Woolgoolga to Ballina Pacific Highway upgrade

Urban Design and Landscape Plan – Bridge over Clarence River at Harwood

Roads and Maritime Services | March 2019

Australian Government
BUILDING OUR FUTURE

Woolgoolga to Ballina Pacific Highway upgrade

Urban design and landscape plan

NSW
MAKING IT HAPPEN

Bridge over Clarence River at Harwood Section 5

Prepared for:

PACIFIC COMPLETE

Comprising Laing O'Rourke and WSP. Parsons Brinkerhoff

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Bridge over Clarence River at Harwood Section 5

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EXECUTIVE SUMMARY

Bridge over Clarence River At Harwood

The new bridge over Clarence River at Harwood is the largest bridge project to be delivered as part of the Pacific Highway Woolgoolga to Ballina upgrade, and is the subject of this draft Urban Design and Landscape Plan (UDLP).

Refer to Figure i-2 for an artist's impression of the bridge over Clarence River at Harwood.

Background

The Pacific Highway upgrade is one of the largest road infrastructure projects in NSW. It connects Sydney and Brisbane, and when complete will be a major contributor to Australia's economic activity. The road provides a vital piece of the nation's infrastructure and will be 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 that 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.

Purpose of this plan

This plan has been developed to address the requirements of the Minister's Conditions of Approval (MCoA) D20 and to present an integrated urban design for the Woolgoolga to Ballina upgrade. This plan specifically addresses the Maclean to Iluka Road – Section 5; Bridge over Clarence River at Harwood and demonstrates commitments 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.

This report (UDLP) should be read in conjunction with the Maclean to Devils Pulpit (Sections 5 and 6) draft UDLP which provides a general contextual setting for the Bridge over Clarence River at Harwood.

The draft UDLP document is available at:

http://www.rms.nsw.gov.au/documents/projects/northern-nsw/woolgoolga-to-ballina/w2b-consultation-maclean-to-devils-pulpit-august-2016.pdf

Overview of the Woolgoolga to Ballina upgrade

The 155 kilometre upgrade between Woolgoolga and 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 highway.

Urban and landscape design methodology

The urban and landscape design methodology utilised in the upgrade's detailed design development is considered best practice, and is guided by Roads and Maritime Services' Urban Design Policy. The design has been revised at each design development stage, and as the project continues to progress, an integrated multidisciplinary design approach continues to be instilled to achieve urban design and landscape objectives. This provides a holistic, yet varied and consistent design strategy, which includes consultation with communities, stakeholders and agencies as part of the development of the design and construction. Consultation will continue throughout the design development and construction to operational stages.

Urban design guidance

Urban design for the project is guided by three 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 urban design framework for the Pacific Highway upgrade – 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.

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

Approval documents:

- P*roject Approval Notice*, dated 14 August 2014, and *Modifications to the Project Approval*, 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 & Visual Impact Assessment*, Roads and Maritime Services, 2012

Figure i-1: (left) *Pacific Highway Urban Design Framework, 2013* (right) *Beyond the Pavement, 2014*

Note: Landscape shown at maturity. Drawing and design is subject to further consultation and development. The number of trees is indicative only and subject to road safety consideration.

Figure i-2: Artist's impression of the bridge over Clarence River at Harwood aerial looking south west (refer to Chapter 6).

- *The Woolgoolga to Ballina – Pacific Highway Upgrade – EIS Working Paper – Biodiversity Assessment*, Roads and Maritime Services, 2012
- *Upgrading the Pacific Highway – Design Guidelines*, Roads and Maritime Services, March 2015.

Guidelines documents:

- *Environmental Impact Assessment Practice Note: Guidelines for Landscape Character and Visual Impact Assessment* ("EIA No4 Guidelines"), Roads and Maritime Services, March 2013
- *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

Minister's Conditions of Approval

The Woolgoolga to Ballina upgrade has been approved as State Significant Infrastructure under Part 5.1 of the New South Wales 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 14/08/14).

Ministerial Condition of Approval (MCoA) D20 relates to the preparation of a UDLP to be prepared and implemented before the start of permanent built work and/or landscaping, unless otherwise agreed by the Secretary.

Consultation

A community and stakeholder engagement strategy was developed and implemented to support the progress of the Woolgoolga to Ballina Pacific Highway upgrade with relation to the draft Urban Design Landscape Plan. The strategy ensured appropriate levels of consultation with key stakeholders to manage expectations and minimise risk. The strategy recommended a co-hosted consultation approach incorporating the draft Urban Design and Landscape Plan alongside the proposed design refinements for consideration as part of the detailed design development process. Consultation with community included draft Urban and Landscape Plans for:

- Glenugie Upgrade to Maclean (Sections 3 and 4)
- Maclean to Devils Pulpit (Sections 5, 6 and 6A) excluding the new bridge over the Clarence River at Harwood
- Devils Pulpit Upgrade to Richmond River (Sections 7, 8 and 9)
- Richmond River to Ballina Bypass (Sections 10 and 11)

Consultation in relation to the above draft UDLP's was undertaken as follows:

1. In April and May 2016 preliminary draft detailed design concepts for the Urban Design and Landscape Plan were available for public review and comment, with information sessions held.

2. From 1-29 August 2016 the draft Urban Design and Landscape Plan was released for public review and comment. The results of the August 2016 consultation are detailed in the Pacific Highway Woolgoolga to Ballina upgrade: Proposed design refinements and Urban Design and Landscape Plan submissions report, October 2016.

Consultation for the bridge over Clarence River at Harwood draft UDLP commenced on 28 November 2016 and ended on 16 December 2016 as detailed in Chapter 3.

The feedback and responses as a result of community, agency and stakeholder consultation on the draft urban design and landscape plan are addressed in the Community Consultation Report, March 2017 with responses incorporated in this report. The consultation report is prepared in accordance with the community and stakeholder engagement strategy for the project is contained in Appendix C of this report.

Project type and staging

The Roads and Maritime Services' Pacific Highway Program Office is responsible for the 657 kilometre Pacific Highway upgrade between Hexham and the Queensland border. A clear benefit of the program office is that 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.

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

The delivery model is based on the approach used to oversee construction of the London Olympics 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 the Roads and Maritime's knowledge to ensure better engineering and design, customer outcomes and public value.

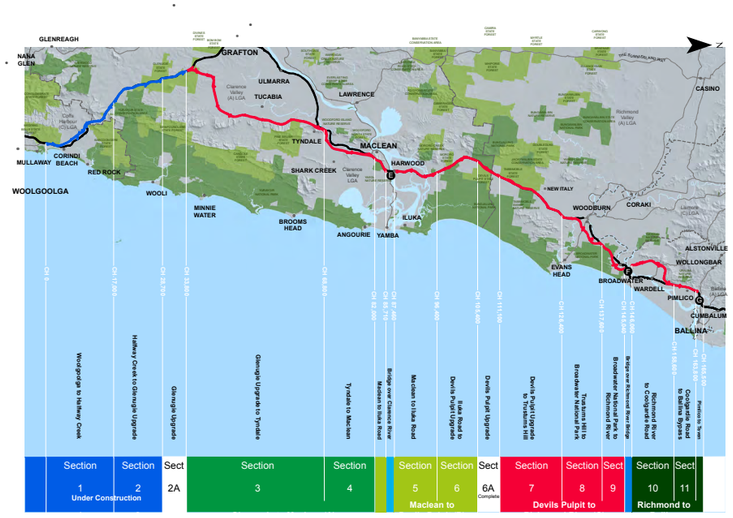

Figure i-3: Project staging map showing Sections 1 to 11, refer to chapter 1

The delivery partner Pacific Complete, comprising Laing O'Rourke and WSP Parsons Brinckerhoff is working closely with the Pacific Highway Program office to oversee the project 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, excluding the completed Glenugie and Devils Pulpit upgrades. Design and construction of the bridges crossing the Clarence and Richmond Rivers are managed separately. Further information is provided in chapter 1.

Tender selection process

In August 2015 three contractors were shortlisted to submit a tender to design and construct the new Bridge over the Clarence River at Harwood, as part of the Woolgoolga to Ballina section of the Pacific Highway upgrade.

The Request for Tenders included extensive design requirements for the bridge. All tenderers were required to submit designs that conformed to the design requirements. The selection of the tender included a comprehensive tender assessment in a multidisciplinary setting. This resulted in a sustainable and balanced approach to the selection that included social, environmental and economic assessments.

In July 2016 the consortium comprising Acciona Ferrovial Harwood Joint Venture (AFHJV) signed the contract to design and construct the new bridge. The design as developed by AFHJV is represented in this draft Urban Design and Landscape Plan.

Vision

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

> *'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.'*

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 that 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.

Urban design and landscape principles

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

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

Contextual setting

The study area for the new bridge is strongly characterised by the Clarence River, the agricultural landscape of the lower Clarence River floodplain and the township of Harwood.

The highway traverses a landscape with significant biodiversity values, including:

- Diverse native vegetation communities, including Endangered Ecological Communities
- Habitat for threatened fauna species, including koalas
- Regional fauna connectivity corridors
- Regionally significant wetlands
- Class 1 aquatic habitats of the Clarence River and its tributaries.

Chapter 5 of this report provides a detailed discussion and analysis of the key environmental, urban and cultural factors and values.

Refer to plate i-1 for an aerial image of the Clarence River setting.

The highway upgrade

The Maclean to Iluka Road (Section 5) of the Pacific Highway Woolgoolga to Ballina upgrade extends over approximately 14.4 km from Maclean (about 46 km north of Grafton). Maclean to Iluka Road is a technically challenging section of the upgrade as it spans the Clarence River and surrounding floodplains. The bridge over Clarence River at Harwood is the major structure in the landscape and includes in its general context:

- Interchanges at Yamba Road and Harwood
- Several local road connections
- Landscape design including visual screening of the bridge.

As the highway is situated on the Clarence River floodplain, substantial earthworks and spanning arrangements are necessary to achieve the required flood immunity for the upgraded highway. Detail is provided in chapter 7 of this report.

Urban design and landscape concept

The urban design and landscape concept for Maclean to Iluka Road (Section 5) is developed in direct response to the Pacific Highway urban design vision and objectives established by the Pacific Highway Urban Design Framework (Roads and Maritime Services, 2013), and the project-wide urban design principles established in the Woolgoolga to Ballina upgrade EIS. These are discussed in chapters 4 and 6 of this report.

Two additional urban design and landscape principles specific to the Maclean to Iluka Road (Section 5) study area are identified in direct response to the specific environmental, cultural and scenic values of the local landscape context. These are:

- To celebrate the 'big landscape' that is the Clarence River floodplain
- To maintain the integrity of existing ecological systems.

Principles governing the bridge design

The overarching principles for the bridge design included reference to the Roads and Maritime Services publication Bridge Aesthetics – design guideline to improve the appearance of bridges in NSW, Roads and Maritime Services, July 2012. Refer to chapter 6 for further information.

Detailed principles include:

1. The road and bridge structure must fit sensitively into the landscape; provide for good connectivity for all road users; and provide a high quality public domain
2. The new bridge is required to respond to the context in an appropriate manner
3. Provide an appropriate response to the scale of the structure being highly visible to road users and local community
4. The design should consider the overall driving experience including a 110km speed zone to a ~30m high bridge crown, resulting in, dramatic views of the Northern Rivers region and view of the delta area
5. Road user safety and the driver experience is an important consideration in the design development
6. Place-making and destination making responses
7. Sustainability responses are required for the structure; these may include maintenance and material considerations
8. Constructability and value for money are important objectives; a balance between aesthetic and constructability and value for money is to be achieved.

The new bridge complies with all these detailed urban design principles.

Figure i-4: Artists impression of the approved bridge at Nambucca River

Description of the new bridge

The new Bridge over Clarence River at Harwood structure comprises an approximately 1.5km long bridge, with about 600m of the bridge spanning the Clarence River. The new bridge is located east and is aligned parallel to the existing Harwood Bridge. The new bridge is a major landmark in the floodplain and a major infrastructure statement for Harwood and the region.

The new bridge has multiple spans of varying span lengths, arranged to align with the existing Harwood Bridge pier layout and functional on-land spanning arrangements. The bridge is a trabeated form structure with pile caps, piers, headstocks, precast spanning elements (U-girders) forming the superstructure. These design strategies are employed to complement the existing Harwood Bridge and are consistent with other major bridges on the Pacific Highway such as the Nambucca River bridge, refer to figure i-4.

Elevation of the bridge and the shipping lane

The profile of the new bridge accommodates a mid-river shipping lane height of 30m above the water level. The bridge deck rises gradually to accommodate the shipping lane maximum height in the centre of the river. This will result in the bridge user experience of maximised view opportunities from the highest location on the bridge over the Clarence River floodplain and across the river.

Figure i-5: Artists impression of a truck drivers view on the northbound carriageway on the bridge over Clarence River at Harwood

Experiential aspects of the new bridge

From the road users' perspective, the highway upgrade is characterised by the wide, flat, open landscape of the Clarence River Floodplain, which is strongly contrasted with the adjacent forested hills north of the Clarence River North Arm and south of the Clarence River. The urban design and landscape concept aims to reinforce the existing experience of landscape contrasts by:

- Maintaining expansive views from the highway as it traverses the agricultural floodplain between the Maclean Pinnacle and Iluka Road, including that of the Clarence River
- Providing extensive revegetation in the forested areas north and south of the floodplain to maintain the visual enclosure of the highway
- Providing extensive roadside revegetation throughout the Maclean to Iluka Road (Section 5) study area to support biodiversity values such as existing vegetation communities, particularly Endangered Ecological Communities
- Providing for Threatened fauna species and their habitat
- Maintaining regional fauna connectivity corridors.

Figure i-6: Artists impression of the bridge over Clarence River at Harwood from VP29 looking south west

User experience is maximised over the bridge allowing expansive distant views of the Clarence River hinterland and out to the Pacific Coast creating a memorable experience and a sense of arrival to both Harwood and the Yamba Interchange. The existing Harwood Bridge will remain in service as part of the local road network. Detail is provided in chapters 6 and 7 of this report. Refer to figure i-5 for an image looking from high point of bridge across the carriageways on the bridge.

Local community experience of the new bridge

The new bridge over the Clarence River is designed to retain the much admired, existing Harwood Bridge. The existing bridge will experience reduced traffic as a result of the Pacific Highway traffic being located onto the new bridge, which will consequently extend the life of the existing structure.

Complementary features include:

- The matching pier locations of the two structures result in complementary rhythms in the forms
- The piers of the two structures are vertical and slender
- The heights of the two structures are similar, accommodating the shipping lane requirements

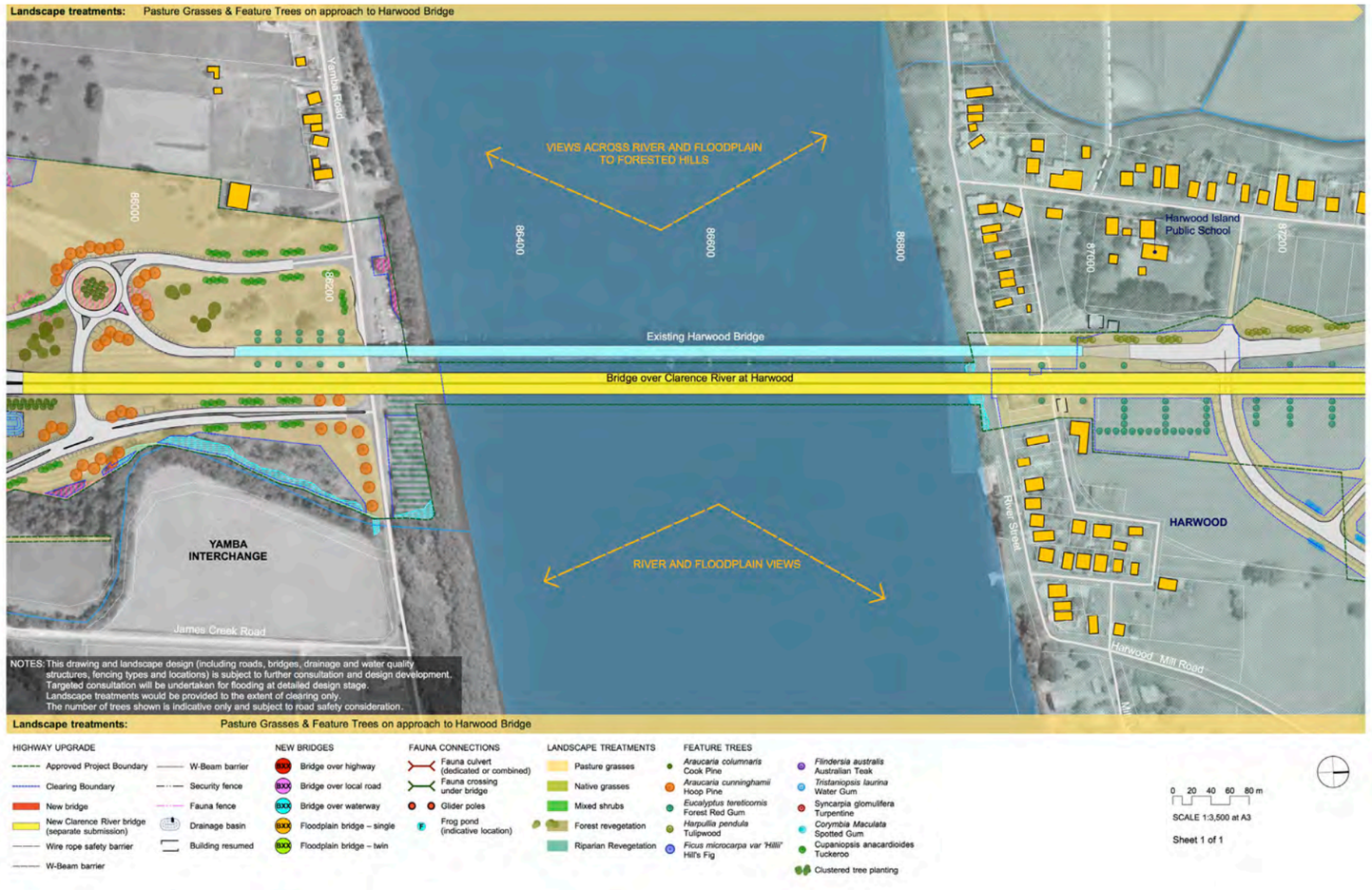

Figure i-7: Landscape design plan for the bridge over Clarence River at Harwood (refer to Chapter 8).

- The scale of both the new and old structure are complementary
- The horizontal alignment of the existing bridge will contrast with the smooth curvilinear form of the new bridge
- The two structures parallel each other; consolidating infrastructure of this scale assists in mitigating impacts overall.

Refer to chapters 6 and 7 for detailed information.

Pedestrian, cyclist and disabled access enhancements

The new bridge and local road connections are designed to enhance local connectivity, and feature new facilities for pedestrians and cyclists.. Once the Pacific Highway traffic is separated from the local traffic conditions, local road conditions are anticipated to improve. Detail is provided in chapter 7 of this report.

Landscape design and highway interchanges

The urban design and landscape concept recognises that the highway interchanges are important place markers along the highway journey, providing an opportunity to signify the specific environmental and cultural values of the communities they support. The landscape design also responds to visual screening of the new bridge as described in the report.

The Yamba interchange includes:

- Distinctive marker plantings to create memorable arrival and departure experiences for interchange
- Roadside plantings of locally distinctive tree species along the entry and exit ramps that reference the distinctive street trees of Maclean and Yamba
- Extensive revegetation of swamp oak swamp forest and paperbark swamp forest to reinforce the existing vegetation adjacent to the interchange
- Distinctive grid plantings to mark the approaches to the Harwood Bridge and new bridge over the Clarence River.

The Harwood interchange includes:

- Distinctive grid plantings to mark the approach to the Harwood Bridge
- Distinctive grid plantings flanking the approach to the new bridge over the Clarence River, which serve to both screen the nearby residences and to mark the bridge approach for highway users.

The visual screening of the bridge has been slightly modified from the proposal contained within the EIS to accommodate the requirements of flood modelling. The visual screening is therefore appropriate to the flood modelling and requirements set out in the EIS.

Refer to figure i-7 for landscape concept plan and figure i-2 for a visualisation of the landscape (refer to chapter 8 for full descriptions).

Landscape character and visual impacts

The Urban Design and Landscape Plan reassesses the impact of the Woolgoolga to Ballina upgrade between Maclean and Devils Pulpit (Sections 5) on the landscape character precincts and key views identified in the Woolgoolga to Ballina EIS.

Assessment of the impact of the detailed design concept for the bridge over Clarence River at Harwood (Section 5) found that there has been no change to the character impacts identified for the precincts at the EIS stage.

Overall, the detailed design concept for the area between Maclean and Devils Pulpit (Sections 5) will have similar landscape character and visual impacts to the EIS.

The EIS noted that at that time three bridge options were under consideration; a box girder, cable stay and balanced cantilever bridge structure (refer to Woolgoolga to Ballina Pacific Highway program - Urban design, character and visual impact report: W2B-wp-urban-design-ch3-part 5 p176-178).

The mitigation measures recommended in the EIS are incorporated into the design presented in the Urban Design and Landscape Plan. Additional mitigation measures are also incorporated into the detailed design in response to modifications to the highway design. The additional mitigation measures include:

- Replacement of proposed permanent architectural headlight screens with vegetation screens
- Development of a project-wide bridge strategy to achieve consistent visual expression of the many bridges across the Woolgoolga to Ballina upgrade.

The urban design and landscape concept strategy and details for the bridge, including the mitigation measures, are described in chapters 6, 7 and 8 of this draft UDLP.

Consistency of the visual assessment with the EIS

The design of the new bridge is consistent with the scale and qualities of the box girder bridge option represented in the EIS. Viewpoints 26A, 26B, 27A, 27B, 28, 29 and 30 are assessed in this report as the same as the impacts in the EIS. The visual impact of the bridge over Clarence River at Harwood will remain unchanged from the EIS assessment as high. The design input into the bridge and landscape screening will assist in mitigating the visual impacts of the structure.

Flood focus groups

Extensive flood modelling is ongoing 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 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 will be reported in the project's Hydrological Mitigation Report which will be submitted to the Department of Planning & Environment for review in early 2017. Once finalised, information will be made available through the project website.

Relevant documentation is available at:

http://www.rms.nsw.gov.au/W2B.

Further information is provided in chapter 7.

Noise

No noise walls are required for the bridge. Operational noise is dealt with in the Operational Noise Management Report: Woolgoolga to Glenugie Pacific Highway Upgrade - Main report,November 2015

http://www.rms.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina/project-documents.html

An assessment of potential construction related noise is available at Construction noise and vibration management plan, Appendix B3, October 2015

http://www.rms.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina/

Further information is provided in chapter 7.

The latest noise modelling on the detailed design of the project indicates that there are no noise mitigation structures required for the project. Noise modelling reports will be submitted to the Department of Planning & Environment for review in early 2017.

Construction

Summary construction information is provided in chapter 9, conclusion of this report. Construction is anticipated to occur over a two year period in 2017 and 2018. Refer to chapter 9 for more information.

Conclusion

The Bridge over Clarence River at Harwood is a similar structure to bridges of a similar scale constructed on Pacific Highway upgrades during the past decade, such as the Pacific Highway Nambucca River bridge. The new and existing bridges at Harwood will complement each other as co-aligned major infrastructure in the Clarence River landscape.

The new bridge is consistent with the visual assessment and commitments identified in the EIS.

The new bridge is a high quality structure and will be a major infrastructure statement for Harwood providing improved safety and environmental conditions and connectivity.

In accordance with MCoA D20, Roads and Maritime Services seeks approval of the Secretary to commence permanent built works.

Plate i-1: Oblique aerial photograph of the existing Harwood Bridge at Harwood crossing the Clarence River looking north west

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GLOSSARY

Bioregion	Classification of Australia's landscape into 89 distinct bioregions based on climate, geology, landform and native vegetation and species information. The W2B project site is within the NNC - New South Wales North Coast Bioregion as defined by ABRA mapping.
Compost blanket	Consists of high quality compost incorporating organic tackifiers, biological stimulants, wetting agents, soil ameliorants and seed mix that is applied to the batter surface with pneumatic blowers at a thickness of between 25-100mm depending on type of vegetation to be established.
Cover crop	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..
Direct return	Stripping and replacement of site soils that contains a seed bank of native indigenous species.
Drill/broadcast seeding	Seeding using a mechanical disc seeder towed by a tractor. Drill seeders have metal discs that 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.
Fauna crossing structure	Structures that allow animals to safely cross over human-made barriers such as 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 diametre of less that 100mm at approximately 500mm above ground are considered frangible.
Native Grasses	Grass species that are native to Australia.
Hydromulching	Various types of organic fibrous materials mixed with water and sprayed onto the soil surface in slurry form that sets to form a layer that 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 that is either modified from a natural soil or manufactured and installed using artificial components for the purpose of sustaining vegetation that is chosen to achieve a particular landscape design outcome or revegetation.
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 Bioregion.
Natural soils	Soils remaining insitu which have formed distinct horizons and typically sustaining specific plant communities.
Non-native	Plants that are not native to the bioregion in which the project site is located.
Noxious weed	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 that 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 diametre in mm. **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% after 12 months from commencement 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.
Seed provenance	The area from which seed is collected from native plants.
Tubestock	Rigid plant containers with a top edge length or diametre of 40-50mm or 75mm. Includes individual containers as well as trays, and may have proprietary names.

ABBREVIATIONS

ABJV	Arcadis Beca Joint Venture
AFHJV	Acciona Ferrovial Harwood Joint Venture
CEMP	Construction Environmental Management Plan
CH	Chainage – location reference along the highway alignment
DEC	NSW Department of Environment and Conservation – subsequently DECC
DECC	NSW Department of Environment Climate Change and Water – now OEH
EIS	Environmental Impact Statement
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Roads and Maritime	NSW Roads and Maritime Services
RTA	NSW Roads and Traffic Authority – now Roads and Maritime Services
OEH	NSW Office of Environment and Heritage
PC	Pacific Complete
SEPP	State Environmental Planning Policy
SEWPAC	Department of Sustainability, Environment, Water, Population and Communities
SPIR	Submissions/Preferred Infrastructure Report
TSC Act	*Threatened Species Conservation Act 1995*
UDLP	Urban Design and Landscape Plan
W2B	Pacific Highway Woolgolga to Ballina Upgrade
W2BPA	Woolgoolga to Ballina Planning Alliance

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1. INTRODUCTION

Chapter contents

Plate 1-1 Oblique aerial photograph of the existing Harwood Bridge at Harwood crossing the Clarence River looking north west

1.1 BACKGROUND

The Pacific Highway upgrade is one of the largest road infrastructure projects in NSW. It connects Sydney and Brisbane, and when complete will be a major contributor to Australia's economic activity. The road provides a vital piece of the nation's infrastructure and will be 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 that 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 1-1: Upgrading the Pacific Highway – status of dual carriageway, Oct 2016 (source: Roads and Maritime)

Figure 1-2: Pacific Highway Woolgoolga to Ballina upgrade Section map (source: Pacific Complete)

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 South Grafton, Ulmarra, Woodburn, Broadwater and Wardell
- More than 100 bridges including major crossings of the Clarence and Richmond rivers
- Bridges over and under the highway to maintain access to local roads that 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 and north of the Richmond River
- 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.

1.3 PROJECT TYPE AND STAGING

The Roads and Maritime Services Pacific Highway Program 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 program office is that 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 program 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 Olympics 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 the 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. Parsons Brinkerhoff is working closely with the Pacific Highway Program Office to oversee the project and handle multiple contracts for professional services and building of the $4.36 billion upgrade. Studio Colin Polwarth PL and Corkery Consulting provide urban design and landscape services as part of the Pacific Complete team and produced this report to assist with delivery; they work closely with Roads and Maritime Services, Centre for Urban Design on all aspects of the project

Arcadis has the the professional service contract with Spackman Mossop and Michaels providing urban design and landscape services for Maclean to Devils Pulpit (Sections 5 and 6).

Acciona Ferrovial Harwood Joint Venture (AFHJV) has appointed Arup as principal designer by to undertake detailed design services for the bridge over Clarence River at Harwood. AFHJV have been engaged to deliver the project by Pacific Complete as a Design and Construct (D&C) contract.

The bridge over Clarence River at Harwood is a discrete design and construction package that has been integrated with surrounding landscape works. The bridge design shown in this report focuses on the bridge and its relationship to the river. A summary of the landscape design integration is also provided. All the teams worked closely together with Roads and Maritime Services to produce the integrated design and construction as represented in this Draft UDLP.

Refer to Maclean to Devils Pulpit (Section 5 and 6), Draft urban design and landscape plan for a full description of the landscape design in and around the project in a detailed context.

The project was divided into 11 sections in the Environmental Impact Statement (EIS) for assessment purposes, excluding the completed Glenugie and Devils Pulpit upgrades. Design and construction of the bridges crossing the Clarence and Richmond rivers managed separately. The bridge over Clarence River at Harwood sits entirely within Maclean to Devils Pulpit area (Section 5) of the Woolgoolga to Ballina upgrade.

Refer to figure 1-2 for a section map for the project.

1.4 TENDER SELECTION PROCESS

In August 2015 three contractors were shortlisted to submit a tender to design and construct the new Bridge over the Clarence River at Harwood, as part of the Woolgoolga to Ballina section of the Pacific Highway upgrade.

The Request for Tenders included extensive design requirements for the bridge. All tenderers were required to submit designs that conformed to the design requirements. The selection of the tender included a comprehensive tender assessment in a multidisciplinary setting. The tender requirements set out principles for the design of the bridge, these are contained in this report in chapters 6 and 7. The tender process resulted in a sustainable and balanced approach to the selection of the bridge and the contractor that included social, environmental and economic assessments. Refer to chapter 6 for further information on the bridge selection process.

In July 2016 the consortium comprising Acciona Ferrovial Harwood Joint Venture AFJV signed the contract to design and construct the new bridge. The design as developed by AFHJV is represented in this Urban Design and Landscape Plan.

1.5 PURPOSE OF THIS PLAN

This plan has been developed to address the requirements of the Minister's Conditions of Approval (MCoA) D20 and presents an integrated urban design for the Woolgoolga to Ballina project. This plan specifically addresses the bridge over Clarence River at Harwood, (Section 5, Maclean to Devils Pulpit) and demonstrates commitment to the mitigation and management measures identified in the Woolgoolga to Ballina upgrade Environmental Impact Statement (EIS), the submissions/ preferred infrastructure report (SPIR, and other approved environmental management documentation).

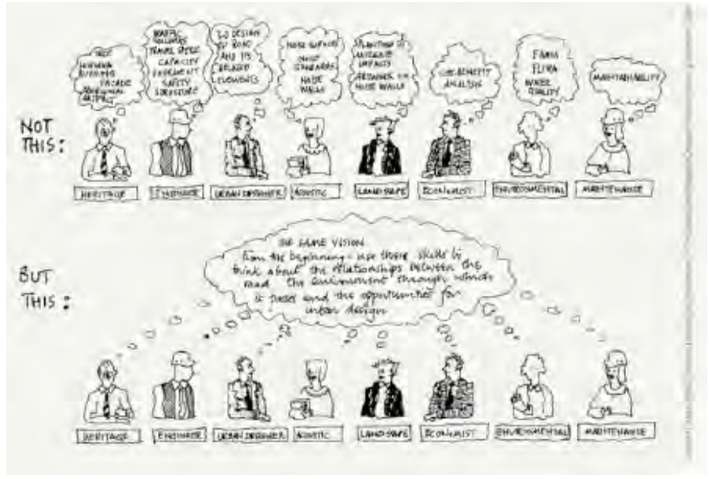

Figure 1-3: The project design team
(source: *Beyond the Pavement* (Roads and Maritime 2014))

This report should be read in conjunction with the Maclean to Devils Pulpit (Sections 5 and 6) Draft UDLP which provides a general contextual setting for the bridge over Clarence River at Harwood. The document is available at:

http://www.rms.nsw.gov.au/documents/projects/northern-nsw/woolgoolga-to-ballina/w2b-consultation-maclean-to-devils-pulpit-august-2016.pdf

1.6 URBAN AND LANDSCAPE DESIGN METHODOLOGY

The urban and landscape design methodology utilised in the upgrade's detailed design development is considered best practice, and is guided by Roads and Maritime Services' Urban Design Policy. The design has been revised at each design development stage, and as the project continues to progress, an integrated multidisciplinary design approach continues to be instilled to achieve urban design and landscape objectives. This provides a holistic, yet varied and consistent design strategy, which includes consultation with communities, stakeholders and agencies as part of the development of the design and construction. Consultation will continue throughout the design development and construction to operational stages.

The integrated design methodology for the urban design in response to this unique setting is to:

- Ensure integrated alignment with the design strategy of the Woolgoolga to Ballina upgrade corridor strategy
- Develop an elegant and aesthetically pleasing design that ties in with the existing landscape and compliments the Clarence River setting
- Meets safety requirements
- Meets flood mitigation and navigation requirements
- Connects and celebrates the existing communities and townships.

Refer to figure 1-3 for a cartoon of the project design process.

1.7 URBAN DESIGN GUIDANCE

Urban design for the project is guided by three 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 urban design framework for the Pacific Highway upgrade – *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*, RMS, 2013
- The Urban Design report prepared as part of the EIS for the Woolgoolga to Ballina project – *Pacific Highway Upgrade Woolgoolga to Ballina Urban Design Report Landscape Character and Visual Impact Assessment*, Hassell, September 2012.

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. Modification 2 of the Project Approval is dated 7 October 2015
- *The Woolgoolga to Ballina – Pacific Highway Upgrade – Environmental Impact Statement* (EIS), Roads and Maritime 2012
- *Woolgoolga to Ballina Urban Design Report Landscape Character & Visual Impact Assessment*, Roads and Maritime 2012
- *The Woolgoolga to Ballina – Pacific Highway Upgrade – EIS Working Paper – Biodiversity Assessment*, Roads and Maritime 2012
- *Upgrading the Pacific Highway – Design Guidelines*, Roads and Maritime March 2015

Guidelines documents:

- *Guideline for Batter Surface Stabilisation using vegetation*, RMS, April 2015
- *Environmental Impact Assessment Practice Note: Guidelines for Landscape Character and Visual Impact Assessment* ("EIA No4 Guidelines"), Roads and Maritime, March 2013
- Soils for Landscape and Garden Use, Australian Standards AS 4419
- Composts, Soil Conditioners and Mulches, Australian Standards AS 4454
- Roads and Maritime construction specifications including R178 Vegetation and R179 Planting

ROADS AND MARITIME URBAN DESIGN GUIDELINES

- *Beyond the Pavement – Urban Design Policy, Procedures and Design Principles*, Roads and Maritime 2014
- *Bridge Aesthetics – design guideline to improve the appearance of bridges in NSW*, Roads and Maritime, July 2012
- *Landscape Guidelines*, Roads and Maritime, April 2008
- *Shotcrete Design Guidelines*, Roads and Maritime, March 2016
- *Noise Wall Design Guidelines*, Roads and Maritime, March 2016
- *Biodiversity Guidelines – Protecting and Managing Biodiversity*, RTA, September 2011.

A full bibliography is provided in the report.

WOOLGOOLGA TO BALLINA DOCUMENTS

1.8 DOCUMENT STRUCTURE

The structure and content of the UDLP is presented in Table 1-1 below.

Table 1-1: Structure and content of the UDLP – Bridge over Clarence River at Harwood (Section 5)

TITLE		CHAPTER DESCRIPTION
Chapter 1	**Introduction**	This chapter provides a broad overview of the project and identifies the purpose and structure of the UDLP.
Chapter 2	**Overview of the Pacific Highway Upgrade**	Chapter 2 provides a broad overview of the Pacific Highway upgrade.
Chapter 3	**Consultation**	The consultation undertaken and identifies the corresponding issues raised and where they are addressed in the UDLP in this chapter. This chapter will be updated after the public exhibition and stakeholder consultation period.
Chapter 4	**Project wide urban design landscape objectives and principles**	Descriptions of the project wide urban design and landscape objectives and principles are provided in this chapter.
Chapter 5	**Contextual analysis**	Contextual analysis and associated landscape and urban design responses for Maclean to Devils Pulpit Section 5 and the local context specific to the bridge over Clarence River at Harwood (Section 5) are provided in chapter 5.
Chapter 6	**Bridge objectives and principles**	This chapter provides an overview of the project and describes the landscape and urban design objectives and principles specific to the bridge over Clarence River at Harwood (Section 5).
Chapter 7	**Bridge project design strategies.**	The landscape and urban design concept specific to the bridge over Clarence River at Harwood (Section 5) is provided in this chapter. This chapter includes urban design and landscape drawings that present the integrated landscape and urban design solutions. This chapter also includes a landscape character and visual impact assessment that describes the impacts of the highway upgrade. This includes key views identified in the EIS. The assessment at draft Detailed Design is compared to the EIS assessment.
Chapter 8	**Landscape design for the Bridge over Clarence River at Harwood (Section 5).**	Detailed descriptions of the landscape design for the bridge over Clarence River at Harwood (Section 5) are provided in this chapter.
Chapter 9	**Conclusion**	The summary of design outcomes, including a summary construction information.
Chapter 10	**Bibliography**	Catalogue of referenced and cited documents.

1.9 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 that occur during construction will be addressed in supplementary reports.

Future design development may therefore occur that is not represented in the report. Artists' impressions are intended to be indicative ideas of a possible future landscape at maturity.

2. COMPLIANCE WITH ENVIRONMENTAL APPROVAL DOCUMENTS

Chapter contents

2.1 MINISTERS CONDITIONS OF APPROVAL

The Woolgoolga to Ballina project has been approved as State Significant Infrastructure under Part 5.1 of the New South Wales 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 14/08/14).

MCoA D20 relates to the preparation of a 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 2-1.

The landscape works associated with the bridge are fully detailed in Maclean to Devils Pulpit Urban and Landscape Design Report for Sections 5 and 6.

Information regarding the landscape design associated with the bridge over Clarence River at Harwood is included in chapter 8 this report.

Table 2-1: Ministerial Condition of Approval D20

MINISTERIAL CONDITION OF APPROVAL D20	DOCUMENT REFERENCE
The Applicant shall prepare and implement an Urban Design and Landscape Plan prior to the commencement of permanent built works and/or landscaping, unless otherwise agreed by the Secretary, to present an integrated landscape and design for the SSI. The Plan shall be prepared in accordance with the RMS 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. The Plan shall include, but not necessarily be limited to:	This document
a) Identification of design principles and standards based on:	N/A
(i) local environmental values	Chapter 5
(ii) heritage values	Chapter 5
(iii) urban design context	Chapter 5
(iv) sustainable design and maintenance	Chapter 6
(v) community amenity and privacy	Chapters 7, 8 and 9
(vi) relevant design standards and guidelines	Chapters 1, 5, 6, 7, 8
(vii) urban design objectives outlined in Section 4.2 of the EIS Working Paper—Urban Design Landscape Character and Visual Impact.	Chapters 5, 6, 7 and 8
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.	Chapters 5, 7 and 8
c) A description of locations along the corridor directly or indirectly impacted by the construction of the SSI (e.g. 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 6
d) Take into account appropriate roadside plantings and landscaping in the vicinity of heritage items and ensure no additional heritage impacts.	Chapters 5, 6, 7 and 8
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 works, procedures for monitoring success of regeneration or revegetation, and corrective actions should regeneration or revegetation not conform to the objectives adopted.	Chapter 6
f) Location and design treatments for associated footpaths and cyclist elements, and other features such as seating, lighting (in accordance with AS 4282-1997 Control of the Obtrusive Effect of Outdoor Lighting), fencing, materials and signs.	Chapter 7
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 7 and 8
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 6, 7 and 8
i) Strategies for progressive landscaping and other environmental controls such as erosion and sedimentation controls, drainage and noise mitigation.	Chapter 8
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 8
k) Evidence of consultation with the relevant council and community on the proposed urban design and landscape measures prior to its finalisation.	Chapter 3 W2B-PC0-E-LX-RPT-00001

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. During the SPIR these measures were further refined, additional commitments were identified and conditions that had already been fulfilled were removed. Table 2-2 outlines compliance with relevant environmental mitigation measures related to landscape and urban design specific to the bridge project works in Sections 5.

