

Woolgoolga to Ballina Pacific Highway upgrade

Draft urban design and landscape plan



Richmond River to Ballina - Sections 10 and 11

Prepared for:



Prepared by:

SPACKMAN MOSSOP AND MICHAELS

PO Box 880 Darlinghurst, NSW 1300
P (02) 9361 4549 • F (02) 9361 4569
www.sm2group.com.au
ABN 65 065 578 985

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EXECUTIVE SUMMARY

INTRODUCTION

The Pacific Highway upgrade is one of the largest road infrastructure projects in NSW. It connects Sydney and Brisbane, and is a major contributor to Australia's economic activity. 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 around six kilometres south of Ballina. The project bypasses the towns of Grafton, South Grafton, Ulmarra, Woodburn, Broadwater and Wardell.

The projects' Environmental Impact Statement (Roads and Maritime, 2012) divided the project into 11 Sections for assessment purposes. Sections 1 and 2 of the upgrade are under construction. Pacific Highway upgrades have also been completed at Glenugie (Section 3) and Devils Pulpit (Section 6A). This report covers:

- Richmond River to Coolgardie Road - Section 10
- Coolgardie Road to Ballina - Section 11.

COMPLIANCE REQUIREMENTS

This Draft Urban Design and Landscape Plan (Draft UDLP) is prepared as part of the Pacific Highway Upgrade Woolgoolga to Ballina Project, to address the requirements of the Minister's Conditions of Approval (MCoA) D20. It documents the design of Richmond River to Coolgardie Road - Section 10, and Coolgardie Road to Ballina - Section 11, located between Broadwater and Pimlico, and bounded by the Richmond River to the east and the Great Diving Range to the west. These sections sit within the floodplain of the Richmond River which extends parallel to the project in a north-south direction.

As part of this process, The Minister's Condition D20 clearly identifies the documents, conditions and commitments undertaken as part of the approval process and the ongoing design development for the project. Particular reference is given to compliance with the:

- EIS - Urban Design, Landscape Character and Visual Impact Assessment (Hassell, 2012)
- 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, 2013)
- Beyond the Pavement – Urban Design Policy Procedures and Design (Roads and Maritime, 2014)



Figure 1: The design on the approach to Coolgardie Interchange signals the entry in to Wardell township (Artists impression subject to further design development. Landscape shown at maturity. Inclusion of shared path subject to further consultation)

- Biodiversity Working Paper (Roads and Maritime, 2012)
- Various design guideline documents by Roads and Maritime.

Key requirements for each document are summarised and the Chapter where these elements are addressed within the report identified.

As part of the Conditions of Approval for the project, the Ballina Koala Plan and Koala Management Plan must be approved before building can start in the area known as section 10, which starts at Broadwater and finishes at Coolgardie, south of Ballina.



Figure 2: Roads and Maritime Design Guidelines (Source: Roads and Maritime, 2013)

CONSULTATION

A key element of the design development has been consultation and in particular the input of these findings into the ongoing project development of the design. Consultation inputs addressed to date will be included in the issue of the Final Report.

DESIGN VISION

The Pacific Highway Upgrade 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.”

DESIGN OBJECTIVES

The design objectives for the project were established as part of the EIS process and informed by the Pacific Highway Urban Design Strategy, these are:

- 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.



Figure 3: The landscape design integrates with the adjoining vegetation communities (Artists impression subject to further design development. Landscape shown at maturity)

As part of the design development further refinement and focus is given to the development of objectives which address the specific issues of this portion of the corridor. The objectives are:

- Objective 1: To ensure that the town of Wardell is acknowledged on the Pacific Highway
- Objective 2: To provide consistency in design language through the overall Woolgoolga to Ballina upgrade and the Pacific Highway, and at the same time provide interest through location specific treatments where appropriate
- Objective 3: To ensure visual impact to rural residences are minimised
- Objective 4: To maintain key views from the highway
- Objective 5: To ensure major cut batters blend with surrounding landscape.

