rating assessed in the EIS, which will remain moderate. The overall visual impact will remain moderate.

Management measures identified in the EIS
- Minimise the loss of existing riparian vegetation
- Minimise the depth of the bridge deck
- Avoid adding acoustic barriers above the bridge deck. If this is necessary use transparent barriers.
- Provide a high quality bridge design.

These management measure are being implemented as part of the concept design. Refer to Chapters 7 and 8 for details.

Viewpoint 48A – Pacific Highway, Broadwater

Description
Foreground view looking east, Pacific Highway, North Broadwater.

EIS assessment
The EIS concept viewpoint was assessed to have high magnitude. This was determined by the inclusion of the major new bridge infrastructure and fill embankments in the foreground across the open agricultural landscape.

The viewpoint was assessed to have moderate – low sensitivity. This view is considered to have low sensitivity for a low number of residents at locations along the existing highway and in the floodplain area. The view will have moderate sensitivity for motorists using the existing Pacific Highway. This gave an overall visual impact of moderate to low.

Visual impact assessment
The magnitude rating has been reduced to moderate to low as the current design although similar to the EIS concept has changed to remove an road embankment that in turn reduces the scale of the upgrade slightly. The current design will not change the sensitivity rating assessed in the EIS, which will remain low. The overall visual impact will remain moderate to low.

Management measures identified in the EIS
- Maintain an agricultural setting for the elevated bridge and embankments in this location over pastoral land
- Minimise the loss of existing riparian vegetation
- Minimise the depth of the bridge deck
- Avoid adding acoustic barriers above the bridge deck. If this is necessary use transparent barriers.
- Provide a high quality bridge design.

These management measure are being implemented as part of the concept design. Refer to Chapters 7 and 8 for details.

Viewpoint 48B – Back Channel Road

Description
Foreground view looking west, Back Channel Road.

EIS assessment
The EIS concept viewpoint was assessed to have high to moderate magnitude due to the new bridge infrastructure over the river in a natural setting.

The viewpoint was assessed to have low sensitivity as this changed view would be visible to a low number of local people from the local road network. This gave an overall visual impact of moderate.

Visual impact assessment
The magnitude rating will remain as moderate as the current design is similar to the EIS concept. The current design will not change the sensitivity rating assessed in the EIS, which will remain low. The overall visual impact will remain moderate.

Management measures identified in the EIS
- Minimise the loss of existing riparian vegetation
- Minimise the depth of the bridge deck
- Avoid adding acoustic barriers above the bridge deck. If this is necessary use transparent barriers.
- Provide a high quality bridge design.

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

6 Design principles

"Landscape character is the aggregate of built, natural and cultural aspects which make up an area and provide its unique sense of place.

The landscape character of the Woolgoolga to Ballina corridor is defined largely by the interplay of tall eucalypt forests interspersed with the repeating patterns of crop, pasture land and water crossings". (Hassell,2012)

Figure 6.0 Aerial view over Broadwater Sugar Mill, Image source: PC

Figure 6.1 Common bridge barrier rail detailing.

6.1___Site description

Regional Context
The proposed Bridge over Richmond River at Broadwater is on the northern coastal plain of NSW. It is located about 60 km north of Harwood and 200 km south of Brisbane.

A connecting piece of the Woolgoolga to Ballina upgrade, the bridge will cross the Richmond River diverting traffic inland along the new Pacific Highway alignment towards Ballina.

Local Context
The bridge will cross the Richmond River about 2km north–east of the existing bridge crossing at Broadwater, and 6km south–west of the existing Pacific Highway bridge crossing connecting Wardell and East Wardell.

6.2___Urban design context

The urban design context of the bridge describes the relationship, arrangement, appearance and function of the bridge design with the environment it passes through.

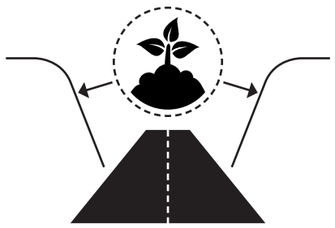
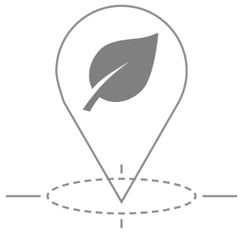
The urban design of the existing Pacific Highway and subsequent highway upgrades has created a relationship between built and natural elements which encourages the built elements to sensitively fit within the landform as well as the built, natural and community environments in which it is situated.

The key elements of the existing Pacific Highway which define the existing urban design context are:

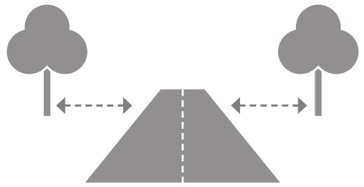
- The existing Pacific Highway arterial road and local adjoining roads and the relationship to the topography
- The iconic Woodburn Riverfront relationship to the highway alignment
- The bridge crossings and the common infrastructure detailing.

6.3___Urban design strategies

The design of the Bridge over Richmond River crossing responds to the overarching urban design objectives and landscape and urban design strategies developed for the adjoining sections of the Pacific Highway. Objectives specific to the design of the bridge crossing are identified in bold below.





WOOLGOOLGA TO BALLINA URBAN AND LANDSCAPE DESIGN OBJECTIVES				PACIFIC HIGHWAY URBAN DESIGN FRAMEWORK OBJECTIVES	
OBJECTIVE 1 **Provide a flowing road alignment which is responsive and integrated with the landscape.**	**OBJECTIVE 2** Provide a well vegetated, natural road reserve.	**OBJECTIVE 3** Provide an enjoyable, interesting highway.	**OBJECTIVE 4** Value the communities and towns along the road.	**OBJECTIVE 5** Provide consistency with variety in road elements.	**OBJECTIVE 6** ***Provide a simplified and unobtrusive road design.***
URBAN AND LANDSCAPE DESIGN STRATEGIES					
STRATEGY 1 **Blend topographic change** **Shape topography and revegetate cuttings and embankments to blend with the existing landform and maintain the visual character of the landscape.**	**STRATEGY 2** **Respect local vegetation** Deliver a local landscape adopting a vegetation palette founded upon local landscape types. Plant species selected from local vegetation communities for local conditions to reinforce the natural landscape character and cultural landscape qualities of the site. Planting application to be seeding along the main alignment and planting at interchanges.	**STRATEGY 3** **Sequence views** Sensitively compose planting to create a varied sequence and depth of views along the journey. Landscaping is used to sequence the driver's views from closed forested views to open views of cropping and pasture land.	**STRATEGY 4** **Emphasise moments** Adopt semi-mature tree plantings and compose character landscapes as markers of communities, rest stops, and moments along the journey.	**STRATEGY 5** **Consistently connect** **Connect communities through infrastructure design, fauna and planting elements which are composed using a consistent design language which contextually responds to local character and cultural values remaining true to the overall Pacific Highway presentation approach.**	**STRATEGY 6** **Safely and sensitively structure** **Structure the landscape to provide a hierarchical treatment which responds to frangibility, structures, maintenance and fauna fence clear zones. This will ensure safe movement for drivers, animals, and maintenance teams at installation and as the landscape matures.**

The Richmond Valley region comprises mountain bush and hilly scrubland, timber country and grazing land, floodplains with sugar cane and tea tree stands, wetland and swamp to coastal heath, rocky headlands and dunal systems.

Figure 6.2 Aerial view of Richmond River, Image source: Pacific Complete

6.4___Local environmental values

A number of local environmental value elements exist along or in the vicinity of the alignment of the proposed bridge crossing. These elements include:

- Flora and fauna habitat needing to be protected or translocated
- Areas of landscape which include threatened flora species
- Landscapes with potential acid sulphate soils
- Aboriginal sites and/or conservation zones
- Aboriginal potential archaeological deposit (PAD) sites.

The construction of the bridge crossing will introduce panoramic views of the Richmond River and patchwork cane fields below. This panoramic view will increase the connection the road users have with the environment and contribute to the scenic value the environment holds.

The impact to these local environmental values was assessed and quantified through the environmental design for the Bridge over Richmond River crossing. Where applicable mitigation measures detailed in the environmental design report have been instilled during the design process of the urban design work.

6.5___Heritage values

Impact to the historically significant sites located within or near the work identified in Chapter 5 of this report have been avoided and mitigated where possible.

Salvaged Aboriginal artefacts have been catalogued and re-buried, and the location of a significant stone feature has been recorded and conserved in situ at depth, in accordance with the wishes of Aboriginal stakeholders.

During construction all identified heritage sites will be protected with protective fencing, exclusion zones or flagging and signage to prevent disturbance during construction.

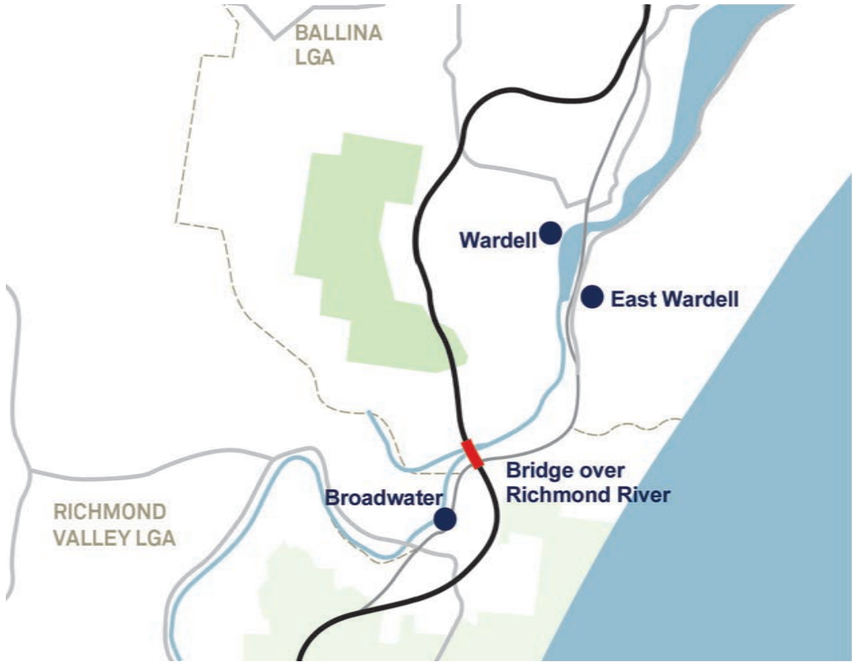


Figure 6.3 Community location map

6.6___Sustainable design and maintenance

A environmental management system is employed to record and measure project performance against international sustainability standards with the objective of protecting and sustaining the natural environment.

The environmental management system:

- Fosters environmental awareness and encourages a genuine respect for environmental protection
- Identifies and manages impacts to the environment throughout the design process
- Will develop and use best practice construction techniques to achieve a positive environmental outcome
- Implements initiatives to reduce energy and water consumption
- Minimises waste generation
- Prevents pollution
- Encourages open communication with the community and government agencies on environmental issues
- Monitors and reviews the Environmental Management Systems policies, objectives, targets and outcomes.

6.7___Sustainable action plan

A Sustainability Action Plan (SAP) was developed for the Devils Pulpit to Richmond River (section 7, 8 and 9) work, to ensure the work are an Ecologically Sustainable Development (ESD) when tested using the Infrastructure Sustainability Council of Australia (ISCA) rating tool. Details of the ISCA rating tool are presented in the Devils Pulpit to Richmond River Sustainability Action Plan Report.

For urban design the SAP focuses specifically on the analysis, planning and design of the infrastructure asset within its community and environment to achieve contextually appropriate infrastructure design.

For the Bridge over Richmond River this will be achieved by allowing the local context to influence the design to create infrastructure which fits its setting, while preserving and enhancing scenic, aesthetic, cultural, community, and environmental resources and values.

6.8___Community amenity and privacy

There are two communities located next to or near the Bridge over Richmond River crossing shown in Figure 6.2.

- Broadwater, identified as ‘the sweet place to stop’ is a smaller community, which is supported by the sugar industry
- Wardell, known for its landmark bridge.