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 UDLP has been developed based on the landscape character and visual assessment and landscape strategy prepared as part of chapter 5, however forms the EIS and revised in the SPIR. Cross reference compliance tables are provided in Appendix A.

2.3 URBAN DESIGN AND LANDSCAPE COMPLIANCE WITH THE 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 Section 5. The draft UDLP provides a full visual assessment including compliance and consistency assessment with the EIS.

For locations of the viewpoints please refer to Chapter 7.

Table 2-2: Compliance with EIS landscape and urban design requirements

EIS COMPLIANCE	DOCUMENT REFERENCE
11.4.1 Urban Design and Landscape Strategy • Retain the strong contrasting experience of driving through forest and open agricultural land as a feature of the Pacific Highway experience • Acknowledge and highlight the small and medium sized coastal towns that mark progress along the coastal Pacific Highway journey • Highlight numerous minor and major creek and river crossings across the Pacific Highway journey over the coastal floodplains • Acknowledge and preserve the natural and cultural landscapes and landmarks identified along the full length of the Pacific Highway journey.	Chapter 6 and 7
Viewpoint mitigation measures for EIS viewpoints located in Sections 5	Chapter 7

Plate 2-1: Oblique aerial photograph of the existing Harwood Bridge at Harwood crossing the Clarence River looking west

2.4 URBAN DESIGN AND LANDSCAPE COMPLIANCE WITH THE EIS WORKING PAPER – BIODIVERSITY

The Woolgoolga to Ballina project 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 a separate Design and Construct contract.

The bridge project is fully integrated into the Maclean to Devils Pulpit design and the EIS, comprised of: a Mitigation Strategy, a Monitoring Strategy and an Offset Strategy. Table 2-3 identifies each of the vegetation and landscape design principles for connectivity measures as outlined in the EIS Biodiversity Connectivity Strategy, and where they are addressed in this report. Reference to Appendix A-3 is also recommended.

Table 2-3: Vegetation and landscape design principles for connectivity measures identified in the Biodiversity Connectivity Strategy

DESIGN PRINCIPLE	DOCUMENT REFERENCE
Riparian corridors to be protected during construction works and any areas of riparian vegetation impacted by construction are to be rehabilitated to a pre- determined benchmark condition to be specified in the CEMP.	Chapter 5, 6, 7 and 8
Revegetation actions around crossing structures should consider the height and density of vegetation so as not to screen the structure from view, but also aim to provide some cover for fauna approaching and exiting the structure	Chapter 7 and 8
Roadside plantings in emu crossing zones should not be within the first 40 metres of the road unless there is fauna exclusion fencing in place or as part of the exclusion barrier discussed above. In particular, common landscape species such as *Gahnia*, *Lomandra* and *Dianella* spp. represent food plants for emus and may attract them to the road edge and should avoid being planted.	Not applicable. No emu habitat identified in Sections 5
Plantings under bridges in emu crossing zones including the approaches to the crossing are to use grasses or low ground covers and avoid dense plantings of trees including low trees such as Acacia or Casuarina. This is to leave the opening clear. Ground cover crops such as soybean and oats or rye grass could be used on disturbed ground around the approaches to the bridge to attract emus to the crossing zone	Not applicable. No emu habitat identified in Sections 5
Plantings around dedicated and combined underpasses is to ensure that entrances to the structure do no obscure the structure and provide a clear line of sight	Not applicable
It is important for landscaping at entrances not to intrude / shadow the window of the entrances	Not applicable.
Landscaping should use locally indigenous species and should target key fauna food resources to encourage usage either side of the structure and thus provide the habitat linkage to the structure.	Not applicable.

2.5 URBAN DESIGN AND LANDSCAPE COMPLIANCE WITH THE 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 project, and their applicability to the section, are outlined in the following Table 2-4. Reference to Appendix A-3 is also recommended.

Table 2-4: Threatened Species Management Plans applicable to the bridge over Clarence River at Harwood (Section 5)

THREATENED SPECIES MANAGEMENT PLAN	APPLICABLE TO THIS REPORT
Coastal emu management plan (RMS 2015)	No
Koala management plan (RMS 2016)	No
Rainforest communities and threatened rainforest plants management plan (RMS 2015)	No
Threatened flora management plan (RMS 2015)	**Yes**
Flora Translocation Strategy (RMS 2016)	**Yes**
Threatened fish management plan (RMS 2015)	**No**
Threatened frog management plan (RMS 2015)	**Yes**
Threatened glider management plan (RMS 2015)	**Yes**
Threatened invertebrate management plan	No
Threatened mammal management plan (RMS 2015)	**Yes**

This UDLP addresses the mitigation measures related to landscape and urban design stipulated in the threatened species management plans that are applicable to the study area of the bridge over Clarence River at Harwood in Section 5 of the project.

Appendix A provides further details about compliance with specific urban design and landscape requirements that are included in these management plans.

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3. CONSULTATION

Chapter contents

Woolgoolga to Ballina

Pacific Highway upgrade – Proposed design refinements
Project update – August 2016

The Australian and NSW governments are jointly funding the $4.36 billion Woolgoolga to Ballina Pacific Highway upgrade. As part of the process of moving from concept to construction, we are seeking community feedback about proposed design refinements in various locations.

IN THIS UPDATE - HAVE YOUR SAY

- Proposed design refinements
- Draft Urban Design and Landscape Plan

Project background

The 155 kilometre upgrade between Woolgoolga and Ballina is Australia's largest regional infrastructure project and the last highway link between Hexham and the Queensland border to be upgraded to four lanes.

The Woolgoolga to Ballina project will duplicate about 155 kilometres to four-lane divided road from about six kilometres north of Woolgoolga (north of Coffs Harbour) to about six kilometres south of Ballina. The project does not include the completed Devils Pulpit and Glenugie upgrades.

Roads and Maritime Services Pacific Highway Office, together with our delivery partner Pacific Complete are seeking public comment about the proposed design refinements and urban design aspects being considered in advance of construction before major work starts.

Figure 3-1: Front page of community update - August 2016; providing information on draft urban design and landscape plans, as well as proposed design refinements.

W2B COMMUNITY UPDATE 2016 V5.indd 2 26/07/2016 3:47 PM

3.1 OVERVIEW

A community and stakeholder engagement strategy was developed and implemented to support the progress of the Woolgoolga to Ballina Pacific Highway upgrade with relation to the draft urban design and landscape plan. The strategy ensured appropriate levels of consultation with key stakeholders to manage expectations and minimise risk.

- The strategy outlined the:
- Level of engagement to be carried out
- Key stakeholders
- Potential issues and mitigation activities
- Consultation and communication activities to ensure effective, relevant and timely input from stakeholders and the community
- Communication protocols and responsibilities within the project team
- Evaluation activities.

The strategy recommended a co-hosted consultation approach incorporating the Urban Design and Landscape Plan alongside the proposed design refinements for consideration as part of the detailed design development process.

The desired outcomes of the stakeholder engagement and consultation included:

- Stakeholder understanding of the detailed design and urban design and landscape development processes
- Stakeholders making submissions which are captured and fed into the development of the final urban design and landscape management plan
- Development of comprehensive final urban design and landscape plans, which will guide and support major planning and investment decisions
- Early stakeholder participation in the planning of the urban design and landscape planning, which will encourage ongoing interest and commitment to its development and implementation
- Risk minimisation, and minimisation of negative media publication.

3.2 COMMUNITY CONSULTATION

Community feedback was sought on the draft urban design and landscape plan. The community was able to provide feedback from 28 November to 16 December 2016.

Consultation activities during this time included:

- distributing about 6500 postcards to resident between Maclean and Devils Pulpit
- static displays at 10 locations
- staffed displays at six locations
- updating the project website with the draft urban design and landscape plan as well as an online survey
- email and SMS messages to more than 200 registered stakeholders
- advertising in two local newspapers.

We received feedback from two organisations and seven people. Of the feedback received:

- three respondents provided general support for the urban design and landscape plan and six were neutral
- three respondents provided general support for the bridge design, two objected and four offered no position.

Specific responses for each Section of the project

Key matters raised included vegetation, fauna species, flora and fauna crossings, general design of the bridge and the consultation. Seven matters raised were 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.

Please refer to Appendix C - Community Consultation Report for the Draft Urban Design and Landscape Plans, March 2017 for further information and the location of the responses in this report.

3.3 STAKEHOLDER CONSULTATION

Agency stakeholders identified in the Woolgoolga to Ballina Communications and Stakeholder Engagement Strategy were advised the draft UDLP would be available for review and comment.

Stakeholders who will be provided the UDLP to review include:

- NSW Environment Protection Agency
- NSW Department of Primary Industries – Fisheries
- Clarence Valley Council. At the time of publication of this document no formal response had been received by Clarence Valley Council

Key issues by raised during this review were:

- Support for riparian rehabilitation and landscape treatments to maintain fauna connectivity
- Support for the design principles to minimise impacts on the waterway, native vegetation and the river habitats are necessary
- Support for use of native vegetation in the corridor upgrade areas with suitable set-backs for vegetation at fauna fences.

Please refer to Appendix C - Community Consultation Report for the Draft Urban Design and Landscape Plans, March 2017 for further information and the location of the responses in this report.

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4. PROJECT WIDE URBAN DESIGN AND LANDSCAPE OBJECTIVES AND PRINCIPLES

Chapter contents

Plate 4-1: View across the Clarence River near Harwood looking west (source: Studio Colin Polwarth for Pacific Complete).

4.1 VISION

The Pacific Highway Urban Design Framework (RMS, 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:

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

4.3 URBAN DESIGN AND LANDSCAPE PRINCIPLES

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

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

To achieve these principles, the project would incorporate urban design and landscape key objectives and design principles that are consistent with the key Roads and Maritime Services guiding documents – *Beyond the Pavement (2014)* and *Pacific Highway Urban Design Framework* (2013).

4.4 PROJECT WIDE URBAN DESIGN AND LANDSCAPE STRATEGIES

The project wide urban design and landscape strategies outlined in the project EIS *Working Paper urban design report, landscape character and visual impact assessment* (Hassell, 2012) are as follows:

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

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 adjacent 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 earthworks. This is particularly important for disturbed areas on prominent ridge lines to maintain a consistent urban design and landscape perspective.
- Adhere also to ecological requirements outlined in specialist reporting.

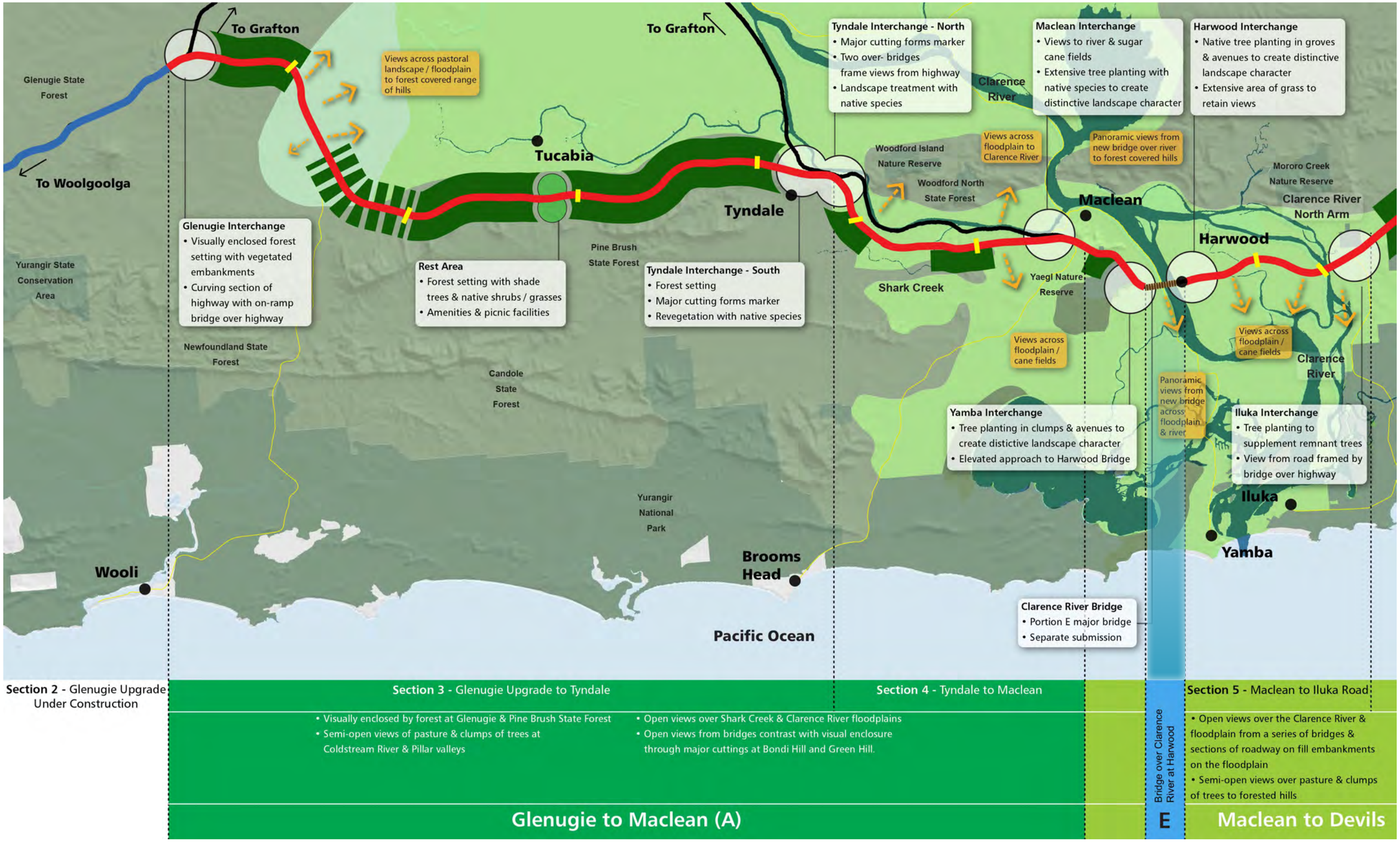
Landscape treatment
- Install large size plant stock at interchanges and near townships to maximise impact and mitigation at project outset
- Lay back the top batter of cuttings and tie back into the existing landform. Revegetate the top of the profile to blend with the existing landscape
- Where competent rock is encountered, steepen batter grades (1V:0.25H) 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.

4.5 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 and have been carried through the detailed design for the UDLP.

The urban and landscape design strategy for Pacific Complete is represented on figure 4-1.


To Grafton
To Grafton
To Woolgoolga
Glenugie State Forest
Views across pastoral landscape / floodplain to forest covered range of hills
Tucabia
Tyndale
Glenugie Interchange
• Visually enclosed forest setting with vegetated embankments
• Curving section of highway with on-ramp bridge over highway
Rest Area
• Forest setting with shade trees & native shrubs / grasses
• Amenities & picnic facilities
Pine Brush State Forest
Tyndale Interchange - South
• Forest setting
• Major cutting forms marker
• Revegetation with native species
Yurangir State Conservation Area
Newfoundland State Forest
Candole State Forest
Yurangir National Park
Wooli
Brooms Head
Pacific Ocean
Tyndale Interchange - North
• Major cutting forms marker
• Two over- bridges frame views from highway
• Landscape treatment with native species
Clarence River
Woodford Island Nature Reserve
Woodford North State Forest
Views across floodplain to Clarence River
Shark Creek
Maclean Interchange
• Views to river & sugar cane fields
• Extensive tree planting with native species to create distinctive landscape character
Panoramic views from new bridge over river to forest covered hills
Maclean
Harwood Interchange
• Native tree planting in groves & avenues to create distinctive landscape character
• Extensive area of grass to retain views
Mororo Creek Nature Reserve
Clarence River North Arm
Harwood
Yaegl Nature Reserve
Views across floodplain / cane fields
Views across floodplain / cane fields
Clarence River
Panoramic views from new bridge across floodplain & river
Yamba Interchange
• Tree planting in clumps & avenues to create distictive landscape character
• Elevated approach to Harwood Bridge
Iluka Interchange
• Tree planting to supplement remnant trees
• View from road framed by bridge over highway
Iluka
Yamba
Clarence River Bridge
• Portion E major bridge
• Separate submission
Section 2 - Glenugie Upgrade Under Construction
Section 3 - Glenugie Upgrade to Tyndale
• Visually enclosed by forest at Glenugie & Pine Brush State Forest
• Semi-open views of pasture & clumps of trees at Coldstream River & Pillar valleys
• Open views over Shark Creek & Clarence River floodplains
• Open views from bridges contrast with visual enclosure through major cuttings at Bondi Hill and Green Hill.
Section 4 - Tyndale to Maclean
Bridge over Clarence River at Harwood
E
Section 5 - Maclean to Iluka Road
• Open views over the Clarence River & floodplain from a series of bridges & sections of roadway on fill embankments on the floodplain
• Semi-open views over pasture & clumps of trees to forested hills
Glenugie to Maclean (A)
Maclean to Devils

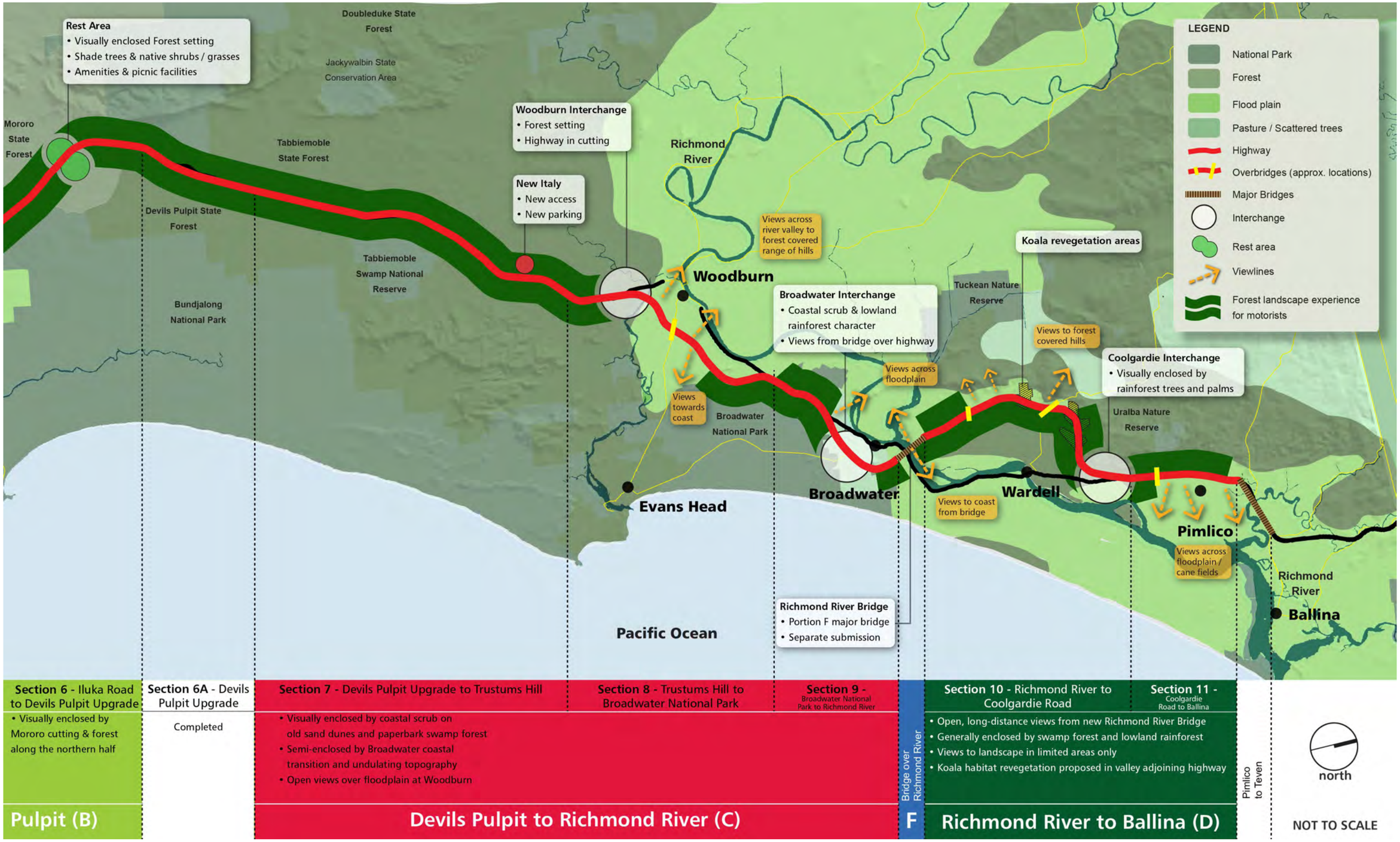


Figure 4-1: Pacific Complete landscape and urban design strategy plan (2 sheets; source: Pacific Complete)

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5. CONTEXTUAL ANALYSIS

This chapter provides analysis of the key environmental, urban design and cultural factors that affect the design of the bridge over Clarence River at Harwood (Section 5) and the relationship to Maclean to Devils Pulpit (Section 5) of the Pacific Highway upgrade.

The purpose of this contextual analysis is to understand the individual aspects that make up the landscape character of the study area and to identify broad scale landscape and urban design opportunities, constraints and design principles that apply. This chapter responds to MCoA D20 condition (a) contextual analysis and (b) location of species.

Chapter contents

Plate 5-1A: Agricultural fields in the Clarence River floodplain near the existing Pacific Highway, near Harwood

5.1 LOCATION

The Bridge over Clarence River at Harwood is located at the Clarence River, slightly east of Harwood and includes the existing Harwood Bridge. The project is located in the Maclean to Devils Pulpit (Section 5) area of the Woolgoolga to Ballina Pacific Highway Upgrade (refer to figure 4-4 for the strategy plan). It consists of the following section as defined in the EIS:

- Maclean to Iluka Road, Mororo – Section 5

The new Bridge over the Clarence River at Harwood, is to be delivered as a separate design and construction package.

The site is located within the Clarence Valley local government area.

The traditional owners of the land on which the project is located are the Yaegl and the Bundjalung peoples. This section of the highway upgrade spans two Local Aboriginal Land Councils (LALCs): Yaegl LALC in the south and Bogal LALC in the north.

Maclean to Devils Pulpit (Section 5) is located in the Northern Rivers region of New South Wales. Section 5 is strongly characterised by the Clarence River and the agricultural landscape of the lower Clarence floodplain, refer to plate 5-6. The highway provides access to the villages of Harwood, on the northern banks of the Clarence River, and Woombah just east of the Iluka Road intersection. The town of Maclean is located on the Clarence River immediately southwest of Maclean to Devils Pulpit (Section 5) area of the project.

A number of national parks, state forests, state conservation areas and nature reserves occur within and in close proximity to the project between Maclean to Devils Pulpit (Section 5). These are:

- Yaegl Nature Reserve
- Chatsworth Hill State Conservation Area
- Mororo Creek Nature Reserve
- Mororo State Forest
- Bundjalung National Park
- Devils Pulpit State Forest
- Bundjalung State Conservation Area.

Refer to figure 5-1.

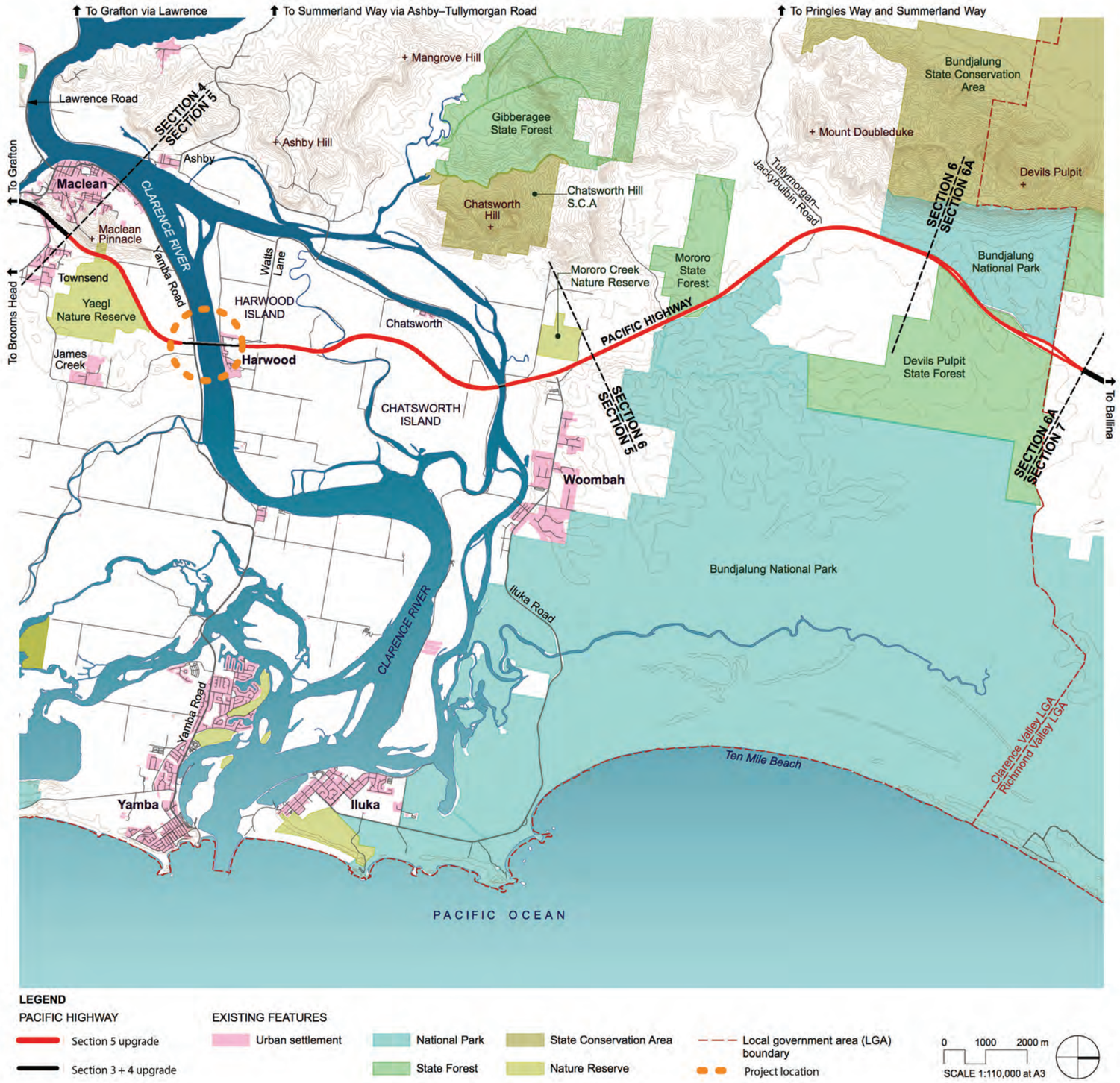

Figure 5-1: Location of the bridge over Clarence River at Harwood in the wider context

5.2 BIOREGION AND ECOSYSTEMS

The Woolgoolga to Ballina project is located wholly within the NSW North Coast (NNC) Bioregion. This bioregion is one of the most diverse in NSW, with complex soil and vegetation patterns resulting from complex interactions of substrate, topographic and climatic variation (W2BPA 2012b).

The Maclean to Devils Pulpit (Section 5) area of the project traverses three ecosystems within the NNC Bioregion described in the NSW Landscapes coverage map (Mitchell 2003):

- Ballina Coastal Ramp (Bal) in the southern part of Section 5 before the Clarence River
- Clarence - Richmond Alluvial Plains (Crp) in the majority of Section 5
- Clarence - Richmond Barriers and Beaches (Clb) in a relatively small and isolated area at the Yaegl Nature Reserve and wetlands south of the Clarence River in Section 5.

The bridge over Clarence River at Harwood is located within the Clarence – Richmond Alluvial Plains (Crp) ecosystem, which is described by Mitchell (2003) as:

- Wide valleys, channels, floodplains, terraces and estuaries of the Clarence and Richmond rivers and other coastal streams on Quaternary alluvium, general elevation 0 to 50 metres, local relief 15 metres
- Deep brown earths and structured brown clay on floodplains. Terrace with yellow texture-contrast soil containing ironstone concretions.
- Extensively cleared valley floors supporting forest of Cabbage Gum, Forest Red Gum, Broad-leaved Apple, River Oak, Silky Oak, Rough-barked Apple, Native Teak, Coastal Grey Box, Pink Bloodwood, Spotted Gum, Grey Ironbark, Broad-leaved Paperbark, Blackwood and Black She-oak.
- Salt marsh, mangrove communities and paperbark freshwater swamps in the estuaries.

Refer to figure 5-2.

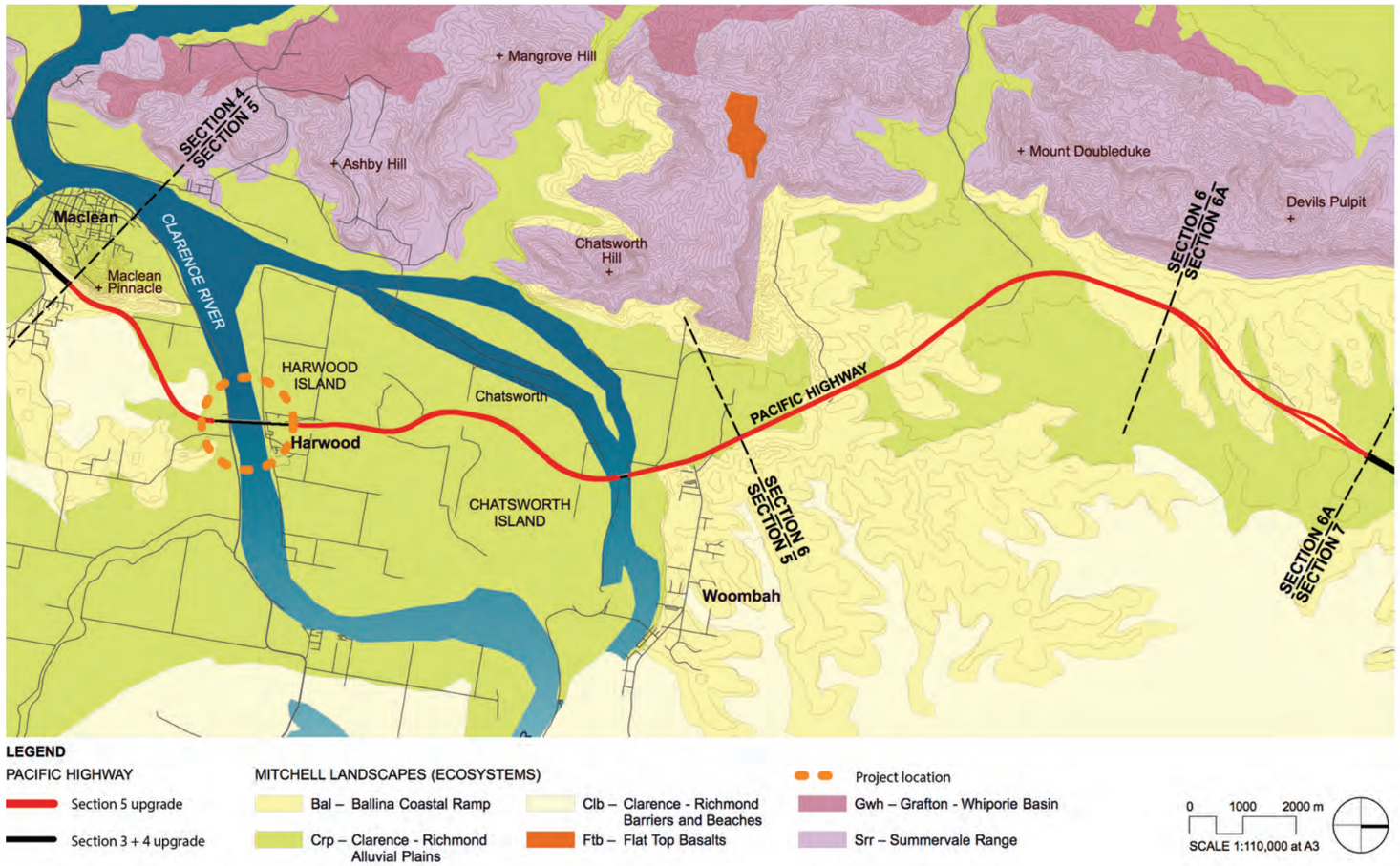

Figure 5-2: Mitchell Landscapes (ecosystems)

5.3 GEOLOGY

Maclean to Devils Pulpit (Section 5) of the project traverses the geological sequence of the Clarence-Moreton Basin, an extensive Mesozoic age sedimentary basin extending from southern Queensland to the NSW North Coast and comprising sedimentary rocks about 2.5 to 4 kilometres thick (W2BPA 2012c).

The section is underlain by three geological units (Geological Survey of NSW, 1970) that closely correspond to the Mitchell landscapes:

- Walloon Coal Measures formation (Jw) underlies the Ballina Coastal Ramp landscape type. It comprises shale, sandstone and coal of the Jurassic Period
- Quaternary undifferentiated alluvial deposits (Qa) underlie the Clarence - Richmond Alluvial Plains landscape type. They include sand, silt, clay and gravel; some residual and colluvial deposits
- Quaternary marine, barrier and estuarine sediments (Qx) underlie the Clarence - Richmond Barriers and Beaches landscape type.

The bridge over Clarence River at Harwood is located on the Clarence-Richmond Alluvial Plains as illustrated on figure 5-3.

5.3.1 Design principles at the bridge over Clarence River at Harwood

- Views to geological landmarks are incorporated into the highway alignment wherever possible in order to reinforce a sense of place to the highway experience.

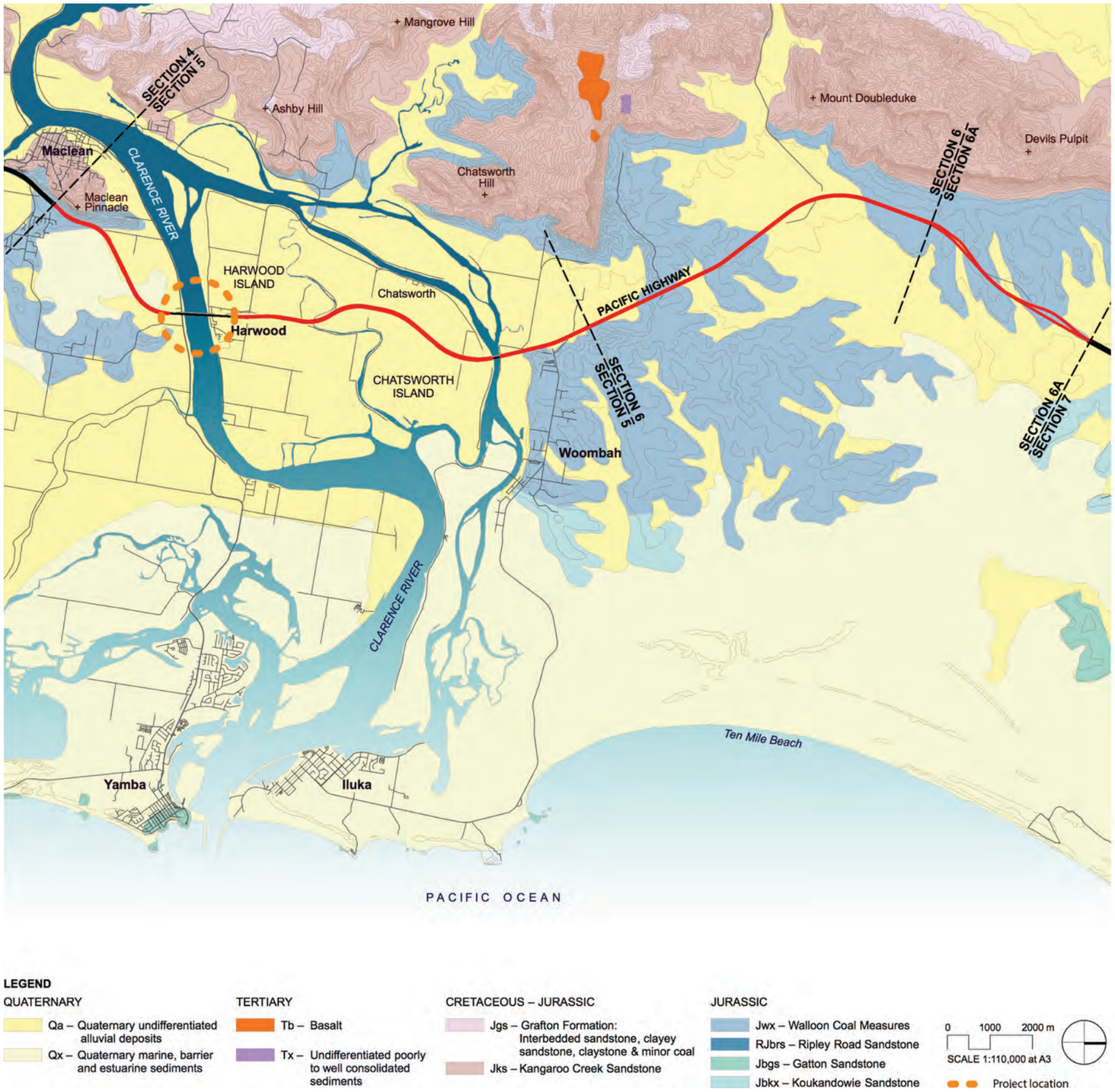

Figure 5-3: Geology mapping in the context of the Clarence River floodplain

5.4 SOILS

The geological landscape types of the Maclean to Devils Pulpit (Section 5) have a direct relationship to the overlying topsoils, with:

- The alluvial plains producing relatively stable sandy/ silty/ gravelly topsoils with low fertility
- The higher ground producing more erosive sandy or stiff clays with higher fertility.

Section 5 of the project traverses eight soil landscape types identified in the Soil Landscapes of the Woodburn 1:100,000 Sheet (Morand 2001). These are (in order of prevalence):

- Alluvial
- Erosional
- Transferral
- Aeolian
- Swamp
- Stagnant alluvial
- Estuarine
- Disturbed terrain.

The bridge over Clarence River at Harwood is located on Alluvial soil landscape type as illustrated on figure 5-4.

5.4.1 Design principles for the Bridge over Clarence River at Harwood

- Topsoil from cleared areas is stripped and reused in revegetation areas. Depending on the location from which it has been sourced, the topsoil may require amelioration to suit the intended revegetation species.
- Soil survey, testing and analysis within each soil and vegetation type is being undertaken to determine the soil amelioration requirements, if any, for successful revegetation.