These in turn have informed the development of an overall Strategy Plan for Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11. This report demonstrates how the vision and objectives are achieved.

CONTEXTUAL ANALYSIS

Contextual analysis was undertaken to both validate the work to date and provide the basis for the design development. The analysis reflects the detailed nature of the design and identifies the primary constraints and inputs. The analysis included the assessment of key contextual elements and the manner in which they influence the design response.

DESIGN PRINCIPLES

Detailed design principles are outlined in Chapter 6 for Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 in relation to environmental values, heritage values, the urban design context, sustainable design and maintenance, and community amenity and privacy. The design principles refer mainly to the mitigation measures identified in the various technical reports in the EIS which are incorporated in the design. Also discussed is the overall project strategy for temporary works, ancillary facilities and access tracks. This reflects a project wide strategy aimed at minimisation of disturbance and rehabilitation in the operational phase of the project.

URBAN DESIGN AND LANDSCAPE RESPONSE

The urban and landscape design response describes the design and drivers experience in plans, cross sections, three dimensional images and text, from the Richmond River crossing through to Pimlico. It describes the key initiatives adopted to address the context of the road and impacts of the proposal, and in doing so addresses the Minister's Conditions. Highlights of the design are:

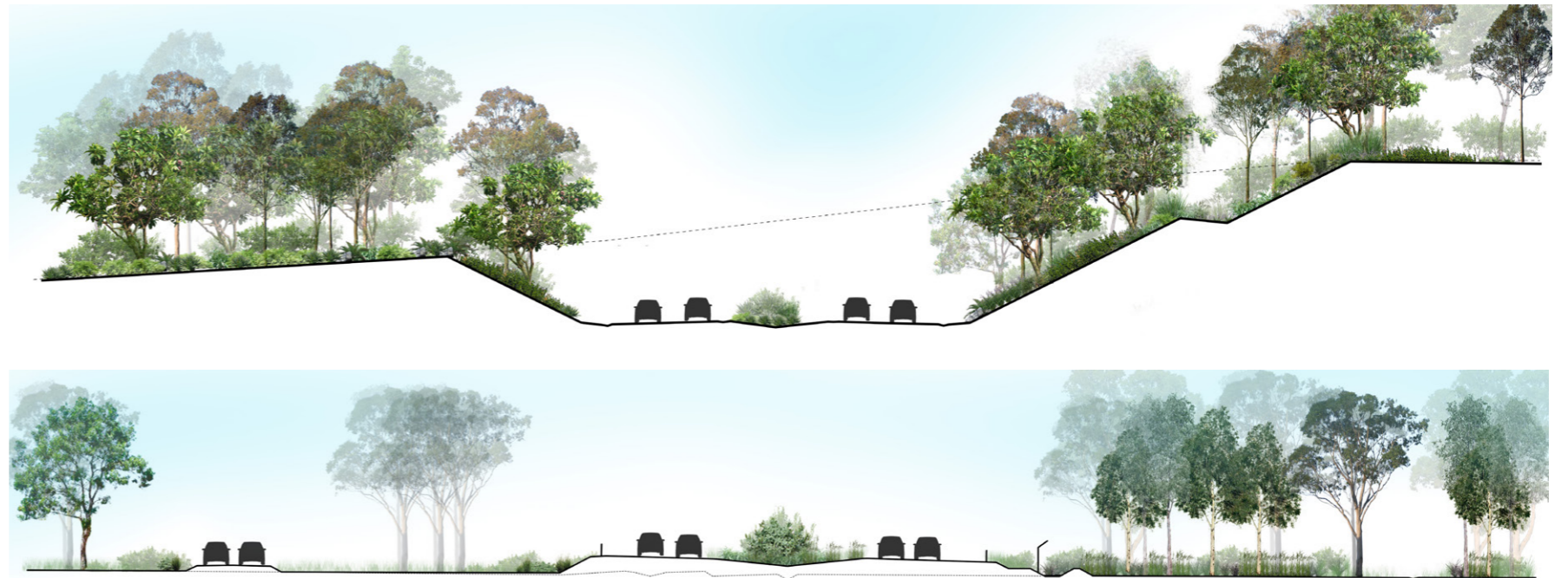


Figure 4: The route alignment passes through a variety of landscapes from enclosed forests (above) to flat open floodplains (below)