The key community values relating to amenity for residents of the Richmond Valley Shire as described in The Richmond Valley Towards 2025 Community Strategic Plan are:

- A quiet, friendly and relaxed lifestyle
- Access to natural attributes
- Open space and recreation.

These values resonate with the Wardell Planning and Environmental Study 2015 with stated important development values of:

- Maintenance of the friendly and peaceful lifestyle
- Provision of opportunities to increase the population of Wardell
- Enhancement of the town’s links to the river, both physically and aesthetically
- Preservation and promotion of the natural assets of Wardell.

The design responds to these values by:

- Diverting the highway from Woodburn, Broadwater and Wardell to remove unnecessary through traffic and encouraging a quiet, friendly and relaxed lifestyle
- Allowing people to view the expansive natural attributes when crossing the Richmond River.

6.9___Pedestrians and cyclists

Pedestrians

For safety reasons, no pedestrian access will be provided to the Bridge over Richmond River.

Cyclists

Provision for cyclists using the bridge shoulder has been allowed for.

6.10 Temporary work, ancillary facilities, access tracks and watercourse crossings

In consultation with Roads and Maritime Services property division the Woolgoolga to Ballina upgrade will require ancillary facilities to support the construction activities associated with the project. The project's conditions of approval defines ancillary facility as:

- Temporary facility for construction, including for example, an office and amenities compound, construction compound, batch plant (concrete or bitumen), material crushing and screening, materials storage compound, maintenance workshop, testing laboratory or material stockpile area.

In line with the Minister's Conditions of Approval (MCoA) D21, Pacific Complete has prepared an Ancillary Facilities Management Plan which outlines how ancillary facilities will be assessed and managed during construction of the project. The Management Plan provides details of the approval pathway, environmental impact assessment, and includes details of all ancillary facilities approved for the project. Ancillary facilities covered by the Management Plan include:

- Office compounds – including the main site compounds, site offices, sheds, workshops and storage
- Satellite compounds – small site offices
- Minor ancillary facilities – including lunch sheds, office sheds, and portable toilet facilities
- Bridge site compounds – site office to allow for easy access to major bridge sites
- Batch plants – for the production of concrete and asphalt
- Crushing plants and material processing sites – plant and equipment for the processing, crushing and screening of excavated material for use on-site
- Plant workshops – for the storage and maintenance of plant and equipment
- Stockpile sites – for the stockpile and storage of excavated material, mulch and spoil
- Material storage (lay down areas) – for the storage of materials delivered to site for construction
- Display centres and visitor parking.

The ancillary facilities associated with the Woolgoolga to Ballina upgrade include areas which are located within the existing or proposed highway corridor and are directly or indirectly impacted by the construction work, in addition to locations nearby or separate to the construction activities. As outlined in the MCoA definitions, all ancillary facilities are temporary and can only be used for the Woolgoolga to Ballina upgrade. MCoA B76 of the project's conditions of approval outlines the rehabilitation requirements of these sites.

The land's on which ancillary facilities are located shall be rehabilitated to at least their pre-construction condition or better, unless otherwise agreed by the landowner.

General location and size

The temporary ancillary facilities used during the highway construction phase will vary in their size and configuration, depending on the nature of use and nearby construction activities. There is likely to be a combination of a large main construction compound on the southern embankment and a smaller satellite compound located on the northern embankment as shown on the landscape strategy diagram.

Temporary ancillary sites are located on two different categories of land which include:

1. Land owned by Roads and Maritime for the purposes of the project
2. Private properties leased for the construction period of the highway.

All ancillary facilities will be managed for the project in line with the approved Ancillary Facility Management Plan. It is anticipated each ancillary facility will be developed and rehabilitated in line with the principles outlined.

Ancillary and site rehabilitation principles

1. Establish landowner requirements and identify rehabilitation objectives.
2. Consideration of the location context and amenity requirements.
3. Integrate rehabilitation with nearby landform, topography.
4. Consider fauna connectivity and wildlife corridors and enhance where possible.
5. Apply landscape treatments consistent with the upgrade UDLP to ensure an integrated outcome.

Commitment to site rehabilitation

The intention with all temporary construction sites is to rehabilitate them as soon as possible after they are no longer required for the highway construction operations.

1. **On Roads and Maritime owned sites used for temporary construction** which are to be sold, and are located within or near native vegetation communities, the area impacted within those properties will be revegetated with species compatible with the remnant vegetation. Where appropriate the revegetation will enhance wildlife habitat values. The rehabilitation work is to include maintenance until the vegetation is well established.

2. **On Roads and Maritime owned sites used for the extraction of construction material** the rehabilitation work may include disposal of soil material classified as 'unsuitable' generated by the highway work, regrading to create landforms compatible with adjoining areas and establishment of a stable revegetation cover. Reuse of this material is subject to all relevant waste and planning approval requirements.

3. **On privately owned land** the rehabilitation work will be in line with an agreement to be reached with the property owner. The rehabilitation work is to meet all relevant environmental requirements.

6.11 Flood focus groups

Extensive flood modelling has been carried out for the upgrade. Roads and Maritime Services has re-formed flood focus groups for the Woolgoolga to Ballina Pacific Highway upgrade. The groups exist for sections of the upgrade not currently in major work where the design is currently being finalised. The focus group meetings address the upgrade's potential flood impacts; review updated flood models and any changes as part of the detailed design development process; review the upgrade's proposed waterway structures, and review flood impact maps.

The latest flood modelling reflects the final design of the project as shown in the UDLP. The results of the flood modelling, any impacts and associated mitigation measures and the outcomes of the community and landowner consultation process has been reported in the project's Hydrological Mitigation Report which was submitted to the Department of Planning and Environment for review. This report is available through the project website.

Relevant documentation is available at: http://www.Roads and Maritime Services.nsw.gov.au/W2B.

Refer to Chapters 8 and 9 for information on the landscape design responses to flood modelling.

6.12__Noise mitigation

Potential noise impacts have been assessed against road traffic noise criteria recommended by the NSW Government's Road Noise Policy (RNP) and mitigation requirements have been guided by the Roads and Maritime Noise Criteria Guideline (NCG,2015) and Noise Management Guidelines.

In accordance with the project conditions of approval an Operational Noise Report is being prepared for the project. When finalised this will be available on the project website, refer to:

http://www.Roads and Maritime Services.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina/project-documents.html

Noise modelling has been carried out as part of the detailed design and has confirmed:

- There are no noise walls required as part of this project
- The range of noise mitigation measures are consistent with the EIS, including the locations of low noise road surfaces
- Mitigation details will be determined through consultation with affected property owners.

An assessment of potential construction related noise is available in the Construction Noise and Vibration Management Plan, Appendix B3, October 2015, refer to:

http://www.Roads and Maritime Services.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina/

Latest noise modelling on the detailed design of the project indicates there are no noise mitigation structures required for the project. The noise modelling report was submitted to the Department of Planning and Environment in mid 2017.

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

7

Detailed response for Landscape design

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

7.1___Urban design and landscape design strategy

The urban and landscape design strategy is focused on delivering the project objectives through practical design and construction measures which support the overarching urban and landscape design principles identified in Chapter 6.