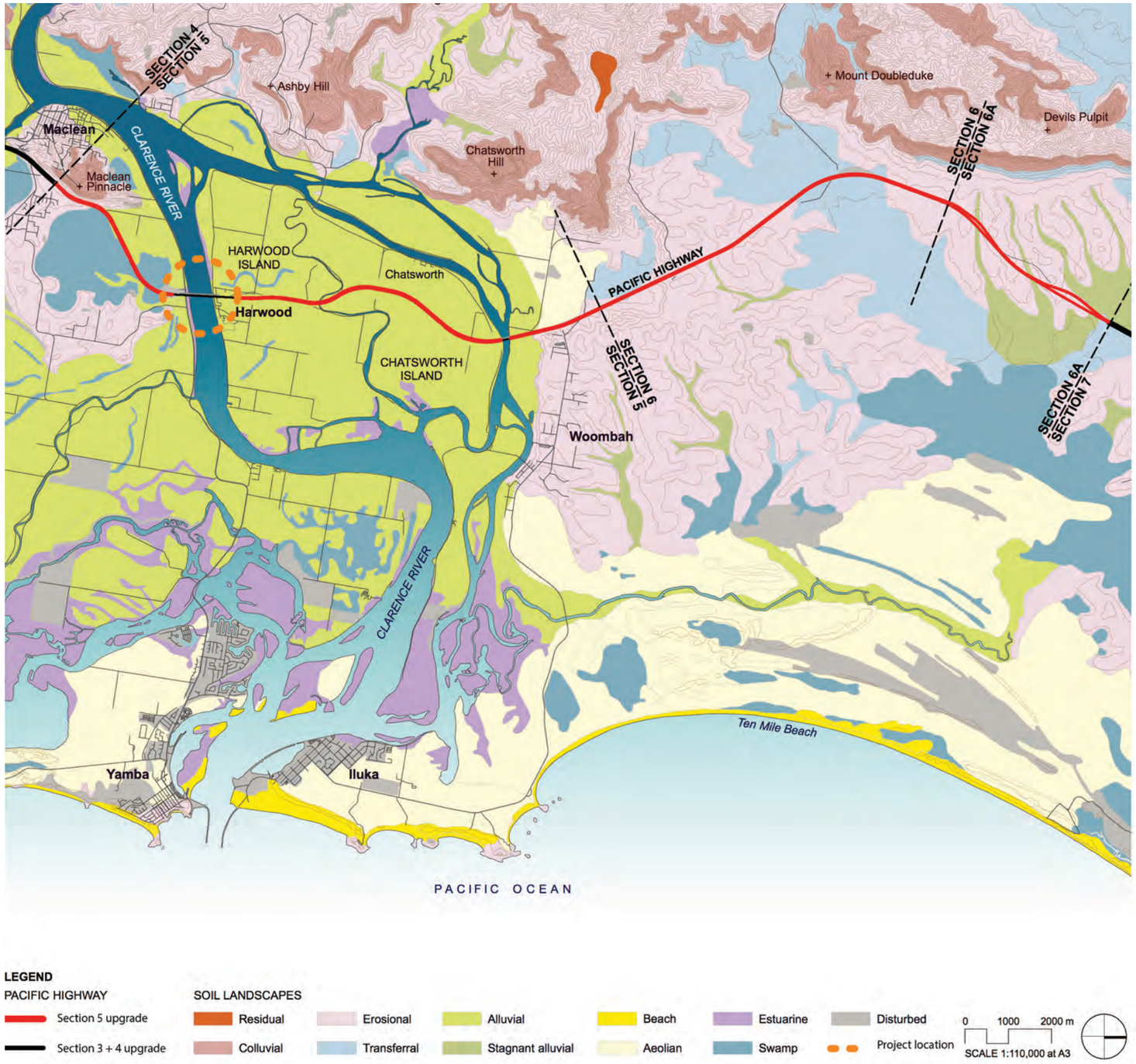

Figure 5-4: Soil landscapes of the region, including the Clarence River floodplain

5.5 LANDFORM AND TOPOGRAPHY

Maclean to Devils Pulpit (Section 5) traverses a distinctive topography:

- Comprising the low, mostly level alluvial terrain of the Clarence River floodplain and delta, with elevations generally between one and five metres.

5.5.1 Design principles at the bridge over Clarence River at Harwood

Design principles for the bridge over Clarence River at Harwood considers:

- The distinctive landform and topography, together with the extensive sugar cane plantations, makes this area highly recognisable. The relationship between the highway alignment and the existing terrain is carefully considered to ensure that the essential qualities of the topographic experience are preserved for the road user
- Urban design input has informed the design of structures, particularly bridges, in order to ensure that they are sensitively integrated with their surroundings
- The design of the fill embankments associated with the new bridge are carefully considered in order to integrate them with the form and character of the existing terrain.

5.6 HYDROLOGY AND DRAINAGE

Maclean to Devils Pulpit (Section 5) is located within the catchment of the Clarence River, which comprises 56 sub-catchments and a large coastal floodplain surrounded by higher elevations. The rivers and creeks provide a broad range of habitat for a wide diversity of aquatic, animal and plant species as well as supporting a range of ecological processes.

5.6.1 Key waterways and catchments

Section 5 is located within the lower Clarence River Floodplain. Downstream of Maclean, the Clarence River splits into the main river and the North Arm. Agricultural landuse, particularly sugarcane plantations, dominate the lower Clarence Floodplain. A network of canefield drains convey local runoff from the agricultural fields to the Clarence River. Refer to figure 5-6.

The lower Clarence Floodplain experiences regular inundation. At times, major flooding can last several days or weeks and inundate some 500 square kilometres due to the large catchment size. Peak flood levels in the 20 year ARI event along the Pacific Highway vary from 2.90 metres at Harwood to 2.55 metres at Chatsworth Island (W2BPA 2012d).

5.6.1 Wetlands

Maclean to Devils Pulpit (Section 5) traverses four wetland catchments that are considered as being significant under:

- State Environmental Planning Policy No 14 – Coastal Wetlands (SEPP14), which aims to protect coastal wetlands
- Department of Sustainability, Environment, Water, Population and Communities (SEWPAC), which identifies nationally important wetlands in its Directory of Important Wetlands.

No internationally important wetlands listed under the Ramsar Convention are located Maclean to Devils Pulpit (Section 5). The following Table 5-1 summarises the *significant* SEPP 14 and SEWPAC wetlands located within or near the Maclean to Devils Pulpit (Section 5). These are not impacted by the bridge over Clarence River at Harwood.

Table 5-1: SEPP 14 and SEWPAC Wetlands

SECTION	SEPP 14 ID	WETLAND NAME & LOCATION	SEWPAC
5	220a	Yaegl Nature Reserve. Adjoins project boundary.	No
5	153c	No name. Located between Clarence River North Arm and Back Channel. Crosses project boundary.	No

5.6.1 Design principles at the bridge over Clarence River at Harwood

Design principles for the bridge over Clarence River at Harwood considers:

- The highway alignment between Maclean to Devils Pulpit (Section 5) is designed for 20 year ARI flood immunity – except where the existing Pacific Highway is retained as the southbound carriageway, which has a 5 year ARI flood immunity with contra flow arrangements to either side
- The design of the bridge over the Clarence River at Harwood responds to hydrological requirements as well as other ecological considerations
- Scour protection (rock armouring and soft scour) is included at locations assessed to be susceptible to scour erosion, including bridge abutments, piers, and embankments
- Appropriate revegetation has been included to assist with erosion protection along the banks of waterways and at other erosion sensitive locations.

Refer to chapters 7 and 8 for information on the landscape design which responds to the flood modelling at Harwood.

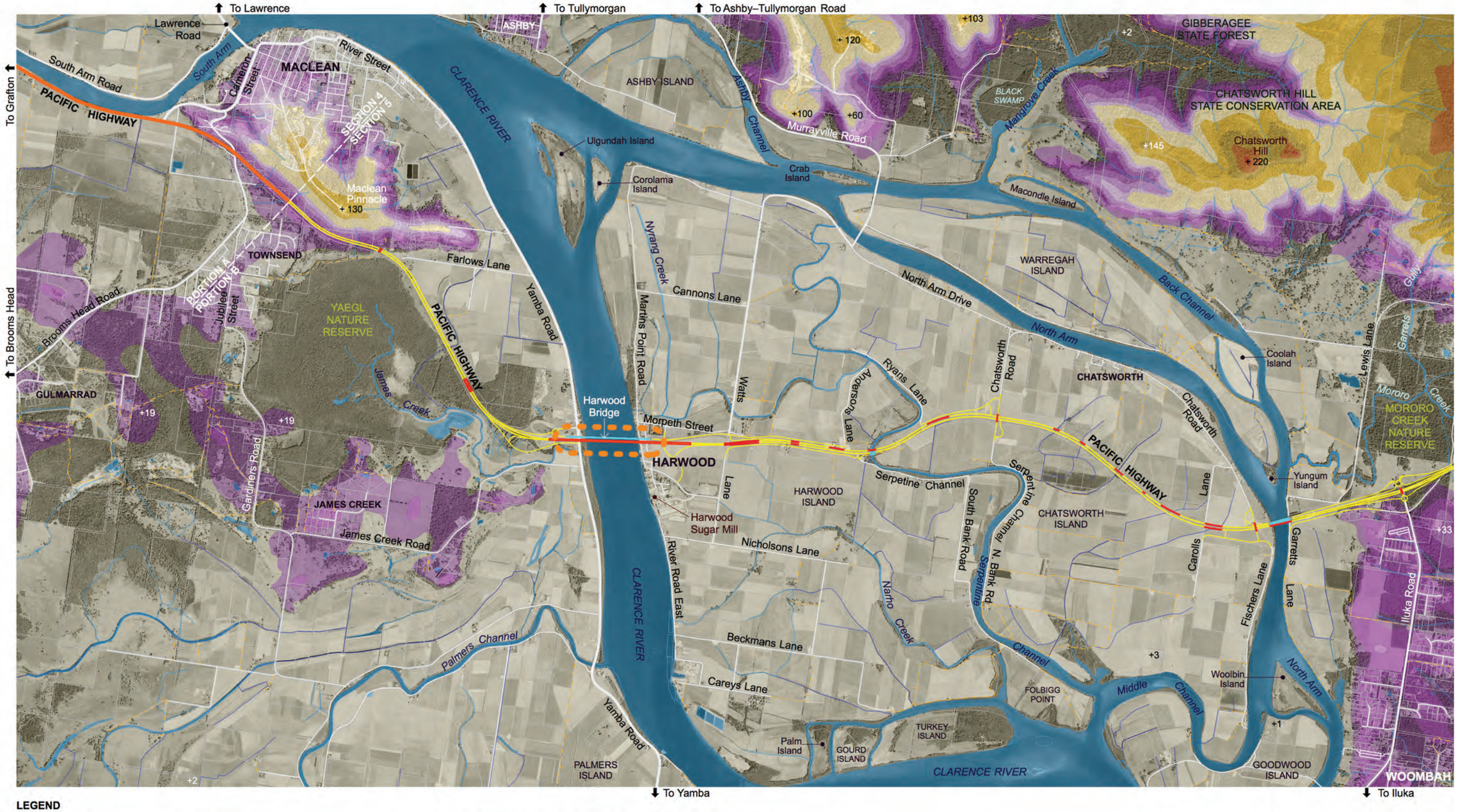

Figure 5-5: Landform and topography mapping of the Clarence River and the region

LEGEND

EXISTING FEATURES
- Existing road
- Existing vehicular track

PACIFIC HIGHWAY
- Highway upgrade Maclean to Devils Pulpit (Sections 5 & 6)
- Adjacent sections of highway upgrade
- Existing upgraded Pacific Highway
- Existing bridge
- New bridge

OPEN SPACE
- National Park
- State Forest
- State Conservation Area
- Nature Reserve

HYDOLOGY
- Waterway / water body
- Canal drain
- SEPP 14 & Nationally important wetlands (refer drawing label for wetland ID)

0 500 1000 m
SCALE 1:40,000 at A3
Project location

Figure 5-6: Hydrology mapping of the Clarence River and the region

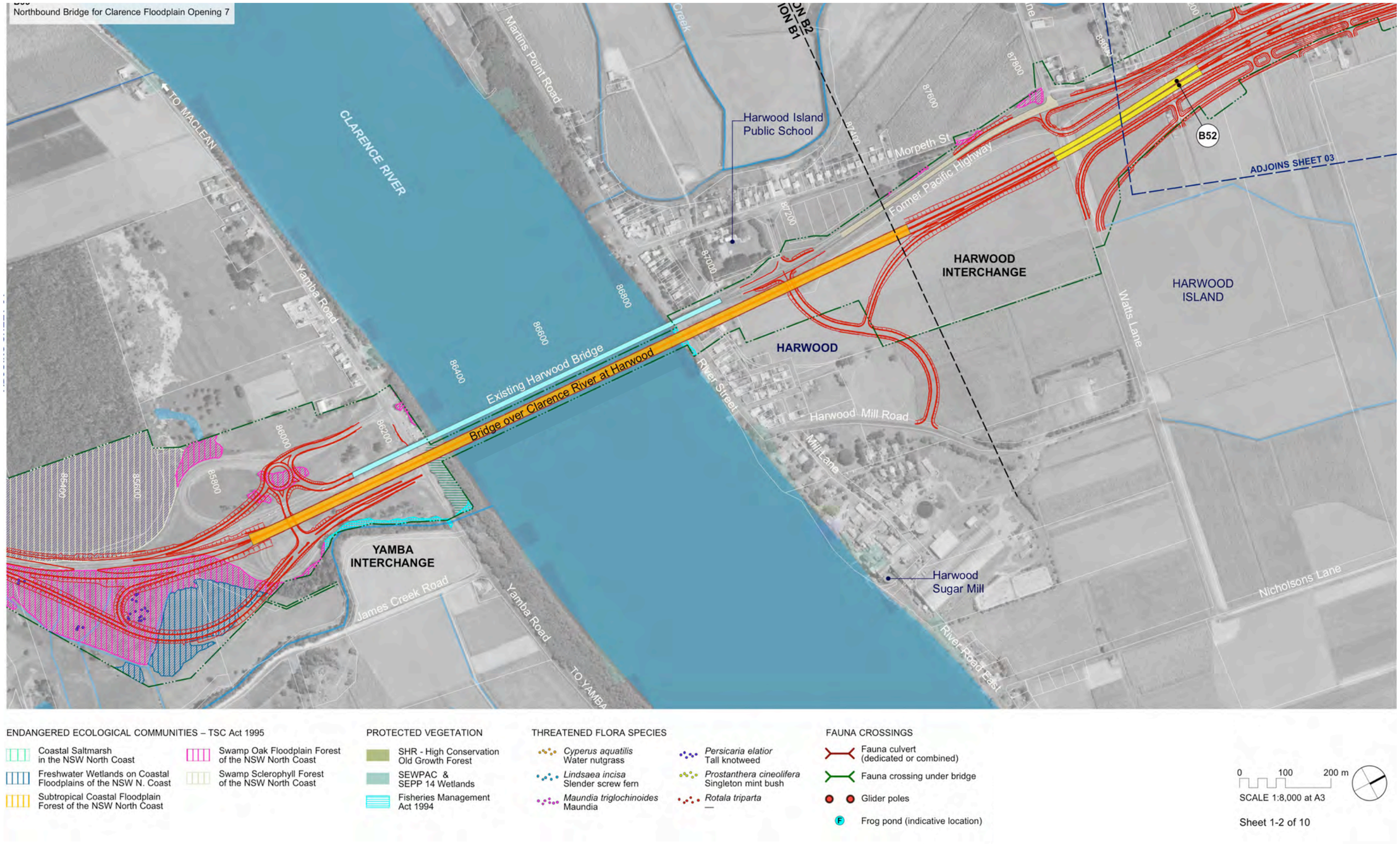

Figure 5-7: Existing vegetation, threatened flora and fauna connectivity

5.7 FLORA

5.7.1 Vegetation communities

Vegetation surveys conducted for the project have identified 18 vegetation communities (biometric vegetation types) within the immediate vicinity of the project between Maclean and Devils Pulpit (Section 5 and 6) (W2BPA 2012b).

Within the area adjoining the bridge over Clarence River at Harwood the vegetation communities include:

Forested wetlands:

- Coastal floodplain sedgelands, rushlands, and forblands
- Paperbark swamp forest of the coastal lowlands of the North Coast
- Swamp Oak swamp forest of the coastal lowlands of the North Coast.

Saline wetlands:

- Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregions
- Saltmarsh complex of the North Coast.

Refer to figure 5-7

5.7.1 Endangered ecological communities

Five threatened ecological communities, as defined by the *Threatened Species Conservation Act 1995* (TSC Act) have been mapped within or adjacent to the project boundary between Maclean and Devils Pulpit (Sections 5 and 6). All five have been classified by the TSC Act to be endangered. The following Table 5-2 provides a summary of these communities.

Refer to Appendix A for compliance checklists and Appendix B for the species list for Sections 5 and 6 of the project.

Table 5-2: Endangered ecological communities (EEC) mapped in Sections 5

EEC NAME	BIOMETRIC TYPE	TSC ACT	SECTION
Coastal Saltmarsh of the NSW North Coast	Saltmarsh complex	Endangered	5
Freshwater Wetlands on Coastal Floodplains	Coastal floodplain sedgelands, rushlands, and forblands.	Endangered	5
Subtropical Coastal Floodplain Forest on Coastal Floodplains	Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast. Narrow-leaved Red Gum woodlands of the lowlands of the North Coast.	Endangered	5 and 6
Swamp Oak Floodplain Forest on Coastal Floodplains	Swamp Mahogany swamp forest of the coastal lowlands of the North Coast.	Endangered	5
Swamp Sclerophyll Forest on Coastal Floodplains	Paperbark swamp forest of the coastal lowlands of the North Coast.	Endangered	5 and 6

In the vicinity of the bridge over Clarence River at Harwood the following EEC occur:

- Coastal Saltmarsh
- Freshwater Wetlands
- Swamp Oak Floodplain Forest

The Mangrove (Grey Mangrove) low closed forest of the NSW Coastal Bioregions community, which is protected under the *Fisheries Management Act 1994*, occurs along sections of the Clarence River foreshore in the vicinity of the bridge over Clarence River at Harwood.

A limited area of Mangroves on the banks of the Clarence River near the bridge will be removed to allow for the construction of the new bridge in accordance with the relevant environmental approval requirements.

Threatened flora species

Targeted threatened flora surveys were undertaken in 2014 as part of the *Threatened Flora Management Plan* (RMS et al. 2015a). Six threatened flora species were mapped within or adjacent to the project boundary between Maclean and Devils Pulpit (Sections 5 and 6). The following

Table 5-3 provides a summary of the species mapped, and their status under the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the TSC Act.

Table 5-3: Endangered and threatened flora mapped in Sections 5

SPECIES	COMMON NAME	TSC ACT	EPBC ACT	SECTION
Persicaria elatior	Tall knotweed	Vulnerable		5

Within the vicinity of the bridge over Clarence River at Harwood no endangered species have been mapped.

5.7.1 Design principles at the bridge over Clarence River at Harwood

Principles regarding vegetation include:

- Clearing of native vegetation is avoided or minimised wherever possible
- Roadside revegetation mixes are consistent with adjacent existing plant communities
- Endangered Ecological Communities and fauna connectivity corridors are connected with additional revegetation within the project works
- Targeted revegetation of disturbed areas adjoining in situ threatened flora in accordance with the *Threatened Flora Management Plan* (RMS et al. 2015a)
- Mangroves will be removed at the banks of the river in accordance with the Construction and Environmental Management Plan.
- Translocation of suitable species in accordance with the *Flora Translocation Strategy* (RMS 2015).

Refer to chapter 8 for detailed information on the landscape design, including how this contextual analysis has informed the landscape design responses for the project.

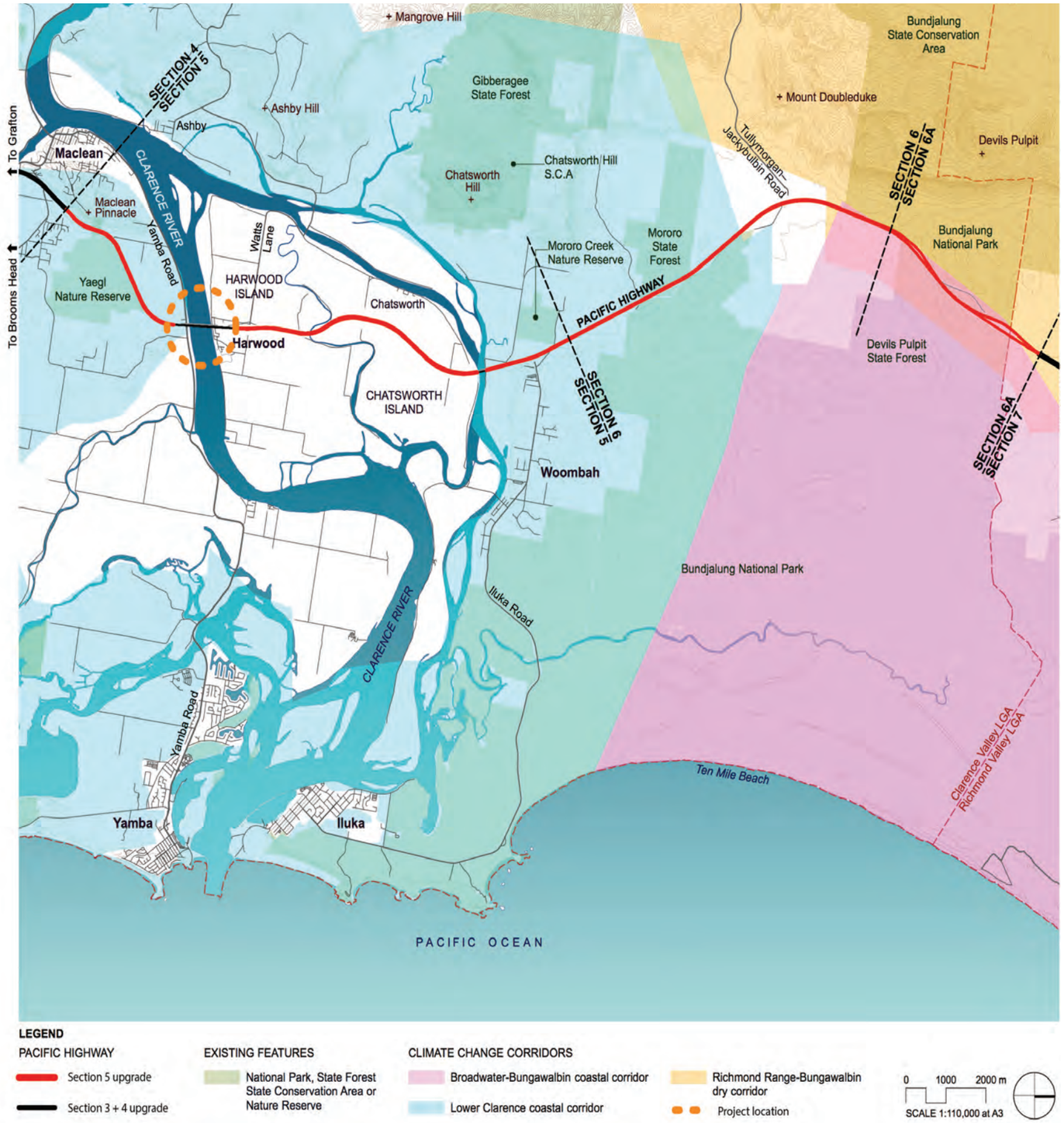

Figure 5-8: OEH climate change corridors – coastal and dry

5.8 FAUNA

5.8.1 Fauna

A number of threatened fauna species or their habitats have been identified in, or adjoining the highway corridor between Maclean and Devils Pulpit (Sections 5 and 6). These are summarised in the following Table 5-4.

Table 5-4: Threatened species (or their habitat) that occur in Sections 5 & 6

SPECIES	COMMON NAME	TSC ACT	EPBC ACT
Phascolarctos cinereus	Koala	Vulnerable	Vulnerable
Petaurus norfolcensis	Squirrel glider	Vulnerable	
Petaurus australis	Yellow-bellied glider	Vulnerable	
Potorous tridactylus	Long-nosed Potoroo	Vulnerable	Vulnerable
Aepyprymnus rufescens	Rufous Bettong	Vulnerable	
Phascogale tapoatafa	Brush-tailed phascogale	Vulnerable	
Litoria brevipalmata	Green-thighed Frog	Vulnerable	
Nannoperca oxleyana *	Oxleyan Pygmy Perch	Endangered	Endangered
Miniopterus australis	Little Bent-wing bat	Vulnerable	
Miniopterus schreibersii oceanensis	Eastern Bent-wing bat	Vulnerable	
Myotis macropus	Southern Myotis	Vulnerable	

* Note that Oxleyan Pygmy Perch habitat occurs downstream of the highway corridor between Maclean and Devils Pulpit; it does not occur within or adjoining the corridor.

Of these species the following are relevant to the Harwood Bridge area:

Microbat

Microbat surveys were undertaken as part of the *Microbat Management Plan Sections 3-11* (GeoLINK 2015). Seven roost locations, including one culvert and six bridges, were identified between Maclean and Devils Pulpit (Sections 5 and 6). None of these roosts are proposed to be removed.

Other known species

An Eastern Osprey (Pandion cristatus) nest site is located to the west of the existing Harwood Bridge and is surrounded by an Osprey Breeding Buffer Zone. The nest site sits in the road verge between Yamba Road and the Clarence River. The existing Harwood Bridge provides a natural buffer between the location of the new Harwood Bridge and the Eastern Osprey breeding Buffer Zone.

The design, construction and operation of the Harwood Bridge is not anticipated to impact the Eastern Osprey nest site due to the distance from the main construction activities and the current vehicle activity at the site, however mitigation measures will be implemented, where feasible and practical, during the construction to deter Ospreys from nesting or roosting in piling rigs and cranes in line with Environmental Report (EX 4000)

The design of the Harwood Bridge does not have elevated structures above the road pavement that could support a nest for breeding Osprey.

Southern Myotis (Myotis macropus), Eastern Grass Owl (Tyto longimembris), Spotted-tailed Quoll (Dasyurus maculatus) Little Bentwing-bat (Miniopterus australis) have previously been observed within the general vicinity of the current bridge over the Clarence River, however the current bridge design in not anticipated to have an impact on the observed fauna.

The high velocity flow and tidal brackish water do not make the area of Harwood Bridge suitable habitat for the Oxley-pygmy perch.

Fauna connectivity

Between Maclean and Iluka Road (Section 5), the highway traverses the Clarence River and its floodplain, from which native vegetation has been largely cleared for agriculture.

The Maclean to Devils Pulpit (Sections 5 and 6) study area intersects with a number of key habitats and movement corridors identified from the Key Habitats and Corridors project (DEC 2003) and Climate Change Corridors project (DECC 2007) as illustrated on figures 5-8 and 5-9.

Table 5-5: Fauna corridors that intersect with Sections 5

REGIONAL CORRIDOR	LOCATION	FOCAL SPECIES
Lower Clarence OEH climate change corridor – coastal corridor	Crosses Sections 5 and 6	Wetland waterbirds Emu

The bridge over Clarence River at Harwood is located outside of these conservation corridors, refer to figures 5-8 and 5-9.

5.8.1 Design principles at Harwood Bridge

- Fauna connectivity structures, including fauna fencing and revegetation, have been designed in collaboration with the Environment team, including ecologists. Refer to chapters 6 and 7 Maclean to Devils Pulpit (Section 5) draft UDLP for more detail.
- Clearing of native vegetation associated with the highway corridor is minimised in order to maintain the connectivity of existing habitats and minimise habitat fragmentation
- Remnant vegetation is retained between the project boundary and the clearing boundary where feasible and reasonable
- Plant species for revegetation around fauna connectivity structures are consistent with the surrounding natural habitat. Revegetation is designed to attract native fauna species to the structures and not obstruct views, overshadow or disguise the entrance to a structure.

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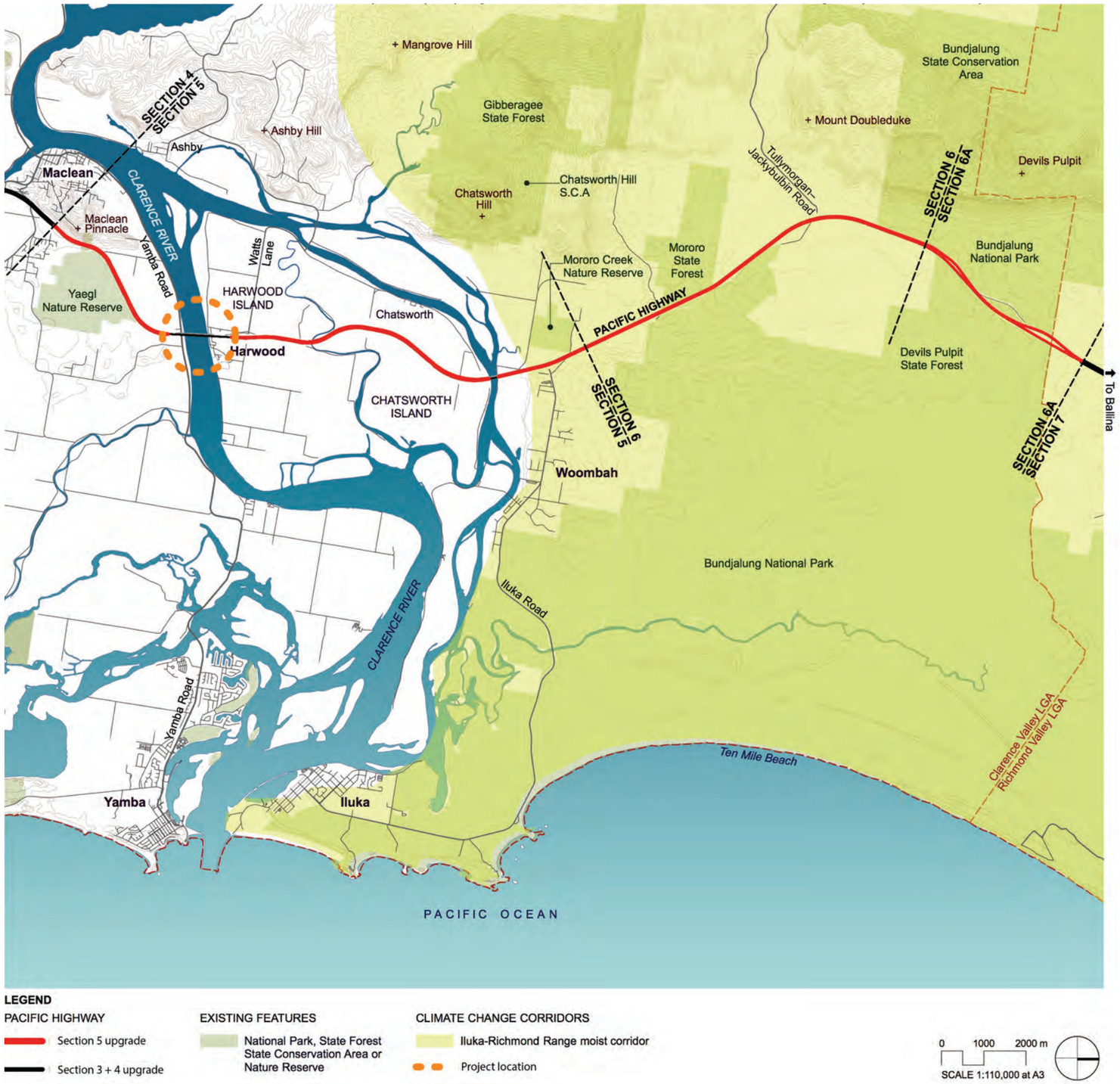


Figure 5-9: OEH climate change corridors – moist

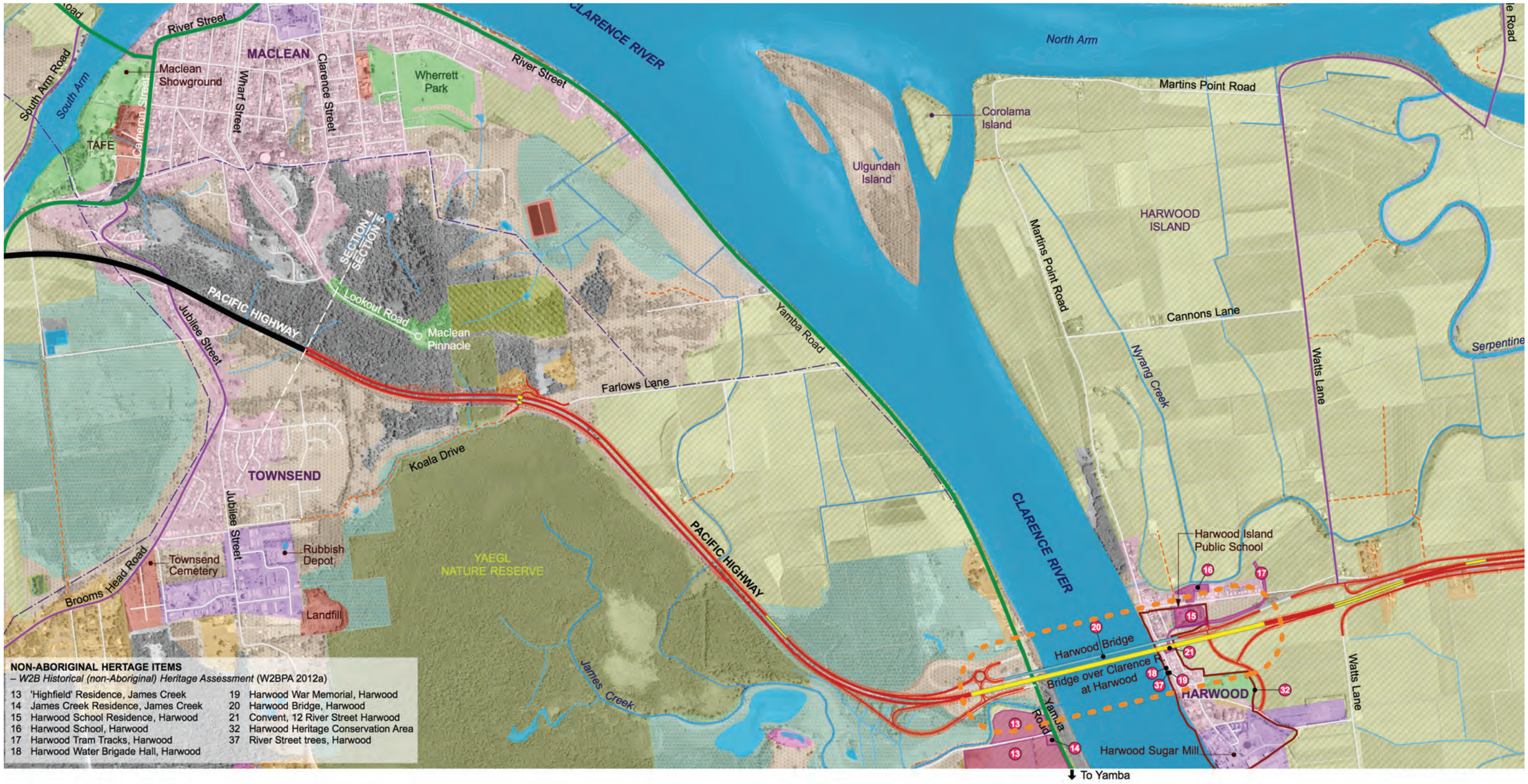


Figure 5-10: Heritage and land use mapping

5.9 HERITAGE

5.9.1 Aboriginal heritage

The area around the bridge over Clarence River at Harwood was originally occupied by two groups of Aboriginal people (Brooke et al. 2012a):

- The Yaegl (Yaygir) people, who occupied the lower Clarence River
- The Bundjalung people, who inhabited the region north of the Clarence River.

The Clarence River separated these two Aboriginal groups, who were associated with distinctly different languages. On Friday 12 August 1799, Matthew Flinders recorded an Aboriginal settlement at the mouth of the Clarence River (Piper 1982, in Brooke et al. 2012a). He described large dome shaped bark huts, baskets, nets and other evidence that suggested that the Aboriginal people of the area utilised the rich terrestrial and aquatic habitats as a source of food and shelter.

While there is the potential for a rich and highly valued Aboriginal history throughout the study area, there are few known Aboriginal sites in the vicinity of the highway corridor. The areas likely to contain these archaeological sites include the Clarence River floodplain; however, post-contact disturbance has largely removed evidence of these sites.

Aboriginal cultural heritage assessment of the study area between Maclean to Devils Pulpit (Section 5) was undertaken for the Woolgoolga to Ballina EIS (Brooke et al. 2012a & 2012b). The assessment identified:

- No potential archaeological deposits (PAD) within or near the project corridor between Maclean to Devils Pulpit (Section 5).
- One Aboriginal cultural place within 200 metres of Maclean to Devils Pulpit (Section 5). The Birrugan and Mindi spiritual sites have high social significance to the Aboriginal communities of North Coast NSW due to the spiritual and cultural importance of the creation stories associated with them. There are no direct or indirect impacts to these sites.

Refer to figure 5-10

5.9.1 Non-aboriginal heritage

The arrival of Europeans to the North Coast in the 1830s-40s was primarily to source timber for the expanding colony. This had an immediate impact on the Aboriginal way of life and brought about conflict. The area was initially logged for cedar and later hardwoods like mahogany and tallowood. Small settlements were developed and the timber transported on the Richmond and Clarence Rivers or by bullock carts. Once the land was cleared, agriculture commenced – initially focussing on maize, sugar cane and later dairying. The influx of new settlers in the 1860s created a hierarchy of towns, villages and hamlets. Maclean was laid out in 1862 and Harwood was established to service sugar cane farming and milling operations.

Due to the low expenditure and rapidity of these early activities, the legacy of historical development has little in the way of physical evidence apart from in the larger towns. However the vast clearing of land is an important early colonial legacy in itself. Refer to figure 5-10.

Local heritage listed items

Nine sites in the vicinity of the highway have been identified in the *Clarence Valley Local Environment Plan* (LEP) *2011* as having local significance. All are located between Maclean and Iluka Road (Section 5). The following Table 5-6 provides a summary of these heritage items, including impacts and mitigation measures identified in the W2B EIS *Historical (non-Aboriginal) Heritage Assessment* (W2BPA 2012a).

Table 5-6: Local heritage listed items and impact mitigation

ITEM NO	ITEM NAME	IMPACT	MITIGATION
13	'Highfield' residence, James Creek	Not impacted	N/A
14	James Creek residence, James Creek	Not impacted	N/A
15	Harwood School and residence, Harwood	Not impacted	N/A
16	Harwood School, Harwood	Not impacted	N/A
17	Harwood Tram Tracks, Old Pacific Highway road reserve, Harwood	Physical damage due to construction traffic on Petticoat Lane Tram Tracks section	Protective covering
18	Harwood Water Brigade Hall, Harwood	Not impacted	N/A
19	Harwood War Memorial, Harwood	Not impacted	N/A
32	Harwood Heritage Conservation Area	Demolition of Convent building. Refer item 21 at potential heritage items.	Archival photographic recording, relocation of building.
37	River Street trees, Harwood	Not impacted	N/A

Potential heritage items

The Woolgoolga to Ballina EIS *Historical (non-Aboriginal) Heritage Assessment* (W2BPA 2012a) identified two additional sites as having potential local significance that are not listed in the Clarence Valley LEP. The following table provides a summary of these potential heritage sites, including impacts and mitigation measures identified.