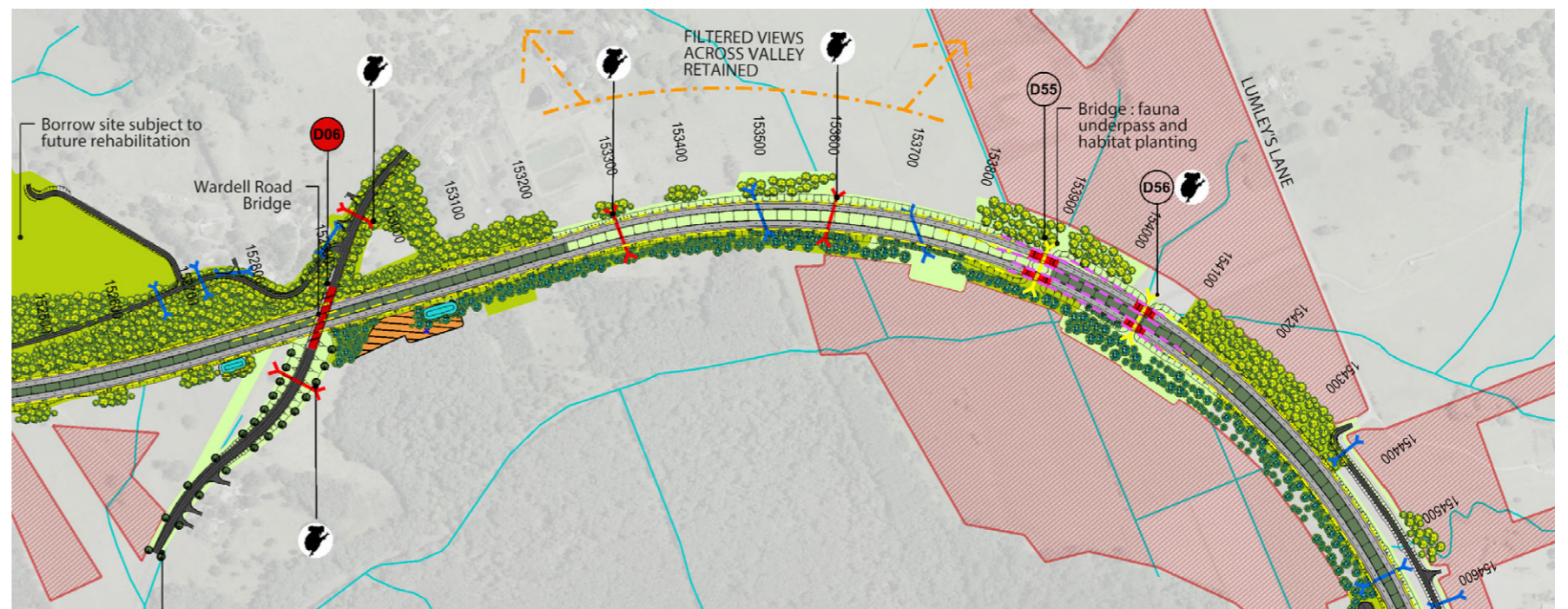


Figure 5: Typical landscape plan within Richmond River to Coolgardie Road - Section 10 indicating vegetation strategy and areas of koala management tree plantation

INTERCHANGE RESPONSE

The treatment of Wardell Road Bridge and the Coolgardie Road Interchange are used to both define progress along the corridor, and also interpret the presence of the nearby town of Wardell.