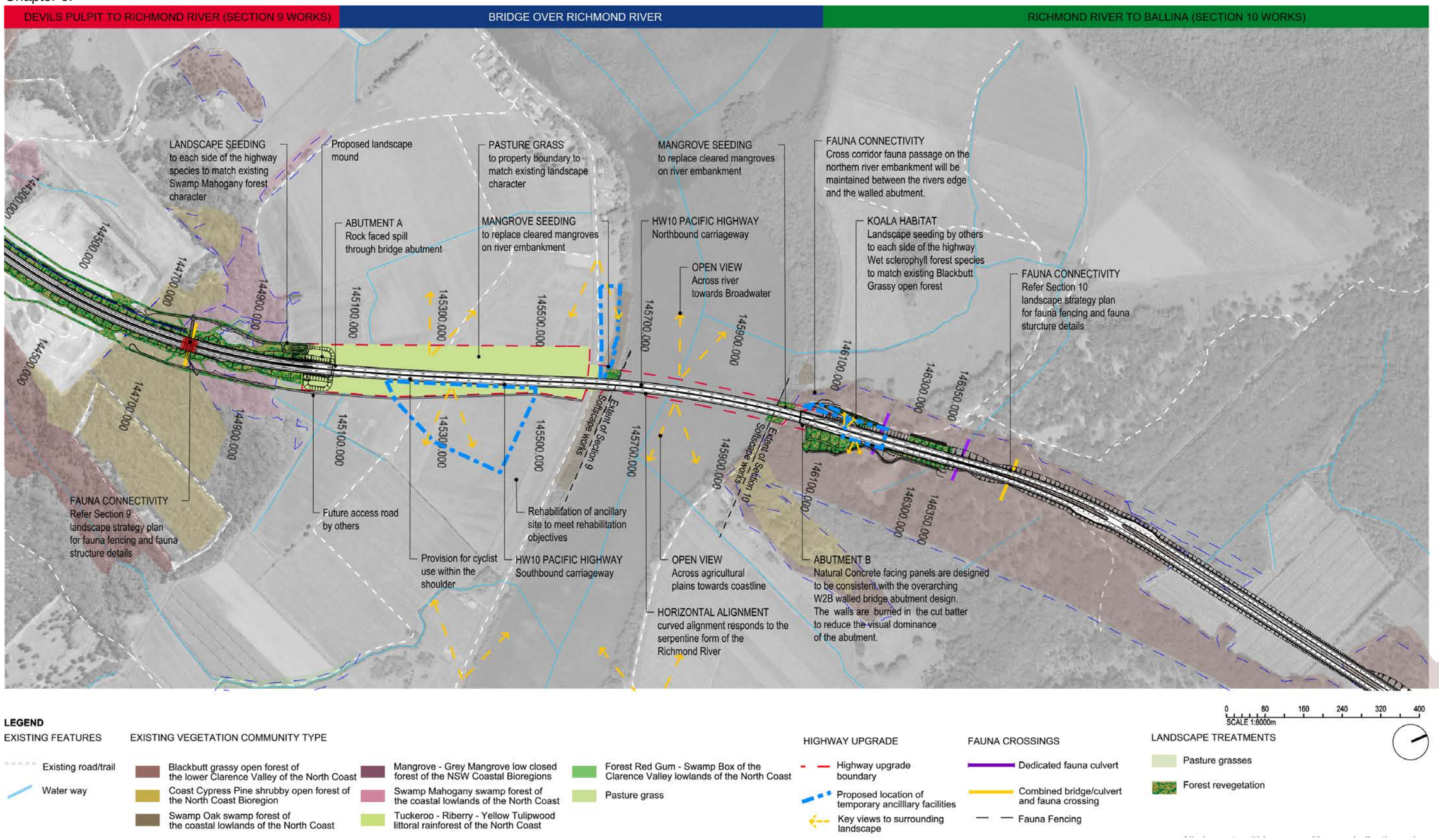


Figure 7.0 Urban design strategy plan

7.2___Urban design and landscape design strategy detail plans

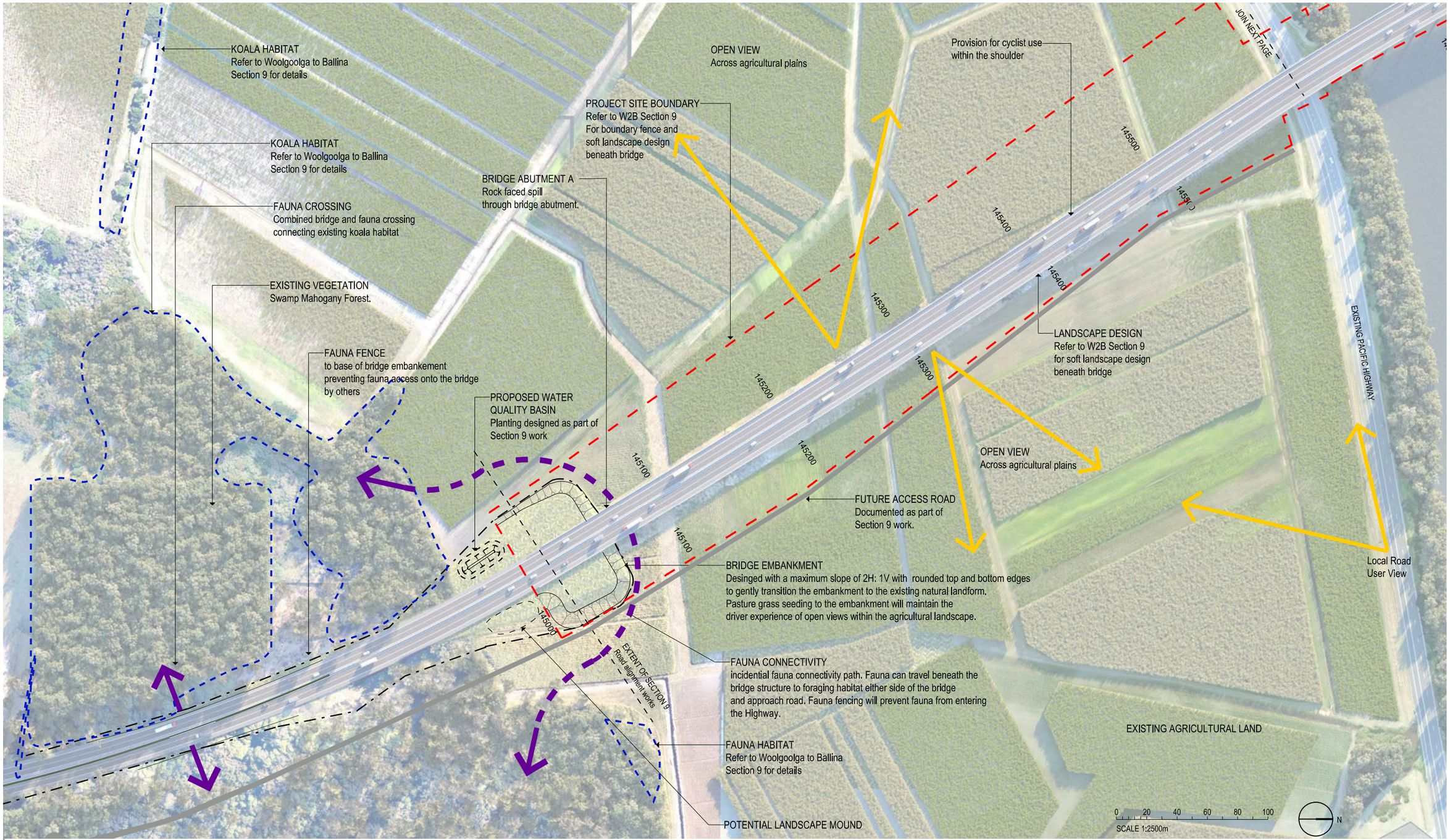


Figure 7.1 Detailed urban design strategy plan

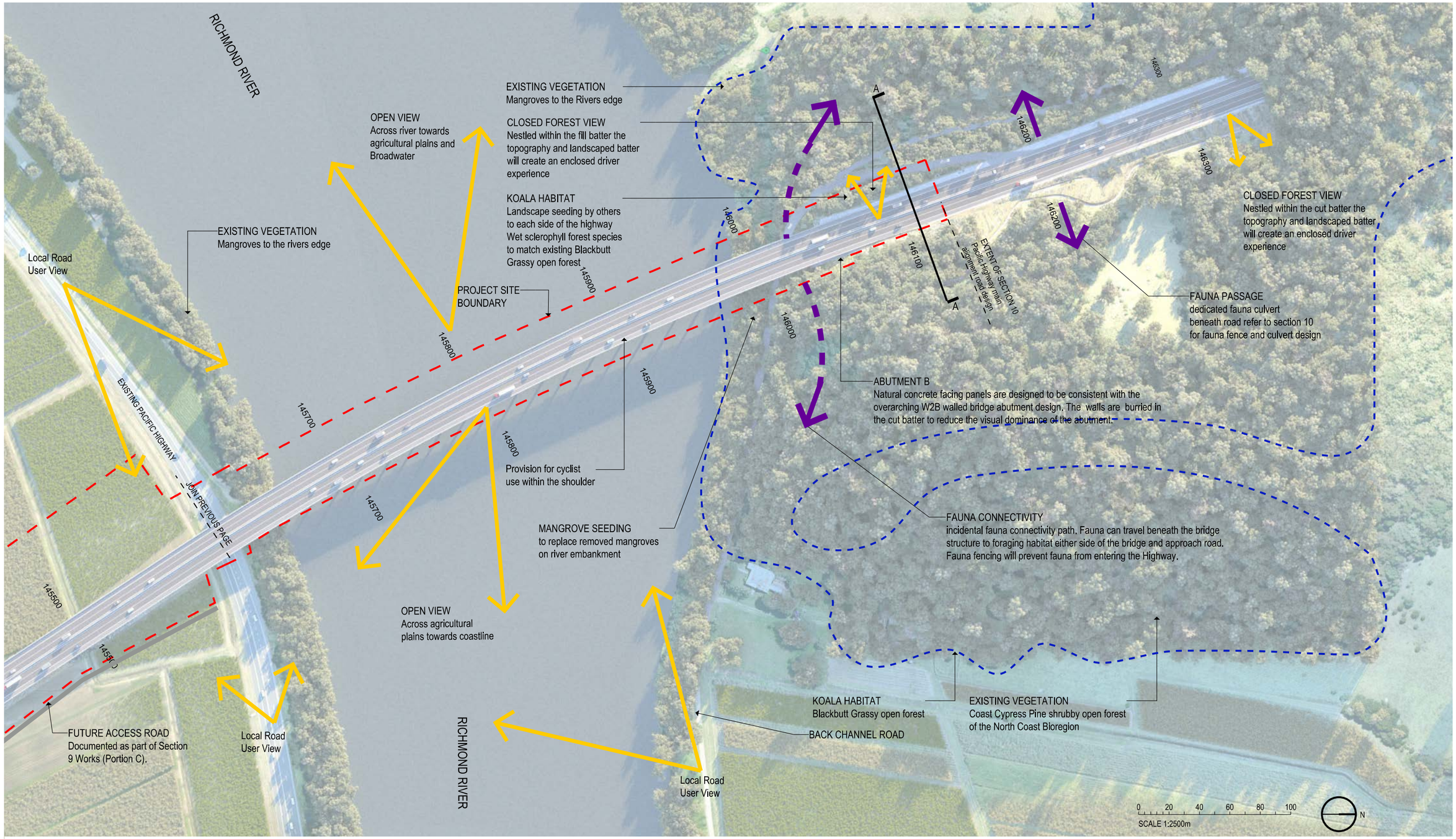


Figure 7.2 Detailed urban design strategy plan

Figure 7.3 Artist impression of View of bridge from existing Pacific Highway departing Broadwater, subject to further design

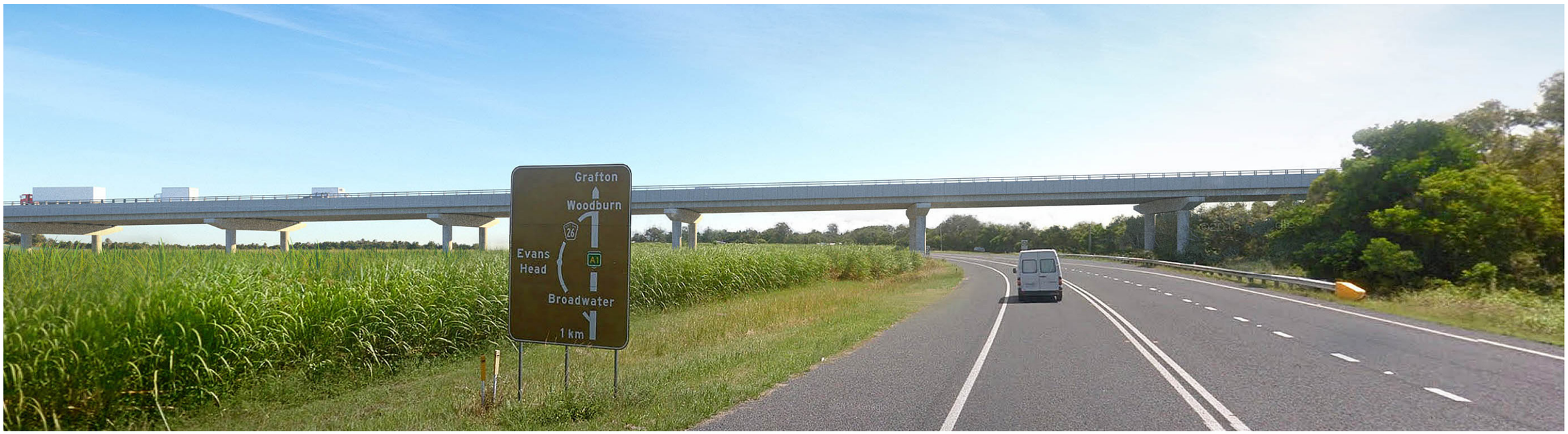


Figure 7.4 Artist impression of view of bridge from existing Pacific Highway approaching Broadwater, subject to further design

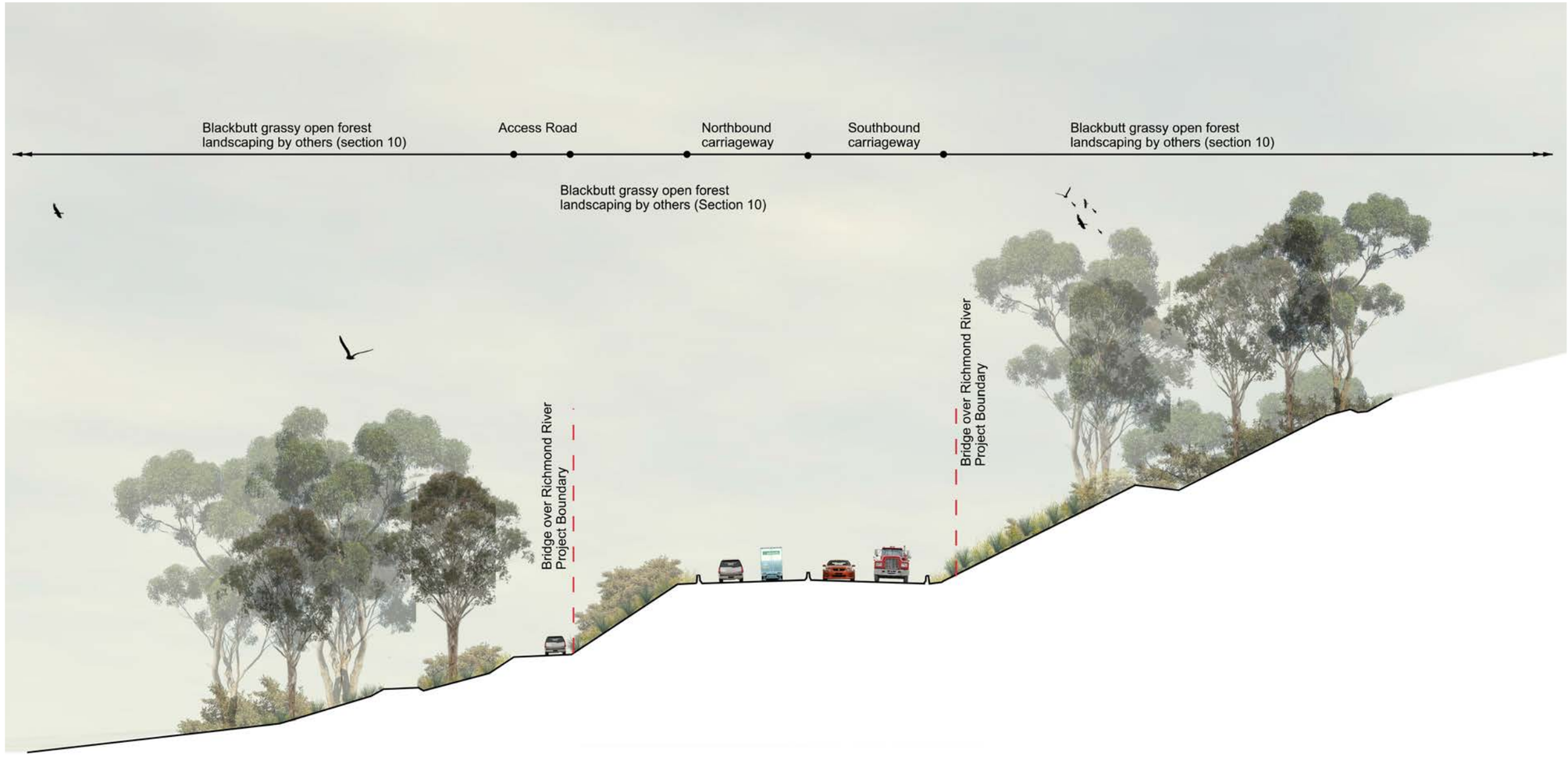


Figure 7.5 Cross section A-A

Landscape principles

Respect local vegetation
Deliver a local landscape adopting a vegetation palette founded upon local landscape types and species selected from local bioregions for local conditions to reinforce local agricultural and natural character.