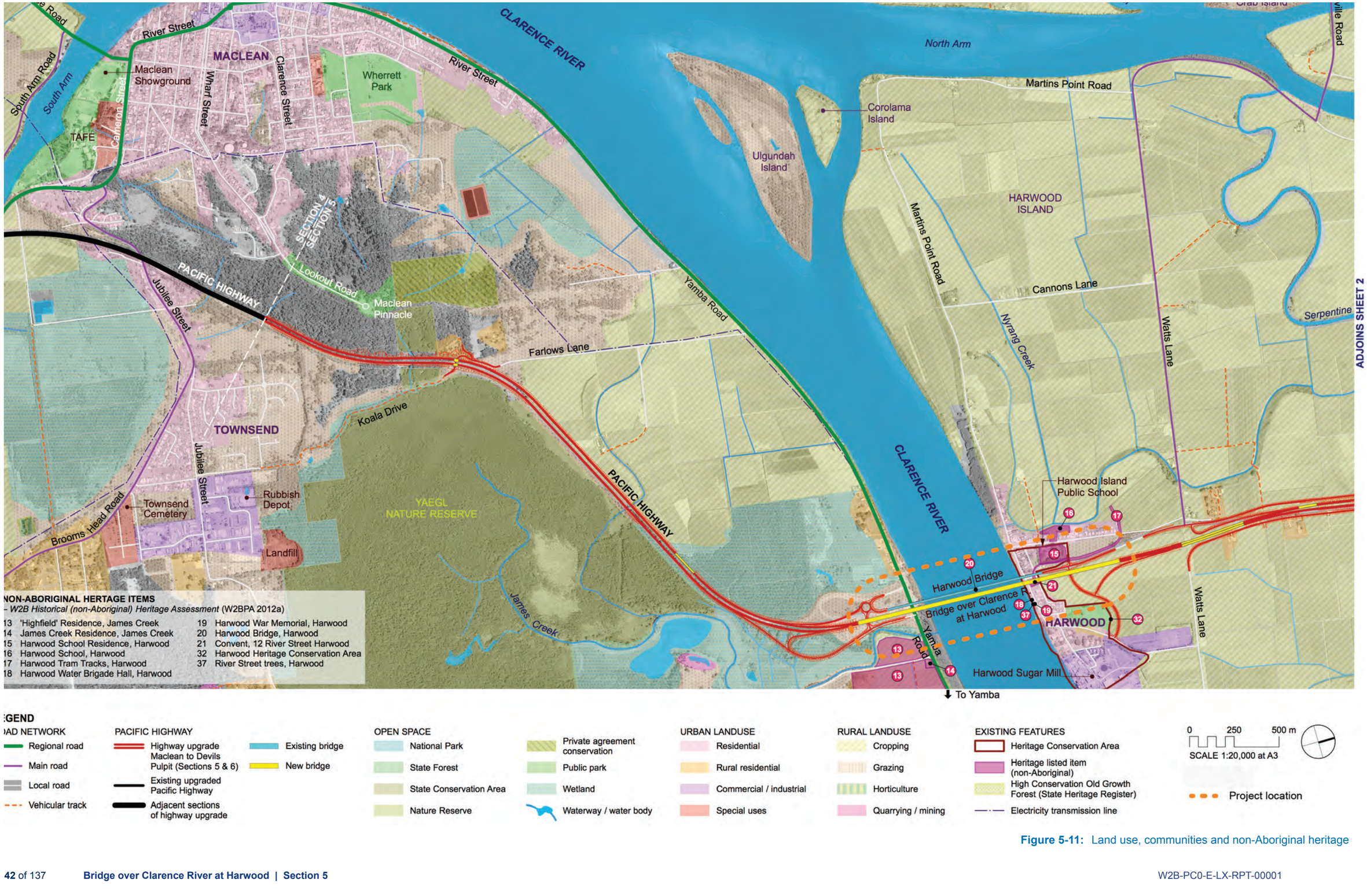
Table 5-7: Local heritage items and impact mitigation

ITEM NO	ITEM NAME	IMPACT	MITIGATION
20	Harwood Bridge	Visual	Design to NSW Roads and Maritime Services' *Bridge Aesthetics* guidelines
21	Convent at 12 River Street, Harwood	Entire site demolished	Archival photographic recording, relocation of building.

The highway itself is an important record of movement in the area and its existing route was created from local roads in operation from around 1895. A continuous route was formed in 1909, while the highway itself was formalised in 1928 and was known as the 'North Coast Road'.

- The existing bridge will experience a visual impact as a result of the new bridge alongside. The existing bridge will also experience a reduction in traffic as highway traffic is diverted to the new bridge.
- The Convent will be removed as identified in the Wollogoolga to Ballina EIS to make way for the new bridge.

Refer to chapters 7 and 8 for visual assessments and visualisation material associated with the new bridge.



NON-ABORIGINAL HERTAGE ITEMS
– W2B Historical (non-Aboriginal) Heritage Assessment (W2BPA 2012a)

13 'Highfield' Residence, James Creek
14 James Creek Residence, James Creek
15 Harwood School Residence, Harwood
16 Harwood School, Harwood
17 Harwood Tram Tracks, Harwood
18 Harwood Water Brigade Hall, Harwood
19 Harwood War Memorial, Harwood
20 Harwood Bridge, Harwood
21 Convent, 12 River Street Harwood
32 Harwood Heritage Conservation Area
37 River Street trees, Harwood

LEGEND

ROAD NETWORK
- Regional road
- Main road
- Local road
- Vehicular track

PACIFIC HIGHWAY
- Highway upgrade Maclean to Devils Pulpit (Sections 5 & 6)
- Existing upgraded Pacific Highway
- Adjacent sections of highway upgrade
- Existing bridge
- New bridge

OPEN SPACE
- National Park
- State Forest
- State Conservation Area
- Nature Reserve
- Private agreement conservation
- Public park
- Wetland
- Waterway / water body

URBAN LANDUSE
- Residential
- Rural residential
- Commercial / industrial
- Special uses

RURAL LANDUSE
- Cropping
- Grazing
- Horticulture
- Quarrying / mining

EXISTING FEATURES
- Heritage Conservation Area
- Heritage listed item (non-Aboriginal)
- High Conservation Old Growth Forest (State Heritage Register)
- Electricity transmission line

0 250 500 m
SCALE 1:20,000 at A3

- Project location

Figure 5-11: Land use, communities and non-Aboriginal heritage

5.10 LAND USE AND COMMUNITIES

High Conservation Old Growth Forest

High Conservation Old Growth Forest is of state heritage significance and is listed on the State Heritage Register. Old growth forest is mature eucalypt forest showing few signs of human disturbance. There are no high conservation old growth forests associated with the bridge over Clarence River at Harwood.

Design principles at Harwood Bridge

- The study area between Maclean to Devils Pulpit (Section 5) has only limited physical remnants of cultural heritage. The identified sites are carefully considered and adverse physical impacts have been avoided or minimised wherever possible
- Where impacts to heritage items are unavoidable, those impacts are mitigated in accordance with the requirements of the EIS and *Aboriginal Cultural Heritage Assessment* (Brooke et al. 2012a & 2012b) or *Historical (non-Aboriginal) Heritage Assessment* (W2BPA 2012a) as appropriate
- Areas previously cleared for agricultural or grazing activities offer expansive views; these views are incorporated into the landscape and urban design to enhance the motorist's experience.

5.10.1 Land use

Land use in the area since European settlement in the 1830s to 1840s has consisted primarily of timber getting and later agriculture, pastoralism and fisheries. Before this, the region supported populations of Aboriginal people living in productive floodplain habitats.

In Maclean to Devils Pulpit (Section 5), agricultural land that the highway traverses is identified as regionally significant farmland by the *Northern Rivers Farmland Protection Project* (W2BPA 2012e). The majority of this is cropping land used for sugar cane growing. Refer to figure 5-11.

5.10.1 Water based activities

The Clarence River is used for a wide range of water based activities including fishing and aquaculture activities on a commercial basis. This includes commercial fishing, trawling and oyster harvesting industries. Section 16.1.1 of the Woolgoolga to Ballina EIS covers the detail of the commercial fishing and aquaculture activities, refer to:

http://www.rms.nsw.gov.au/documents/projects/northern-nsw/woolgoolga-to-ballina/w2b-eis-chapter-16.pdf

The Clarence River also provides a number of water based recreational activities. These are referred to in the Woolgoolga to Ballina EIS, refer to:

http://www.rms.nsw.gov.au/documents/projects/northern-nsw/woolgoolga-to-ballina/w2b-eis-chapter-17.pdf

Refer to chapter 7.9 of this report for impacts on water based activities as a result of the bridge over Clarence River at Harwood.

5.10.1 Communities

The village of Harwood is located on both sides of the Pacific Highway on the northern bank of the Clarence River and is dominated by the Harwood Sugar Mill on its eastern edge.

5.10.1 Design principles at Harwood Bridge

- Maintaining and enhancing local and regional connectivity are important considerations in relation to land use and communities
- Any areas of residual land resulting from the upgrade works are carefully integrated, and are revegetated where appropriate with consideration given to proposed/ future land uses.

5.11 TRANSPORT NETWORK

The Pacific Highway and the North Coast Railway Line form the primary land transport corridors connecting Sydney to Brisbane via the eastern seaboard of New South Wales. The highway is the major road freight, tourist and commercial link in the region and is the principal road access between the towns and villages along its route. Summerland Way is the only other regional road connection, linking Grafton to Casino and the Bruxner Highway which heads east to Ballina via Lismore. Both Ballina and Grafton are serviced by domestic airports, with Ballina having the most regular services.

This highway between Maclean to Devils Pulpit (Section 5) provides access to a number of tourist destinations on the coast, such as Yamba and Angourie, as well as local access to the villages and properties within the floodplain and in the adjoining ranges. The key regional and main roads in the area are:

- Yamba Road, which provides access from the highway to Yamba and Maclean from an interchange at the southern end of Harwood Bridge
- Watts Lane, the main road that connects Harwood to the Summerland Way, via the hinterland ranges west of the Clarence River.

Local roads and adjoining properties currently directly access the highway between Maclean to Devils Pulpit (Section 5). There are no footpaths on the highway. The Coastline Cycleway is a planned regional cycle connection along the coast. The Pacific Highway is designated as an alternative regional cycle route, with connections to the Coastline Cycleway via Yamba Road and Iluka Road, refer to figure 5-12

5.11.1 Design principles at the Bridge over Clarence River at Harwood

The highway upgrade will improve safety by reducing the number of intersections and controlled access points, including major interchanges at Yamba Road and Harwood.

- The local road network is improved with new access roads that increase connectivity within the local road network
- A continuous regional cycle connection along the highway is provided on the shoulders of the upgraded highway, with connections to the local road network at the Yamba Interchange and Harwood Interchange

Refer to chapter 6 and 7 for information on local connections for pedestrians, cyclists and shared path use.

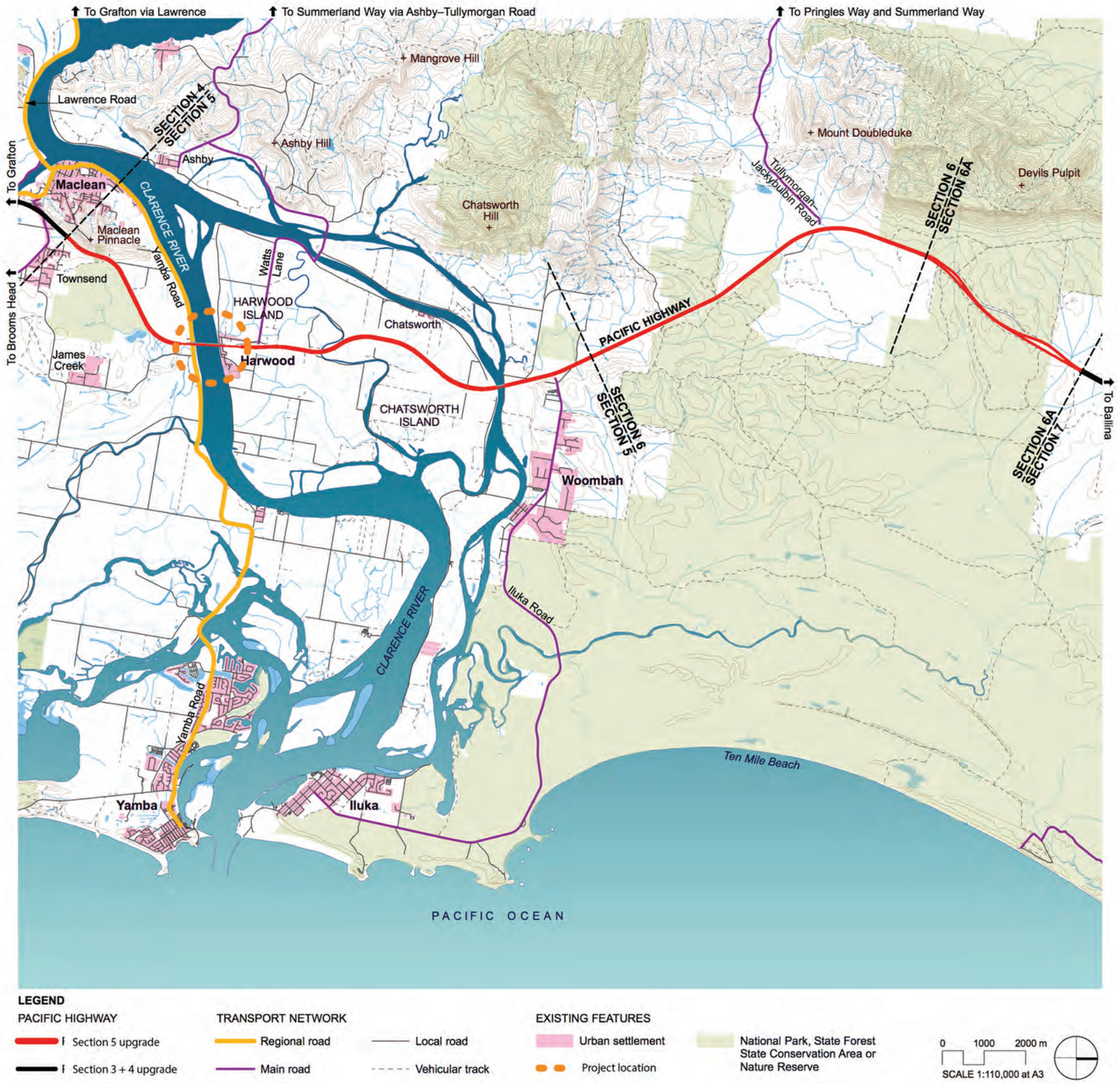


Figure 5-12: Regional transport network

5.12 CULTURAL AND SCENIC VALUES

The landscape setting of the bridge over Clarence River at Harwood is characterised by the 'big' landscape of the Clarence River floodplain with its extensive sugar cane plantations, set off to a backdrop of forested ranges to the north and west.

Travelling north on the Pacific Highway on the approach to the bridge over Clarence River at Harwood, highway users will experience expansive views over the flat agricultural land to the north and west. Following a final small stretch through forest, the first glimpses of the existing truss bridge at Harwood becomes evident as the highway traverses a flat area with a parkland character.

As the highway crosses the existing bridge, panoramic views are available and are particularly spectacular looking along the Clarence River in both directions. There are also middle distance views to Harwood, dominated by the Harwood Sugar Mill and smoke stack. For the next seven kilometres, the views are expansive over the sugar cane plantations on the floodplain to the mountain ranges in the west and north. These views vary according to the growth and harvesting patterns of the sugar cane with a slight sense of enclosure as the sugar cane reaches its full height of about 4 metres just before harvest.

The combination of natural and cultural qualities, in particular the sugar cane fields on the floodplain, establishes a unique identity to the area. These values have a special meaning and provide a sense of place for the local residents, as well as tourists and those passing through.

5.12.1 Design principles at the bridge over Clarence River at Harwood

- Careful consideration is given to the relationship between the form and character of the upgraded highway alignment, its associated bridges and earthworks, and the form and character of the existing landscape
- As the highway would be visible from numerous locations, the overall highway upgrade is designed to 'fit' visually with the surrounding landscape character as much as possible through appropriate alignment, earthworks and planting
- The new and existing bridges will be designed as complementary structures that have a visual 'dialogue' with each other and the surrounding landscape.
- Specific bridge design principles are defined to ensure a high quality outcome.

Plate 5-2: Existing Harwood bridge crossing of the Clarence River VP26B

Plate 5-3: Soya bean paddock and exotic tree planting at the Watts Lane intersection

Plate 5-1: Agricultural land of the floodplain south of the Clarence River

Plate 5-4: Aerial photograph of Harwood and the Clarence River

Plate 5-5: Aerial photograph of Harwood and the existing bridge looking north west

5.13 LANDSCAPE CHARACTER

Following is a discussion of the character of each character zone. Maclean to Devils Pulpit (Section 5) which is characterised by the wide flat Clarence River floodplain with its extensive sugar cane plantations, viewed with a backdrop of forested ranges to the north and west.

The Roads and Maritime Guideline for Landscape Character and Visual Impact Assessment (RMS 2013) provides the following definition of landscape character:

'The combined quality of built, natural and cultural aspects that make up an area and provide its unique sense of place.'

The project EIS identified eleven sections of the project into manageable areas for landscape character assessment. Within these sections, 54 landscape character precincts were identified. Two sections and part of a third section fall within the Maclean to Devils Pulpit (Section 5) area and contain ten landscape character precincts.

The Bridge over Clarence River at Harwood is associated with the following two landscape character zones:

- 27 - Clarence River floodplain
- 29 - Harwood township

Refer to figure 5-13 for landscape character zones. Refer to chapter 7 for the visual assessment and chapter 8 for landscape information.

5.13.1 Landscape character zone 27 – Clarence River floodplain

The Clarence River floodplain precinct is a large area covering much of Harwood and Chatsworth Islands and a number of smaller islands as well as the southern banks of the Clarence River and the northern banks of the North Arm. The area is predominately open and flat, with much of its landuse consisting of agriculture including sugar cane and soya beans. Widespread views are available from the highway over the agricultural land, terminating with the forested ranges to the west. Rural residential dwellings with their associated tree planting are scattered over the precinct, providing a vertical element to the generally flat, homogenous landscape. However, views are impacted by the growing cycle of the sugar cane, refer to plates 5-6 and 5-7. Riparian vegetation is found on the banks of the Clarence River.

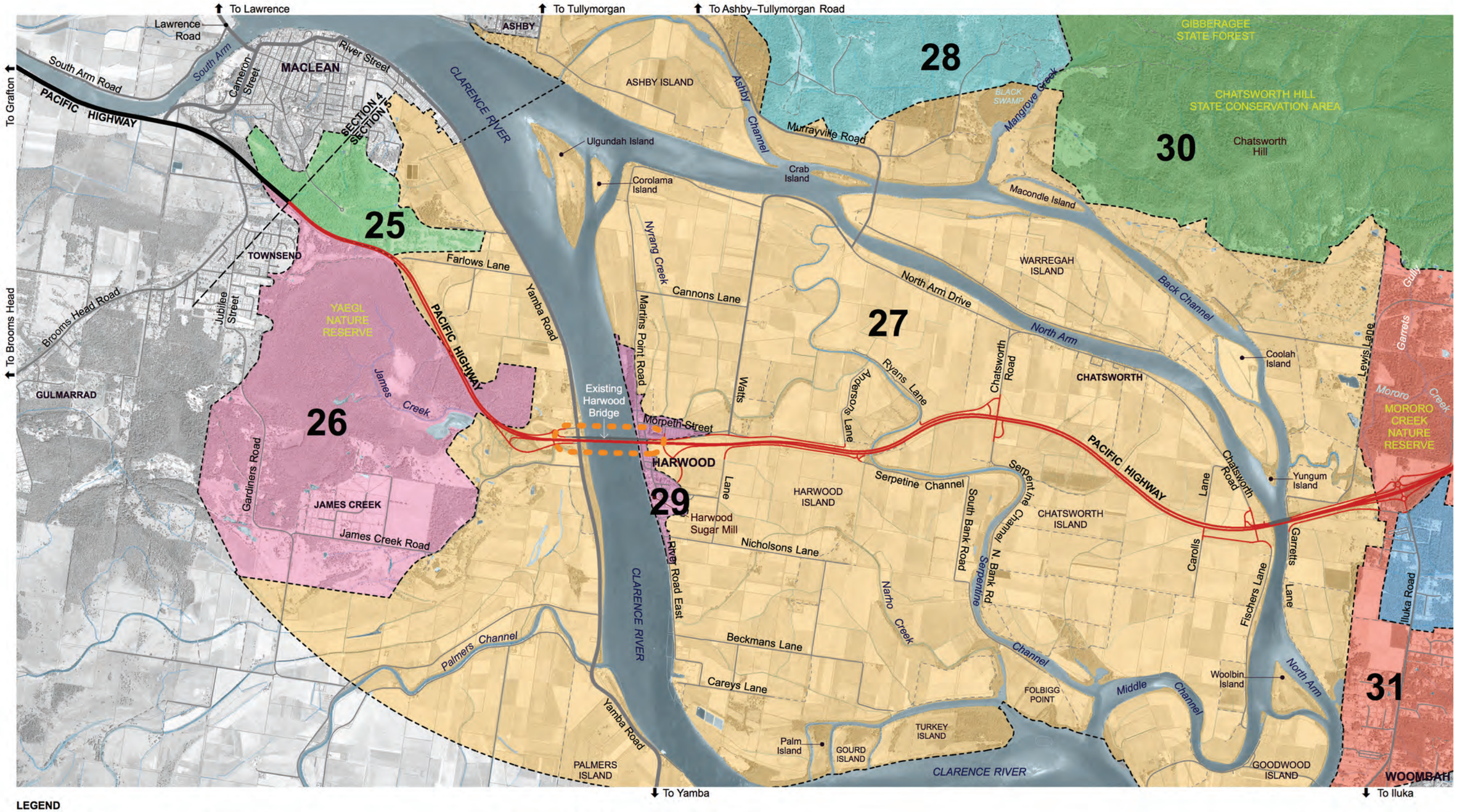
Plate 5-6: View north in landscape character zone 27, travelling on the Pacific Highway with the Richmond Range in the background

Plate 5-7: Landscape character zone 27 is open and flat with predominately agricultural land use

5.13.1 Landscape character zone 29 – Harwood township

Harwood is located on the northern shore of the Clarence River, on both sides of the Harwood Bridge. Harwood is dominated by the Harwood Sugar Mill on the eastern edge of the town, a large industrial complex consisting of refinery buildings, a large storage building and a smoke stack. Single storey residential dwellings line River Street on the foreshore as well as Morpeth Road that run parallel to the highway. The town also contains a number of commercial buildings and a primary school. The town has a strong edge, transitioning abruptly from residential lots to agricultural land. Views from within the town are dominated by the Harwood Sugar Mill smoke stack and Harwood Bridge. The town also has a number of historic items of local significance, refer to plate 5-8.

Plate 5-8: View north to Harwood township, the existing Harwood bridge and the Clarence River (source: Pacific Complete)



LEGEND

EXISTING FEATURES
- Existing road
- Existing vehicular track

PACIFIC HIGHWAY
- Highway upgrade Maclean to Devils Pulpit (Sections 5 & 6)
- Existing upgraded Pacific Highway
- Adjacent sections of highway upgrade

LANDSCAPE CHARACTER ZONES
- Landscape Zone 25
- Landscape Zone 26
- Landscape Zone 27
- Landscape Zone 28
- Landscape Zone 29
- Landscape Zone 30
- Landscape Zone 31
- Landscape Zone 32
- Landscape Zone 33
- Landscape Zone 34

0 500 1000 m
SCALE 1:40,000 at A3

Project location

Figure 5-13: Landscape Character Zones

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6. DESIGN OBJECTIVES, PRINCIPLES AND STRATEGY FOR BRIDGE OVER CLARENCE RIVER AT HARWOOD

Chapter contents

6.2.1 Complementary design

The new bridge over the Clarence River aims to complement the existing heritage bridge – a steel, seven-span truss bridge with a central vertical lift span allowing ships and watercraft to navigate the Clarence River. The existing Harwood River bridge is the longest of its type in New South Wales, in a series of steel truss bridges of this type of design constructed in the 1960s in New South Wales.

The two bridges will be approximately eighteen metres apart, with similar pier spacing. The new bridge's curved profile (superelevation) contrasts with the horizontal format of the existing Harwood Bridge, while remaining parallel to each other. The existing bridge's lift bridge with pylons allow ships and watercraft to navigate the Clarence River and reflect the height of the super elevation of the new bridge. The two structures will be seen as a single composition in the landscape, defining Harwood's location on the Clarence River.

The existing bridge's elegant truss structure concertinas across the Clarence River on a flat alignment, the new bridge has a curvilinear form that resonates in contrast to the existing truss structure. The curvilinear form of the new bridge reflects the shapes of the hills in the flat landscape, with the two structures to have a visual dialogue with each other and their context.

The existing bridge is not listed on any heritage register but is considered to have 'significant local heritage value'. Detail is provided in chapter xyz of this report.

Enhancing the road user experience, ensuring local connectivity and the retention of the existing Harwood River Bridge as a local heritage element are important responses in the new bridge's design development.

Refer to figures 6-1 and 6-2.

Note: Landscape shown at maturity. Drawing and design is subject to further consultation and development. The number of trees is indicative only and subject to road safety consideration.

Figure 6-1: An artists impression of the bridge over Clarence River at Harwood with the existing Harwood bridge and Harwood township looking south west

6.1 URBAN DESIGN AND LANDSCAPE OBJECTIVES AND PRINCIPLES

6.1.1 Urban design principles for the bridge project

The Bridge over Clarence River at Harwood forms part of the wider Pacific Highway Woolgoolga to Ballina upgrade aligning with the project principles:

- **Principle 1:** Retain the strong contrasting experience of driving through forest and open agricultural land as a feature of the Pacific Highway experience
- **Principle 2:** Acknowledging and celebrate the small and medium sized coastal towns that mark progress along the coastal Pacific Highway journey
- **Principle 3:** Highlight and celebrate the numerous minor and major creek and river crossings that punctuate the Pacific Highway journey over the coastal floodplains
- **Principle 4:** Acknowledge and preserve the natural and cultural landscapes and landmarks identified along the full length of the Pacific Highway journey

6.1.1 Principles governing the bridge design

The overarching principles for the bridge design included reference to the Roads and Maritime Services publication Bridge Aesthetics – design guideline to improve the appearance of bridges in NSW, Roads and Maritime Services, July 2012.

Detailed principles include:

1. The road and bridge structure must fit sensitively into the landscape; provide for good connectivity for all road users; and provide a high quality public domain
2. The new bridge is required to respond to the context in an appropriate manner
3. Provide an appropriate response to the scale of the structure being highly visible to road users and local community
4. The design should consider the overall driving experience including a 110km speed zone to a ~30m high bridge crown, resulting in, dramatic views of the Northern Rivers region and view of delta area
5. Road user safety and the driver experience is an important consideration in the design development
6. Place-making and destination making responses
7. Sustainability responses are required for the structure; these may include maintenance and material considerations
8. Constructability and value for money are important objectives; a balance between aesthetic and constructability and value for money is to be achieved.

Tenderers were required in their competitive submissions to comply with these principles. The new bridge complies with these detailed urban design principles for the bridge.

6.1.1 Experiential qualities of the design

The bridge over clarence River at Harwood is described in Chapter 7 of this report.

The bridge user's experience

User experience is maximised over the bridge allowing expansive distant views of the Clarence River hinterland and out to the Pacific Coast creating a memorable experience and a sense of arrival to both Harwood and the Yamba Interchange.

The existing Harwood Bridge will remain in service as part of the local road network.

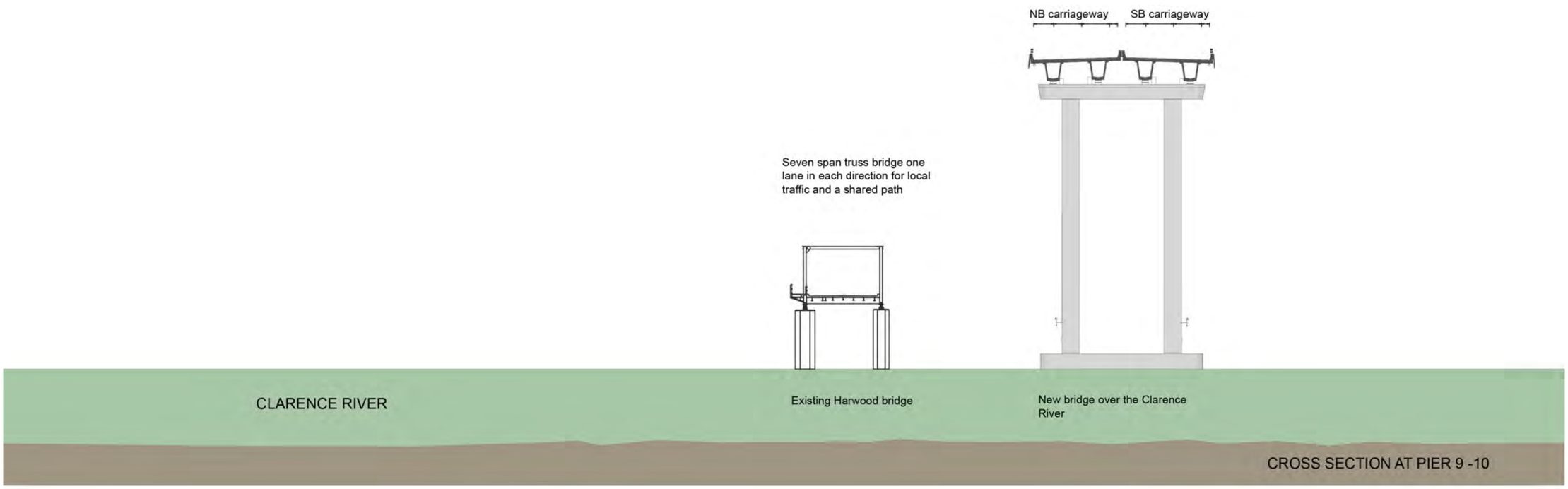
Local community experience of the new bridge

The new bridge over the Clarence River is designed to retain the much admired, existing heritage Harwood River Bridge. The existing bridge will experience reduced traffic as a result of the Pacific Highway traffic being located onto the new bridge, and will consequently extend the life of the existing structure.

The new bridge is specifically designed to increase local connectivity. The connectivity will be increased for local traffic and for pedestrians and cyclists on local roads through new traffic management facilities that associated with the Pacific Highway is separated from the local traffic conditions. Local connectivity will also be improved with the interchange at Yamba and connections at Harwood. Refer to Chapter 7.4 for additional detail.

The new bridge located on land is on piers, allowing for localised movement under the bridge for pedestrians and cyclists. Overall, the new bridge improves connectivity at a local level, as well as for Pacific Highway users and respects the existing Harwood bridge as a functional heritage item of significant community value.

Refer to figures 6-2 and 6-3.



Note: Landscape shown at maturity. Drawing and design is subject to further consultation and development. The number of trees is indicative only and subject to road safety consideration.

Figure 6-2: Sections through the new and existing bridge

6.2 COMPLEMENTARY STRUCTURES IN THE LANDSCAPE

6.2.1 Complementary design

The new bridge over the Clarence River aims to complement the existing heritage bridge – a steel, seven-span truss bridge with a central vertical lift span allowing ships and watercraft to navigate the Clarence River. The existing Harwood River bridge is the longest of its type in New South Wales, in a series of steel truss bridges of this type of design constructed in the 1960s in New South Wales.

The two bridges will be approximately eighteen metres apart, with similar pier spacing. The new bridge's curved profile (superelevation) contrasts with the horizontal format of the existing Harwood Bridge, while remaining parallel to each other. The existing bridge's lift bridge with pylons allow ships and watercraft to navigate the Clarence River and reflect the height of the super elevation of the new bridge. The two structures will be seen as a single composition in the landscape, defining Harwood's location on the Clarence River.

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The existing bridge is not listed on any heritage register but is considered to have 'significant local heritage value'. Detail is provided in chapter xyz of this report.

Enhancing the road user experience, ensuring local connectivity and the retention of the existing Harwood River Bridge as a local heritage element are important responses in the new bridge's design development.

Refer to figures 6-1 and 6-2.

6.2.1 Local context

The Clarence River, one of the largest rivers on the east coast of Australia, is an active tourist destination with cargo transport, boating and fishing occurring along the length. A full contextual analysis of the area and the river is provided in Maclean to Devils Pulpit Sections 5 and 6 urban and landscape design plan for the Pacific Highway Woolgoolga to Ballina upgrade.

Coastal towns of Iluka and Yamba are located at the mouth of the Clarence River to the north and south respectively. These towns historically have both been known as commercial fishing towns with pristine beaches and vast expanse of seaside littoral rainforest (Iluka) and State Forest and Crown Reserve surrounding. Both towns are holiday destinations, often increasing in population by up to 70% for the summer months.

The bridge over Clarence River at Harwood is a key connection for the Clarence Valley community linking a number of local and coastal townships including;

- Yamba
- Maclean
- Iluka
- Harwood
- Ashby
- Palmers Island
- Chatsworth
- Townsend

Refer to figures 5-12 and 6-3.

6.3 SUSTAINABLE DESIGN AND MAINTENANCE

6.3.1 Overview

Ecologically Sustainable Development (ESD) has been defined by the Australian Government (1992) as 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'. The key principles of sustainable development include:

- The precautionary principle
- Intergenerational equity
- Biodiversity and ecological diversity
- Improved economic valuation including environmental factors.

For sustainability matters please refer to *Maclean to Devils Pulpit – (Sections 5 and 6) Sustainability Action Plan* (ABJV 2016). The key objectives identified in the Sustainability Action Plan that related to urban design and landscape are:

- Minimise water use
- Maintain the integrity and quality of the ecological environment through appropriate planning during detailed design
- Maintain the integrity and quality of the cultural environment through appropriate planning during detailed design
- Urban design and landscape – identify design principles and standards for sustainable design and maintenance.

6.3.1 Sustainable design and maintenance

The Urban Design and Landscape Plan outlines principles that address sustainable design and maintenance. These include:

- Revegetation of the project works to maintain biodiversity, the integrity of existing vegetation communities and fauna connectivity
- Roadside plantings to enhance and frame views and connect with the cultural values of the surrounding agricultural floodplain landscape
- Use of indigenous plant species and low maintenance drought tolerant non-native species for the revegetation works.

Refer to Maclean to Devils Pulpit Sections 5 and 6 Urban design and landscape plan May 2017, Chapter 6.6, Chapter 8.9 and Appendix D Landscape Management Plan for more detail.

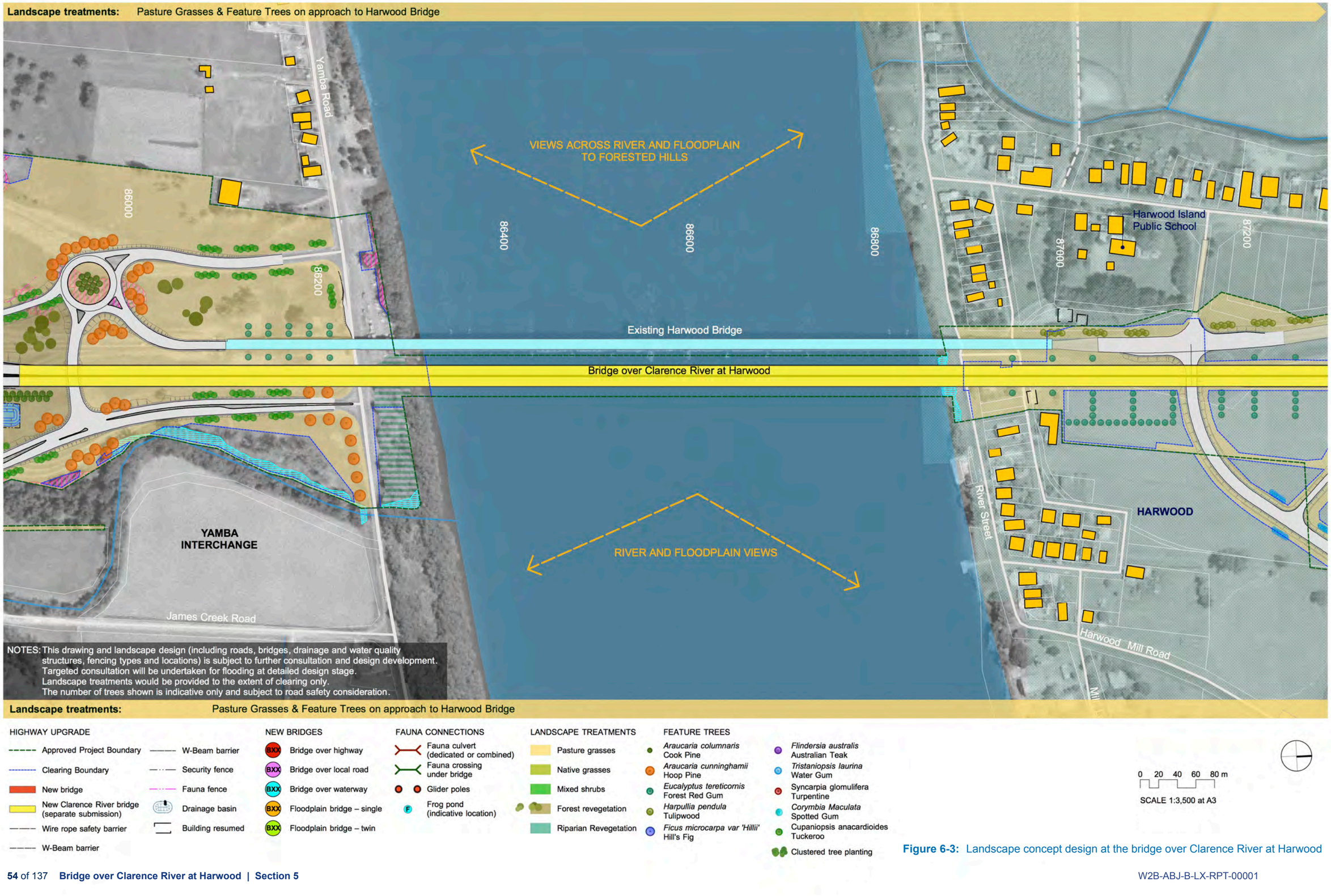

Figure 6-3: Landscape concept design at the bridge over Clarence River at Harwood

6.4 ANCILLARY FACILITIES

The highway upgrade will require ancillary facilities to support the construction activities associated with the project. The Project 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 accordance 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 onsite
- 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 (laydown areas) – for the storage of materials delivered to site for construction
- Display centres and visitor parking.

The ancillary facilities associated with the project include areas that are located within the existing or proposed highway corridor that are directly or indirectly impacted by the construction works, in addition to locations adjacent to 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 project. MCoA B76 of the Project Approval outlines the rehabilitation requirements of these sites:

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

6.4.1 Borrow sites

The project will also require that a number of borrow sites will be used to source material for construction of the project. For Maclean to Devils Pulpit (Sections 5) project, the borrow site is the Mororo Cut located south of Mororo Road.