Coolgardie Interchange - the landscape design has responded to the landscape character of Wardell (adopting the Ficus tree which defines the main street of Wardell) and interprets this within the corridor to provide an arrival sequence that informs the highway user of the approaching interchange. Figures 1 and 3 provide visualisations of the corridor.

Wardell Overbridge - the landscape response acts as a visual marker and helps define progression along the alignment and context for the road user.

KOALA REVEGETATION STRATEGY

The Koala Revegetation Strategy will establish 130 hectares of new forest cover. The connection of the landscape within the corridor to these plantations is adopted to facilitate fauna movement, reconnecting previously fragmented fauna and flora corridors and provides a landscape legacy for future generations. This is an important environmental initiative for the project and for the region. Figure 5 shows a landscape plan within Richmond River to Coolgardie Road - Section 10 indicating proposed Koala Management Tree Plantation.

GENERAL

- The vegetation communities adopted within the design respond to those adjoining the corridor, reinforcing the landscape character of the alignment and its broader setting within its context
- The strategies adopted for the integration of the earthworks associated with the road blend the civil works with the adjoining landform. Figure 4 illustrates the dominant forms and the design response
- Bridge structures are simple and elegant in design and adopt a consistent design approach across all Sections of the W2B project
- Service roads are separated from the corridor and landscape used to limit the potential for headlight glare
- Visual screening is provided where the outlook of properties are altered by the construction of the road alignment
- Views are retained across valleys and floodplains to connect the highway alignment with the broader landscape.

LANDSCAPE CHARACTER ASSESSMENT

Included in the response is a review of the landscape character assessment and key viewpoints identified as part of the EIS process. The landscape character assessment revealed that there was no change in the overall landscape character assessment for the eight EIS precincts which make up or adjoin the corridor.

VISUAL ASSESSMENT

The visual assessment revealed a number of revisions to the assessment which resulted in an overall reduction in the impact of the proposal. Of the 15 sites assessed six were identified as having been improved by the proposed design through careful design and mitigations strategies. The changes in the design are predominantly in relation to the implications of the Koala Revegetation Strategy. This strategy introduces 130 hectares of land to be revegetated with forest adjoining the corridor. The impact of this is assessed as reducing the overall sensitivity or magnitude of the proposal. Five of the seven 'moderate to high' impact ratings within this portion of works were mitigated to moderate. All other impacts are either 'moderate', or 'moderate to low'.

As a result of the changes to the visual assessment some minor amendments were made to the mitigation measures associated with the works. The changes in measures have been summarised against those proposed in the EIS.

DETAILED RESPONSES TO DESIGN

Chapter 8 of the report details the specific responses to the design and methods of implementation/ management of the works. Items addressed include structures, interchange design, median and verge treatments, pedestrian and cycle network, fauna crossing, boundary and fauna fencing, lighting, planting, top soil management, drainage and water quality.

SUMMARY DRAFT URBAN DESIGN AND LANDSCAPE PLAN

The report presents a plan, cross sections, illustrative perspectives and supporting text to illustrate the compliance and addressing of the key environmental conditions of the project. In doing so it:

- Clearly identifies the principles and standards adopted for the projects urban and landscape design response
- Defines the vegetation communities which occur within the corridor and the revegetation strategies to be adopted in response to these
- Details the approach to the management and revegetation of ancillary facilities
- Addresses planting in relation to heritage constraints
- Integrates the revegetation of disturbed sites within the overall revegetation strategy
- Addresses the issue of local access including lighting and signage and path connectivity
- Address the visual impacts of the project through the adoption of a range of mitigation measures consistent with the EIS
- Defines the ongoing maintenance of the works to ensure it establishes and achieves the design intent
- Illustrates the involvement of community and councils in the development of the plan.
- Provides a high quality urban and landscape design that is consistent with the other upgrades of the Pacific Highway
- Delivers a project within a novel construction and delivery program to achieve operation for the benefit of the greater community.