Blend topographic change
Shape topography and revegetate cuttings and embankments to blend with the landform and maintain the visual character of the landscape.

Consistently connect
Reinstate and enhance fauna and vegetation community connectivity along and across the corridor through linking remnant verge, underpass, culvert and overhead crossings through contextual planting.

Sequence views
Sensitively compose planting to create a varied sequence and depth of views along the journey to selectively screen sensitive receptors while featuring the driver experience of character variance from ridge to floodplain, forest to crop and pasture.

7.3___Existing vegetation and proposed landscaping

The landscape concept for the Bridge over Richmond River has been developed in direct response to the landscape principles designed for the adjoining projects Devils Pulpit to Richmond River (section 9), and Richmond River to Ballina (section 10).

This chapter provides an overview of the key components of the landscape concepts described in the adjoining projects and describes how these concepts will be implemented to integrate the bridge into the existing landscape.

The contextual analysis in Chapter 5 described the ecological diversity of the adjoining projects based upon the NSW North Coast (NNC) bioregion it exists within.

Six existing vegetation communities within the NNC bioregion were identified through flora and fauna assessments during the EIS phase of the Woolgoolga to Ballina upgrade. These are listed in Table 7.0.

Table 7.0 Existing vegetation community types

Vegetation community type	Description
Wet Sclerophyll and Floodplain Forest Blackbutt grassy open forest of the lower Clarence Valley of the North Coast	Tall to very tall open forest. Mainly on high and low quartz sediments in the near coastal lowlands of the Clarence Valley east of the Coast Range with scattered occurrences on the southern Richmond Range and inland in Ewingar State Forest.
Dry Forest Coast Cypress Pine shrubby open forest of the North Coast bioregion	Ecological community dominated by Callitris columellaris, found typically on coastal sand plains, and typically has a closed to open canopy of C. *columellaris*, which may be mixed with eucalypts, wattles, banksias and/or rainforest trees, and an open to sparse understorey of shrubs, sedges and herbs.
Swamp Forest Swamp mahogany swamp forest on coastal lowland	Named for the *Lophostemon suaveolens*, this community also features a range of species across the upper, middle and ground strata including *Eucalyptus, Corymbia, Melaleuca, Glochidion, Melicope, Baeckia, Cordyline, Blechnum, Hypolepis* and *Xanthorrhoea*.
Swamp Forest Swamp oak swamp forest on coastal lowlands of the North Coast (EEC)	Named for the *Lophostemon suaveolens*, this community also features a range of species across the upper, middle and ground strata including *Eucalyptus, Corymbia, Melaleuca, Glochidion, Melicope, Baeckia, Cordyline, Blechnum, Hypolepis* and *Xanthorrhoea*. Low to very tall woodland and forest. Widespread on poorly drained sites in coastal areas.
Swamp Forest Mangrove – Grey Mangrove low closed forest of the NSW coastal bioregions	Named for the *Lophostemon suaveolens*, this community also features a range of species across the upper, middle and ground strata. The mangroves are located on alluvial flats, drainage lines and river terraces which are periodically inundated on coastal floodplains.
Wet Sclerophyll and Floodplain Forest Forest red gum Grassy open forest of the coastal ranges	Named for the *Eucalyptus tereticornis* this community features a range of species across the upper and ground strata including *Eucalyptus, Corymbia, Angophora, Breynia, Dianella, Lomandra, Themeda, Imperata and Hardenbergia*.

7.4___Landscape design response

The identified communities have been used to inform species selection to support, maintain and preserve the existing biodiversity values of the region. The species selection aim to reinstate the existing landscape experience.

Travelling south to north this is achieved by reinstating the closed forested driver experience on the bridge approach. Where the bridge embankment adjoins existing agricultural areas it is proposed pasture grass seeding is used to maintain the existing landscape character and views to and from the bridge.

Areas on the river embankment cleared of mangroves will be rehabilitated using a seed collection and planting strategy. Seeds used for rehabilitation should be sourced from local populations within the same catchment. Only the seeds which have dropped from mangrove trees should be collected. The seeding strategy will require approval from relevant authorities.

The northern approach is constructed in a fill batter which is also located within a significant koala habitat corridor. Seeding and planting in this area will replicate species of the Blackbutt grassy open forest to reinstate the existing landscape character and habitat corridor.

7.5___Seed mixes

Seeding species will be selected from plants known to grow naturally within the project area and has sought to use these species due to the suitability to the climatic and site conditions but also their contribution to biodiversity. Proposed seed mixes are shown in Table 7.1. Note all species listed in the following table are subject to further design development including confirmation which seeds are commercially available.

Table 7.1 Proposed seeding mixes

Vegetation community type	Frangible species		Non frangible species
Wet Sclerophyll and Floodplain Forest Blackbutt grassy open forest of the lower Clarence Valley of the North Coast Forest red gum Grassy open forest of the coastal ranges *indicates fauna habitat species	Acacia disparrima subsp. disparrima Acacia ulicifolia Breynia oblongifolia Carex appressa Dianella caerulea Dichanthium sericeum Dichelachne micrantha Dodonaea triquetra	Hardenbergia violacea Imperata cylindrica Indigofera australis Kennedia rubicunda Leucopogon lanceolatus Lomandra longifolia Ozothamnus diosmifolius Parsonsia straminea	Acacia floribunda Acacia implexa Allocasuarina littoralis Angophora woodsiana Corymbia gummifera* Eucalyptus pilularis* Eucalyptus planchoniana* Syncarpia glomulifera
Dry Forest Coast Cypress Pine shrubby open forest of the North Coast bioregion	Acacia complanata Acacia concurrens Acacia falcata Acacia myrtifolia Acacia suaveolens Acacia terminalis subsp. Long inflorescences Acacia ulicifolia Banksia oblongifolia	Banksia spinulosa var. collina Cymbopogon refractus Daviesia umbellulata Dodonaea viscosa Gahnia aspera Imperata cylindrica Leptospermum polygalifolium subsp. cismontanum Lomandra longifolia Pultenaea villosa Themeda triandra	Acacia floribunda Acacia implexa Allocasuarina littoralis Angophora woodsiana Corymbia gummifera Eucalyptus pilularis Eucalyptus planchoniana Syncarpia glomulifera
Forested Wetland Swamp mahogany swamp forest on coastal lowland Swamp oak swamp forest on coastal lowlands of the North Coast (EEC)	Acacia leiocalyx subsp. leiocalyx Callistemon citrinus Callistemon pachyphyllus Carex appressa Cynodon dactylon Cyperus polystachyos Gahnia sieberiana Hardenbergia violacea Juncus usitatus Kennedia rubicunda Leptospermum juniperinum	Leptospermum polygalifolium subsp. cismontanum Lomandra longifolia Melaleuca nodosa Melaleuca sieberi Melaleuca thymifolia Microlaena stipoides Oxylobium robustum Parsonsia straminea Pultenaea retusa Pultenaea villosa	Casuarina glauca Eucalyptus resinifera subsp. hemilampra Eucalyptus robusta Eucalyptus tereticornis Lophostemon suaveolens Melaleuca quinquenervia
Forested Wetland Mangrove – Grey Mangrove low closed forest of the NSW coastal bioregions			Avicennia marina

7.6___Embankments

Embankments occur at the bridge approaches with the southern approach founded on an earth mound and the northern approach founded in a cut batter.

The height, bulk, scale and materiality of the finishes have been considered to reduce the impact of the embankments against the character of the existing landscape.

The embankment at each bridge approach is neatly transitioned into the existing landscape to reduce the visual impact the new upgrade will have at the intersection between the existing landform and introduced road formation.

7.7___Batter stabilisation planting

Batter stabilisation planting is applied to revegetate exposed fill batters to help minimise erosion and weed infestation.

The stabilisation technique chosen across the adjoining project sites was developed in line with the Roads and Maritime Services Guideline for batter surface stabilisation using vegetation and considers:

- The level of erosion protection required
- The planting application
- The visual amenity and ecological outcome
- Existing technical specifications and procedures.

Fill batter

Fill batters throughout the design are typically profiled to a gradient of 2H:1V with varying shallower profile departures to accommodate feathering into the natural topography.

Subject to specific location and local context, fill batters will have upstream surface flows diverted away from the batters using gutters and catch drains. This reduces the erosion protection required as it only needs to withstand raindrop splash impact and self generated overland flow.

The fill batters will be topsoiled and revegetated with tree, shrub and ground cover species suited to the existing vegetation community and consistent with frangibility clear zone and sight line requirements.

A maximum fill batter slope of 2H:1V is adopted to ensure flexibility of revegetation technique. With a preference for vegetative based stabilisation (hydroseeding and bush regeneration) which is free from matting and netting.

In addition to hydroseeding, hydromulch will be used when protection from surface erosion is required.

7.8___Earth mounds

The SPIR requirements for the Woolgoolga to Ballina upgrade includes:

UD14 – Earth mounds
The mounding profile of any earth mound will blend suitably into the existing landscape setting. Any mounding to be landscaped will be compacted in 1.5 metre layers with 1:3 maximum batter slopes where reasonable in consideration of constraints within the project corridor. Where feasible and reasonable, permanent mounds will be treated with ameliorants and overlaid with topsoil to minimum 150 millimetres to ensure suitable planting conditions are achieved.

Earth mounds may be required near the southern abutment. If required the earth mounds will be designed to form part of the landscape work.

The technical landscape drawings will indicate possible sites for earth mounds. However, the need for these mounds and their size will depend on the volume of surplus spoil which needs to be disposed of.

Earth mound design principles
Design of the earth mounds will respond to local conditions and where possible their margins will be graded to blend with existing adjoining landforms. Under most circumstances stand-alone earth mounds will have slopes no steeper than 3H:1V to assist successful establishment of vegetation and to create a natural appearance. However, as these mounds will form part of the embankment, they will be formed with slopes no steeper than 2H:1V.

Earth mounds will be revegetated by seeding with selected native species of trees, shrubs and grasses. Supplementary planting of trees and tall shrubs will be carried out at some locations where rapid revegetation is required to achieve a desirable outcome

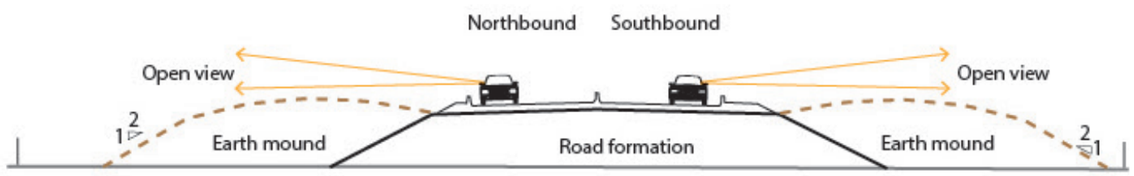


Figure 7.6 Earth mound at Bridge Abutment A.

7.9___Monitoring maintenance and ecological establishment.