MCoA D22 of the Project Approval requires the preparation of a Borrow Sites Management Plan for each of the borrow sites proposed for the project. The Plan needs to identify details of the site, assessment of impacts resulting from the borrow operations, and rehabilitation details of the borrow site. The rehabilitation details are to include future landform and use of the borrow site, landscaping and revegetation, and measures to be implemented to minimise or manage the ongoing environmental effects of the site.

6.4.1 General location and size

The temporary ancillary facilities utilised during the highway construction phase will vary in their size and configuration, depending on the nature of use and adjacent construction activities. There is likely to be a combination of larger main construction compounds in addition to smaller satellite compounds located within each section of the project. The specific locations of the ancillary facilities to be used for the project are not fully known at the time of preparation of the urban design and landscape plan, and as a result are not detailed. Temporary ancillary and borrow sites are located on two different categories of land that 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 accordance with the approved Ancillary Facility Management Plan. It is anticipated that each ancillary facility will be developed and rehabilitated in accordance with the following principles in consultation with RMS property division.

6.4.1 Ancillary and borrow site rehabilitation principles

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

6.4.1 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 in consultation with RMS property division.

1. On RMS owned sites used for temporary construction that 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 to enhance wildlife habitat values. The rehabilitation works are to include maintenance until the vegetation is well established.
2. On RMS owned sites used for the extraction of construction material the rehabilitation works may include disposal of soil material classified as 'unsuitable' generated by the highway works, 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 works will be in accordance with an agreement to be reached with the property owner. The rehabilitation works are to meet all relevant environmental requirements.

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7. URBAN DESIGN FOR THE BRIDGE OVER CLARENCE RIVER AT HARWOOD

Chapter contents

Note: Landscape shown at maturity. Drawing and design is subject to further consultation and development. The number of trees is indicative only and subject to road safety consideration.

Figure 7-1: Artist's impression of Yamba interchange with the bridge over Clarence River at Harwood

7.1 BRIDGE OVER CLARENCE RIVER DESIGN PRINCIPLES

7.1.1 Principles

The overarching principles for the bridge design included reference to the Roads and Maritime Services publication Bridge Aesthetics – design guideline to improve the appearance of bridges in NSW, Roads and Maritime Services, July 2012.

7.1.2 Detailed bridge principles

The following eight detailed bridge design principles apply:

1. The road and bridge structure must fit sensitively into the landscape; provide for good connectivity for all road users; and provide a high quality public domain
2. The new bridge is required to respond to the context in an appropriate manner
3. Provide an appropriate response to the scale of the structure being highly visible to road users and local community
4. The design should consider the overall driving experience including a 110km speed zone to a ~30m high bridge crown, resulting in, dramatic views of the Northern Rivers region and view of delta area
5. Road user safety and the driver experience is an important consideration in the design development
6. Place-making and destination making responses
7. Sustainability responses are required for the structure; these may include maintenance and material considerations
8. Constructability and value for money are important objectives; a balance between aesthetic and constructability and value for money is to be achieved

Tenderers were required to comply with these principles. The new bridge complies with these detailed urban design principles.

Construction information is provided in the conclusion, chapter 9 of this report.

7.2 DESCRIPTION OF THE BRIDGE

7.2.1 Overview

The new bridge over Clarence River at Harwood structure comprises an approximately 1.5km long bridge, with about 600m of the bridge spanning the Clarence River. The new bridge is located east and is aligned parallel to the existing Harwood Bridge. The new bridge is a major landmark in the floodplain and a major infrastructure statement for Harwood and the region.

The new bridge has multiple spans of varying span lengths, arranged to align with the existing Harwood Bridge pier layout and functional on-land spanning arrangements. The bridge is a trabeated form structure with pile caps, piers, headstocks, precast spanning elements (U-girders) forming the superstructure. These design strategies are employed to complement the existing Harwood Bridge and are consistent with other major bridges on the Pacific Highway such as the Nambucca River bridge, refer to figures i-4 and 7-17.

7.2.2 The bridge profile and the shipping lane

The profile (superelevation) of the bridge accommodates mid-river shipping lane heights of 30m above the water level. The bridge deck rises gradually to accommodate the shipping lane maximum height in the centre of the river. This will result in the bridge user experience of maximised view opportunities from the highest location on the bridge over the Clarence River floodplain and across the river, refer to figure 7-18.

7.2.3 Structural composition

The bridge structure comprises twin U-girders with composite cast, in-situ concrete decks that support each carriageway, refer to figure 7-11:

- On the approach spans, the twin decks are supported by a single reinforced concrete headstock on two circular piers. Each pier is supported by pile.
- On the river spans, the twin decks, the headstock and piers are supported by a narrow pile cap with a single line of piles.
- The pier locations approximately match those of the existing Harwood Bridge, refer to figure 7-10.

7.2.4 The bridge users' experience

User experience is maximised over the bridge allowing expansive distant views of the Clarence River hinterland and out to the Pacific Coast creating a memorable experience and a sense of arrival to both Harwood and the Yamba Interchange. The existing Harwood Bridge will remain in service as part of the local road network, refer to figure 7-1.

7.2.5 Local community experience of the bridge

The new bridge over the Clarence River is designed to retain the much admired, existing heritage Harwood River Bridge. The existing bridge will experience reduced traffic as a result of the Pacific Highway traffic being located onto the new bridge, and will consequently extend the life of the existing structure.

The new bridge is specifically designed to increase local connectivity. The connectivity will be increased for local traffic and for pedestrians and cyclists on local roads through new traffic management facilities that associated with the Pacific Highway is separated from the local traffic conditions. Local connectivity will also be improved with the interchange at Yamba and connections at Harwood, refer to chapter 7.4.

The new bridge located on land is on piers, allowing for localised movement under the bridge for pedestrians and cyclists. Overall, the new bridge improves connectivity at a local level, as well as for Pacific Highway users and respects the existing Harwood River Bridge as a functional heritage item of significant community value.

7.2.6 Landscape design at the bridge embankments

The landscape design at the northern and southern embankment areas is designed complement the bridge structure and soften visual character of bridge and abutments to adjacent residents. Flood management strategies for the bridge require that landscape design be associated with the location of the bridge piers on the land. Where earthen embankments are employed for the bridge, a thicket or small forest of trees has been designed to screen the bridge from the local residents. In time, the Eucalyptus trees will reach a maximum height of 12-15m and will provide strong screening for the bridge on the land.

All land associated with construction of the bridge, temporary construction areas, including the embankments will be treated with suitable landscape treatments on completion of the bridge. A description of the landscape design is contained in chapter 8 of this report.

Note: Landscape shown at maturity. Drawing and design is subject to further consultation and development. The number of trees is indicative only and subject to road safety consideration.

Figure 7-2: Artist's impression of the bridge over Clarence River at Harwood looking north from the northbound carriageway

Figure 7-3: Artist's impression of the bridge over Clarence River at Harwood from VP 29 northern bank

Note: Landscape shown at maturity. Drawing and design is subject to further consultation and development. The number of trees is indicative only and subject to road safety consideration.

Figure 7-4: Artist's impression of the bridge over Clarence River at Harwood aerial looking south west.

7.3 KEY FEATURES OF THE BRIDGE WITH REFERENCE TO THE EIS

7.3.1 Overview

The Bridge over the Clarence River at Harwood meets the performance criteria outlined within the EIS (Chapter 5):

- Meet Roads and Maritime standards in terms of sight lines, structural performance and maintenance via anti-graffiti applications and the use of concrete barriers and twin rails to maximise handrails and simplify the urban design materials palette
- Meet expectations for bridge aesthetics and visual requirements, while addressing the urban design and landscape design principles and objectives (described in the *EIS Chapter 11 - Visual amenity, urban design and landscape*).
- Specific urban design strategies (*Ref EIS Section 4.2 and xref to MCoA D20*); EIS Compliance with urban and landscape design requirements (schedule) and SPIR requirements.

7.3.2 Local environmental values

The new bridge over Clarence River at Harwood design will take into account any land and aquatic flora and fauna communities including the Mangrove – Grey Mangrove low closed forest to the southern embankments during detailed design and construction and comply with the extent of vegetation removal and mitigation as outlined within the *Woolgoolga to Ballina EIS Volume 1A Chapter 10*. The landscape design is developed as Part of Maclean to Devils Pulpit (Sections 5 and 6) and is a separate report.

7.3.3 Heritage values

The design development of the Bridge over Clarence River at Harwood will take into account the immediate surrounding heritage elements to the north and south of the bridge including*:

- Item No. 17 Harwood Tram Tracks
- Item No. 15/16 Harwood School and residence
- Item No. 20 Harwood Bridge
- Item No. 32 Harwood Heritage Conservation Area
- Item No. 18 Harwood Water Brigade Hall
- Item No. 37 River Street trees, Harwood
- Item No. 19 Harwood War Memorial
- Item No. 14 James Creek Residence
- Item No. 13 Residence, Highfield

**Woolgoolga to Ballina Environmental Impact Statement Main Volume 1B, pp 13-19*.

The heritage sites are considered to be of local heritage significance with the project resulting in impacts on the historical significance of a range of sites.

The urban design response aims to maximise the views of the existing heritage bridge for water users, local users and those using the new bridge. The new bridge piers have been designed to ensure alignment with the existing heritage piers, therefore framing the steel truss span that is the vertical lift allowing for ships to navigate the Clarence River and celebrating the significance of this heritage bridge, refer to figures 7-3 and 7-10.

7.3.4 Indigenous heritage

As part of the Pacific Highway Woolgoolga to Ballina upgrade the project boundary was considered, and in areas, realigned to avoid areas and sites of indigenous heritage sensitivity. The project team will continue to monitor this as part of the new bridge project, mitigating impacts as specified in the EIS while detailed design development is completed. refer to chapter 5.

7.3.5 Non-indigenous heritage

As part of the Pacific Highway Woolgoolga to Ballina upgrade the project boundary was considered, and in areas, realigned to avoid areas and sites of non–indigenous heritage sensitivity. The team will continue to monitor this as part of the new bridge project, mitigating impacts as specified in the EIS while detailed design development is completed., refer to chapter 5.

7.4 IMPACTS ON THE RIVER

7.4.1 Commercial fishing and aquaculture

The Clarence River is used for a wide range of water based activities including fishing and aquaculture activities on a commercial basis. This includes commercial fishing, trawling and oyster harvesting industries Construction of the bridge over the Clarence River at Harwood may disrupt river access and increase noise and dust for commercial users of the river. The Construction and Environmental Management Plan for the bridge over Clarence River at Harwood addresses detailed issues in relation to the construction of the bridge and impacts on the waterway including that of impacts on commercial activities. The project team will communicate proactively with stakeholders and the community in order to minimise inconvenience and ensure public safety during construction The long term impacts (once the highway is opened) on commercial fishing operations as a result of the bridge over Clarence River at Harwood are limited to those identified in this report such a visual impacts.

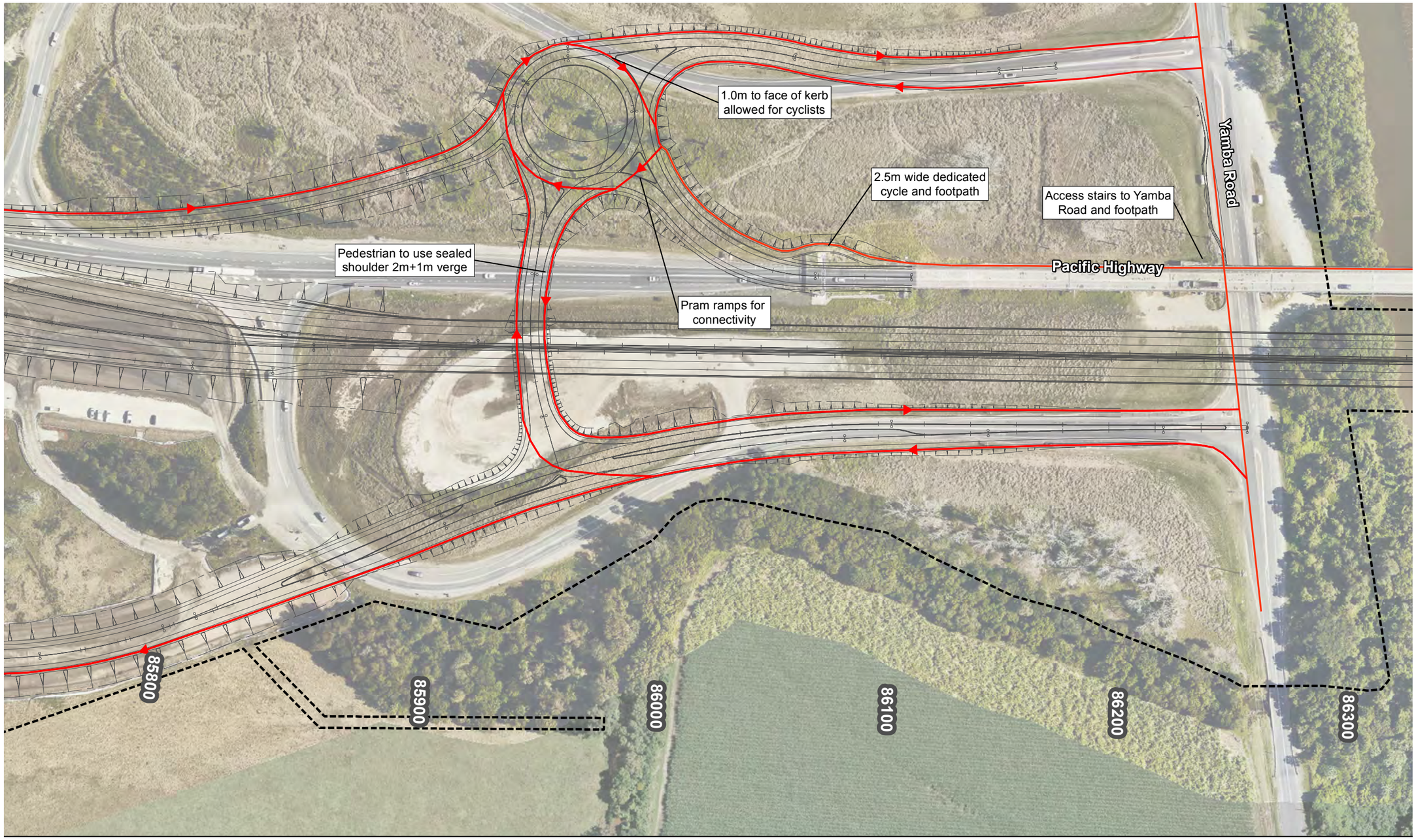
7.4.2 Recreational boating activities

The Clarence River is used for recreational boating activities Construction of the bridge over the Clarence River at Harwood may disrupt river access and increase noise and dust for recreational users such as recreational fishers and boat users. The Construction and Environmental Management Plan for the bridge over Clarence River at Harwood addresses detailed issues in relation to the construction of the bridge and impacts on the waterway including that of impacts on recreational activities. The project team will communicate proactively with stakeholders and the community in order to minimise inconvenience and ensure public safety during construction. The long term impacts (once the highway is opened) on recreational activities as a result of the bridge over Clarence River at Harwood are limited to those identified in this report such a visual impacts.

7.4.3 Flood focus groups

Extensive flood modelling has been undertaken 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 will be reported in the project's Hydrological Mitigation Report which will be submitted to the Department of Planning & Environment for review in early 2017. Once finalised, information will be made available through the project website. Relevant documentation is available at:http://www.rms.nsw.gov.au/W2B. Refer to chapters 8 and 11 for information on the landscape design responses to flood modelling.



PACIFIC COMPLETE

PACIFIC HIGHWAY UPGRADE

Woolgoolga to Ballina

Harwood Bridge Pedestrian and Bicycle paths

Cycleway
PSC Design - W/E 7/10/2016
Approved Project Boundary (Version 11, 30/06/2016)

1:1,500 at A3

0 10 20 40 60 80
Meters

Print Date:	31/10/2016
Author:	LABRUYEREA

Path: \\Apsydfil03\proj\P\PACIFIC_COMPLETE\2270001_WOOLGOOLGA_TO_BALLINA_DELIVER\10_GIS\02_Maps\03_MXD\2270001A_0274_MovementPlan_20161031.mxd

Figure 7-5: Cyclists, pedestrian and disabled person's connections to local roads at the bridge over Clarence River at Harwood

7.5 PEDESTRIAN, CYCLIST AND DISABLED ACCESS ENHANCEMENTS

7.5.1 Overview

Shared paths refer to facilities that are shared by pedestrians, cyclists and disabled persons. Please refer to figure 7-5 which shows the local connections, footpaths and cycle paths in and around the new and existing bridge as summarised below.

Pedestrians

- For safety reasons, no pedestrian access would be provided to the motorway class sections of the main carriageways.
- Pedestrians are permitted to utilise the shoulders of A Class roads.
- Pedestrian access across the project would be provided via overpasses and underpasses which are listed in the Table 7-1.
- Pedestrian footways would be provided on overpasses where warranted based on safety and future demand and agreed with council and stakeholders, in accordance with the Table 7-1.

Shared paths

- Consultation with councils and local communities in relation to future provisions for shared paths connections across the Pacific Highway has been completed.
- The project will provide for future shared path provisions as agreed with council and stakeholders.
- Cyclist / shared paths and footpaths beyond the project corridor are not in the scope of the project and will be provided by councils.

Cyclists

- Current NSW legislation permits cyclists to use the project's road shoulders, including across bridges.
- Cyclists would also be able to use service roads, where there would be less traffic.
- Cyclist access would be provided across the project in accordance with Table 7-1.

7.5.2 Facilities associated with the bridge over Clarence River at Harwood

The new bridge and local road connections are designed to enhance local connectivity, and feature new facilities for pedestrians and cyclists. Once the Pacific Highway traffic is separated from the local traffic conditions, local road conditions are anticipated to improve.

- Cyclists on the new Pacific Highway alignment will be directed to exit the upgrade at the interchanges north and south of the new bridge, providing local connections and cyclist and pedestrian access to the existing Harwood bridge.
- The existing bridge has a flat grade which is considered suited to pedestrian and cyclist use
- The path for cyclists and pedestrians on the existing Harwood bridge is about 1.6m wide Pedestrians and cyclists on the existing bridge will experience improved safety due to slower traffic speeds
- The existing Harwood bridge will accommodate slower speed local traffic, resulting in improved conditions for cyclists and pedestrians using the path on the western side of the bridge
- The connections to the existing Harwood bridge will be widened at the southern end to improve conditions for cyclists and pedestrians

Refer to figure 7-5.

7.5.3 Cyclist, pedestrian and disabled person connections to local roads

- The interchange roads have been provided with 2.0m wide shoulders which will cater for cyclists
- Pedestrians will be encouraged to use the sealed shoulder of interchange roads
- Connections for pedestrians and cyclists to Yamba Road and the existing highway will remain
- Local road connectivity will also be enhanced through new traffic management facilities and the removal of highway traffic from the existing Harwood bridge and local roads
- Existing stair access to the Harwood bridge will remain in the southern embankment area
- Disabled persons will continue to be able to use the existing bridge facilities.

Refer to figure 7-5.

Table 7-1: Cyclist and pedestrian facilities for the Woolgoolga to Ballina upgrade

Sections	Bridge name	Pedestrian/Cyclist Access
3 and 4	Glenugie Southbound entry ramp overpass	Shoulder
3 and 4	Eight Mile Lane overpass	Shoulder
3 and 4	Old Six Mile Road overpass	Shoulder
3 and 4	Avenue Road overpass	Shoulder
3 and 4	Wooli Road overpass	Shoulder
3 and 4	Firth Heinz Road overpass	Shoulder
3 and 4	Bostock Road overpass	Shoulder
3 and 4	Twin Bridges at Somervale Road	Cyclists on shoulder
3 and 4	Crowley's Road overpass	Shoulder
3 and 4	Tyndale Interchange (south)	Shoulder
3 and 4	Bondi Hill Road overpass	Shoulder
3 and 4	Southbound Exit Ramp overpass	Cyclists on shoulder
3 and 4	Byron's Lane overpass	Shoulder
3 and 4	McIntyres Lane overpass	Shoulder - widened following Council consultation
3 and 4	Maclean Interchange Bridge	Shared use path provided under Jubilee Street and past Maclean Interchange
3 and 4	Twin Bridges over Jubilee Street	
5 and 6	Koala Drive underpass	Shoulder
5	Existing Harwood Bridge	Shared use path on western side
5	Bridge over Clarence River at Harwood	Cyclists to use Harwood bridge
5 and 6	Serpentine Channel Road North overpass	Shoulder
5 and 6	Chatsworth Road overpass	Shoulder
5 and 6	Iluka Road Interchange overpass	3.0m Footpath northern side
7, 8 and 9	Woodburn Interchange overpass	3.0m Footpath southern side
7, 8 and 9	Woodburn-Evans Head Road overpass	3.0m Footpath southern side
7, 8 and 9	Broadwater Evans Head Road overpass	3.0m Footpath northern side
9 (F)	Bridge over Richmond River	Cyclists on shoulder
10 and 11	Old Bagotville Road underpass	Shoulder
10 and 11	Wardell Road overpass	Shoulder
10 and 11	Coolgardie Road Interchange overpass	3.0m Footpath northern side
10 and 11	Whytes Lane overpass	1.8m Footpath southern side
Pimilco to Tavern (Ballina)	Smiths Drive bridge	3.0m Footpath - Construction deferred

Figure 7-6: Shadow study winter solstice, 22 July at 9am

Figure 7-7: Shadow study winter solstice, 22 July at 3pm

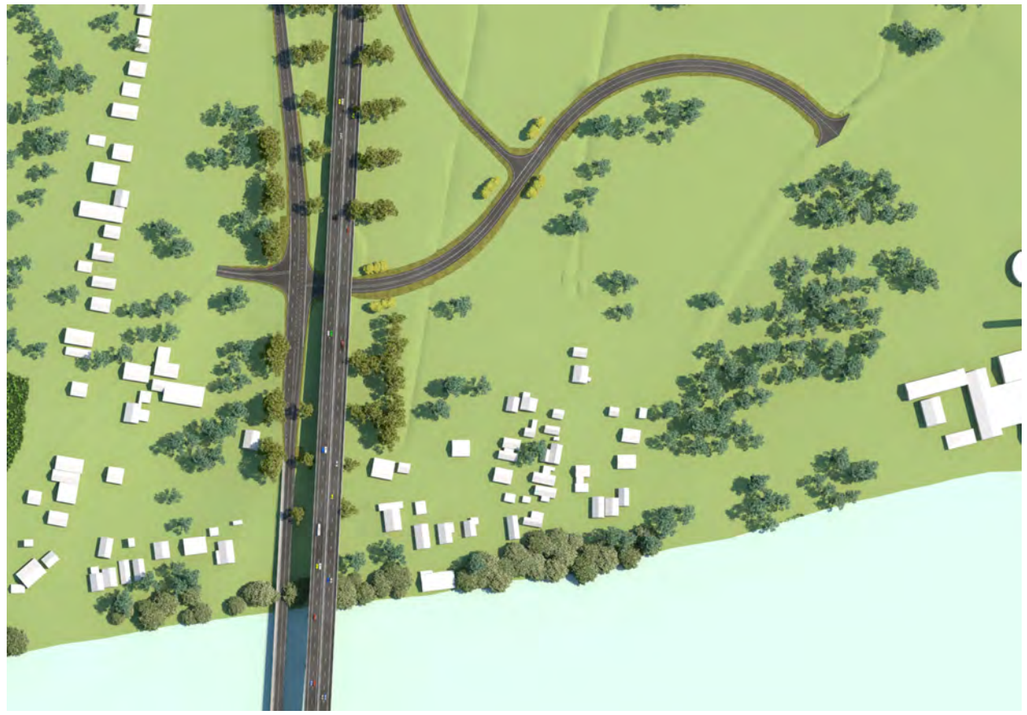


Figure 7-8: Shadow study summer solstice, 22 December at 9am

Figure 7-9: Shadow study summer solstice, 22 December at 3pm

7.6 SHADOW STUDY OF THE BRIDGE AND LANDSCAPE

7.6.1 Overview

Urban design and landscape environmental management measures identified in Chapter 5 (UD05) of the SPIR require a shadow study for the landscape design and bridge over Clarence River at Harwood.

7.6.2 Shadow study principles

The computer aided design modelling was limited to the northern side of the Clarence at Harwood as initial modelling indicated that no residential properties were impacted by shadowing on the southern side of the river.

Shadow studies for the northern embankment area (Harwood) were prepared:

- Winter solstice, 22 July at 9am and 3pm
- Summer solstice 22 December at 9am and 3pm
- Noon modelling was not regarded as useful for the study due to the relationship of the bridge to nearby properties.

Refer to figures 7-6 to 7-9 for the shadow studies.

7.6.3 Summary

There will be partial shadowing impacts on neighbouring properties as a result of the bridge and landscape as follows:

1. A limited number of properties east of the bridge from before 3pm in winter, refer to figure 7-7.
2. A limited number of properties east of the bridge after 3pm in summer, refer to figure 7-9.

Mitigation of shadowing has been carefully considered with the width of the corridor at the bridge, which allowed for the bridge to be set back from existing properties.

Trees have been carefully located to assist with visual screening of the bridge. The location of trees is designed to limit shadowing effects on nearby properties.

7.7 BRIDGE DESIGN ELEMENTS

7.7.1 Bridge elements

The new bridge comprises of a mixture of precast and in-situ concrete elements for the superstructure, supported by a reinforced concrete substructure.

- It is a bold structure crossing the Clarence River enabling clear visibility through the bridge
- The user experience both from the existing Harwood Bridge and the northern and southern embankments provides a visual harmony and frames the heritage bridge from a number of aspects
- The longitudinal pier spacing positions align with the existing heritage bridge piers to maintain navigational channels and views along the river
- A 30m navigation zone has been applied to maintain navigational requirements
- The views from the new bridge are emphasised through the double steel railing allowing for sweeping, distant district views in both directions, primarily on the down slope of the bridge.

Refer to figure 7-11 for a cross section of the bridge

7.7.2 Bridge design development

The Bridge over Clarence River will undergo continuing design development throughout the design phase of the project and during construction. Design development is likely to occur to improve constructability and consequently the overall appearance of the bridge. The improvements are unlikely to modify the overall structural appearance of the bridge. Improvements that may occur include but are not limited to the following:

- Consideration of precast concrete piers (match cast) which may be post tensioned in lieu of cast in-situ piers.
- Reduction in the last span of the bridge on the northern embankment in accordance with latest flood modelling. Removing span 36 and shifting Abutment B south.

7.7.3 Piers, pile caps, headstocks, abutments and parapets

The following is a summary of the piers, pile caps, headstocks, abutments, parapets:

- The twin decks are supported by a slender, single, reinforced concrete headstock on two circular reinforced concrete piers
- On the approach spans, each pier is supported by a single pile
- On the rivers spans, the piers are supported by a pile cap and single line of piles.
- Piers have been evenly spaced and ordered with a rhythm that relates to the existing heritage bridge structure
- The piers are designed to be slender to improve viewing opportunities through the bridge and to improve the aesthetics of the structure
- The abutments comprise a reinforced concrete sill beam, supported on a single line of piles
- Abutment screen walls on the sill beams mask the end of the girders and the bridge bearings from view
- Pile caps are designed to reflect the dimensions and shape of the piers and the proportions of the bridge superstructure
- Precast parapets are proposed for the bridge with twin rails to maximise viewing
- Integrated longitudinal drainage pipes are masked behind the parapet skirt to ensure consistent visual lines across the bridge from all water and land views.

Refer to figure 7-10 for an elevation of the bridge and figure 7-11 for a cross section of the bridge which illustrates these elements.

7.7.4 Retaining walls

There are no retaining walls associated with the bridge.

7.7.5 Cuttings and embankments, stabilisation and erosion control

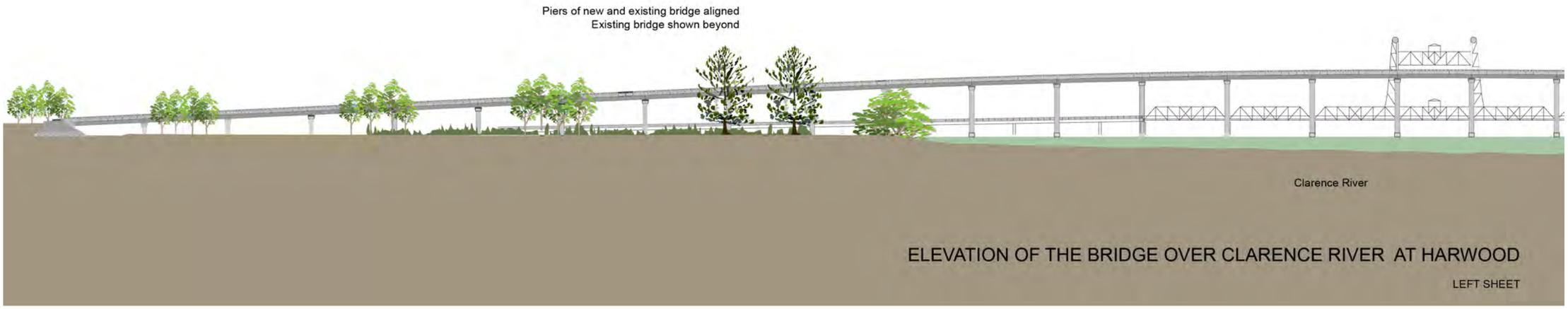
- There are no cuttings associated with the bridge or embankment earthworks
- Embankments are envisaged to be 2:1 batters for stability and will be vegetated in accordance with the landscape design to assist with erosion control
- The hard surface abutment areas extend one metre from the face of parapets to minimise maintenance.

Refer to figure 7-10 for an elevation of the bridge and figure 7-11 for a cross section of the bridge which illustrates these elements.

7.7.6 Median and verge treatments on land

The verge treatment is typically a spray seal to approximately 0.5m behind the wire rope safety barrier for maintenance purposes. Beyond this, grassed verges are provided.

Refer to figure 7-10 for an elevation of the bridge and figure 7-11 for a cross section of the bridge which illustrates these elements.


Piers of new and existing bridge aligned
Existing bridge shown beyond
Clarence River
ELEVATION OF THE BRIDGE OVER CLARENCE RIVER AT HARWOOD
LEFT SHEET

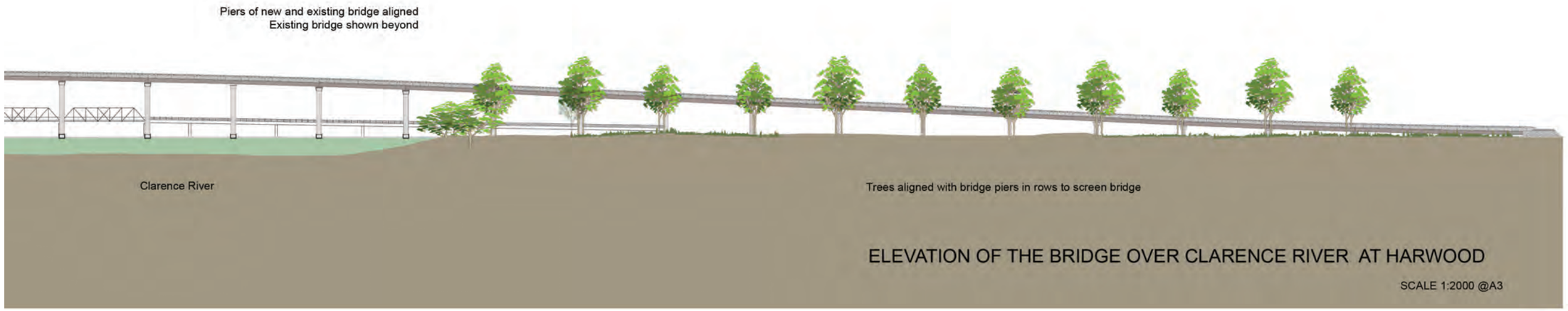


Figure 7-10: Elevation of the bridge over Clarence River at Harwood

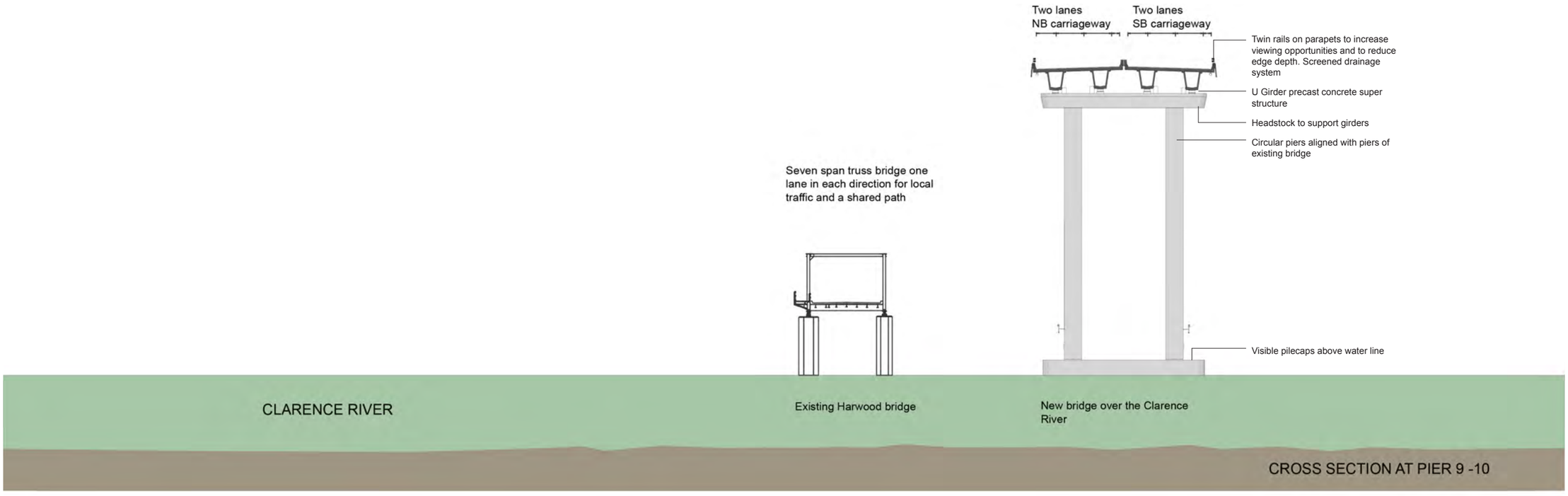


Figure 7-11: Cross section through the bridges

7.8 BRIDGE FURNITURE

7.8.1 Fencing

Fencing requirements will tie in with the overall Woolgoolga to Ballina upgrade fencing strategy. Refer to Maclean to Devils Pulpit (Section 5) Urban Design and Landscape Plan, Chapter 6.6.1.

7.8.2 Headlight screening

The urban design response includes central precast concrete safety barriers that mitigates headlight glare across the bridge.

7.8.3 Noise mitigation (expansion joints etc)

Operational noise is dealt with in the Operational Noise Management Report: Woolgoolga to Glenugie Pacific Highway Upgrade - Main report, November 2015

http://www.rms.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina/project-documents.html

- There are no noise walls required within this section of the works. Refer to figure 7-11
- Noise mitigation is consistent with the EIS
- Four expansion joints are required for the full extent of the bridge, this is substantially less expansion joints than the existing bridge which has joints at each pier
- Reduced traffic on the existing bridge at Harwood will improve the noise environment
- The noise impacts of traffic going over the joints are minimised utilising contemporary jointing systems
- Asphalt surfacing is provided on the bridge over Clarence River at Harwood, which reduces noise
- An assessment of potential construction related noise is available at *Construction noise and vibration management plan, Appendix B3, October 2015.*

http://www.rms.nsw.gov.au/projects/northern-nsw/woolgoolga-to-ballina/

The latest noise modelling on the detailed design of the project indicates that there are no noise mitigation structures required for the project. Noise modelling reports will be submitted to the Department of Planning & Environment for review in early 2017.

7.8.4 Lighting

- There is no lighting on the bridge
- Street lighting will be provided at the Yamba and Harwood Interchanges, this is described in Maclean to Devils Pulpit (Sections 5, 6 and 6A) Urban Design and Landscape report
- Lighting requirements are described in relation to AS 4282-1997 Control of the Obtrusive Effects of Outdoor lighting in the Maclean to Devils Pulpit (Sections 5, 6 and 6A) Urban Design and Landscape report.

7.8.5 Safety and traffic barriers on the bridge

The bridge's safety and traffic barriers on the outer parapets are Roads and Maritime Services standard barrier details:

- Safety traffic barriers on the outer edge of the bridge comprise concrete parapets with twin steel rails
- The twin steel rail and post system is mounted on top of the concrete parapet to maximise road user views to the surrounding landscape
- Separating the northbound and southbound carriageways in the median is a standard concrete median traffic barrier on each carriageway, separated by a 50mm gap
- The overall height of the median barrier allows road user views to the surrounding landscape
- On the outer verges of the approach to the bridge, the concrete bridge barriers transition to a wire rope safety barrier (WRSB) on the approaches
- The central concrete barrier will continue to the bridge approach
- The central concrete barrier will transition to a WRSB once the width of the median permits, this maximises road user views to the surrounding landscape.

Refer to figures 7-2 and 7-11.

7.8.6 Signage

- There are no signage structures on the bridge that will impede viewing opportunities.
- Future community and stakeholder consultation is planned for signage along the alignment. There are signage standards which apply to the project, these will be communicated to the community and agencies at an appropriate time in the development of the project.

YAEGL NATURE RESERVE

PAPERBARK SWAMP FOREST

Cluster of Paperbark Swamp Forest trees, offset 4m from wire rope safety barrier and planted within forest revegetation.

SWAMP OAK SWAMP FOREST

'Moreton Bay Fig' tree plantings – starting at 200m spacing at CH83600, gradually reducing to 20m spacing at CH84800; planted within forest revegetation.

85200

Marker planting. Staggered grid of 'Cook Pine' tree plantings, offset 3m from wire rope safety barrier planted within forest revegetation.

85400

PAPERBARK SWAMP SWAMP FOREST

Groupings of 'Tuckeroo' tree plantings within pasture grass revegetation.

Swamp Oak Swamp Forest revegetation

85600

PASTURE GRASS

85800

5-G

ADJOINS SHEET 02

S/B ENTRY RAMP

N/B EXIT RAMP

S/B EXIT RAMP

JAMES CREEK

Groupings of 'Tuckeroo' tree plantings within pasture grass revegetation.

Marker planting. Staggered grid of 'Cook Pine' tree plantings, offset 3m from wire rope safety barrier planted within forest revegetation.

Groupings of 'Tuckeroo' tree plantings 5m from the verge, planted within forest revegetation.

Marker planting. Staggered grid of 'Cook Pine' tree plantings, offset 3m from wire rope safety barrier planted within forest revegetation.

SWAMP OAK SWAMP FOREST

Swamp Oak Swamp Forest revegetation

NOTES: This drawing and landscape design (including roads, bridges, drainage and water quality structures, fencing types and locations) is subject to further consultation and design development.
Landscape treatments would be provided to the extent of clearing only.
The number of trees shown is indicative only and subject to road safety consideration.