The report is therefore considered to comply with the conditions of consent stipulated in the D20 of the Minister's Conditions of Approval.

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GLOSSARY AND ABBREVIATIONS

DEFINITIONS IN THIS REPORT	DEFINITION
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 25-100 mm depending on type of vegetation to be established.
Cover crop	Fast growing, but short lived non-native pasture grasses 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. After 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 diameter of less than 100 mm at about 500 mm above ground are considered frangible.
Hydromulching	Various types of organic fibrous materials mixed with water and sprayed onto the soil surface in slurry form 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.
Native Grasses	Grass species that are native to Australia.
Natural soils	Soils remaining in situ 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	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.

DEFINITIONS IN THIS REPORT	DEFINITION
Plant container	Containers for plant stock in various sizes and volumes. Pots are containers with rigid walls, which are identified by their diameter 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 building activity; the process involves soil treatment, which may include return of bushland soil, followed by drill seeding, hydromulching or mass planting.
Regeneration	The practice of restoring disturbed or cleared bushland areas where the soil profile remains intact by reinstating and reinforcing the natural regeneration processes in areas within or adjoining bushland, primarily through weed control (weed cover should be less than 15 percent after 12 months from 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 diameter of 40-50 mm or 75 mm. Includes individual containers as well as trays, and may have proprietary names.

ABBREVIATION	DESCRIPTION
AHMS	Aboriginal Heritage Management System
CEMP	Construction Environmental Management Plan
DP&E	Department of Planning and Environment
EIS	Environmental Impact Statement
EPBC Act	Environment Protection and Biodiversity Conservation Act
LMP	Landscape Management Plan
MCoA	Minister's Conditions of Approval
NPWS	National Parks and Wildlife Services
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PAD	Potential Archaeological Deposits
Roads and Maritime	Roads and Maritime Services
SPIR	Submissions/Preferred Infrastructure Report
TSC Act	Threatened Species Conservation Act
UDLP	Urban Design and Landscape Plan
WMP	Weed Management Plan
W2B	Woolgoolga to Ballina