The objectives for monitoring landscape rehabilitation areas and ecological establishment include:

- Plant species must be representative of each of the structural strata (tree, shrub and herb layer) of the target vegetation community
- At least 50 per cent of the vascular plant species should be representative of the target vegetation community
- Sufficient cover of native herbs established at a density which is sufficient to ensure continuous plant coverage by completion of the landscaping maintenance period
- Weed species comprise no greater than five percent of all plant species per restored area with exception of 15 per cent in riparian vegetation communities
- Weed cover is less than five per cent per restored area.

Landscape and rehabilitation work will be monitored and remedial measures implemented where required until vegetation has stabilised. Particular attention will be given to the monitoring of planted areas within the first 18 months after planting. This is the most sensitive time for newly installed planted hydroseeded and hydromulched material. Additionally, the inspections will monitor the germination of Acacia species. If this is too dense, selected plants will be removed by hand or using an appropriate non-residual herbicide.

Roads and Maritime Services requirements for maintenance are contained in QA specifications R178 and R179. The specification covers standards and methods for all the normal tasks required for landscape/horticultural maintenance. The maintenance work begins at the time of occupation of the site and, together with measures designed to protect the biodiversity of the corridor, will be carried out over the duration of the construction work and maintenance period covered by the contract.

The corridor furniture is in accordance with Roads and Maritime standards and is designed to be as visually recessive as possible by integrating with the landscape treatments to blend into the background.

Figure 7.7 Typical fauna fence

Figure 7.8 Artist impression of fauna culvert with fauna furniture, landscape shown at full maturity

7.10___Fences

Fencing is provided to:

- Prevent livestock from entering the road or bridge corridor
- Prevent access into water basins
- Prevent fauna access into the road corridor
- Promote fauna use of fauna structures.

Fencing selection and locations have been developed based on the main alignment road geometry and consultation with individual property owners. Where possible fauna fencing is combined with property fencing in order to reduce the environmental and maintenance impact resultant from additional clearing which would have been required. All fencing finishes are designed to be visually permeable with wide aperture infill mesh to be visually recessive and blend harmoniously into the background landscape.

7.10.1 Boundary fence

When not combined with fauna fencing boundary fencing is standard post, wire and dropper stock proof fencing along the road reserve. Boundary fencing near glider crossing structures will not have barbed wire for the top two strands.

7.10.2 Security fence

Security fencing is included for both temporary and permanent drainage basins when the basins are accessible to the public. Visually recessive chain wire mesh is to be used to blend the fence into the surrounding landscape.

7.10.3 Fauna Fence

A range of mitigation measures were identified during the EIS phase to minimise the impact of habitat loss and fragmentation on threatened fauna species. These include installation of fauna fencing.

Fauna fencing is designed to facilitate the effective crossing of wildlife and funnelling of fauna to fauna crossing locations, with the main goal of reducing wildlife mortality. The alignment of fauna fencing will not create any trapping points.

All fencing has been designed as part of the adjoining clearing and fencing strategies for Devils Pulpit to Richmond River (section 9) and Richmond River to Ballina (section 10) work.

7.11___Fauna connectivity

A substantial part of the project is located within or next to native vegetation, including National Parks and Reserves, State Forests and regional wildlife corridors.

The maintenance of corridor function and habitat connectivity between and within the project area and the wider locality is essential to ensure the long-term viability of existing fauna populations, including threatened species.

Strategies have been developed during the design process to ensure that the projects fauna connectivity goals are achieved, these goals include:

- Reduce and minimise roadkill
- Avoid and minimise habitat loss and fragmentation
- Maintain and improve connectivity

Minimising the impact of the bridge construction on habitat areas was a key consideration during the design development of the bridge over the Richmond River. In particular the bridge abutment design in both the north and south has minimised the fragmentation of the existing fauna habitat. At the northern abutment B, this was achieved by eliminating the cut and fill batters and reducing the clearing by about 20m each side of the bridge. In the south at abutment A, the length of the bridge embankment was reduced decreasing the incidental journey between habitat patches. Both of these measures will enhance the potential for incidental fauna passage beneath the bridge at each embankment. Incidental fauna passage paths are indicated on Figures 7.1 and 7.2.

7.11.1_Fauna crossing structures

Where key threatened fauna species were recorded in project sections 9 and 10, crossing structures will be installed to facilitate continued population viability following the upgrade of the highway. The locations of these are shown in Figure 7.0.

Landscape planting to fauna connectivity structures is designed to replicate the surrounding habitat and where possible to provide foraging resources for fauna. Remnant vegetation will be maintained near structures and woody debris collected during site clearing will be strategically placed to provide additional fauna refuge. Indicative plant species are listed in Table 7.1.

Fauna underpasses

An underpass is a structure which allows wildlife to cross the road beneath the road surface. It includes bridge underpasses, dedicated and combined box culverts, combined with koala and small mammal structures and fish passages.

Fauna structures include horizontal logs placed as high off the ground as possible for koalas and small mammals to avoid predators. The logs are also supported by vertical logs to allow for koalas and small mammals to climb down if required.

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

8 Detailed response for urban design

Figure 8.0 Artist impression of bridge over Richmond River. Landscape shown at full maturity, subject to further design.

8.1___Bridges

Bridges are a major component of the proposed work to be carried out across the Woolgoolga to Ballina upgrade with 170 new bridges over rivers, creeks and floodplains.

The key design principles for bridges on the wider upgrade have taken into account the bridge height, bulk, scale and materiality to ensure the bridges are well integrated into the surrounding landscape context.

8.2___Description of Bridge

The new bridge over the Richmond River is a 980 m long bridge located about 2 km north–east of Broadwater. The new bridge will be a significant visual landmark linking the Richmond Valley and Ballina Shire.

The bridge has been designed to address the bridge design principles and the functional requirements of the bridge structure.

8.3___Bridge design principles

Context
The design of all elements must be relevant to the existing context and road function.

Consistency
The design and arrangements of all elements should be considered as part of a family of elements which relate to each other and other sections of the highway upgrade to provide consistency with variety.

Integrated design
The design, form, materials and finishes of the bridges on the upgrade must be consistent and integrated with each other to ensure visual continuity.

Unobtrusive appearance
The bridges must be visually unobtrusive allowing the landscape and environmental attributes of the area to be fully appreciated by road users. Bridges must present smooth clean lines.

Simplicity and refinement
The design, form, materials and arrangement of all elements must be simple and refined and carefully integrated with adjoining elements.

Transparency
The bridge superstructure must be as transparent as possible to optimise views through the bridge to the landscape beyond. This includes minimising the depth of structure and refining the bridge abutments.

8.4___Response to bridge design principles

Context
The horizontal alignment of the bridge has been designed to respond to the serpentine riparian form of the Richmond River landscape as shown in Figure 7.0. The design uses a gentle curve in the alignment to complement the serpentine form of the river and surrounding landform to ensure the bridge sits in harmony with its environment.

The vertical alignment of the bridge responds to the functional requirements of the vertical clearances required above the existing Pacific Highway and Back Channel Road as well as the navigational channel located within the Richmond River.

The vertical alignment is designed with a gentle curve to connect the southern and northern abutments complementing the natural environment.

Consistency and Integrated design
The bridge has been designed to show a consistent aesthetic to the urban design of the bridges crossing rivers in the adjoining sections of the Pacific Highway upgrade including the Bridge over Clarence River. The individual bridge elements are designed to specifically address consistencies in overall bridge form as well as bridge materials and finishes. The commonalities in the design of bridge elements across these projects include bridge parapets, girders and barriers and are described further in Chapter 8.5.

Unobtrusive appearance
The bridge design carefully considers the overall bridge form (combination of proportion, order, rhythm and simplicity) to ensure the bridge will have an unobtrusive appearance within its natural setting.

The proportion between depth of superstructure and bridge span is an important ratio as it conveys an impression of balance between the suspended structure and its supporting columns as well as a satisfactory composition to the overall bridge aesthetic. This ratio is referred to as the slenderness ratio of the bridge. This is defined as the span length divided by the superstructure depth. Common ratios vary from 5 to 35 where a lower ratio indicates where bridge elements such as noise barriers have been superimposed onto the bridge structure increasing the visual thickness of a bridge. A higher ratio indicates a very slender bridge. The slenderness ratio for this bridge is 1:15 which is common to pier and girder bridge designs and appropriate to the bridge setting.

Order and rhythm
Repetition of the central 23 piers at equal spans of 37.7 m provides a consistent rhythm of vertical elements which provides a pleasing aesthetic and harmonious design to the whole bridge structure. The alignment of vertical details including bridge parapet joins, bridge barriers and bridge piers also supports the cumulative effect of order on the overall pleasing visual aesthetic of the bridge.

Simplicity and refinement
The simple design is deliberately without unnecessary embellishments to encourage integration with the surrounding landscape as well as providing an aesthetic which represents a combination of its structural stability and engineering achievements.

Transparency
Optimal views for bridge users have been developed through the use of the open two rail tubular metal barrier. Wide pier spans also optimise views for local road users beneath the bridge structure.

Figure 8.1 *Artist impression of bridge elevation. Landscape shown at full maturity, subject to further design.*

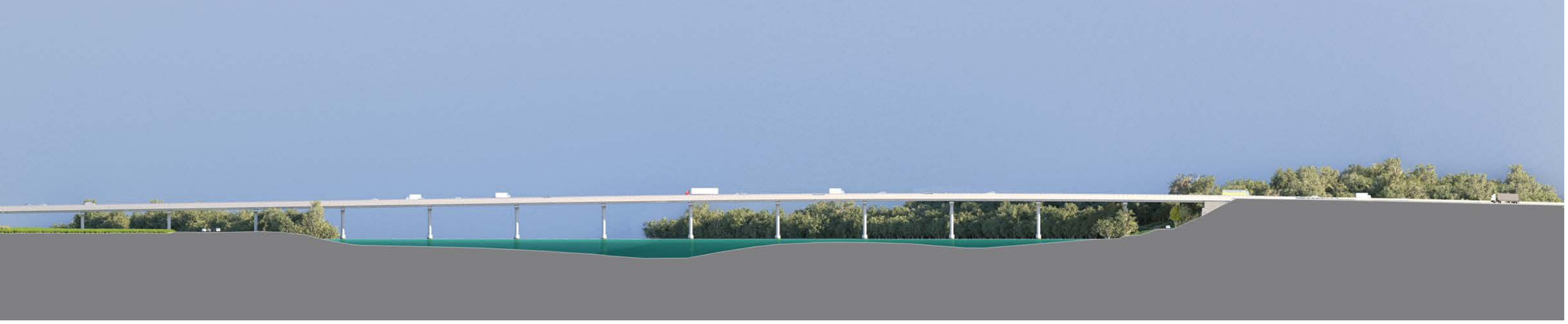
8.5___Bridge elevation

The elevation of the bridge structure is designed to gently transition the user from land over water and back again. The vertical alignment of the bridge accommodates the navigational channel clearance heights of 15 m above the mean high water (MHW) level. The bridge deck rises gradually to accommodate the navigational channel and will result in the bridge user experience of maximised view opportunities from the highest location on the Bridge over the Richmond River floodplain and across the river.

The design of the bridge pier spans has been maximised to minimise the number of piers, the bridge is comprised of 25 piers with all the internal spans a consistent 37.7 m long and the two end spans designed at 37m. The piers have been arranged to span both the existing Pacific Highway and Back Channel Road with the vertical clearance in these locations exceeding 5.3 m.

The superstructure is comprised of nine 1800 mm deep super-T girders and a composite cast-in place deck slab.

The bridge approach embankments are key elements of the project work and are designed to minimise their presence and appearance by lengthening the bridge deck and locating the embankments as close as possible to the existing forested landscape. This allows landscape treatments to be used to visually integrate the structure within the landscape. The positioning of the embankments is also favourable to the hydraulic design as it has minimal impact to flood levels.