LEGEND

EXISTING FEATURES
- Waterway / water body
- Property boundary

HIGHWAY UPGRADE
- Approved project boundary
- Clearing Boundary
- Wire rope safety barrier
- W-Beam barrier
- Dedicated fauna culvert
- Fauna fence
- Drainage basin

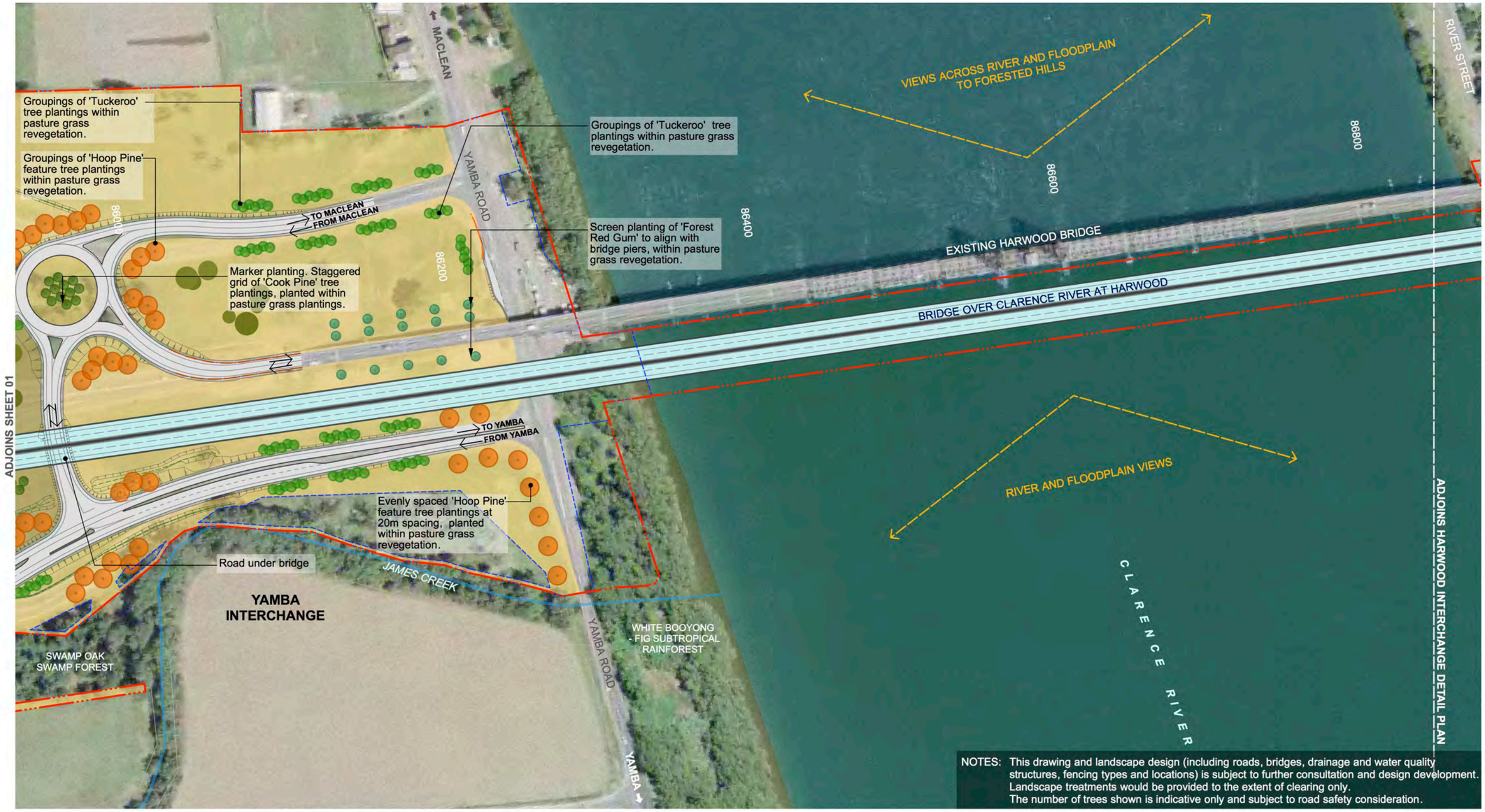
LANDSCAPE TREATMENTS
- Pasture grasses
- Native grasses
- Mixed shrubs
- Forest revegetation
- Riparian revegetation

FEATURE TREES
- *Araucaria columnaris* Cook Pine
- *Araucaria cunninghamii* Hoop Pine
- *Eucalyptus tereticornis* Forest Red Gum
- *Harpullia pendula* Tulipwood
- *Ficus microcarpa var 'Hillii'* Hill's Fig
- *Flindersia australis* Australian Teak
- *Cupaniopsis anacardioides* Tuckeroo
- *Tristaniopsis laurina* Water Gum
- Syncarpia glomulifera Turpentine
- *Corymbia Maculata* Spotted Gum
- Clustered Native tree planting

0 20 40 60 80 m
SCALE 1:2,500 at A3

Sheet 1 of 3

Figure 7-12: Detail plan of Yamba interchange



LEGEND

EXISTING FEATURES
- Waterway / water body
- Property boundary

HIGHWAY UPGRADE
- Approved project boundary
- Clearing Boundary
- Wire rope safety barrier
- W-Beam barrier
- Dedicated fauna culvert
- Fauna fence
- Drainage basin

LANDSCAPE TREATMENTS
- Pasture grasses
- Native grasses
- Mixed shrubs
- Forest revegetation
- Riparian revegetation

FEATURE TREES
- *Araucaria columnaris* Cook Pine
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- *Tristaniopsis laurina* Water Gum
- Syncarpia glomulifera Turpentine
- *Corymbia Maculata* Spotted Gum
- Clustered Native tree planting

0 20 40 60 80 m
SCALE 1:2,500 at A3

Sheet 2 of 3

Figure 7-13: Detail landscape design at the southern embankment

7.9 DRAINAGE

7.9.1 Drainage & water quality

Drainage systems for the bridge

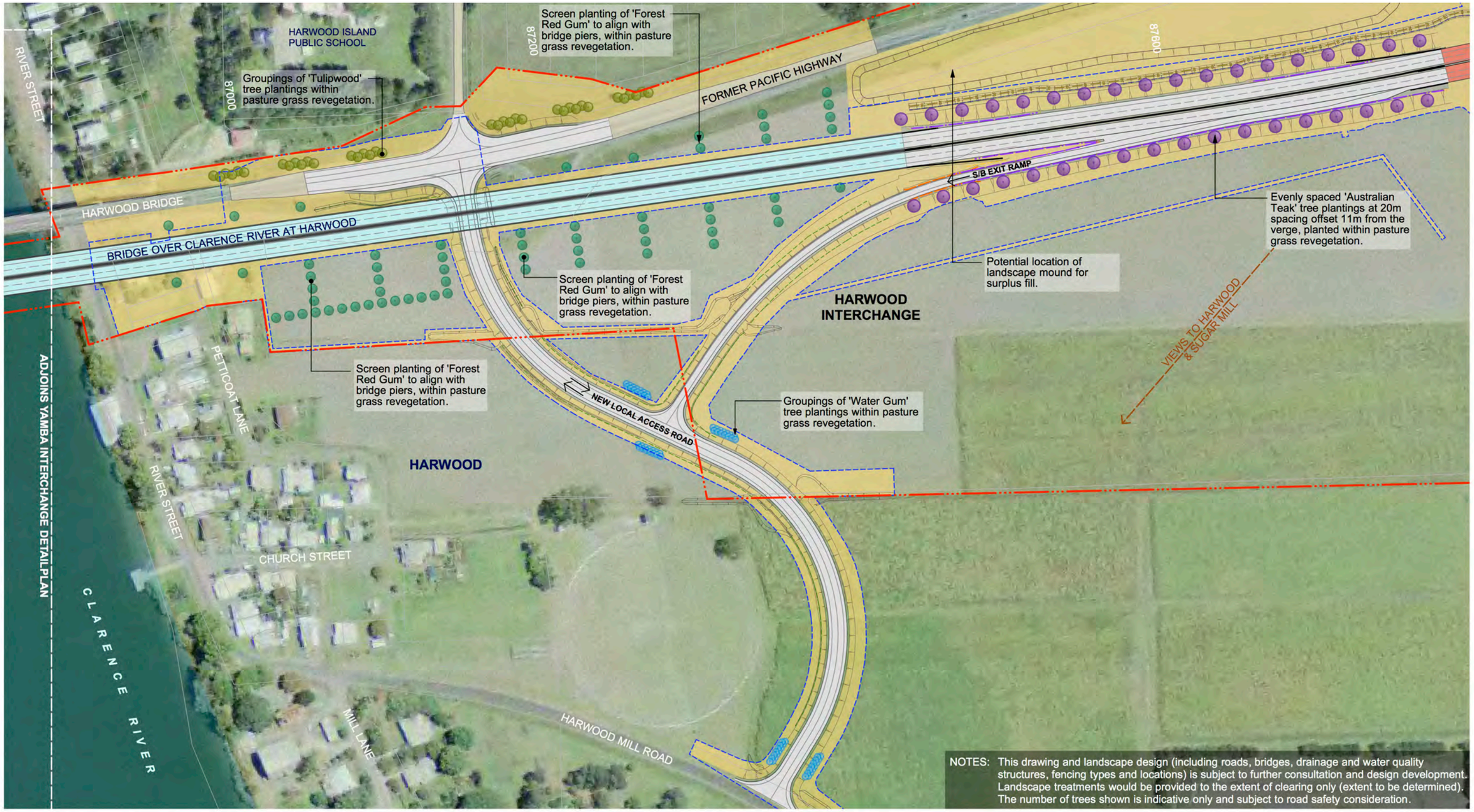
The new bridge employs a comprehensive gravity fed drainage system refer to figure 7-10:

- The drainage design will efficiently collect the stormwater runoff, whilst minimising the number of intrusions within the bridge deck structure and minimising maintenance requirements
- The longitudinal drainage for the new bridge will be via scuppers into pipes, suspended longitudinally under the deck
- The pipes are screened by concrete parapets to improve the visual appearance of the structure
- All drainage will be carried through the pipe network to the abutments and connected to the road drainage off the bridge
- The water from the bridge will be treated in water quality control ponds located on land, refer to figure 7-12.

7.9.2 Water quality control systems (including basins)

Best practice for water quality will be followed during the construction and operational stages of the project:

- AFHJV will set up site compounds on the north and south sides of the river
- Temporary erosion and sediment control basins will be designed using the *Blue Book – Soils and Construction Volume 1, 4th edition, March 2004*
- In addition to the basins, temporary water quality measures such as berms, channels and siltation fences will be used to direct the flow across the site into the basins
- The location of the temporary basins will be determined during the detailed design phase, refer to figure 7-12.
- AFHJV will coordinate the design with delivery partner Pacific Complete and the Section 5 designers to allow the temporary basins to be converted to permanent basins where possible.



LEGEND

EXISTING FEATURES
- Waterway / water body
- Property boundary

HIGHWAY UPGRADE
- Approved project boundary
- Clearing Boundary
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- *Tristaniopsis laurina* Water Gum
- Syncarpia glomulifera Turpentine
- *Corymbia Maculata* Spotted Gum
- Clustered Native tree planting

0 20 40 60 80 m
SCALE 1:2,500 at A3

Sheet 3 of 3

Figure 7-14: Landscape design at the northern embankment

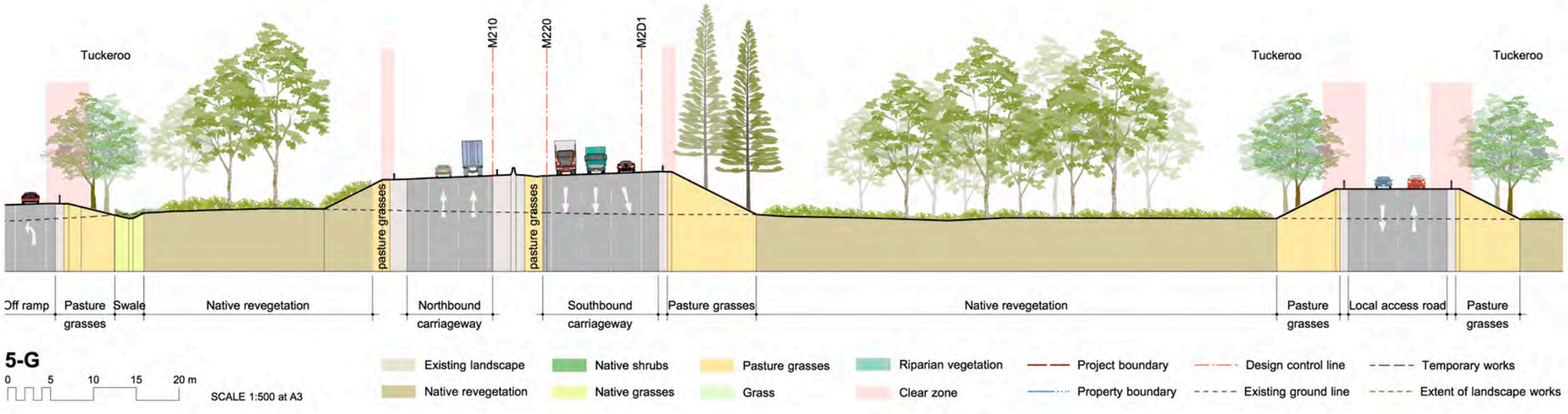

Figure 7-15: Section 5-G at Yamba interchange refer to figure 7-28 for location

7.10 LANDSCAPE CHARACTER AND VISUAL IMPACT ASSESSMENT

7.10.1 Overview

This landscape character and visual impact assessment provides a re-assessment of the impacts of the highway upgrade at detailed design stage on the character of a place and the views within that place as compared to the EIS design. The landscape character assessment relates to the built, natural and cultural aspects that makes a place unique, while the visual impact assessment is intended to identify design improvements that can address adverse impacts either through design integration or as mitigation measures.

This landscape character and visual impact assessment follows the *'Guideline for Landscape Character and Visual Impact Assessment'* (Roads and Maritime Services, 2013). It is consistent with the Roads and Maritime urban design process that addresses visual and character issues, both of which are key aspects for delivering good urban design outcomes.

7.10.2 Landscape character assessment

In landscape character assessment, magnitude refers to the type of highway upgrade and its compatibility with the character of the existing landscape. All anticipated elements of the highway upgrade, including the alignment, road infrastructure, ITS, planting, lighting, etc, are considered. The scale of elements (height, length), as well as its location or setting (within woodland, rural land, or over creek crossings), all have a bearing on the magnitude of the physical presence of the highway upgrade.

A high magnitude results if the highway upgrade is a major development or piece of road infrastructure and contrasts highly with the surrounding landscape, or entails heavy modification of the existing landscape. This would occur as a result of the large scale removal of existing vegetation. A moderate magnitude rating would result if the highway upgrade is moderately integrated into the landscape. A low magnitude rating would occur if the highway upgrade is of a small scale and integrates well into the landscape.

The magnitude impact rating also considers whether the highway upgrade has a positive or negative impact on the landscape character of the zone. For example, the upgrade may be of a large scale but may provide beneficial outcomes such as increased open space, enhancement of the areas 'sense of place', better connectivity and a safer road environment.

Sensitivity refers to how sensitive the character of the setting is to the proposed change. A judgement has been made as to the quality of the landscape, its cultural and historical importance to the community, scenic quality, and overall composition of the place and its inhabitants. The following sensitivity judgements have been used as the basis for this assessment:

- Places with high social, recreational, and historical significance to local residents have higher sensitivity
- Generally, water and natural environments are more highly valued than modified areas, though views over rolling farmland are still highly valued
- Areas of unique scenic quality have higher sensitivity
- A pristine environment would have greater sensitivity with less ability to absorb new elements in the landscape than modified landscapes or those areas with contrast and variety of landscape types.

Landscape character impact is the combination of the magnitude and sensitivity rating in accordance with the Impact Assessment Grading Matrix (refer to Table 7-2).

7.10.3 Key views assessment

The potential visual impact of the highway upgrade is assessed in relation to a number of key viewpoints. Locations and directions of chosen viewpoints are representative of the range of viewpoints both within the visual catchment of the highway upgrade.

Magnitude of change to existing views refers to the nature and scale of the highway upgrade, and the extent and proximity of the view to it. Magnitude represents the contrast in scale, form and type of highway upgrade to the location and context to which it is to be placed.

A high magnitude results if the highway upgrade is of a major scale and is considered out of scale or uncharacteristic of the existing visual character, or if there is considerable modification to the existing landscape. A moderate magnitude would result if the highway upgrade is prominent but not considered to be substantially uncharacteristic with the existing visual character. A low magnitude results if there is minimal alteration to the existing view and the highway upgrade is of a scale and nature that is consistent with the existing visual character.

Sensitivity is the measure of the visual importance of the view and is dependent on:

- Distance between viewer and the highway upgrade
- The category of viewer, for example, resident, worker, shopper, open space user
- The elements of the highway upgrade that are visible
- Importance of the view, for example, identified in tourist guides, static or moving viewpoint, do people deliberately seek the view.

Visual sensitivity includes the consideration of the perceived cultural and historical values of the visual environment and the elements within it.

Generally, viewers with the highest sensitivity include:

- Residents who have existing attractive views that will be affected by the highway upgrade
- Users of public open space where their attention is focused on the visual landscape, for example, lookouts or other scenic natural areas
- Communities that place high cultural and historical significance on the visual landscape.

Viewers with the lowest sensitivity are most likely to be:

7.11 LANDSCAPE CHARACTER IMPACTS

- Employees focused on their work
- Motorists whose attention is focused on driving.

Visual impact is the combination of the magnitude and sensitivity rating in accordance with the Impact Assessment Grading Matrix (refer to Table 7-2).

SENSITIVITY	MAGNITUDE: High	Moderate	Low	Negligible
High	High	High-Moderate	Moderate	Negligible
Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
Low	Moderate	Moderate-Low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Table 7-2: Impact assessment grading matrix

The Impact Assessment Grading Matrix, adopted from *Guideline for Landscape Character and Visual Impact Assessment* (Roads and Maritime 2013), is used in both the landscape character and key views assessments. The matrix illustrates how magnitude and sensitivity ratings are combined to achieve an overall impact rating.

Note: The EIS referenced an earlier edition of the Impact Assessment Grading Matrix produced in the *Guideline for Landscape Character and Visual Impact Assessment* (RTA 2009).

The results of the EIS assessment have been reviewed and re-assessed below for the Detailed design stage in accordance with Roads and Maritime Impact Assessment Grading Matrix (refer to Table 7-2), taking into consideration the design amendments between the EIS and detailed design stages. The results are summarised in Table 7-1

For landscape character zones refer to figure 5-13

7.11.1 Landscape Character Zone 27 – Clarence River floodplain

EIS Assessment

The zone was assessed to have Moderate sensitivity as it is a floodplain with extensive sugar cane plantations with seasonal variations. The project was assessed to be of High magnitude due to the consistant 3 m embankment within existing road corridor across floodplain, new overpasses with associated embankments and new bridge crossing over the Clarence River. The overall impact on the landscape character of this zone was Moderate to High.

Detailed design changes

For landscape character zones refer to figure 5-13

The construction and operational changes in zone 27 in relation to the bridge over Clarence River at Harwood include:

- Cycle access on the shoulders of the upgraded highway, including bridges
- A new two-way cycle path on Yamba Road providing dedicated pedestrian and cyclist access to the existing bridge at Harwood.
- Cycle access to the northbound carriageway, adjacent to the roundabout at the western side of the interchange
- Cycle access from the southbound carriageway, with a connection under the highway to link to the existing bridge at Harwood
- Cycle connection under the bridge over Clarence River at Harwood
- Removal of Watts Lane intersection with the highway
- The existing highway will become a local access road connecting to Watts Lane
- On-ramp to the northbound carriageway from Watts Lane

Landscape Character Assessment

The detailed design would not change the sensitivity rating assessed in the EIS, which would remain Moderate. The detailed design changes, while extensive, are generally minor in nature and involve modification of access road layouts. Despite the new bridge not being included in the detailed design scope for this draft UDLP, it is expected that its design will be similar in scale to the EIS design; therefore, the magnitude rating which would remain High. As such, the overall Landscape Character Impact would remain Moderate to High.

7.11.2 Landscape Character Zone 29 – Harwood Township

EIS Assessment

The zone was assessed to have High sensitivity as it contains a small residential township with sensitive heritage items. The project was assessed to be of High magnitude as it includes the bridge crossing over Clarence River with associated embankments. The overall impact on the landscape character of this zone was High.

Detailed design changes

For landscape character zones refer to figure 5-13.

The construction and operational changes in zone 29 include:

- Local access road under the new Clarence River bridge, between Mill Road and the former Pacific Highway immediately north of Harwood Island Public School
- Existing highway becomes a local access road connecting to Watts Lane
- Exit-ramp from the southbound carriageway to the local access road between Mill Road and the former Pacific Highway
- The new bridge over the Clarence River subject to a separate submission and is not part of the scope of this report.

Landscape Character Assessment

The detailed design would not change the sensitivity rating assessed in the EIS, which would remain High. The detailed design changes are not sufficient to change the magnitude rating and despite the new bridge not being included in the detailed design scope for this draft UDLP, it is expected that its design will be similar in scale to the EIS design. Therefore, the magnitude rating which would remain High. As such, the overall Landscape Character Impact would remain High.

7.11.3 Summary of landscape character impacts

Overall, the detailed design is considered to have a similar impact on landscape character as the EIS concept. There are a number of changes between the designs, the most noticeable being the:

- Removal of the Watts Lane overpass bridge (landscape character zone 27).

The changes within landscape character zone 27 are similar in nature, and within the overall scale of the project within this zone, are not deemed sufficient to increase or decrease the magnitude rating assessed in the EIS.

A summary of the EIS and detailed design impact assessment is presented in Table 7-3.

Table 7-3: Landscape character impact summary

LANDSCAPE CHARACTER ZONE	EIS SENSITIVITY	DETAILED DESIGN SENSITIVITY	EIS MAGNITUDE	DETAILED DESIGN MAGNITUDE	EIS IMPACT RATING	DETAILED DESIGN IMPACT RATING
27. Clarence River floodplain	Moderate	*No change*	High	*No change*	**Moderate to High**	***No change***
29. Harwood township	High	*No change*	High	*No change*	**High**	***No change***

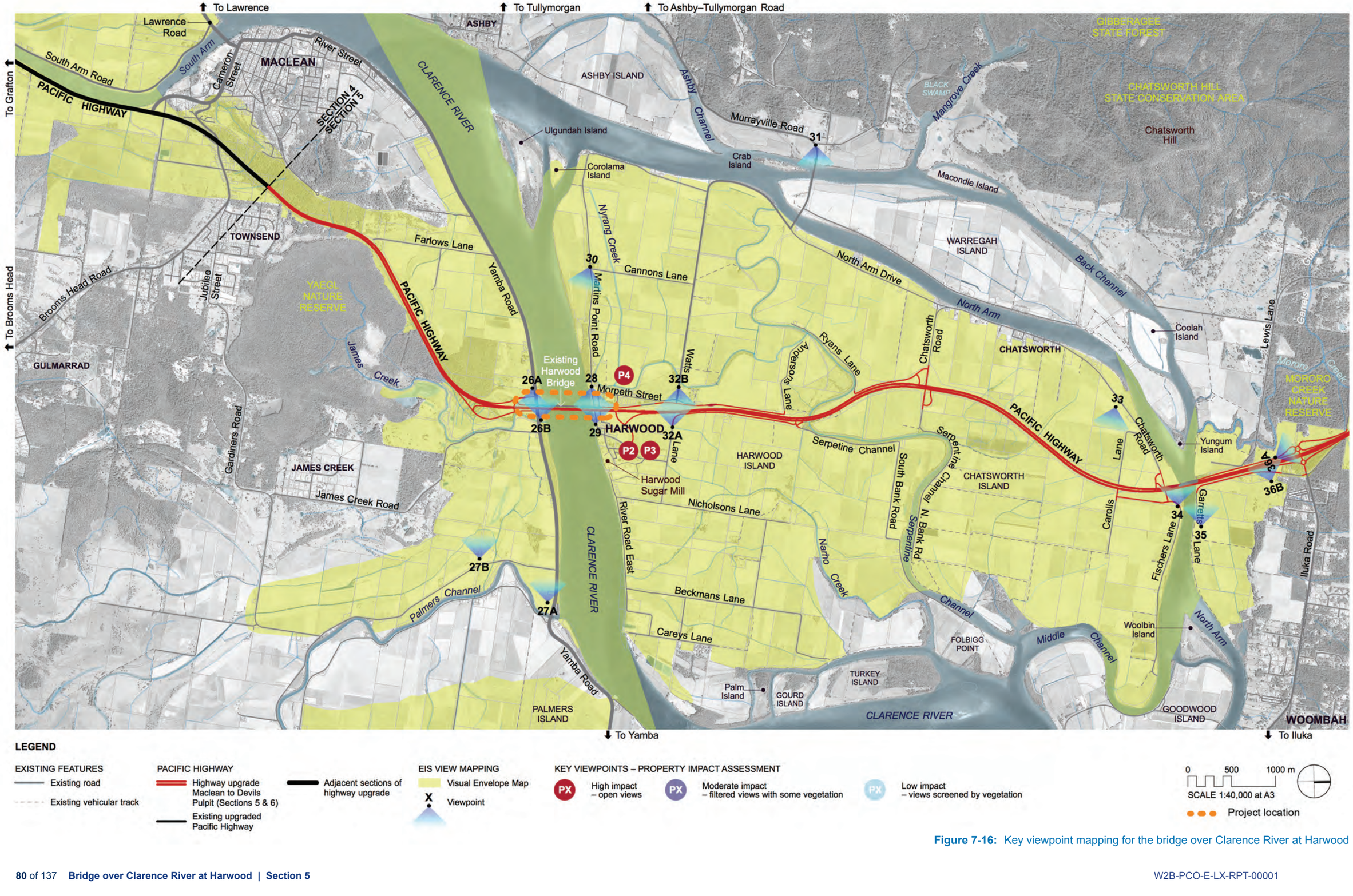

Figure 7-16: Key viewpoint mapping for the bridge over Clarence River at Harwood

7.12 IMPACTS ON KEY VIEWS

Visual impact ratings were determined in the EIS based on 75 key viewpoints (VP. Of these viewpoints, 15 are located between Maclean and Iluka Road (Section 5) and one is located between Iluka Road and Devils Pulpit (Section 6). These VP locations are shown on figure 7-16 and listed below:

Maclean to Iluka Road, Mororo (Section 5):

- Viewpoint 26A - Yamba Road, Harwood
- Viewpoint 26B - Yamba Road, Harwood
- Viewpoint 27A - Palmers Channel bridge, Yamba Road
- Viewpoint 27B - South Bank Road, Palmers Channel
- Viewpoint 28 - Public Jetty, Clarence River, Harwood
- Viewpoint 29 - End Harwood Road, Harwood
- Viewpoint 30 - Corner Cannons Lane & River Street, Harwood

The results of the EIS assessment have been reviewed and re-assessed below for the detailed design stage in accordance with Roads and Maritime impact grading matrix (refer to Table 7-2, taking into consideration the design amendments between the EIS and detailed design stage. The comparative assessment results are summarised in Table 7-3.

Figure 7-1: Location of key viewpoints shown on Figure 7-16

Plate 7-1: Viewpoint 26A – Yamba Road, Harwood

Plate 7-2: Viewpoint 26B – Yamba Road, Harwood

Plate 7-3: Viewpoint 27A – Palmers Channel bridge, Yamba Road, Harwood

7.12.1 Viewpoint 26A – Yamba Road, Harwood

Description

Foreground view north-east near the public boat ramp and next to residential dwellings, Yamba Road, South Harwood.

EIS Assessment

The viewpoint was assessed to have Moderate to High sensitivity around the local heritage listed existing Harwood bridge and many local residents and motorists would have repeated access to this view. The EIS concept was assessed to have Moderate to Low magnitude as the new elevated bridge would be visible, however, existing vegetation would screen much of it in the view. This gave an overall visual impact of Moderate.

Visual Impact Assessment

The detailed design would not change the sensitivity rating assessed in the EIS, which would remain Moderate to High. While the new bridge is not part of the detailed design scope for this draft UDLP, it will be constructed at the same time as these works and is assessed in a separate submission. The new bridge scale will be similar to the EIS concept, therefore the magnitude rating would remain the Moderate to Low. The overall visual impact would remain Moderate.

7.12.2 Viewpoint 26B – Yamba Road, Harwood

Description

Middle ground view west along Yamba Road, Harwood (south) on the riverbank.

EIS Assessment

The viewpoint was assessed to have Moderate to High sensitivity around the local heritage listed existing Harwood bridge and many local residents and motorists would have repeated access to this view. The EIS concept was assessed to have Moderate to High magnitude as the new bridge and fill embankments would dominate the view. This gave an overall visual impact of Moderate to High.

Visual Impact Assessment

The detailed design would not change the sensitivity rating assessed in the EIS, which would remain Moderate to High. While the new bridge is not part of the detailed design scope for this draft UDLP, it will be constructed at the same time as these works and is assessed in a separate submission. The new bridge scale will be similar to the EIS concept, therefore the magnitude rating would remain the Moderate to Low. The overall visual impact would remain Moderate to High.

7.12.3 Viewpoint 27A – Palmers Channel bridge, Yamba Road, Harwood

Description

Distant view north-west across agricultural land near Palmers Channel Bridge, Yamba Road, Harwood.

EIS Assessment

The viewpoint was assessed to have Moderate sensitivity as a moderate number of local people would have long duration or repeated access to the changed view. The EIS concept was assessed to have Low magnitude as the new bridge would only impact a small portion of the overall landscape view. This gave an overall visual impact of Moderate to Low.

Visual Impact Assessment

The detailed design would not change the sensitivity rating assessed in the EIS, which would remain Moderate. While the new bridge is not part of the detailed design scope for this draft UDLP, it will be constructed at the same time as these works and is assessed in a separate submission. The new bridge scale will be similar to the EIS concept, therefore the magnitude rating would remain the Low. The overall visual impact would remain Moderate to Low.

Plate 7-4: Viewpoint 27B – South Bank Road, Palmers Channel

Plate 7-5: Viewpoint 28 – Public Jetty, Clarence River, Harwood

Plate 7-6: Viewpoint 29 – End Harwood Road, Harwood

7.12.4 Viewpoint 27B – South Bank Road, Palmers Channel

Description

Distant view north-west over sugar cane plantations, South Bank Road, Palmer Channel.

EIS Assessment

The viewpoint was assessed to have Moderate sensitivity for a low number of residents and local people who will have long duration and/or repeated access to a changed foreground view. The EIS concept was assessed to have Low magnitude as the new elevated bridge would intercept the horizon in this view, however, it would impact only a small portion of the view. This gave an overall visual impact of Moderate to Low.

Visual Impact Assessment

The detailed design would not change the sensitivity rating assessed in the EIS, which would remain Moderate. While the new bridge is not part of the detailed design scope for this draft UDLP, it will be constructed at the same time as these works and is assessed in a separate submission. The new bridge scale will be similar to the EIS concept, therefore the magnitude rating would remain the Low. The overall visual impact would remain Moderate to Low.

7.12.5 Viewpoint 28 – Public Jetty, Clarence River, Harwood

Description

Foreground view south-east from a public jetty on the Clarence River, Harwood.

EIS Assessment

The viewpoint was assessed to have High sensitivity due to the local heritage listed existing Harwood bridge with many local residents having repeated access to this changed view in a highly scenic setting. The EIS concept was assessed to have High magnitude due to the major new elevated bridge infrastructure at an existing bridge crossing. This gave an overall visual impact of High.

Visual Impact Assessment

The detailed design would not change the sensitivity rating assessed in the EIS, which would remain High. While the new bridge is not part of the detailed design scope for this draft UDLP, it will be constructed at the same time as these works and is assessed in a separate submission. The new bridge scale will be similar to the EIS concept, therefore the magnitude rating would remain the High. The overall visual impact would remain High.

7.12.6 Viewpoint 29 – End Harwood Road, Harwood

Description

Middle ground view south-west, end of Harwood Road, Harwood on the foreshore opposite residential dwellings.

EIS Assessment

The viewpoint was assessed to have High sensitivity around the local heritage listed existing Harwood bridge and Harwood Heritage Conservation Area with many local residents having repeated access to this changed view in a highly scenic setting. The EIS concept was assessed to have High magnitude due to the major new elevated bridge infrastructure at an existing bridge crossing. This gave an overall visual impact of High.

Visual Impact Assessment

The detailed design would not change the sensitivity rating assessed in the EIS, which would remain High. While the new bridge is not part of the detailed design scope for this draft UDLP, it will be constructed at the same time as these works and is assessed in a separate submission. The new bridge scale will be similar to the EIS concept, therefore the magnitude rating would remain the High. The overall visual impact would remain High.

Plate 7-7: Viewpoint 30 – Corner Cannons Lane and River Street, Harwood

7.12.7 Viewpoint 30 – Corner Cannons Lane and River Street, Harwood

Description

Distant view east over sugar cane plantations from the intersection of Cannons Lane and River Street, Harwood,

EIS Assessment

The viewpoint was assessed to have Low sensitivity as a low number of local residents/ motorists would have repeated access to this changed view. The EIS concept was assessed to have Low magnitude due to the distance of the new elevated bridge structure and it only impacting a small portion of the overall landscape view. This gave an overall visual impact of Low.

Visual Impact Assessment

The detailed design would not change the sensitivity rating assessed in the EIS, which would remain Low. While the new bridge is not part of the detailed design scope for this draft UDLP, it will be constructed at the same time as these works and is assessed in a separate submission. The new bridge scale will be similar to the EIS concept, therefore the magnitude rating would remain the Low. The overall visual impact would remain Low.

Plate 7-8: Viewpoint 31 – Ashby Heights

7.12.8 Viewpoint 31 – Ashby Heights

Description

Distant view over grazing land next to rural residential dwellings, Murrayville Road, Ashby Heights.

EIS Assessment

The viewpoint was assessed to have Low sensitivity as a low number of people/ motorists would have long duration or repeated access to this changed view. The EIS concept was assessed to have Low magnitude due to the distance of the upgrade in an agricultural setting. This gave an overall visual impact of Low.

Visual Impact Assessment

The detailed design would not change the sensitivity rating assessed in the EIS, which would remain Low. The detailed design will be similar to the EIS concept, therefore the magnitude rating would remain the Low due to the distance of the upgrade. The overall visual impact would remain Low.

7.13 VISUAL IMPACT ON NEARBY HOUSES

In addition to the key views, the visibility of the project to nearby houses along the corridor (that were not considered in the EIS) was assessed. At the time of writing, it was not possible to inspect individual properties, therefore a desktop assessment was undertaken using aerial photography and views to properties from the highway.

The assessment takes into consideration the screening effect of vegetation not impacted by the project, vegetation cleared by the project, and sugarcane fields that have seasonal impacts on visibility. Affected property owners have been consulted.

7.13.1 Properties 2 and 3

Distance to highway: 35 metres

Foreground views to the existing Harwood Bridge. Existing trees next to property two partially screen the existing bridge.

Visual impact: High

A staggered triple row of Spotted Gum will be planted on the western side of the existing bridge to provide additional screening as the trees mature over time.

7.13.2 Property 4

Distance to highway: 40 metres

Foreground views to the existing Harwood Bridge. Existing trees partially screen the northern end of the bridge.

Visual impact: High

The existing trees will be retained. A row of Spotted Gum will be planted on the western side of the existing bridge to provide additional screening as the trees mature over time.

7.14 SUMMARY OF VISUAL IMPACTS

7.14.1 Summary of visual impacts

Overall, the detailed design is considered to have a similar impact on key views as the EIS concept. For two viewpoints there is an change in the magnitude rating for the detailed design assessment. These are:

- Viewpoint 32B Watts Lane (west), where the removal of the Watts Lane overbridge and replacement with the highway alignment elevated about 3 m above the existing ground level on twin bridges, reduces the magnitude rating from Moderate to High to Moderate

Refer to figure 7-16 for locations of view points

A summary of the EIS and detailed design impact assessment is presented in Table 7-4.

A number of residential dwellings are located in close proximity to the highway with varying degrees of visibility to the highway depending of the the amount of vegetation next to the highway or around the dwelling. Where roadside vegetation will be removed for the project near these dwellings, it will be replaced with native species.

- At Property 1, no roadside screen planting will be provided in order to maintain good quality views over the floodplain and to maintain the integrity of the marker planting.

Table 7-4: Key viewpoints summary

VIEWPOINT	EIS SENSITIVITY	DETAILED DESIGN SENSITIVITY	EIS MAGNITUDE	DETAILED DESIGN MAGNITUDE	EIS IMPACT RATING	DETAILED DESIGN IMPACT RATING
26A. Yamba Road, Harwood	Moderate to High	*No change*	Moderate to Low	*No change*	**Moderate**	***No change***
26B. Yamba Road, Harwood	Moderate to High	*No change*	Moderate to High	*No change*	**Moderate to High**	***No change***
27A. Palmers Channel bridge, Yamba Road	Moderate	*No change*	Low	*No change*	Moderate to Low	No change
27B. South Bank Road, Palmers Channel	Moderate	*No change*	Low	*No change*	Moderate to Low	No change
28. Public Jetty, Clarence River, Harwood	High	*No change*	High	*No change*	**High**	***No change***
29. End Harwood Road, Harwood	High	*No change*	High	*No change*	**High**	***No change***
30. Cnr Cannons Lane & River Street	Low	*No change*	Low	*No change*	Low	***No change***

7.15 VISUAL MITIGATION STRATEGY

7.15.1 Mitigation recommended during concept design

The *Landscape Character and Visual Impact Assessment* report (Hassell, 2012) undertaken during the EIS outlined specific mitigation measures provided at every vantage point to seek to ensure that areas assessed at high impact were properly and appropriately considered at design and implementation stages.

In summary, mitigation recommended for viewpoints within Sections 5, excluding those related to the bridge over Clarence River at Harwood, are shown in Table 7-5.

Table 7-5: Mitigation measures recommended in the EIS

	Viewpoints where applicable					
MITIGATION MEASURE	**VP26A**	**VP26B**	**VP27A**	**VP28**	**VP29**	**VP30**
Minimise loss of existing screen/riparian trees	●	●	NA	NA	NA	NA
Minimise the loss of existing riparian vegetation as much as possible	●	●	●	●	●	NA
Provide screen planting to the new elevated approach road embankment in accordance with the concept design	●	●		●	●	
Plant dense low grasses/ ground covers on fill batters	●	●		●	●	
Reinstate agricultural land where possible	NA	NA	NA	NA	NA	NA
Reinstate riparian vegetation where possible	●	●		●	●	
Minimise loss of existing trees	●	●	NA	●	●	●
Provide screen tree and shrub planting on embankments and between access and service roads in accordance with the landscape concept strategy and to provide a dense screen to nearby homes	●	●		●	●	
Highlight the highway and over pass routes with formal tree planting	●	●		●	●	
Prepare detail landscape design in accordance with the landscape concept strategy	●	●		●	●	
Consider filling between service roads and highway to reduce height of embankments						
Retain existing Araucaria which is prominent in the existing landscape						
Minimise the depth of the bridge deck	●	●		●	●	
Provide new screen and forest planting along the alignment of the project (including on/off ramps, service roads) in accordance with the concept design	●	●				
Revegetate between the interchange at Iluka Road and existing homes located on the east side in accordance with the concept design						
Retain existing vegetation wherever possible to provide a natural screen to the project	●	●		●	●	
Plant local forest trees on fill batters	●	●		●	●	
Reinstate the forest edge where applicable	●	●		●	●	

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8. LANDSCAPE DESIGN FOR THE BRIDGE OVER CLARENCE RIVER AT HARWOOD

Chapter contents

Note: Landscape shown at maturity. Drawing and design is subject to further consultation and development. The number of trees is indicative only and subject to road safety consideration.