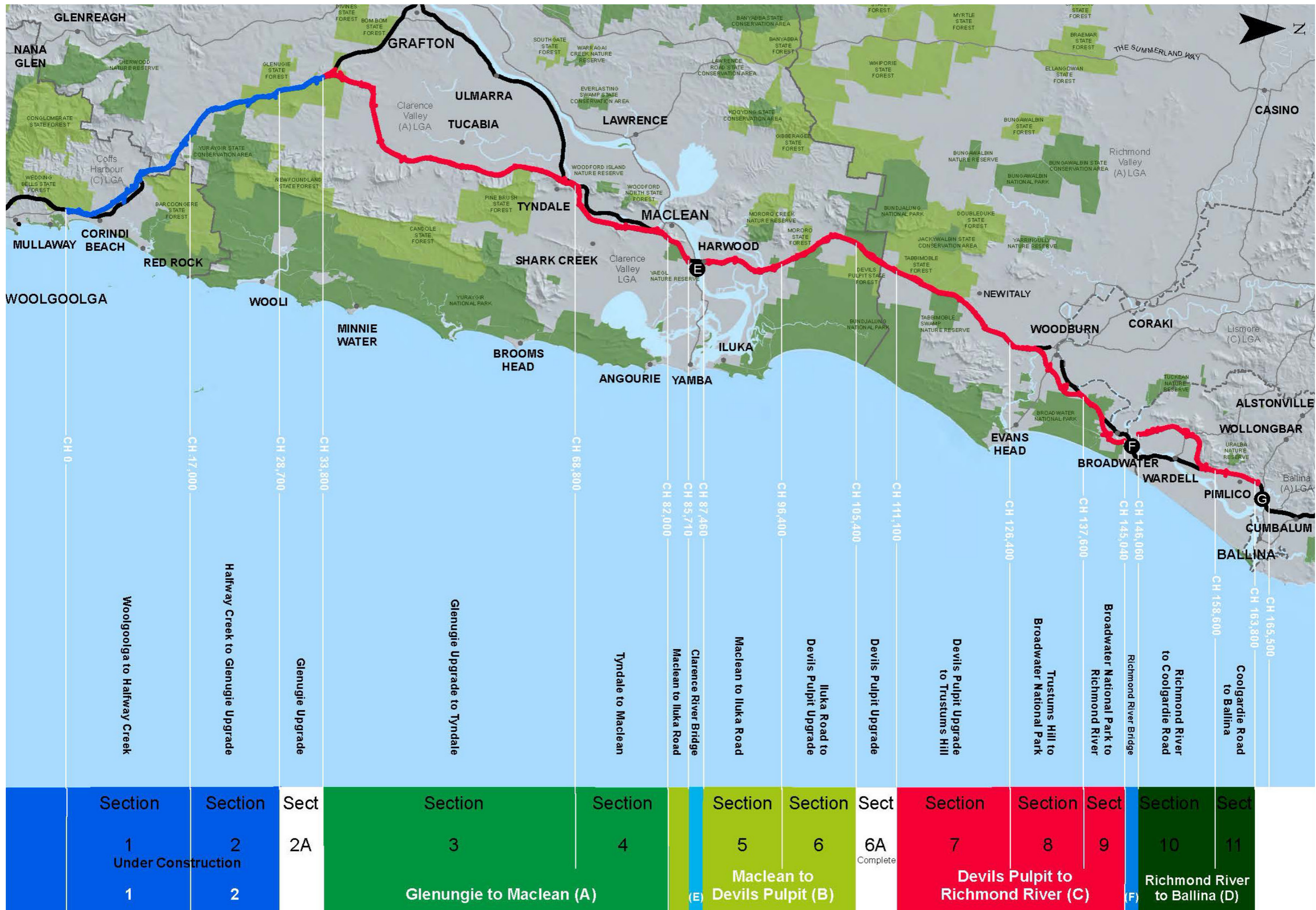


Figure 6: Woolgoolga to Ballina Upgrade division of Sections for project delivery (Source: Pacific Complete)

CHAPTER 1.

INTRODUCTION

1.1 BACKGROUND

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

An upgraded Pacific Highway must continue to service the needs of the travelling public and achieve transport efficiencies, while also ensuring ecological sustainability and meeting the needs of the coastal communities 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.

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 Pacific Highway 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 businesses, 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 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.

Sections 1 and 2 of the upgrade, between Woolgoolga and Glenugie, are being built and Sections 3-11 are being managed during design development.

Design and construction of the bridge crossing the Richmond River is being managed separately.

1.4 EIS & SPIR ENVIRONMENTAL MITIGATION MEASURES

This plan has been developed to address the requirements of the Minister's Conditions of Approval (MCoA) D20 and present an integrated urban design for the Woolgoolga to Ballina project. This plan specifically addresses Richmond River to Ballina (Sections 10 and 11) and demonstrates commitment to the mitigation and management measures identified in the Woolgoolga to Ballina Environmental Impact Statement (EIS), the submissions/preferred infrastructure report (SPIR, and other approved environmental management documentation).

1.5 URBAN AND LANDSCAPE DESIGN METHODOLOGY

The urban and landscape design methodology has been revised at each design stage. As the project progresses through detailed design an integrated multidisciplinary design approach has been instilled to achieve urban design and landscape objectives which provide a holistic, yet varied and consistent design strategy.