8.6___Detailed bridge elevations

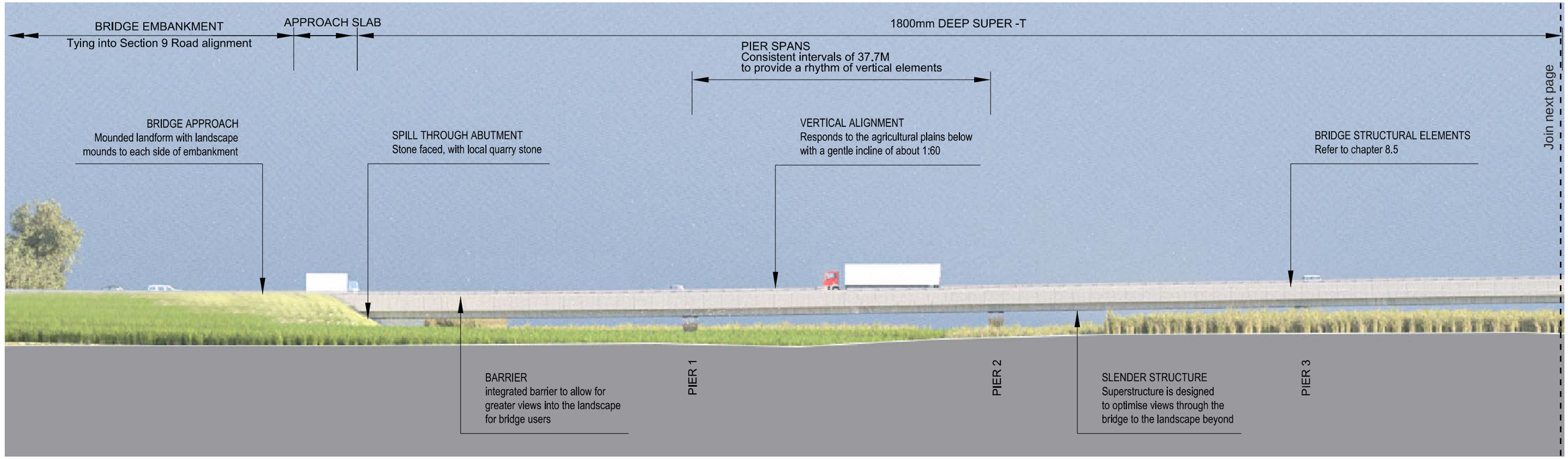


Figure 8.2 *Concept elevation 1:500@ A3*

0 5 10 20m

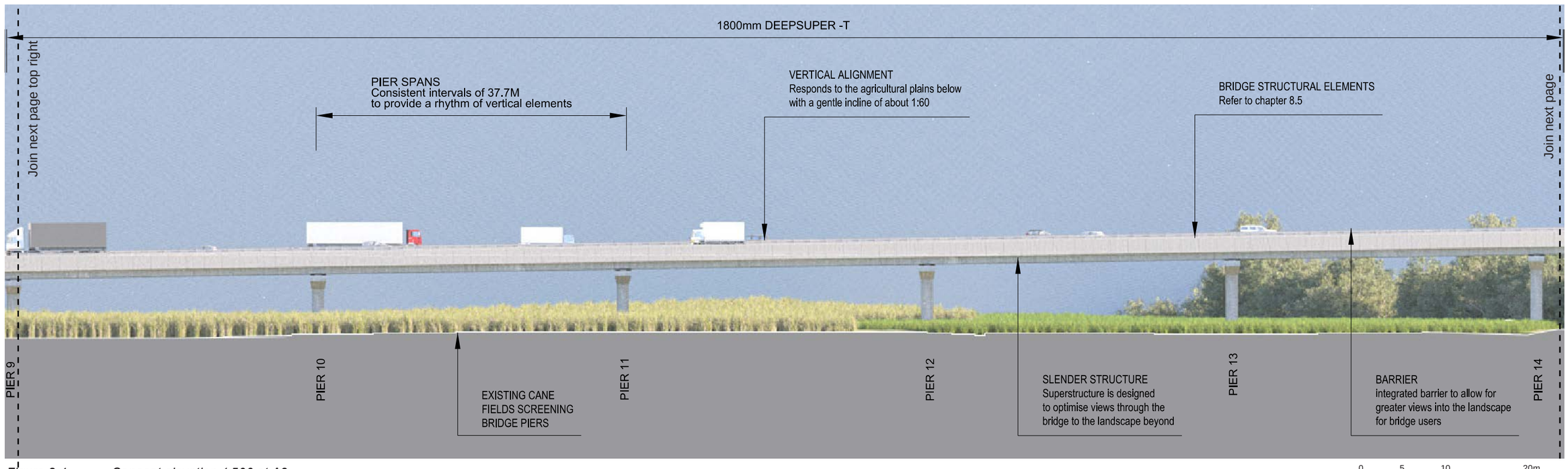


Figure 8.4 *Concept elevation 1:500 at A3*

0 5 10 20m

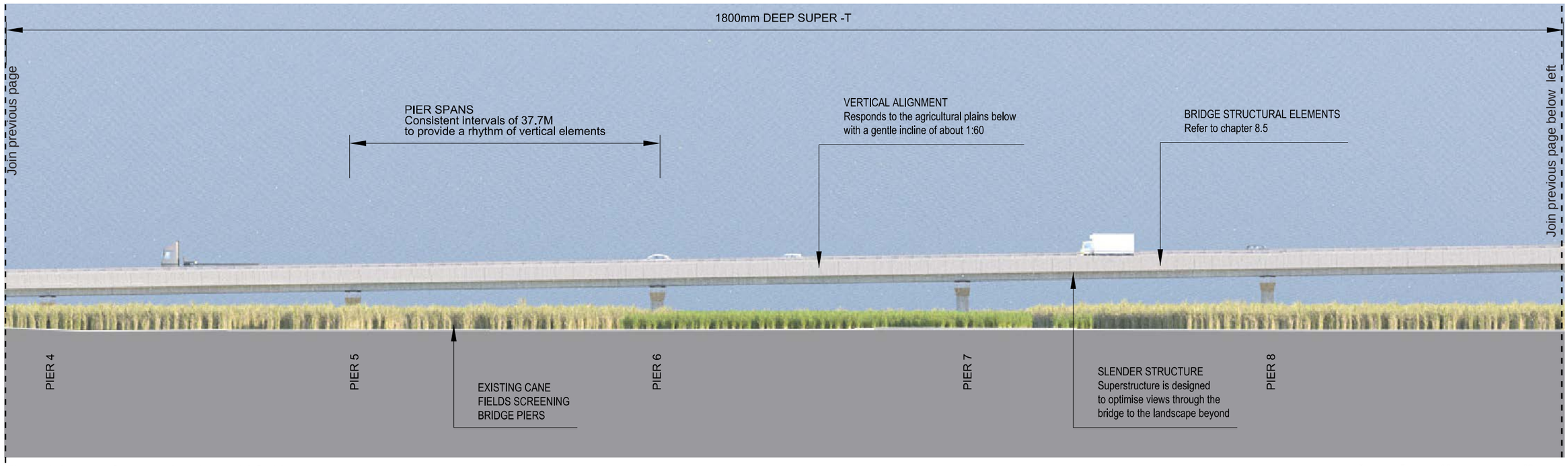


Figure 8.3 Concept elevation 1:500@ A3

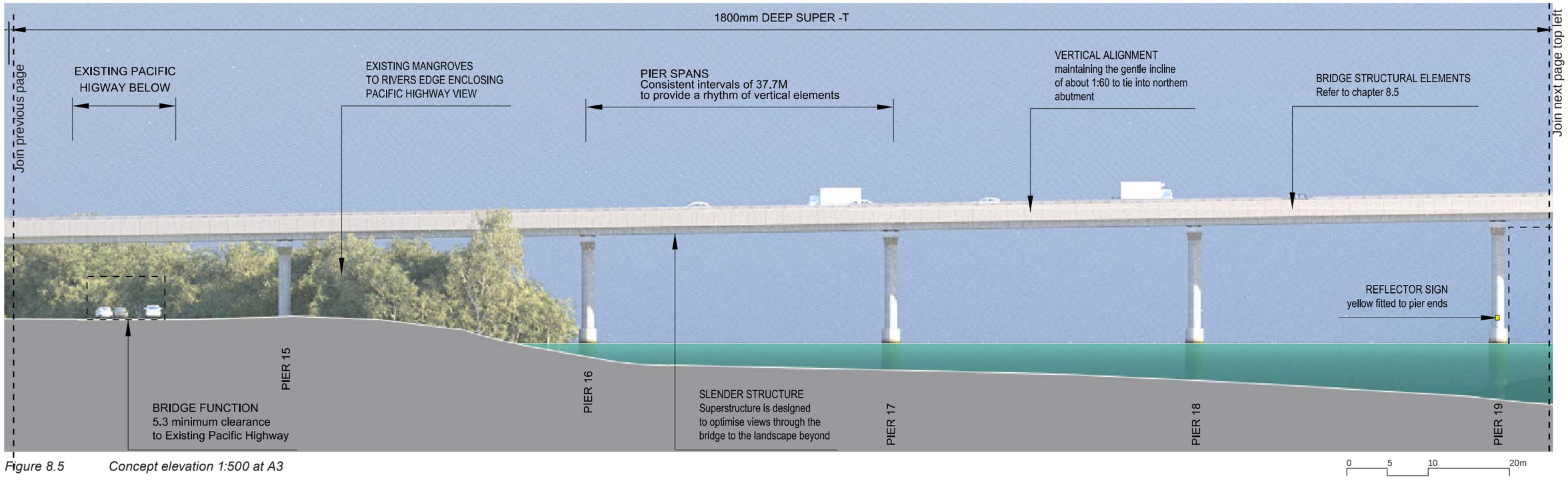


Figure 8.5 Concept elevation 1:500 at A3

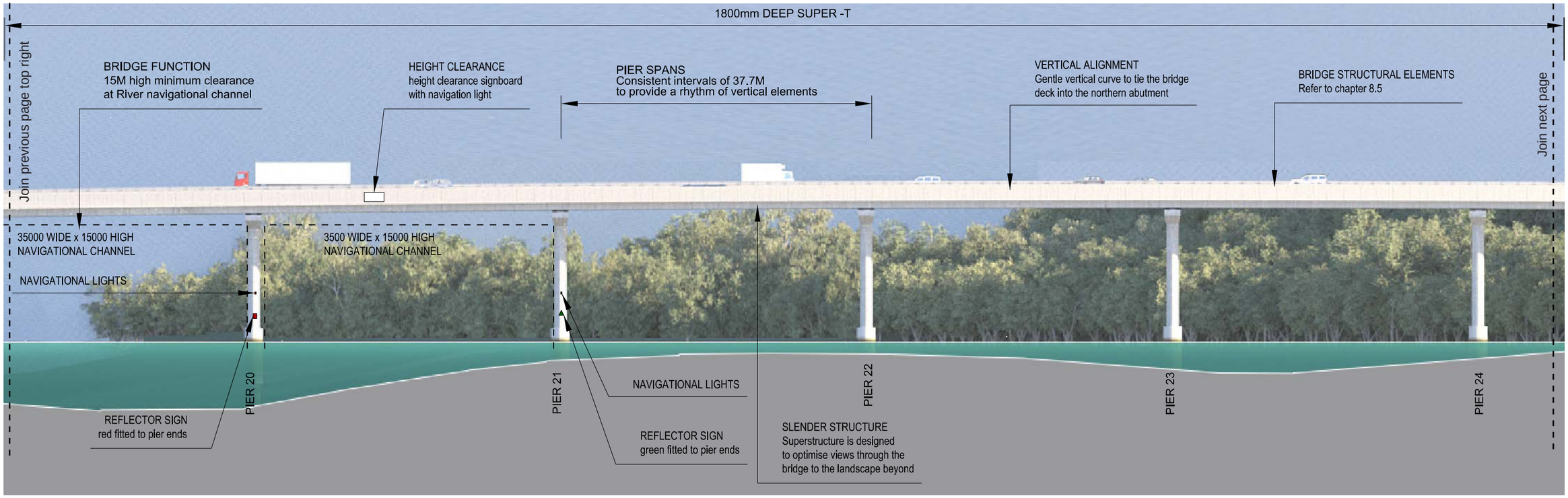


Figure 8.6 *Concept elevation 1:500 at A3*

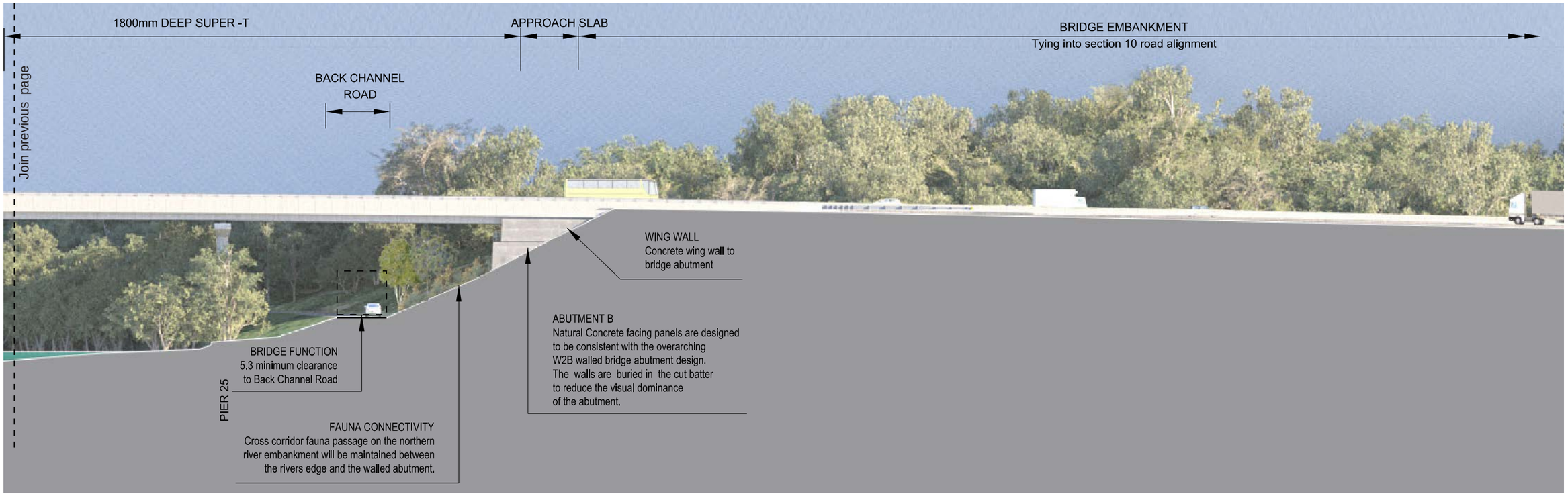


Figure 8.7 *Concept elevation 1:500 at A3*

8.7___Bridge elements

The Bridge over Richmond River has been designed as part of the Woolgoolga to Ballina family of bridges and is consistent with the urban design of the bridges in the adjoining sections of the Pacific Highway upgrade.

The individual bridge elements are designed in accordance with the bridge aesthetics guidelines and specifically address consistencies in form (combination of proportion, symmetry, order, rhythm, simplicity) materials and finishes on the Woolgoolga to Ballina upgrade.

There is no lighting on the bridge or approach roads but navigational lighting will be added to the bridge piers 19, 20 and 21 as steering markers to guide vessel movements within the navigational channel. The locations of these are shown on Figures 8.5 and 8.6.

Signage structures located on the bridge are limited to the height clearance sign for passage in the navigational channel.

Common elements of bridge abutments, parapets and girders, piers and headstocks are described here.

Figure 8.8 *Artist impression of bridge cross section subject to further design*

Figure 8.9 Artist impression of Abutment A.
Subject to further design

Figure 8.10 Artist impression of Abutment B.
Subject to further design

Abutment A
Abutment A is a spill-through embankment with a slope of 1.5H:1V.

The abutment has a reinforced concrete abutment headstock and wing walls.

Permanent maintenance access is provided through an access bench at the front of the abutment. The bench is accessible through stairs located along the eastern abutment wing wall.

The spill-through embankment will require protection with rock armour extending down the embankment at a slope of 1.5H:1V wrapping around and tying in with the road formation slopes.

Placed local quarry stone anchors the bridge infrastructure into the landscape through material selection and a confident natural junction is achieved through local species planting.

Abutment B
Abutment B presents as a reinforced soil retaining wall wrapping around the abutment and returning back toward the bridge The vertical wall design minimises the impact of the bridge construction on fauna habitat areas by eliminating the cut and fill batters and reducing the clearing by about 20m each side of the bridge as discussed in chapter 7.11.

The abutment has a reinforced concrete abutment headstock and wing walls.

It is finished in concrete panels with horizontal joints aligned to accentuate the horizontal banding.

Permanent maintenance access is provided through an access bench at the front of the abutment. The bench is accessible through stairs located along the front face of the abutment and the eastern side face of the retaining wall. The access path for maintenance is provided on the Eastern side of the abutment and is connected to an access road accessible from Back Channel Road.

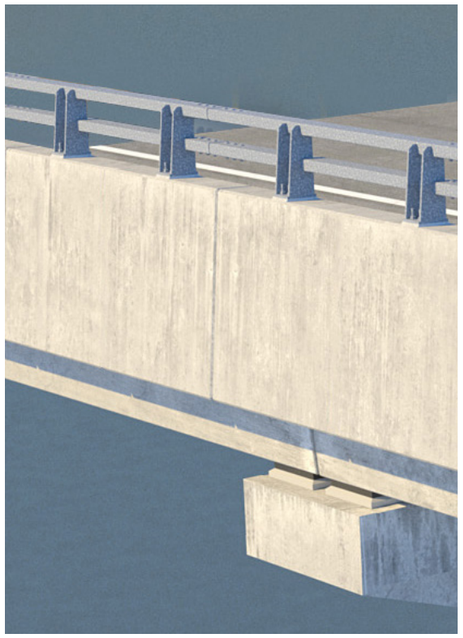


Figure 8.11 Artist impression of bridge barrier Subject to further design

Barriers
Integrated with the barrier, an open two rail tubular metal barrier and metal supporting posts will be mounted on top of the concrete parapet in order to maximise road user views to the landscape and reduce the height of the concrete portion of the structure in elevation.

Figure 8.12 Artist impression of parapet and girder. Subject to further design

Parapets and girders
Integrated with the medium performance traffic barrier the parapet has a continuous uninterrupted outer face with neat sharp edges and extends the full length of the bridge.

The outer face is slanted to self clean and catch sunlight. With a top face angled toward the road to channel drainage, the parapet extends beyond the deck soffit to mask the depth of the Super-T Girder. In doing so, it creates a shadow line which decreases the perceived depth of the girder and gives the bridge structure a slender appearance.

Figure 8.13 *Artist impression of bridge headstock Subject to further design*

Piers and headstock
Piers are designed as portal frames comprising of a reinforced concrete in filled precast headstock shell which directly supports the girders on two circular columns. Distribution of piers is described in section 8.5.

The headstock is shaped to provide an attractive pier and headstock combination with the headstocks tapered and formed to match the width of the piers.

The reinforced concrete piers present a simplified structural foundation for the bridge. Spaced 37.7 m apart the bridge piers gently rise from 2.6 m in height to 14.3 m at the bridge peak.

Figure 8.14 *Artist impression of pile cap subject to further design*

Pile cap in water
Integral pile caps have been designed to elegantly mark the transition from Bridge to River. The rounded edges provide a hydraulically efficient shape which reflects the dimensions and shape of the piers.

The pile cap extends to the top of the splash zone and 0.5 m below the mean low water spring level. The design incorporates a purpose built precast concrete shell which is capable of resisting ship impact loads along its length.