Figure 8-1: Artist's impression of the landscape design at the bridge over Clarence River at Harwood aerial view looking south west

8.1 LANDSCAPE DESIGN AT THE BRIDGE

Overview

The landscape concept for the bridge over Clarence River at Harwood has been developed in direct response to the project wide objectives and principles for Maclean to Iluka Road (Section 5).

Refer to the Maclean to Devils Pulpit (Sections 5 and 6) draft urban design and landscape plan for a full description of the landscape and urban design concept.

This chapter provides an overview of the key components of the bridge over Clarence River at Harwood landscape concept, and its relationship with the road alignment and road elements as they would be experienced when travelling from south to north along the Pacific Highway Upgrade.

From the road users' perspective, the highway upgrade is characterised by the wide, flat, open landscape of the Clarence River floodplain, which is strongly contrasted with the adjacent forested hills to the north and south. The bridge project passes through two landscape character zones defined in the EIS:

- 27: Clarence River floodplain
- 29 - Harwood township

This chapter describes the landscape design associated with the bridge over Clarence River at Harwood. Landscape context has been provided with a description of:

- The southern approach
- Yamba Interchange
- Harwood Interchange
- The northern departure.

Refer to figure 8-1.

8.2 LANDSCAPE DESIGN DESCRIPTION

8.2.1 Landscape Management Plan

The scale of the project requires a consistent approach to the establishment and maintenance of the landscape which is documented in the Woolgoolga to Ballina Landscape Management Plan (LMP). The LMP relates to Section 5 of the project (ie. the landscape either side of the bridge) and is included in the Pacific Complete, Maclean to Devils Pulpit Section 5 and 6, Urban design and landscape plan, dated February 2017. Chapters 7 and 8 contain descriptions of the landscape, establishment and maintenance principles; the LMP is included in Appendix C.of the report.

8.2.1 Southern approach

The current landscape experience from the highway on the southern approach to the Clarence River is defined to the west primarily by sweeping views across the agricultural floodplain, which are occasionally filtered by intermittent groups of trees, to the forested hills beyond the Clarence River. The roadside groups of trees will to be cleared to facilitate the roadworks. To the east, the highway is defined by the coastal forest of the Yaegl Nature Reserve. On the northern approach to the Yamba Interchange area, the highway is enclosed on both sides by coastal forest.

Landscape and urban design

The landscape design concept is to reinstate the existing landscape experience. This will be achieved with forest revegetation where the highway currently adjoins forest, using plant species from the adjoining vegetation communities. Where the highway currently adjoins agricultural land, the revegetation works will consist of pasture grasses to maintain existing views to the agricultural fields and forested hills to the west. A dense shrub landscape is provided in the median to visually separate the two carriageways, reinforce the sense of enclosure and screen headlight glare from oncoming traffic.

8.2.1 Yamba Interchange landscape design

The south entry to the interchange has a sweeping left hand curve that forms the southern approach to the new bridge as well as an interchange with Yamba Road on the southern bank of the Clarence River. Yamba Road is a regional road that provides access to Maclean to the south-west and Yamba to the east.

Landscape and urban design

The landscape and urban design for the Yamba Interchange is to provide distinctive maker tree plantings alongside the northbound carriageway from approximately 2 kilometres south of the interchange, in order to visually signify and reinforce the approach to the interchange.

The Mangrove (Grey Mangrove) low closed forest of the NSW Coastal Bioregions community, which is protected under the *Fisheries Management Act 1994*, occurs along the Clarence River foreshore in the vicinity of the bridge over Clarence River at Harwood. A limited area of Mangroves on the banks of the Clarence River near the bridge will be removed. This will allow for the construction of the new bridge in accordance with the relevant environmental approval requirements and as documented in the Construction and Environmental Management Plan.

Note: Landscape shown at maturity. Drawing and design is subject to further consultation and development. The number of trees is indicative only and subject to road safety consideration.

Figure 8-2: Artist's impression of the landscape design at the bridge over Clarence River at Harwood from Viewpoint 28

8.3 LANDSCAPE SCREENING OF THE BRIDGE

8.2.1 Northbound arrival experience

The design for the interchange arrival sequence from the south includes:

- A small grid planting of Cook Pine *(Araucaria columnaris)* just north of Farlows Lane at leading to the Yamba Interchange
- Roadside planting of Moreton Bay Fig *(Ficus macrophylla*) starting at 200 metre spacing gradually decreasing to 20 metre spacing at CH on the apprach to the interchange
- A medium sized grid planting of Cook Pine *(Araucaria columnaris*) at CH 84,400 to signal 1 kilometre from the Yamba Interchange
- From CH 84,800 the highway is defined on both sides by coastal forest. From here, the roadside plantings of Hills Weeping Fig *(Ficus microcarpa var. hillii)* would be at 20 metre spacings that would continue to the interchange
- A large grid planting of Cook Pine *(Araucaria columnaris)* at the start of the northbound exit ramp, at approximately CH 85,400.
- Roadside groupings of Tuckeroo *(Cupaniopsis anacardioides)* to define the northbound exit ramp, connection to Yamba Road and connection to the existing Harwood Bridge
- Grid planting of Cook Pine *(Araucaria columnaris)* within the new roundabout and roadside planting of Hoop Pines (*Araucaria cunninghamii*) around the outside of the roundabout

Refer to figures 8-4, 8-5 and 8-7.

8.2.1 Southbound departure experience

The design for the southbound departure sequence includes:

- A large grid planting of Cook Pine *(Araucaria columnaris)* alongside the highway, starting at the southern abutment of the new Clarence River bridge
- Roadside groupings of Tuckeroo *(Cupaniopsis anacardioides)* to define the eastern side of the southbound exit ramp
- A large grid planting of Cook Pine *(Araucaria columnaris)* to define the inside curve of the southbound exit ramp as it joins the entry/exit road to Yamba Road.

Refer to figure 8-5 and 8-7.

8.2.1 Southbound arrival experience

The design for the southbound highway entry sequence includes:

- Roadside groupings of Tuckeroo *(Cupaniopsis anacardioides)* to define both sides of the entry/exit road to Yamba Road and the southbound entry ramp
- Roadside planting of Hoop Pines *(Araucaria cunninghamii)* on Yamba Road on the eastern side of the new Clarence River bridge
- Roadside planting of Hoop Pines *(Araucaria cunninghamii)* on the southbound entry/exit road at the intersection with the local access road under the new bridge.

Tree species selection

The signature tree species selections reference the natural and cultural landscapes of the area in the following ways:

- The Cook Pine is currently being introduced as a signature tree species in Yamba
- The Moreton Bay Fig is a large rainforest tree of appropriate scale for roadside planting next to grazing land
- The Tuckeroo is a distinctive native tree that can be found throughout the region
- The Hoop Pine is a locally appropriate species, similar in habit to the Norfolk Island Pine which is a predominant street tree species in Yamba. They have been used to define key intersections on the route to Yamba within the interchange.

Refer to figures 8-6 and 8-7.

8.3.1 Landscape screening of the bridge and flood modelling

The landscape and urban design proposes to screen the new bridge on the northern banks of the river from the properties within Harwood. This will be achieved by providing rows of Forest Red Gum *(Eucalyptus tereticornis)* that are aligned to be perpendicular to the bridge and align with the bridge piers.

Beyond this, a single row of Forest Red Gum will be planted parallel to the bridge, south of Watts Lane, reinforcing the screening and providing a sense of enclosure. The overall appearance will be of a tree canopy screening the bridge when the landscape reaches maturity. The ground plane will consist of pasture grasses and soft scour protection.

On the southern bank, Forest Red Gums will be planted to align with the bridge piers of the existing Harwood Bridge. This will provide partial screening if the new bridge to viewers from the west. The Hoop Pine and Tuckeroo planting associated with the Yamba Interchange is located east of the new bridge.

The visual screening of the bridge has been slightly modified from the proposal EIS to accommodate the requirements of flood modelling. The visual screening is therefore appropriate to the flood modelling and requirements set out in the EIS.

Tree species selection

The signature tree species selections reference the natural and cultural landscapes of the area in the following ways:

- The Forest Red Gum is a locally appropriate floodplain species with a striking trunk and high branching to provide screening of the bridge

Refer to figures 8-3, 8-4, 8-5, 8-6 and 8-7.

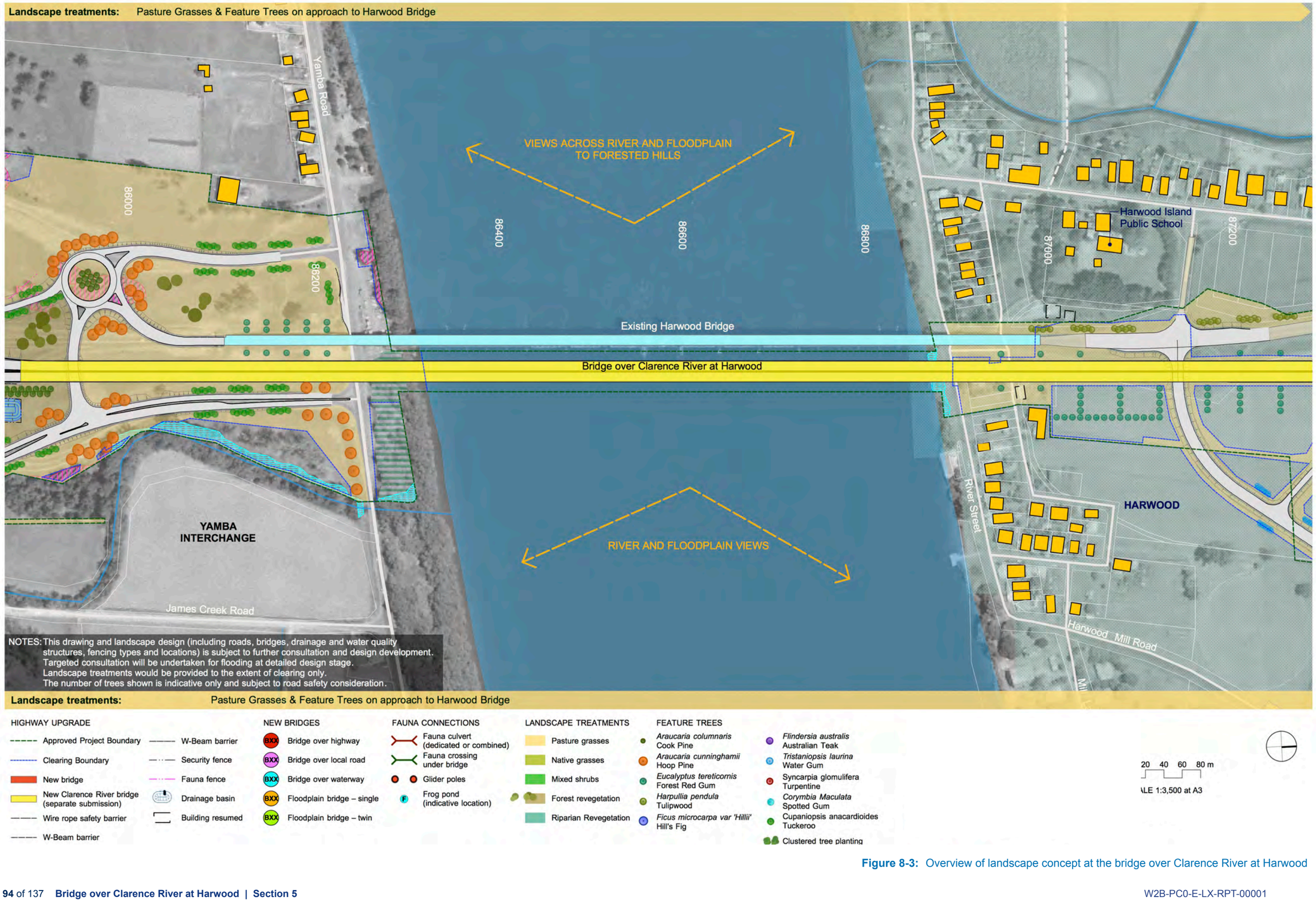


Figure 8-3: Overview of landscape concept at the bridge over Clarence River at Harwood

8.3.1 Harwood Interchange design

At approximately 700 metres north of Watts Lane, the new carriageways deviate from the existing highway alignment on the northern approach to the new bridge over the Clarence River. In the vicinity of Watts Lane, the highway is supported by Bridge B52 – Twin bridges for Clarence Floodplain Opening 4, a new 370 metre long pair of bridges over Watts Lane. The northern abutment for the new bridge over the Clarence River is located about 355 metres south of Bridge B52. The southbound exit ramp connects with a new local access road between the existing Pacific Highway and Mill Road. The former Pacific Highway is retained as a local road between the existing Harwood Bridge and Watts Lane.

The current landscape experience from the highway at the Harwood Interchange is characterised by views to rural residential properties in Harwood township and the existing Harwood Bridge, the primary built landmark that distinguishes the local area. Located to the east of the interchange, the chimney stack of the Harwood Sugar Mill is also a prominent built landmark that can be seen from the southbound carriageway but primarily from Harwood Bridge. The Harwood Island Public School is located adjacent to the existing Pacific Highway and immediately south of the new local access road to Mill Road.

Landscape and urban design

The landscape and urban design for the Harwood Interchange is to provide distinctive avenue planting south of Watts Lane to visually signify and reinforce the approach to Harwood Bridge.

8.3.1 Driver experience

The design for the highway sequence in both directions includes:

- Roadside planting of Australian Teak *(Flindersia australis)* on both sides of the highway south of Watts Lane to alert motorists to the upcoming Clarence River crossing and southbound exit road to Harwood

Refer to figure 7-10 for an elevation of the bridge with indicative trees.

- Roadside groupings of Tulipwood *(Harpullia pendula)* on both sides of the highway north of Bridge B52 identifies the northbound entry onto the highway from Watts Lane and provides the first formalised tree planting on the floodplain for southbound motorists, alerting them to the upcoming town of Harwood
- Roadside groupings of Water Gum *(Tristaniopsis laurina)* on the new road linking Morpeth Street to Mill Road.

Tree species selection

The signature tree species selections reference the natural and cultural landscapes of the area in the following ways:

- The Australian Teak provides a striking avenue with its rounded habit and glossy leaves
- The Tulipwood is a distinctive native tree that can be found throughout the region
- The Water Gum is a small street tree common to the area and has been used to reinforce the entry into Harwood whilst still allowing views into and out of the town.

Refer to figure 8-3 and 8-7.

8.3.1 Northern departure

North of the Clarence River the highway upgrade crosses the wide flat agricultural floodplain landscape of Harwood Island and Chatsworth Island to reach the Clarence River North Arm.

The length of highway between the Clarence River and the Clarence River North Arm is approximately 7.1 kilometres, which is singularly characterised by the vast flat agricultural landscape of sugar cane fields. The only exceptions to this consistent landscape experience are encountered at:

- Harwood, a small township located on either side of the Pacific Highway at northern banks of the Clarence River
- The Serpentine Channel, which separates Harwood Island in the south from Chatsworth Island in the north. The Serpentine Channel is encountered on the highway approximately one third of the distance from the Clarence River to the Clarence River North Arm. It is defined by riparian vegetation along its banks that provide a strong visual contrast to the surrounding agricultural fields.
- Riparian vegetation on the southern banks of the Clarence River North Arm, which marks the northern end of Chatsworth Island.

The highway upgrade across Harwood Island and Chatsworth Island duplicates the alignment of the existing Pacific Highway, which would be retained as the new southbound carriageway. The new northbound carriageway would be built entirely on fill embankment approximately three metres high.

Shadowing of properties in Harwood by landscape and the bridge is illustrated and described in chapter 7.

Landscape and urban design

The landscape and urban design is to celebrate the ‘big landscape’ that is the Clarence River floodplain at Harwood Island and Chatsworth Island. This is done by limiting tree planting in order to allow the highly recognisable sugar cane plantation landscape to dominate the visual experience from the highway. The revegetation works on Harwood Island and Chatsworth Island would consist of pasture grasses to maintain views across the agricultural floodplain.

Refer to figures 8-1 and 8-3.

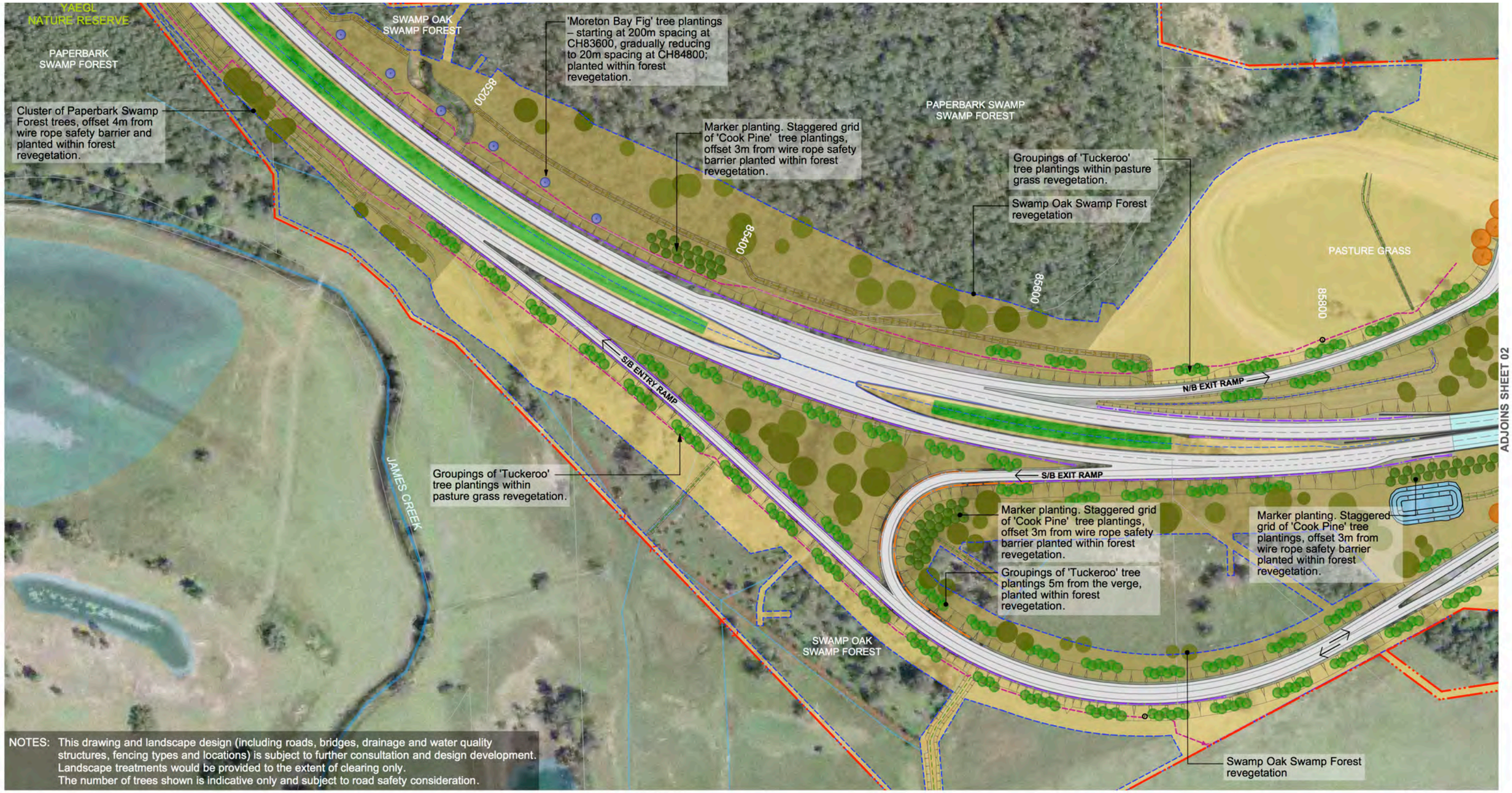
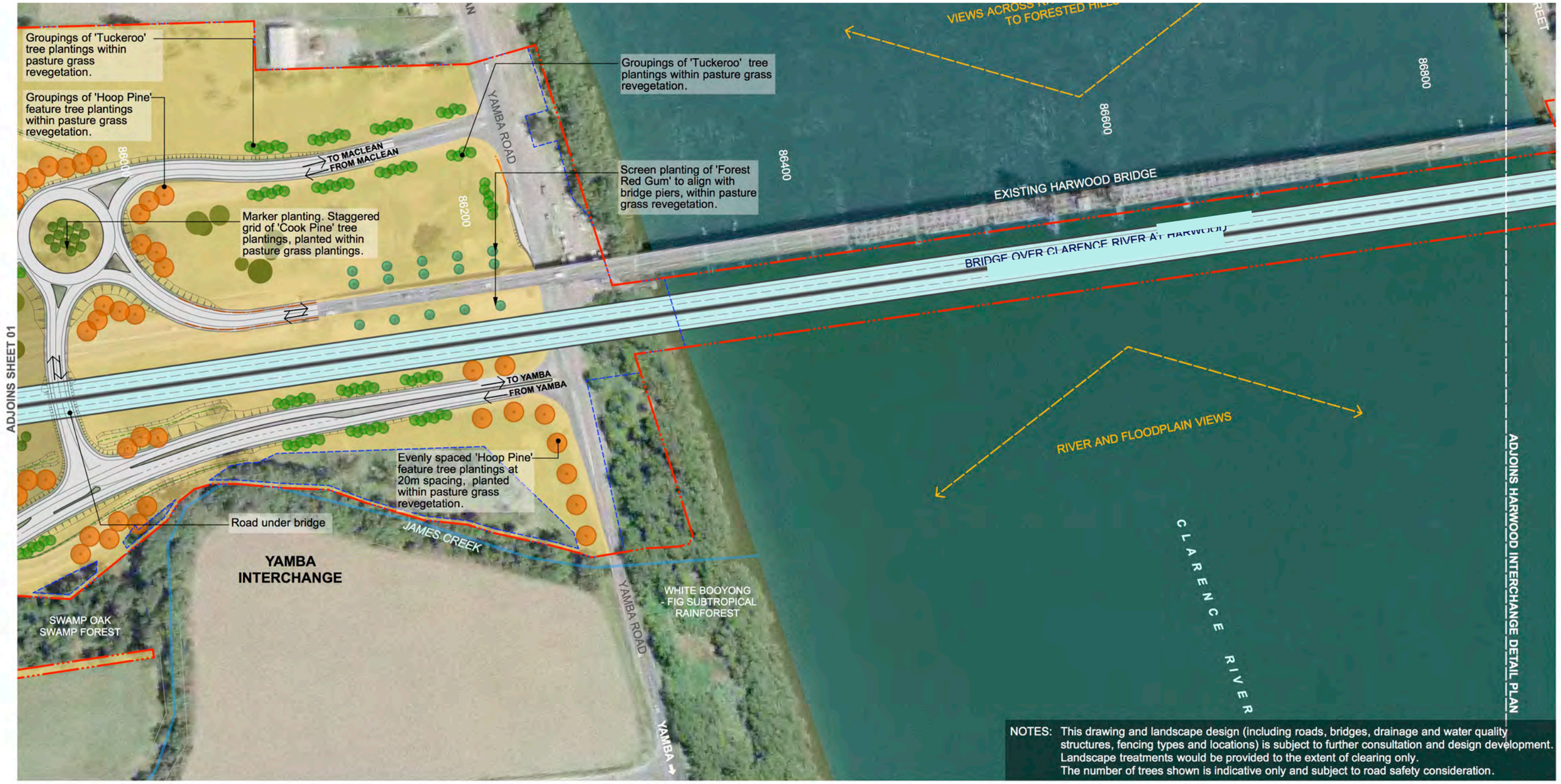


Figure 8-4: Yamba interchange landscape design on approach to the new bridge



LEGEND

EXISTING FEATURES
- Waterway / water body
- Property boundary

HIGHWAY UPGRADE
- Approved project boundary
- Clearing Boundary
- Wire rope safety barrier
- W-Beam barrier
- Dedicated fauna culvert
- Fauna fence
- Drainage basin

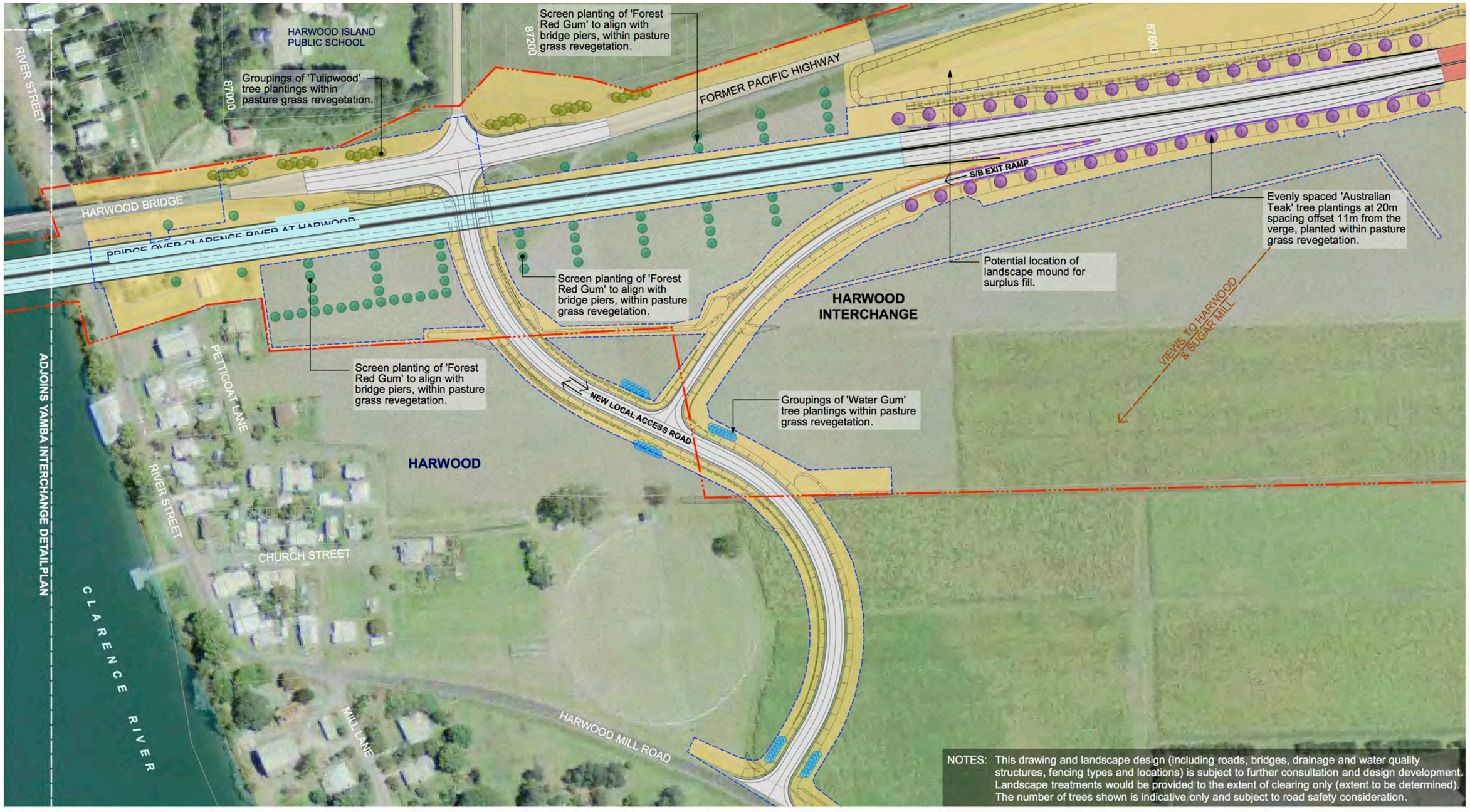
LANDSCAPE TREATMENTS
- Pasture grasses
- Native grasses
- Mixed shrubs
- Forest revegetation
- Riparian revegetation

FEATURE TREES
- *Araucaria columnaris* Cook Pine
- *Araucaria cunninghamii* Hoop Pine
- *Eucalyptus tereticornis* Forest Red Gum
- *Harpullia pendula* Tulipwood
- *Ficus microcarpa var 'Hillii'* Hill's Fig
- *Flindersia australis* Australian Teak
- *Cupaniopsis anacardioides* Tuckeroo
- *Tristaniopsis laurina* Water Gum
- Syncarpia glomulifera Turpentine
- *Corymbia Maculata* Spotted Gum
- Clustered Native tree planting

0 20 40 60 80 m
SCALE 1:2,500 at A3

Sheet 2 of 3

Figure 8-5: Yamba interchange and the approach to the bridge over Clarence River at Harwood



LEGEND

EXISTING FEATURES
- Waterway / water body
- Property boundary

HIGHWAY UPGRADE
- Approved project boundary
- Clearing Boundary
- Wire rope safety barrier
- W-Beam barrier
- Dedicated fauna culvert
- Fauna fence
- Drainage basin

LANDSCAPE TREATMENTS
- Pasture grasses
- Native grasses
- Mixed shrubs
- Forest revegetation
- Riparian revegetation

FEATURE TREES
- *Araucaria columnaris* Cook Pine
- *Araucaria cunninghamii* Hoop Pine
- *Eucalyptus tereticornis* Forest Red Gum
- *Harpullia pendula* Tulipwood
- *Ficus microcarpa var 'Hillii'* Hill's Fig
- *Flindersia australis* Australian Teak
- *Cupaniopsis anacardioides* Tuckeroo
- *Tristaniopsis laurina* Water Gum
- Syncarpia glomulifera Turpentine
- *Corymbia Maculata* Spotted Gum
- Clustered Native tree planting

0 20 40 60 80 m
SCALE 1:2,500 at A3

Sheet 3 of 3

Figure 8-6: Harwood interchange and the approach to the bridge over Clarence River

Note: Landscape shown at maturity. Drawing and design is subject to further consultation and development. The number of trees is indicative only and subject to road safety consideration.

Figure 8-7: Artists impression of Yamba interchange and the approach to the bridge over Clarence River

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9. CONCLUSION

Chapter contents

Plate 9-1: Clarence River with the existing Harwood Bridge with the Pacific Ocean in the background. Source: Pacific Complete

9.1 CONSTRUCTION

As a Design and Construct contract, one of the benefits of this delivery approach is that summary construction information can be provided for the bridge over Clarence River at Harwood, based on current information. Construction strategies are likely to undergo further development in later stages of the project, and some of these strategies may change:

Construction is anticipated to occur during a two-year period in 2017 and 2018

- Piling is proposed to be a combination of driven steel and bored piles
- U-girders will be precast on site in Harwood at a dedicated temporary precast facility, including concrete batch plant
- The concrete batch plant is likely to be constructed adjacent to the eastern side of the alignment at the north end of the bridge
- The construction of U-girders in Harwood will reduce the need for on-road transport
- Pile caps, piers and headstocks to be cast in-situ (although piers may yet be pre-cast)
- U-girders may be placed by crane on a barge or on a launching frame for construction in the river
- The concrete deck for the bridge will be cast in-situ on precast panels
- Precast concrete parapets will be installed on the deck
- An asphalt surfacing will be applied to the concrete deck of the bridge
- Twin barrier steel railing will be placed on the outer parapets
- Construction access to the river will be via a jetty on the northern bank of the river on the eastern (downstream) side of the new bridge
- Interchange and local road earthworks and final pavement construction will be staged to accommodate both geotechnical ground settlement issues and traffic management requirements.

9.2 CONCLUSION

This Urban Design and Landscape Plan addressed the requirements of the Minister's Conditions of Approval (MCoA) D20 and presents an integrated urban design for the Woolgoolga to Ballina upgrade. This plan specifically addresses the Maclean to Iluka Road – Section 5; bridge over Clarence River at Harwood project and demonstrates the commitment to mitigation and management measures identified in the Woolgoolga to Ballina upgrade Environmental Impact Statement (EIS), the Submissions / Preferred Infrastructure Report (SPIR), and other approved environmental management documentation.

The Urban Design and Landscape Plan outlines the best practice methodology and processes that have been used to achieve a high quality outcome for the design of the new bridge, the complimentary relationship with the existing Harwood bridge and its integration in the regional and local context.

The new bridge and local road connections are designed to enhance local connectivity, and feature new facilities for pedestrians and cyclists. The new bridge will afford new opportunities for Pacific Highway users to experience the Clarence River floodplain, Pacific Ocean and Great Dividing Range from the elevated position over the Clarence River shipping lane.

The plan provides the vision, objectives and design strategies with respect to the design of the new bridge over the Clarence River at Harwood. The report provides information on the tender, design, selection and construction process. It also provides detailed information on how the design addresses the design principles identified in the EIS and EIS Working Paper, Biodiversity. The draft plan provides confirms that design of the new bridge is consistent with the visual assessment in the EIS.

The plan addresses all items in the Minister's Condition of Approval D20, Project Approval Notice, dated 14 August 2014, and Modifications to the Project Approval, dated 15 January 2015, and 7 October 2015.

The draft plan was prepared by the applicant, Roads and Maritime Services for consultation with stakeholders, agencies and the community, Appendix C contains the Consultation report with responses which have been incorporated and cross referenced to the UDLP. In accordance with MCoA D20 Roads and Maritime Services seeks approval of the Secretary to commence permanent built works.

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10. BIBLIOGRAPHY

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10.1 BIBLIOGRAPHY

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A. APPENDIX A - COMPLIANCE SCHEDULES & REFERENCING

Chapter contents

A.1 URBAN DESIGN AND LANDSCAPE ENVIRONMENTAL MANAGEMENT MEASURES IDENTIFIED IN CHAPTER 5 OF THE SPIR

The following Table A-1 summarises the urban design and landscape environmental management measures identified in Chapter 5 of the Submissions / Preferred Infrastructure Report (SPIR) and identifies where these measures are addressed in this document.

Table A-1: Urban design and landscape environmental management measures identified in Chapter 5 of the SPIR

ISSUE	ID	ENVIRONMENTAL MANAGEMENT MEASURE	TIMING	DOCUMENT REFERENCE
Noise wall visual impacts	UD1	If further noise modelling identifies that noise walls are required, further visual assessment address the visual implications of the change. Their location and design will be in accordance with the *Noise Wall Design Guideline* (RTA, 2007) and the principles identified in *Working Paper – Urban design, Landscape Character and Visual Impact* (Section 4.6.3).	Pre-construction	N/A There are no noise walls required for the bridge over Clarence River at Harwood nor in Maclean and Devils Pulpit (Sections 5)
Clarence River and Richmond River bridge impacts	UD2	Changes to the design of the Clarence and Richmond rivers bridges from this EIS, will require further visual assessment. Any changes will consider the principles identified in *Working Paper – Urban design, Landscape Character and Visual Impact* (Section 4.6.2), the performance criteria outlined in Chapter 5 of the EIS and funding arrangements.	Pre-construction	No. The new bridge over the Clarence River at Harwood the subject of this report, the visual assessment is in Chapter 7 of this report
Landscaping and planting strategy	UD3	The project will be carried out in accordance with the urban design and landscaping strategy, as identified in Section 11.4.1 of this EIS. Detailed landscape design for all project batters, and median planting areas will be developed in accordance with the *Landscape Guidelines* (RTA, 2008), the requirements of the *Working Paper – Biodiversity* (Section 5.2.2) and the landscape strategy to provide a robust, successful and effective planting design.	Pre-construction	Chapters 6, 7, and 8 Compliance tables are provided in Chapter 3
Design of urban design features and road furniture	UD4	The built form of the project, including consideration of the height, bulk, scale, materials and finishes for: • Bridges • Retaining walls • Cuttings and embankments • Road barriers • Signage • Fences • Clear zones • Topsoil management. • Water quality control ponds. • Fauna crossing. • Place marking and cultural plantings. 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 guidelines.	Pre-construction	Chapters 6, 7 and 8
Shadowing	UD5	Further assessment will be undertaken of the impact of overshadowing on areas surrounding the project, particularly around Harwood Bridge, interchanges and overpasses near residential properties.	Pre-construction	Chapter 7
Visual impacts and viewpoints	UD6	Measures to mitigate visual impacts to viewpoints will be implemented, as identified in Table 11-42 and *Working Paper – Urban Design, Landscape Character and Visual Impact*. If any further viewpoints were identified during detailed design that have a moderate–high or high impact, screen planting is also to be considered.	Construction	Chapter 7
Construction visual impacts	UD7	Disturbed areas will be progressively re--vegetated throughout the construction period.	Construction	Chapters 6, 7 and 8

ISSUE	ID	ENVIRONMENTAL MANAGEMENT MEASURE	TIMING	DOCUMENT REFERENCE
Visual impacts of ancillary facilities	UD8	Where required, typical landscape treatments for ancillary facilities in forest areas will include: • Providing screen planting • Considering reinstatement of disturbed forest in heavily forested • Considering the importance of the visual landscape at each location and allowing restoration of important forest vegetation to prominent ridge lines or other landscape elements where feasible and reasonable • Negotiating with private landowners, as applicable, to determine future treatments for other non-forested ancillary facility locations • Re-grading disturbed areas to achieve a sustainable and functional landform • Stabilising all surfaces in accordance with good engineering and environmental practice.	Construction	Chapter 6
Visual impacts of ancillary facilities	UD9	Typical landscape treatments for ancillary facilities in agricultural areas will include: • Considering returning remnant agricultural land to agricultural uses • Providing screen planting • Reinstating riparian vegetation through ancillary facilities, where practicable, in the open landscape • Considering the visual landscape at each ancillary facility and considering restoration of important forest vegetation to prominent ridge lines or other landscape elements where feasible and reasonable • Re-grading disturbed areas to achieve a sustainable and functional landform • Stabilising all surfaces in accordance with good engineering and environmental practice.	Construction	Chapter 6
Visual impact of borrow sites	UD10	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.	Pre-construction	Chapters 6, 7 and 8
Visual impact of borrow sites	UD11	Any backfilling of the Lang Hill and West of Wardell borrow sites will be undertaken with available surplus material from the project. Rehabilitation of the sites will be undertaken in accordance of the landscape strategy (UD3), design principles (UD5) and the intended future land use of the sites.	Construction	N/A Not part of Maclean to Devils Pulpit (Sections 5)
Visual impact of borrow sites	UD12	Any backfilling of the Eatons and Gibson borrow sites will be undertaken with available surplus material from the project. Landscaping on the site use indigenous species, including those species suitable for Koala. The landscaping will connect to the existing vegetation to the east of the project by a fauna land bridge to be constructed at station 147.6. Rehabilitation of the sites will be undertaken in accordance of the landscape strategy (UD3) and design principles (UD5).	Construction	N/A Not part of Maclean to Devils Pulpit (Sections 5)
Monitoring of landscaping and rehabilitation	UD13	Landscape and rehabilitation works will be monitored and remedial measures implemented where required until vegetation has stabilised.	Operation	Chapter 8
Earth mounds	UD14	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 to ensure suitable planting conditions are achieved.	Construction	N/A Not part of Maclean to Devils Pulpit (Sections 5)

A.2 ENVIRONMENTAL MANAGEMENT MEASURES IDENTIFIED IN CHAPTER 5 OF THE SPIR THAT ARE RELATED TO URBAN AND LANDSCAPE DESIGN

The following Table A-2 summarises the environmental management measures identified in Chapter 5 of the Submissions/Preferred Infrastructure Report (SPIR) that are related to urban and landscape design and are addressed by the Maclean to Devils Pulpit (Sections 5 and 6) area of the project. It also identifies where these measures are addressed in the current document.