Figure 8.15 Artist impression of bridge drainage Subject to further design

Drainage pipes
The bridge deck draining systems will be discreet and concealed from view. Drainage pipes will be concealed behind the parapet skirt.

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

9 Drainage and water quality

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

9.1___Drainage and water quality

Water quality control systems
Drainage and water quality control systems designed include:

- Grass lined channels
- Batter vegetation
- Operational basins.

These water quality control systems are designed to:

- Minimise the extent of clearing by incorporating swales into the earthwork design in preference of permanent basins.
- Retain existing vegetated swales for reuse (where possible), particularly in areas where the existing alignment is being retained
- Consider the competing environmental requirements of minimising impact to native vegetation, fauna habitat and wildlife corridors.

In order to capture and convey the runoff from the bridge surface, drainage pipes will be designed to convey bridge deck runoff to water quality treatment channels or water quality basins located near the bridge abutments.

The grassed channels treat stormwater by allowing interception, settling filtration and infiltration of pollutants, primarily solids based.

Removal of pollutants such as sediments, nutrients and hydrocarbons occurs as these particles attach to the suspended solids and drop out of suspension.

Batter vegetation treats the batter surface water runoff as it flows down the vegetated fill batters. Shallow vegetated swales will be located along the toe of each batter bordered by highway fill on one side where required and bounded by a vegetated, earth-covered biofiltration media on the other, to direct the sheet flow to water quality basins where required.

Water quality basin
A permanent water quality basin has been proposed next to the road carriageway as part of the Devils Pulpit to Richmond River (section 9) work. This basin will treat runoff from the bridge deck before discharge to the cane drains or before it percolates through into the natural ground below.

Permanent basins will be shaped with an organic shaped edge where possible. When constrained by available space, selective tree planting will be used at basin edges to soften the rectilinear visual presentation through cast shadows and vertical disruption. Fencing of basins when required will be a visually recessive chain wire fence.

Culverts
Culverts have been installed where the work cross existing watercourses and low points in the landscape. The culverts will facilitate the passing of clean non-highway water flow under the highway, service roads, access ramps, local roads and access tracks ensuring the watercourse is not disturbed. Scour protection will be provided at both the inlet and outlet of culverts to prevent erosion at the transition between the culvert and the natural channel.

Creek and river rehabilitation planting
Appropriate plant species will be incorporated into the rehabilitation of disturbed aquatic habitats and drains as a result of the built work. Typical species are included in Table 9.0. The rehabilitation work will be monitored and remedial measures implemented where required until vegetation has stabilised. The bed and banks will be reinstated to a condition similar to or better than the original condition ensuring there are no adverse impacts on the aquatic values.

Table 9.0 Planting species for riparian environments

Dry grass species – botanical name	Common name
Gahnia clarkei	Saw sedge
Lomandra filiformis	Wattle matt rush
Lomandra hystrix	Matt rush
Lomandra longifolia	Spiny headed matt rush
Margin grass species – botanical name	
Dianella caerulea	Blue flax lily
Ficinia nodosa	Knobby club rush
Gahnia clarkei	Saw sedge
Juncus usitatus	Common rush
Lomandra filiformis	Wattle matt rush
Wet grass species – botanical name	
Baumea arthrophylla	Swamp twig rush
Ficinia nodosa	Knobby club rush
Gahnia clarkei	Saw sedge
Juncus usitatus	Common rush
River bank – botanical name	
Avicennia *marina*	Grey Mangrove

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

10 Conclusion

Figure 10.0 *Artist impression of Bridge over Richmond River looking north–west over the existing cane fields. Subject to further design*

10.1___Conclusion

This document is prepared to address the Minister's Condition of Approval (D20) for Bridge over Richmond River of the Pacific Highway Upgrade – Woolgoolga to Ballina. As part of this process the key conditions and approval requirements are identified. The design responds to and address the D20 conditions. The UDLP identifies key design outcomes proposed to achieve the Pacific Highway vision and deliver a safe environmentally responsible landscape. The UDLP is submitted in fulfilment of MCoA D20 by the applicant Road and Maritime Services for approval for construction to proceed.

The design as described in this document will achieve the environmental requirements and measures set by the project Environmental Impact Statement (EIS) and Submissions/Preferred Infrastructure Report (SPIR) and in so doing will fulfil the stated requirements of the Minister's Conditions of Approval for the project's (MCoA).

The overall bridge design outcomes will ensure the upgraded Pacific Highway not only is environmentally responsible but also continues to service the needs of the travelling public, achieve transport efficiencies, sit comfortably within the local environment and contribute positively to neighbouring communities.