Table A-2: Environmental management measures identified in Chapter 5 of the SPIR that are related to urban and landscape design and addressed by the Maclean to Devils Pulpit (Sections 5 and 6) area of the project

ISSUE	ID	ENVIRONMENTAL MANAGEMENT MEASURE	TIMING	DOCUMENT REFERENCE
Soils, sediment and water	SSW7	Exposed areas will be progressively rehabilitated. Methods will include permanent revegetation, or temporary protection with spray mulching or cover crops.	Construction	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 6, 7 and 8
Soils, sediment and water	SSW9	All work potentially affecting wetlands will be undertaken in consideration of the requirements outlined in the *NSW Wetlands Management Policy 2010*.	Construction	Not applicable to UDLP. Refer to Water Quality design package.
Soils, sediment and water	SSW10	Topsoil, earthworks and other excess spoil material will be stockpiled and managed in accordance with Roads and Maritime *Stockpile Management Guidelines* (Roads and Maritime, 2011) and the "Management of Surplus Material" in Section 3.9 of the SPIR	Construction	Not applicable to UDLP. Refer to Alignment and Earthworks design package.
Soils, sediment and water	SSW11	Where reasonable and feasible, stockpiles will: • Not require removal of areas of native vegetation • Be located outside of known areas of weed infestation • Be located such that waterways and drainage lines are not directly or indirectly impacted	Construction	Not applicable to UDLP. Refer to Alignment and Earthworks design package.
Biodiversity	B3	All fauna connectivity structures will be developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the *Working paper – Biodiversity and the Supplementary Biodiversity Assessment* in Appendix J of the SPIR.	Pre-construction	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 5, 7 and 8. For more detail, refer to the Fauna Connectivity design report.
Biodiversity	B5	Fauna exclusion fencing locations and design will be further developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the *Working paper – Biodiversity*.	Pre-construction and construction	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 5, 7 and 8. For more detail, refer to the Fauna Connectivity design report.
Biodiversity	B12	A landscape management plan will be developed to provide specific details for the re-establishment of native vegetation on batters, cut faces, surrounding sediment basins and other areas disturbed during construction. This includes details for the appropriate removal and restoration of temporary creek crossings. The landscape management plan will be developed in line with Roads and Maritime *Biodiversity Guidelines* (RTA, 2011), the design principles identified in the Connectivity Strategy and the design principles in *Working paper – Urban design, landscape character and visual impact*.	Pre-construction	Chapter 8
Biodiversity	B13	Disturbance and clearing of vegetation will be minimised, particularly: • Avoiding and minimising vegetation removal wherever possible through the detailed design process • Placing water quality basins in the optimal location for treating surface runoff. During detailed design, the location of water quality treatment measures will consider minimising vegetation removal, particularly where there is the potential for threatened plant species, threatened fauna habitat or in identified regional wildlife corridors.	Pre-construction and construction	Chapters 5, 6, 7, and 8.
Biodiversity	B26	Woody debris and bushrock will be re-used on site for habitat improvement where possible and will be detailed in the landscape management plan in accordance with the Roads and Maritime *Biodiversity Guidelines* (RTA, 2011).	Construction	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapter 8
Biodiversity	B40	Appropriate plant species will be incorporated into the rehabilitation of disturbed aquatic habitats and drains as a result of construction.	Construction	Chapter 8
Non-aboriginal heritage	HH22	Impacts on item 17: Harwood tram tracks,Harwood. The Petticoat Lane tram tracks section will have a protective covering placed over them, (eg a geo textile fabric and heavy duty metal sheeting or similar) to minimise impacts from construction in the area. The covering will be secured before construction and will remain in place until the end of construction.	Pre-construction and construction	Chapters 6
Traffic and transport	T&T13	The layout of the intersection at Yamba Road will be reviewed to better meet the needs of truck movements from Harwood Mill, where reasonable and feasible.	Pre-construction	Not applicable to UDLP. Refer to Alignment and Earthworks design package.

ISSUE	ID	ENVIRONMENTAL MANAGEMENT MEASURE	TIMING	DOCUMENT REFERENCE
Traffic and transport	T&T14	The need for a full interchange at Yamba Road will be investigated should traffic growth warrant it in the future and when funding is available.	Pre-construction	Not applicable to UDLP. Refer to Alignment and Earthworks design package.
Traffic and transport	T&T15	The need for a full interchange with south facing ramps at Watts Lane, Harwood will be investigated should traffic growth warrant it in the future and when funding is available.	Pre-construction	Not applicable to UDLP. Refer to Alignment and Earthworks design package.
Traffic and transport	T&T16	The need for the overpass and the arrangement of local access at Chatsworth Road will be reviewed at the detailed design stage depending on specific staging and delivery of the highway.	Pre-construction	Not applicable to UDLP. Refer to Alignment and Earthworks design package.
Traffic and transport	T&T17	The need for the overpass and arrangement of local access at Carrols Lane will be reviewed at the detailed design stage depending on specific staging and delivery of the highway.	Pre-construction	Not applicable to UDLP. Refer to Alignment and Earthworks design package.
Traffic and transport	T&T18	Connectivity between the shared user path from Harwood Bridge to Yamba Road would be reviewed to refine pedestrian and cyclist access	Pre-construction	Connectivity has been provided. Refer Chapter 7. For more detail, refer to Alignment and Earthworks design package.

A.3 MITIGATION MEASURES IDENTIFIED IN THE THREATENED SPECIES MANAGEMENT PLANS THAT ARE RELATED TO URBAN AND LANDSCAPE DESIGN

The following Table A-3 summarises the mitigation measures related to urban and landscape design stipulated in the threatened species management plans that are applicable to the area between Maclean and Devils Pulpit (Sections 5 and 6). It also identifies where these measures are addressed in the current document.

Table A-3: Mitigation measures identified in the threatened species management plans that are related to urban and landscape design and are applicable to Maclean to Devils Pulpit (Sections 5 and 6)

THREATENED SPECIES MANAGEMENT PLAN	MITIGATION MEASURE APPLICABLE URBAN AND LANDSCAPE DESIGN IN SECTIONS 5 & 6	DOCUMENT REFERENCE
Koala management plan	Koala fencing at the following locations: • CH 94700 – 95200 (koala fencing) • CH 95200 – 95800 (combined koala/frog fencing) • CH 95800 – 97900 (koala fencing) • CH 97900 – 98000 (combined koala/mammal fencing)	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 6, 7 and 8 For more detail, refer to the Fauna Connectivity design report. Note that the locations and types of fencing may be adjusted in response to the detailed design. Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6)
	Mororo Cut (borrow site) Temporary Koala fencing on the eastern side of the existing Pacific Highway for a total length of 1.1km (CH 97,500 to 98,600)	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 6, 7 and 8. For more detail, refer to the Fauna Connectivity design report.
	Targeted koala connectivity structure (dedicated culvert) at CH 96150	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 6, 7 and 8 For more detail, refer to the Fauna Connectivity design report..
	Habitat revegetation using primary and secondary koala food trees that will not cause a road safety traffic hazard, specifically focussed around crossing structures and riparian corridors within the project boundary.	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 7 and 8
Threatened flora management plan	Targeted weed management measures will be considered for each section of the project where there are threatened plant species being managed in situ. The 'weed management zones' will be clearly identified and targeted weed control methods will be described in the CEMP.	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapter 8
	Revegetation with native species reflective of the local area and pre-disturbed vegetation communities where possible will occur post construction. Revegetation design of areas adjacent to in situ threatened plant populations will ensure the plantings will not impact on the species (e.g. will not compete for light or moisture) and are consistent with their habitat requirements.	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 6, 7 and 8
	Seeds and other propagation material to be collected from threatened plants prior to clearing works.	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapter 8
Flora Translocation Strategy	Translocation of suitable threatened flora species (identified in the strategy) to the identified receiving sites for the species within each project section. Seed collection, propagation and preparation of the receiving sites is to be in accordance with the guidelines set out in the strategy.	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapter 8
Threatened frog management plan	Identify exclusion zones, frog fencing and compensatory pond locations Install exclusion zones, temporary frog fencing prior to clearing Install compensatory ponds after clearing complete.	Chapters 6, 7 and 8 For more detail, refer to the Fauna Connectivity design report
Threatened glider management plan	Provision of glide poles in the vicinity of CH 99550, targeting Yellow-bellied Glider and Squirrel Glider.	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 6, 7 and 8 For more detail, refer to the Fauna Connectivity design report
	Implementation of the UDLP that considers threatened glider population, habitat and revegetation of habitat areas, including strategic revegetation around crossing structures and in disturbed areas.	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 7 and 8

THREATENED SPECIES MANAGEMENT PLAN	MITIGATION MEASURE APPLICABLE URBAN AND LANDSCAPE DESIGN IN SECTIONS 5 & 6	DOCUMENT REFERENCE
Threatened mammal management plan	Permanent fauna exclusion fencing in the following locations: • CH 82500 - 85100 • CH 97900 - 101300 • CH 101300 - 101900	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 6, 7 and 8 For more detail, refer to the Fauna Connectivity design report
	Fauna connectivity structures at the following locations: • CH 83100 (bridge over Koala Drive) • CH 93990 (bridge over Clarence River North Arm) • CH 99730 (reinforced concrete box culvert) • CH 100640 (reinforced concrete box culvert) • CH 101100 (reinforced concrete box culvert) • CH 101541 (bridge over Tabbimoble Creek)	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 6, 7 and 8 For more detail, refer to the Fauna Connectivity design report. Note that the locations of the connectivity structures may be adjusted in response to the detailed design.
	Disturbed known and potential habitat areas within the project are to be revegetated progressively through and at the end of the construction.	Chapters 7 and 8
	Revegetation around fauna connectivity structures using appropriate habitat species for the targeted threatened mammals.	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 7 and 8
Threatened mammal management plan	Strategic revegetation would be undertaken to enhance connectivity through revegetation of lands within the road reserve and completed ancillary areas (where owned by Roads and Maritime). Priority for this road reserve revegetation should be given to: • Local or regional fauna corridors, SEPP 14 wetlands and environmental protection zones, particularly where these might provide seasonal foraging resources • Habitat for important populations • Areas that have been identified to have road kills of threatened mammal species • Cleared landscapes with limited connectivity, aiming to link current isolated patches with potential habitat for threatened mammals.	Refer to Draft UDLP Maclean and Devils Pulpit (Sections 5 and 6) Chapters 7 and 8

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B. APPENDIX B - SPECIES LISTS

Chapter contents

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B.1 DRAFT TREE PLANTING SPECIES LISTS

Note that all species listed in the following tables are subject to further design development including confirmation that plants are commercially available. This is a full listing for Section 5, and is not specific to the bridge over Clarence River at Harwood.

Table B-1: Feature trees at interchanges and approaches

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Araucaria columnaris	Cook Pine	75L
Araucaria cunninghamii	Hoop Pine	75L
Cupaniopsis anacardioides	Tuckeroo	75L
Eucalyptus tereticornis	Forest Red Gum	75L
Ficus macrophylla	Moreton Bay Fig	75L
Flindersia australis	Australian Teak	75L
Harpulia pendula	Tulipwood	75L
Syncarpia glomulifera	Turpentine	75L
Tristaniopsis laurina	Water Gum	25L

Table B-2: Tree planting mix 1A – Swamp Oak swamp forest

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Casuarina glauca	Swamp Oak	Tubestock
Melaleuca quinquinervia	Broad-leaved Paperbark	Tubestock
Eucalyptus tereticornis	Forest Red Gum	Tubestock

Table B-3: Tree planting mix 1B – Paperbark swamp forest

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Melaleuca quinquinervia	Broad-leaved Paperbark	Tubestock
Melaleuca linariifolia	Snow-in-Summer	Tubestock
Melaleuca sieberi	Sieber's Paperbark	Tubestock
Melaleuca alternifolia	Narrow-leaved Paperbark	Tubestock
Melaleuca styphelioides	Prickly-leaved Paperbark	Tubestock
Melaleuca nodosa	Ball Honeymyrtle	Tubestock

Table B-4: Tree planting mix 2A – Flooded Gum - Tallowood - Brush Box moist open forest

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Eucalyptus grandis	Flooded Gum	Tubestock
Eucalyptus microcorys	Tallowwood	Tubestock
Lophostemon confertus	Brush Box	Tubestock
Syncarpia glomulifera	Turpentine	Tubestock
Corymbia intermedia	Pink Bloodwood	Tubestock

Table B-5: Tree planting mix 2B – Tallowood dry grassy forest

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Eucalyptus microcorys	Tallowwood	Tubestock
Eucalyptus acmenoides	Narrow-leaved White Mahogany	Tubestock
Corymbia intermedia	Pink Bloodwood	Tubestock
Eucalyptus propinqua	Small-fruited Grey Gum	Tubestock
Lophostemon confertus	Brush Box	Tubestock
Eucalyptus siderophloia	Grey Ironbark	Tubestock

Table B-6: Tree planting mix 3A – Blackbutt - Bloodwood dry heathy open forest

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Eucalyptus pilularis	Blackbutt	Tubestock
Corymbia gummifera	Red Bloodwood	Tubestock
Eucalyptus resinfera subsp. hemilampra	Red Mahogany	Tubestock

Table B-7: Tree planting mix 3B – Grey Gum - Grey Ironbark open forest

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Eucalyptus propinqua	Small-fruited Grey Gum	Tubestock
Eucalyptus siderophloia	Grey Ironbark	Tubestock
Corymbia variegata	Spotted Gum	Tubestock
Syncarpia glomulifera	Turpentine	Tubestock
Corymbia intermedia	Pink Bloodwood	Tubestock

Table B-8: Tree planting mix 4A – Forest red Gum - Swamp Box

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Eucalyptus tereticornis	Forest Red Gum	Tubestock
Lophostemon suaveolens	Swamp Box	Tubestock
Corymbia intermedia	Pink Bloodwood	Tubestock
Eucalyptus siderophloia	Grey Ironbark	Tubestock

B.2 DRAFT PLANT MIX SPECIES LISTS

Note that all species listed in the following tables are subject to further design development including confirmation that plants are commercially available.

Table B-9: Plant mix 1 – Forested wetlands

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Shrubs		
Goodenia ovata	Hop Goodenia	Tubestock
Hibiscus diversifolius	Swamp Hibiscus	Tubestock
Leptospermum juniperinum	Prickly Tea-tree	Tubestock
Melaleuca ericifolia	Swamp Paperbark	Tubestock
Groundcovers		
Baumea rubiginosa	Soft Twig Rush	Tubestock
Blechnum indicum	Swamp Water Fern	Tubestock
Gahnia clarkei	Tall Saw-sedge	Tubestock
Hypolepis muelleri	Harsh Ground Fern	Tubestock
Ischaemum australe	Southern Grass	Tubestock
Juncus kraussii	Sea Rush	Tubestock

Table B-10: Plant mix 2 – Wet sclerophyll forest

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Shrubs		
Acacia spp.	Wattle	Tubestock
Acmena smithii	Lilly Pilly	Tubestock
Allocasuarina littoralis	Black She-oak	Tubestock
Allocasuarina torulosa	Forest Oak	Tubestock
Archontophoenix cunninghamina	Bangalow Palm	Tubestock
Banksia oblongifolia	Fern-leaved Banksia	Tubestock
Cordyline stricta	Slender Palm Lily	Tubestock
Elaeocarpus reticulatis	Blueberry Ash	Tubestock
Leptospermum polygalifolium	Tantoon	Tubestock
Melaleuca sieberi	Sieber's Paperbark	Tubestock
Persoonia stradbrokensis	Broad-leaved Geebung	Tubestock
Pultenaea spp.	Bush Pea	Tubestock
Syzigium oleosum	Blue Lilly Pilly	Tubestock
Groundcovers		
Adiantum hispidulum	Rough Maidenhair Fern	Tubestock
Blechnum cartilagineum	Gristle Fern	Tubestock
Cissus antarctica	Kangaroo Vine	Tubestock
Cissus hypoglauca	Water Vine	Tubestock
Dianella caerulea	Blue Flax-lily	Tubestock
Entolasia stricta	Wiry Panic	Tubestock
Hardenbergia violacea	False Sarsaparilla	Tubestock
Hibbertia scandens	Climbing Guinea Flower	Tubestock
Imperata cylindrica var. major	Blady Grass	Tubestock
Lomandra longifolia	Mat Rush	Tubestock
Smilax glyciphylla	Sweet Sarsaparilla	Tubestock
Themeda australis	Kangaroo Grass	Tubestock

Table B-11: Plant mix 3 – Dry schlerophyll forest

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Shrubs		
Acacia concurrens	Curracabah	Tubestock
Acacia ulicifolia	Prickly Moses	Tubestock
Allocasuarina littoralis	Black She-oak	Tubestock
Allocasuarina torulosa	Forest Oak	Tubestock
Banksia oblongifolia	Fern-leaved Banksia	Tubestock
Banksia spinulosa var. collina	Hill Banksia	Tubestock
Gompholobium pinnatum	Pinnate Wedge Pea	Tubestock
Leptospermum polygalifolium	Tantoon	Tubestock
Leptospermum trinervium	Flaky-barked Tea-tree	Tubestock
Leucopogon lanceolatus	Lance-leaved Beard Heath	Tubestock
Lomatia silaifolia	Crinkle Bush	Tubestock
Melaleuca sieberi	Sieber's Paperbark	Tubestock
Persoonia stradbrokensis	Broad-leaved Geebung	Tubestock
Pultenaea spp.	Bush Pea	Tubestock
Groundcovers		
Aristida vagans	Three-awned Speargrass	Tubestock
Cymbopogon refractus	Barbed Wire Grass	Tubestock
Dianella caerulea	Blue Flax-lily	Tubestock
Entolasia stricta	Wiry Panic	Tubestock
Eragrostis brownii	Brown's Lovegrass	Tubestock
Goodenia hederacea	Ivy Goodenia	Tubestock
Hardenbergia violacea	False Sarsaparilla	Tubestock
Imperata cylindrica var. major	Blady Grass	Tubestock
Lomandra longifolia	Mat-Rush	Tubestock
Lomandra multiflora	Many-flowered Mat-Rush	Tubestock
Panicum simile	Two-colour Panic	
Themeda australis	Kangaroo Grass	

Table B-12: Plant mix 4 – Grassy woodland

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Shrubs		
Alphitonia excelsa	Red Ash	Tubestock
Melaleuca quinquinervia	Broad-leaved Paperbark	Tubestock
Melaleuca sieberi	Sieber's Paperbark	Tubestock
Melaleuca styphelioides	Prickly-leaved Tea Tree	Tubestock
Groundcovers		
Cymbopogon refractus	Barbed Wire Grass	Tubestock
Entolasia stricta	Wiry Panic	Tubestock
Gahnia sieberiana	Red-fruit Saw-sedge	Tubestock
Imperata cylindrica var. major	Blady Grass	Tubestock
Lomandra longifolia	Mat-Rush	Tubestock
Panicum simile	Two-colour Panic	Tubestock
Themeda australis	Kangaroo Grass	Tubestock

Table B-13: Plant mix 5 – Rainforest

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Shrubs		
Cordyline petiolaris	Broad-leaved Palm Lily	Tubestock
Cyathea leichhardtiana	Prickly Tree Fern	Tubestock
Harpullia alata	Wing-leaved Tulip	Tubestock
Linospadix monostachya	Walking Stick Palm	Tubestock
Neolitsea dealbata	White Bolly Gum	Tubestock
Wilkiea austro-queenslandica	Smooth Wilkiea	Tubestock
Groundcovers		
Adiantum formosum	Giant Maidenhair	Tubestock
Elatostema reticulatum	Rainforest Spinach	Tubestock
Helmholtzia glaberrima	Stream Lily	Tubestock
Lastreopsis spp.	Shield Fern	Tubestock
Pteris umbrosa	Jungle Brake	Tubestock

Table B-14: Plant mix 6 – Saline wetlands

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Shrubs		
Aegiceras corniculatum	River Mangrove	Tubestock
Groundcovers		
Juncus kraussii	Sea Rush	Tubestock
Sarcocomia quinqueflora	Bearded Samphire	Tubestock
Sporobolus virginicus	Marine Couch	Tubestock
Zoysia macrantha	Prickly Couch	Tubestock

Table B-15: Plant mix 7 – Frangible shrubs

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Shrubs		
Banksia spinulosa var. collina	Hill Banksia	Tubestock
Callistemon citrinus 'Endeavour'	Endeavour Bottlebrush	Tubestock
Leptospermum polygalifolium	Tantoon	Tubestock
Groundcovers		
Lomandra longifolia	Mat Rush	Tubestock
Lomandra multiflora	Many-flowered Mat-Rush	Tubestock

Table B-16: Plant mix 8 – Creek banks

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Shrubs		
Melaleuca ericifolia	Swamp Paperbark	Tubestock
Leptospermum juniperinum	Prickly Tea-tree	Tubestock
Groundcovers		
Carex appressa	Tall Sedge	Tubestock
Gahnia clarkei	Tall Saw-sedge	Tubestock
Juncus usitatus	Common Rush	Tubestock
Lomandra longifolia	Mat-Rush	Tubestock
Lomandra multiflora	Many-flowered Mat-Rush	Tubestock

Table B-17: Plant mix 9A – Permanent water quality basins - ephemeral zone

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Grasses and sedges		
Carex appressa	Tall Sedge	Tubestock
Dianella caerulea	Blue Flax-lily	Tubestock
Ficinia nodosa	Knobby Club-rush	Tubestock
Gahnia clarkei	Tall Saw-sedge	Tubestock
Gahnia sieberiana	Red-fruit Saw-sedge	Tubestock
Juncus usitatus	Common Rush	Tubestock

Table B-18: Plant mix 9B – Permanent water quality basins - dry zone

BOTANICAL NAME	COMMON NAME	PLANT CONTAINER SIZE
Grasses and sedges		
Carex appressa	Tall Sedge	Tubestock
Gahnia sieberiana	Red-fruit Saw-sedge	Tubestock
Lomandra filiformis subsp. filiformis	Wattle Mat-Rush	Tubestock
Lomandra longifolia	Mat-Rush	Tubestock
Lomandra multiflora	Many-flowered Mat-Rush	Tubestock

B.3 DRAFT SEED MIX SPECIES LISTS

Note that all species listed in the following tables are subject to further design development including confirmation that seeds are commercially available.

Table B-19: Seed mix 1 – Forested wetlands shrubs, groundcovers and grasses

BOTANICAL NAME	COMMON NAME
Shrubs	
Acacia maidenii	Maiden's Wattle
Baeckea frutescens	Weeping Baeckea
Callistemon pachyphyllus	Wallum Bottlebrush
Cordyline stricta	Slender Palm Lily
Glochidion ferdinandi	Cheese Tree
Hibiscus diversifolius	Swamp Hibiscus
Leptospermum juniperinum	Prickly Tea-tree
Groundcovers	
Baumea rubiginosa	Soft Twig Rush
Gahnia clarkei	Tall Saw-sedge
Juncus kraussii	Sea Rush

Table B-20: Seed mix 2 – Wet sclerophyll forest shrubs, groundcovers and grasses

BOTANICAL NAME	COMMON NAME
Shrubs	
Acacia spp.	Wattle
Allocasuarina littoralis	Black She-oak
Allocasuarina torulosa	Forest Oak
Banksia oblongifolia	Fern-leaved Banksia
Cordyline stricta	Slender Palm Lily
Elaeocarpus reticulatis	Blueberry Ash
Leptospermum polygalifolium subs. cismontanam	Tantoon
Melaleuca sieberi	Sieber's Paperbark
Pultenaea spp.	Bush Pea
Groundcovers	
Cissus antarctica	Kangaroo Vine
Cissus hypoglauca	Water Vine
Dianella caerulea	Blue Flax-lily
Entolasia stricta	Wiry Panic
Hardenbergia violacea	False Sarsaparilla
Imperata cylindrica var. major	Blady Grass
Lomandra longifolia	Mat Rush
Smilax glyciphylla	Sweet Sarsaparilla
Themeda australis	Kangaroo Grass

Table B-21: Seed mix 3 – Dry sclerophyll forest shrubs, groundcovers and grasses

BOTANICAL NAME	COMMON NAME
Shrubs	
Acacia concurrens	Curracabah
Acacia ulicifolia	Prickly Moses
Allocasuarina littoralis	Black She-oak
Allocasuarina torulosa	Forest Oak
Banksia oblongifolia	Fern-leaved Banksia
Banksia spinulosa var. collina	Hill Banksia
Gompholobium pinnatum	Pinnate Wedge Pea
Leptospermum polygalifolium	Tantoon
Leucopogon lanceolatus	Lance-leaved Beard Heath
Melaleuca sieberi	Sieber's Paperbark
Pultenaea spp.	Bush Pea
Groundcovers	
Aristida vagans	Three-awned Speargrass
Cymbopogon refractus	Barbed Wire Grass
Entolasia stricta	Wiry Panic
Hardenbergia violacea	False Sarsaparilla
Imperata cylindrica var. major	Blady Grass
Lomandra longifolia	Mat-Rush
Panicum simile	Two-colour Panic
Themeda australis	Kangaroo Grass

Table B-22: Seed mix 4 – Grassy woodland shrubs, groundcovers and grasses

BOTANICAL NAME	COMMON NAME
Shrubs	
Alphitonia excelsa	Red Ash
Melaleuca quinquinervia	Broad-leaved Paperbark
Melaleuca sieberi	Sieber's Paperbark
Melaleuca styphelioides	Prickly-leaved Tea Tree
Groundcovers	
Cymbopogon refractus	Barbed Wire Grass
Entolasia stricta	Wiry Panic
Gahnia sieberiana	Red-fruit Saw-sedge
Imperata cylindrica var. major	Blady Grass
Panicum simile	Two-colour Panic
Themeda australis	Kangaroo Grass

Table B-23: Seed mix 7 – Native grasses for medians and verges

BOTANICAL NAME	COMMON NAME
Shrubs	
Entolasia stricta	Wiry Panic
Imperata cylindrica var. major	Blady Grass
Lomandra longifolia	Mat-Rush
Lomandra multiflora	Many-flowered Mat-Rush
Themeda australis	Kangaroo Grass

Table B-24: Seed mix 8 – Pasture grasses

BOTANICAL NAME	COMMON NAME
Shrubs	
Axanopis fissifolius	Carpet Grass
Cymbopogon refractus	Barbed Wire Grass
Cynodon dactylon	Couch Grass
Eclipse rye	Eclipse Rye
Secale cereale 'Sterile' (April - August) *Echinochloa utilis (September - March)*	Sterile Rye Corn Japanese Millet
Tirifolium pratense	Red Clover

Table B-25: Seed mix 9 – Vegetated drainage swale

BOTANICAL NAME	COMMON NAME
Shrubs	
Carex appressa	Tall Sedge
Ficinia nodosa	Knobby Club-rush
Gahnia clarkei	Tall Saw-sedge
Gahnia sieberiana	Red-fruit Saw-sedge
Imperata cylindrica var. major	Blady Grass
Juncus usitatus	Common Rush

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C. APPENDIX C - CONSULTATION REPORT

C.1 COMMUNITY CONSULTATION REPORT

Roads & Maritime

New bridge over the Clarence River at Harwood
Draft urban design and landscape plan

Community Consultation Report

March 2017

Executive summary

The Woolgoolga to Ballina Pacific Highway upgrade will duplicate 155 kilometres to four lane divided road from about six kilometres north of Woolgoolga (north of Coffs Harbour) to about six kilometres south of Ballina. The project does not include the completed Devils Pulpit and Glenugie upgrades.

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 Clarence River at Harwood from 28 November 2016 until 16 December 2016.

Consultation activities during this time included:

- distributing about 6500 postcards to resident between Maclean and Devils Pulpit
- static displays at 10 locations
- staffed displays at six locations
- updating the project website with the draft urban design and landscape plan as well as an online survey
- email and SMS messages to more than 200 registered stakeholders
- advertising in two local newspapers.

We received feedback from two organisations and seven people.

Of the feedback received:

- three respondents provided general support for the urban design and landscape plan and six were neutral
- three respondents provided general support for the bridge design, two objected and four offered no position.

Key matters raised included vegetation, fauna species, flora and fauna crossings, general design of the bridge and the consultation. Seven matters raised were 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 Clarence River at Harwood.

The Woolgoolga to Ballina project team has decided to proceed with the proposed urban design and landscape plan with changes to the fauna species.

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 area from Glenugie to the Ballina bypass, excluding the new bridges over the Clarence and Richmond rivers from 1 August to 29 August 2016. The outcomes of this consultation is provided in the Woolgoolga to Ballina, Pacific Highway

upgrade, *Community Consultation Report for the Urban Design and Landscape Plans, March 2017*.

Contents

Figures and tables

1. Introduction

1.1. 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. The Woolgoolga to Ballina project will upgrade 155 kilometres of road.

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 Clarence River at Harwood which will be:

- 1.5 kilometre long
- four lanes
- about 20 metres east of the existing Harwood Bridge
- clearance of 30 metres at the centre to allow for marine vessels to pass underneath.

1.2. Urban design and landscape plan

During August 2016 community and stakeholder feedback was sought on four draft urban design and landscape plans (Glenugie to Maclean, Maclean to Devils Pulpit, Devils Pulpit to Broadwater and Broadwater to Ballina) as part of the design development process for the Woolgoolga to Ballina Pacific Highway upgrade. These plans 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.

At the time, preliminary images for the design for the new bridge over the Clarence River at Harwood were included in the Maclean to Devils Pulpit plan however design had not progressed to a stage to allow for its full inclusion.

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 Clarence River at Harwood and surrounding intersections.

The draft plan has been prepared to align with the Woolgoolga to Ballina project. The new bridge over the Clarence River at Harwood draft urban design and landscape plan was made available for placed on public exhibition from 28 November to 16 December 2016.

2. Consultation approach

2.1. Consultation objectives

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

- seek comment, feedback, ideas and suggestions 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.

2.2. 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 28 November to 16 December 2016. Postcards were delivered to about 6500 residential and business properties inviting feedback on the proposal (Appendix A). Table 1 provides details on consultation activities.

Table 1 – Types of egagement

Date	Type of engagement	Number of people and organisations
28 November 2016	**Community postcard**	**About 6500 residences**
	Website update	**-**
	SMS notification	**219**
	Email notification	**201**
	Static display – copy of document and poster	**3**
	Static display – poster	**7**
30 November 2016	**Advertisement -** Grafton Daily Examiner	**-**
	Advertisement - Clarence Valley Review	**-**
	Staffed pop-up display -Yamba Farmers Market, Whiting Beach car park, Yamba	**71**
1 December 2016	**Staffed pop-up display -Harwood General Store,** Morpeth Street, Harwood	**17**
3 December 2016	**Advertisement -** Grafton Daily Examiner	**-**
4 December 2016	**Staffed pop-up display - Iluka Market,** Iluka Sports Oval, Iluka	**96**
10 December 2016	**Staffed pop-up display -Maclean Community Market,** Main Car Park, Maclean	**133**
11 December 2016	**Staffed pop-up display -Yamba River Market,** Ford Park, Yamba	**73**
18 December 2016	**Staffed pop-up display -Ashby Markets,** Lismore Street, Ashby	**35**

3. Consultation summary

3.1. Overview

We received comments from seven people and two local organisations. Of the responses received:

- three respondents provided general support for the urban design and landscape plan and six were neutral
- three respondents provided general support for the bridge design, two objected and four offered no position.

Key matters raised included vegetation, fauna species, flora and fauna crossings, general design of the bridge and the consultation. Seven matters raised were considered outside the scope of the urban design and landscape plan and will be addressed with the stakeholders individually.

Tables 2 and 3 outline the feedback received and the project teams responses.

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.

Table 2 – Community and stakeholder feedback

Category	Matters raised	Response
Flora **Four comments**	Requested pine trees be replaced with natives	The Hoop Pine occurs naturally in the region, it has a visually distinctive form, grows relatively fast in good soil and can reach more than 20 metres. The Coastal Cypress Pine is much smaller, grows much slower, is very different in form and prefers sandy soils. The Coastal Cypress Pine occurs naturally on sandy soils near Wardell. Both trees were considered for the Harwood interchange, the new bridge over the Clarence River at Harwood and the surrounding landscaping. On balance the Hoop Pine was assessed as being more appropriate for the area. The Hoop Pine has a desirable, distinctive, design outcome and is a native species. Hoop Pines are a superior street and feature tree for the purposes intended for the project.
	Requested pine trees be replaced with natives. Suggested Coastal Cypress Pine Callitris columellaris.	
Bridge design **Two comments**	Requested the bridge design include more innovation.	We will continue to refine the bridge design and this might include minor changes to the finishes and to ensure flood modelling and suitable construction is considered. The overall conceptual design of the structure will not be modified as it achieves the objectives for the project.
Community consultation **One comment**	Community consultation process to date has been to focussed on communication and not engagement	The project team will continue to work with stakeholders and the community on matters and concerns as the project progresses. All community feedback provided on the draft urban design and landscape plan has been considered in this consultation report. This report will be provided to Department of Planning and Environment for consideration along with the final urban design and landscape plan.
Out of scope **Seven comments**	Dredging of Lake Wooloweyah	Feedback provided outside the scope of the urban design and landscape plan and will be addressed with stakeholder individually.
	Improvement to the local fishing boat ramps and access	
	Flood mitigation and the impact to overflow on the Clarence River	
	Tidal flow because of the new bridges piers	
	Impact to prawn pockets	

Category	Matters raised	Response
	from project construction	
	Impact of temporary jetty on fishing	
	Removal and control of the aquatic pest Hyacinth found in the Clarence Rivers and tributaries	

4.0 Decision

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

In response to community and stakeholder feedback changes to the urban design and landscape plan includes changes to the fauna species listed.

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.

5.0 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.

Appendix A – consultation materials

- Postcard
- Poster
- Advertisement

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Artists impression of the bridge over the Clarence River at Harwood

Woolgoolga to Ballina - Bridge over the Clarence River at Harwood

Draft urban design and landscape plan

Australian Government

BUILDING OUR FUTURE

NSW MAKING IT HAPPEN

Woolgoolga to Ballina - Bridge over the Clarence River at Harwood

Draft urban design and landscape plan

The draft urban design and landscape plan for the new bridge over the Clarence River at Harwood will be on display until Friday 16 December 2016.

The plan is available online at **rms.nsw.gov.au/W2B** and in hard copy at:

Clarence Valley Council
50 River Street, Maclean
Monday – Friday: 8.30am – 4.30pm

Harwood Island General Store
10 Morpeth Street, Harwood
Monday – Friday: 6am – 5pm
Saturday and Sunday: 7.30am – 12 noon

Roads and Maritime Services Pacific Highway Office
21 Prince Street, Grafton
Monday – Friday: 8.30am – 4.30pm

You can provide feedback online, in person, over the phone or in writing.

Meet the project team

To meet with the project team drop in between 7.30am and 12 noon:

Yamba Farmers Market
Whiting Beach car park, Yamba
Wednesday 30 November

Harwood General Store,
10 Morpeth Street, Harwood
Thursday 1 December
9am – 12 noon only

Iluka Market
Iluka Sports Oval, Iluka
Sunday 4 December

Maclean Community Market
Main Car Park, Maclean
Saturday 10 December

Yamba River Market
Ford Park, Yamba
Sunday 11 December

Have your say

To tell us what you think or for more information about the project:

Phone: 1800 778 900 (toll free), press 1
Email: W2B@pacificcomplete.com.au
Post: Woolgoolga to Ballina upgrade
Att: Communications
PO Box 546, Grafton NSW 2460
Fax: (02) 6640 1001
Web: rms.nsw.gov.au/W2B

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Australian Government
BUILDING OUR FUTURE

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Woolgoolga to Ballina

Bridge over the Clarence River at Harwood

Draft urban design and landscape plan

As part of the Woolgoolga to Ballina Pacific Highway upgrade project, a new bridge will be built over the Clarence River at Harwood.

Artists impression of the bridge over the Clarence River at Harwood looking north

The Australian and NSW governments are jointly funding the $4.36 billion Woolgoolga to Ballina Pacific Highway upgrade. As part of the project, a new bridge will be built over the Clarence River at Harwood.

The draft urban design and landscape plan for the new bridge over the Clarence River at Harwood will be on display until Friday 16 December 2016.

The plan is available online at **rms.nsw.gov.au/W2B** and in hard copy at:

Clarence Valley Council
50 River Street, Maclean
Monday – Friday: 8.30am – 4.30pm

Harwood Island General Store
10 Morpeth Street, Harwood
Monday – Friday: 6am – 5pm
Saturday and Sunday: 7.30am – 12 noon

Roads and Maritime Services Pacific Highway Office
21 Prince Street, Grafton
Monday – Friday: 8.30am – 4.30pm

Have your say

You can provide feedback online, in person, over the phone or in writing. To meet with the project team drop in at any time between 7.30am – 12 noon at the following locations and markets:

Yamba Farmers Market
Whiting Beach car park, Yamba
Wednesday 30 November 2016

Artists impression of the bridge over the Clarence River at Harwood

Artists impression of the bridge over the Clarence River at Harwood looking south east

Harwood General Store,
10 Morpeth Street, Harwood
Thursday 1 December
9am – 12 noon only

Iluka Market
Iluka Sports Oval, Iluka
Sunday 4 December

Maclean Community Market
Main Car Park, Maclean
Saturday 10 December

Yamba River Market
Ford Park, Yamba
Sunday 11 December

Contact the project team

To tell us what you think or for more information about the project:

Phone: 1800 778 900 (toll free), press 1
Email: W2B@pacificcomplete.com.au
Post: Woolgoolga to Ballina upgrade
Att: Communications
PO Box 546
Grafton NSW 2460
Fax: (02) 6640 1001
Web: rms.nsw.gov.au/W2B

NSW GOVERNMENT Transport Roads & Maritime Services

Bridge over the Clarence River at Harwood

Draft urban design and landscape plan

The Australian and NSW governments are jointly funding the $4.36 billion Woolgoolga to Ballina Pacific Highway upgrade. As part of the project, a new bridge will be built over the Clarence River at Harwood.

The draft urban design and landscape plan will be on display until Friday 16 December 2016.

You are invited to provide feedback on the draft plan. It is available on Roads and Maritime Services' website rms.nsw.gov.au/W2B and at:

- Clarence Valley Council
  50 River Street, Maclean
  Monday – Friday: 8.30am – 4.30pm
- Harwood Island General Store
  10 Morpeth Street, Harwood
  Monday – Friday: 6am – 5pm
  Saturday – Sunday: 7.30am – 12 Noon
- Roads and Maritime Services Pacific Highway Office
  21 Prince Street, Grafton
  Monday – Friday: 8.30am – 4.30pm

You can provide feedback online, in person, over the phone or in writing. To meet with the project team, drop in between 7.30am and 12pm at:

- **30 November** – Yamba Farmers Market,
  Whiting Beach car park, Yamba
- **1 December** – Harwood General Store,
  10 Morpeth Street, Harwood
  9am – 12 Noon only
- **4 December** – Iluka Market,
  Iluka Sports Oval, Iluka
- **10 December** – Maclean Community Market,
  main car park, Maclean
- **11 December** – Yamba River Market,
  Ford Park, Yamba

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For more information call
1800 778 900 (dial 1),
email: W2B@Pacificcomplete.com.au
or visit rms.nsw.gov.au/W2

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rms.nsw.gov.au/W2B

1800 778 900

Woolgoolga to Ballina upgrade
Att: Communications
PO Box 546
Grafton NSW 2460

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