This document has been deliberately structured with the design described in a logical linear format progressing from broad scale planning through to small scale design. The structure starts with a summary of the wider corridor planning and then moves sequentially through approval processes to contextual analysis and then onto design principles and strategies. These principles and strategies are then articulated graphically within the strategy plans prior to the document completing with detailed design intentions discussed by bridge infrastructure element.

The design of the bridge crossing has been developed as a cohesive suite of structural elements which collectively sit comfortably within the Pacific Highway infrastructure design "family". In particular the design has adopted the spill through stone abutments and barrier detailing which characterises a number of visually appealing, well integrated sections of the Pacific Highway within the NSW North Coast region.

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

11 Bibliography

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

Bibliography

Brooke, J., Jenkins, R, Costello, A., Edmonds, V. & Goldfarb, A. 2012a, Upgrading the Paciifc Highway Woolgoolga to Ballina Upgrade: Working Paper - Aboriginal Cultural Heritage Assessment, Iluka Road to Woodburn Section, Roads and Maritime Services.

HASSELL (2012) Pacific Highway Upgrade Woolgoolga to Ballina Urban Design Report Landscape Character and Visual Impact Assessment.

Roads and Maritime Services (2012) Woolgoolga to Ballina | Pacific Highway Upgrade. Environmental Impact Statement, Main Volume 1b, pages 17–48.

Roads and Maritime Services (2012) The Woolgoolga to Ballina – Pacific Highway Upgrade – EIS Working Paper – Biodiversity Assessment.

Roads and Maritime (2015a) Woolgoolga to Ballina Pacific Highway Upgrade: Koala Management Plan. Report prepared by Roads and Maritime Services, Aurecon and Sinclair Knight Merz.

Roads and Maritime Services(2015b) Woolgoolga to Ballina Pacific Highway Upgrade: Threatened Mammal Management Plan. Report prepared by Roads and Maritime Services, Aurecon and Sinclair Knight Merz.

Roads and Maritime Services (2012) The Woolgoolga to Ballina Urban Design Report Landscape Character and Visual Impact Assessment.

Richmond Valley Council (2013) Richmond Valley Towards 2025 Community Strategic Plan.

“Aboriginal Community,” Richmond Valley N.p., 2016. Web. 27 April 2016.

“Indigenous Culture,” Aboriginal Culture in the Richmond Valley. N.p., n.d. Web. 17 February 2016.

“Northern Rivers Regional Biodiversity Management Plan”. Environment.gov.au. N.p., 2016. Web. 25 January 2016.

“VIS Classification 2.1”. Environment.nsw.gov.au. N.p., 2016. Web. 25 January 2016.

ARUP CARDNO JV (2017) Woolgoolga to Ballina Pacific Highway Upgrade, Urban Design and Landscape Plan, Devils Pulpit to Richmond River, Sections 7, 8 and 9.

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

Community Consultation Report A

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

EXECUTIVE SUMMARY

The Woolgoolga to Ballina Pacific Highway upgrade will duplicate 155 kilometres to a four-lane divided road from about six kilometres north of Woolgoolga (north of Coffs Harbour) to about six kilometres south of Ballina.
The Woolgoolga to Ballina project team invited community and stakeholder feedback on the draft urban design and landscape plan for the new bridge over the Richmond River at Broadwater from Monday 14 August 2017 to Friday 1 September 2017.
Consultation activities during this time included:

- Distributing about 3500 postcards to residents between Woodburn to Coolgardie
- Static displays at eight locations
- Staffed displays at two locations
- Updating the project website with the draft urban design and landscape plan as well as an online survey
- Emailed to 281 registered stakeholders
- Advertising in three local newspapers.

We received feedback from one organisation and four people. Of the feedback received:

- Three respondents provided general support for the urban design and landscape plan and two offered no position
- Three respondents provided general support for the bridge design and two offered no position.

Key matters raised included bridge lighting, fauna crossings, cycle ways and operational noise. One matter raised was considered outside the scope of the urban design and landscape plan and will be addressed with the stakeholders individually.

Responses to key matters raised will be provided to the people and organisations who provided feedback. This feedback is included in this report and will be made available to the public.
We thank everyone who provided comments and the community and stakeholders for considering the proposal.
All feedback and this report will be submitted to the NSW Department of Planning and Environment with the final urban design and landscape plan for the new bridge over the Richmond River at Broadwater.
The Woolgoolga to Ballina project team has decided to proceed with the proposed urban design and landscape plan with no changes.

Roads and Maritime will continue to work with the community and stakeholders to mitigate and manage impacts of the work it needs to carry out to build the Woolgoolga to Ballina Pacific Highway upgrade.
The Woolgoolga to Ballina project team invited feedback from the community and stakeholders on the draft urban design and landscape plan for the new bridge over the Richmond River from 14 August 2017 to 1 September 2017. The outcomes of this consultation is provided in the Woolgoolga to Ballina, Pacific Highway upgrade, Community Consultation Report for the Urban Design and Landscape Plan, November 2017.

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

CONTENTS

A1.0__Introduction

Background
The Australian and NSW governments are jointly funding the $4.36 billion Woolgoolga to Ballina Pacific Highway upgrade. Roads and Maritime Services Pacific Highway office and Pacific Complete are working together to deliver the project.
When complete, the 155 kilometre Woolgoolga and Ballina project will:

- Reduce overall length from 180 kilometres to 167 kilometres, saving about 13 kilometres in travel distance
- Allow for a higher posted speed limit of up to 110 kilometres/hour
- Reduce travel time from 130 minutes to about 105 minutes, saving 25 minutes
- Reduce crash rates by an expected 27 percent due to divided carriageways
- Improve travel reliability through better flood immunity, fewer incidents and more readily available alternative routes.

As part of the upgrade, a new bridge will be built over the Richmond River at Broadwater which will be:

- Almost one Kilometer long
- Four lanes
- clearance of 18 metres at the centre to allow for marine vessels to pass underneath.

A1.1__Urban Design and landscape plan

During August 2017, community and stakeholder feedback was sought on the draft urban design and landscape plan for the new bridge over the Richmond River as part of the design development process for the Woolgoolga to Ballina Pacific Highway upgrade.
This plan proposed implementing a visual similarity across some major design elements in this project, linking the Woolgoolga to Ballina upgrade to the rest of the Pacific Highway.
Subsequently, a draft urban design and landscape plan was prepared and the Woolgoolga to Ballina project team sought community and stakeholder feedback. This plan outlines the proposed visual identity for the new bridge over the Richmond River at Broadwater.

A2.0__Consultation Approach

A2.1__Consultation objectives

We consulted with the community and stakeholders on the proposal to:

- Seek feedback and level of support for the Woolgoolga to Ballina project team to consider in its decision making
- Build a database of interested community members who the Woolgoolga to Ballina team could continue to engage throughout the project.

A2.2__How consultation was done

The community and stakeholders were encouraged to provide feedback via information pop-ups at markets, online, mail, email or phone. Consultation was carried out from 14 August to 1 September 2017.

Postcards were delivered to about 3500 residential and business properties inviting feedback on the proposal.

Table A1 provides details on consultation activities.

Table A1 Types of Engagement

Date	Type of engagement	Number of people and
14 August 2017	Community postcard	About 3500 residences
15 August 2017	Email notification	281
	Website update	-
	Static display – copy of document, poster and feedback forms	8
	Key stakeholder - targeted email/ contact	4
19 August 2017	Advertisement – Lismore Northern Star	-
21 August 2017	Advertisement – Lismore Northern Star	-
23 August 2017	Advertisement – Clarence Valley Review	-
	Advertisement – Ballina Shire Advocate	-
26 August 2017	Staffed pop-up display – Evans Head Market	47
30 August 2017	Staffed pop-up display – Broadwater Community Hall	6

A3.0__Consultation summary

A3.1__Overview

We received feedback from one organisation and four people. Of the feedback received:

- Three respondents provided general support for the urban design and landscape plan and two offered no position
- Three respondents provided general support for the bridge design and two offered no position.

Key matters raised included bridge lighting, fauna crossings, cycle ways and operational noise. One matter raised was considered outside the scope of the urban design and landscape plan and will be addressed with the stakeholders individually. Responses to key matters raised will be provided to the people and organisations who provided feedback. This feedback is included in this report and will be made available to the public.

Table A1 outlines the feedback received and the project teams' responses

A3.2__Feedback and Roads and Maritime's responses

The Woolgoolga to Ballina project team has provided responses to all feedback received on this proposal. The responses are provided directly to the person who commented as well as being summarised in this report, which will be made available to the public.
All comments have been considered to help the Woolgoolga to Ballina team make decisions on this proposal.

A4.0__Decision

We thank those who provided comments and the community and stakeholders for considering the proposal.

The Woolgoolga to Ballina project team has decided to proceed with the proposed urban design and landscape plan with no changes.

The revised urban design and landscape plan and supporting documentation will now be submitted to the NSW Department of Planning and Environment for consideration and approval.

A5.0__Next Steps

During the next phase of the project we will continue to keep the community informed of the projects progress.

The community are encouraged to contact the project team directly should they have any questions or would like any further information about the project.

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

Table A1. Feedback received and the project teams' responses

Category	Matters raised	Response
Bridge Design	Request no changes to the exclusion of bridge lighting	No street lighting is proposed on or near the bridge.
	Requested information on noise abatement of the bridge surface	Noise modelling has been carried out as part of the EIS and detailed design phase of the project. The range of noise mitigation measures are consistent with the EIS, including the locations of low noise road surfaces where a stone mastic asphalt will be used. Based on detailed design, a low noise pavement has been incorporated into the design of the bridge over the Richmond River. The details of the noise modelling are outlined in the Operational Noise Report currently under preparation. Once approved it will be located on project website at http://www.rms.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina
	Request for pedestrian and cyclist provisions	As outlined in the urban design landscape plan, for safety reasons no pedestrian access has been provided to the bridge. The bridge has been designed with a 2.5 metre-wide road shoulder to provide a suitable width for cyclists.
Fauna	Requested more details of fauna crossings	Comments about fauna connectivity structures noted. Further information on fauna connectivity for the Woolgoolga to Ballina project can be found in the connectivity strategy for sections 3-11 on the project website at http://www.rms.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina
Out of scope	Suggestion to build a new boat ramp on the southern side of the new bridge	Thank you for the suggestion for additional boat ramp facilities near the new bridge. The sketches provided with submission include areas that are privately owned and not within the scope of the Woolgoolga to Ballina project. The provision of a boat ramp at the bridge site is not within the scope of work for this project. The suggestions will be forwarded to Council who are the relevant owners of boat ramps in this area for their consideration.

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

Agency Comments B

THIS PAGE HAS BEEN LEFT BLANK INTENTIONALLY

AGENCY DESIGN REVIEW

Document title:		Bridge over Richmond River, August 2017	**Document no.** (where allocated)**:**
Designer/originator:			**Lot No.**
Agency		DPI, EPA, Richmond Valley Council, Ballina Shire Council.	

Reviewer comment summary and close-out (insert additional rows as required)

Agency	Reference/item	**Reviewer comment** (refer attached sheets where applicable)	Designer/originator response
NSW DPI Fisheries		NSW DPI Fisheries had no comment on this design package	
EPA (Biodiversity)	Section 5.7 Fauna. Heading - **Fauna design response**	The EPA seeks to start a conversation regarding the installation of fauna furniture on the northern bank.	Noted. Initial discussions have been held with EPA on site regarding final fauna furniture on the northern bank. RMS will consult further to determine final location of fauna furniture prior to operation.
EPA (POEO)	n/a	Thank you for the opportunity to review the UDLP. No comment.	Noted.
Ballina Shire Council		No formal response was received from Ballina Shire Council	
Richmond Valley Council		No formal response was received from Ballina Shire Council	

Record of task completion and agreement of comments

Designer/originator – The above verification comments have been addressed and incorporated or responded to as appropriate.			
Designer/originator			
Signature:			
Date:			

pacifichighway.nsw.gov.au

1800 778 900

PO Box 546 Grafton NSW 2460

March 2019
RMS 19.1189
ISBN: 978-1-925891-25-6