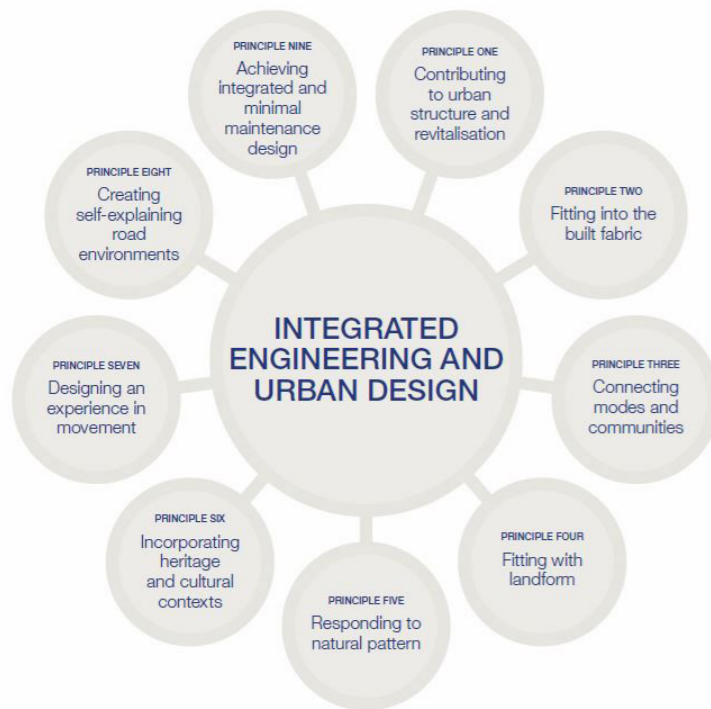


Figure 7: Urban design methodology process (Source: Roads and Maritime, 2013)

1.6 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 Draft 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 Services 2012
- *Woolgoolga to Ballina Urban Design Report Landscape Character & Visual Impact Assessment*, Roads and Maritime Services 2012
- *The Woolgoolga to Ballina – Pacific Highway Upgrade – EIS Working Paper – Biodiversity Assessment*, Roads and Maritime Services 2012
- *Upgrading the Pacific Highway – Design Guidelines*, March 2015.

Guidelines documents:

- *Guideline for Batter Surface Stabilisation using vegetation*, RMS, April 2015
- *Environmental Impact Assessment Practice Note: Guidelines for Landscape Character and Visual Impact Assessment ("EIA No4 Guidelines")*, RMS, March 2013
- *Soils for Landscape and Garden Use*, Australian Standards AS 4419
- *Composts, Soil Conditioners and Mulches*, Australian Standards AS 4454
- *Construction Specifications including R178 Vegetation and R179 Planting*, RMS
- *Beyond the Pavement – Urban Design Policy, Procedures and Design Principles*, RMS 2014
- *Bridge Aesthetics*, RMS, July 2012
- *Landscape Guidelines*, RMS, April 2008

- *Shotcrete Design Guidelines*, RMS, March 2016
- *Noise Wall Design Guidelines*, RMS, March 2016
- *Biodiversity Guidelines – Protecting and Managing Biodiversity*, RTA Sept 2011.



Figure 8: Roads and Maritime design guidelines (Source: Roads and Maritime, 2013)

1.7 DOCUMENT STRUCTURE

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

TITLE	DESCRIPTION
Executive Summary	Provides a summary of the Draft UDLP
Chapter 1 Introduction	Provides a broad overview of the project and identifies the purpose and structure of the Draft UDLP
Chapter 2 Compliance With Environmental Approval Documents	Provides a broad overview of the Pacific Highway Upgrade
Chapter 3 Consultation	Describes the consultation undertaken, and identifies the corresponding issues raised and where they are addressed in this Draft UDLP
Chapter 4 Pacific Highway Urban Design, Landscape Objective and Principles	Describes the project wide urban design and landscape objectives and principles
Chapter 5 Contextual Analysis for Sections 10 and 11	Describes specific contextual analysis & design implications
Chapter 6 Sections 10 and 11 Design Principles	Presents urban design principles in relation to the requirements outlined in the MCoA
Chapter 7 Sections 10 and 11 Urban Design and Landscape Design	Concept urban design and landscape design presenting the integrated landscape and urban design solutions
Chapter 8 Detailed responses for the urban and landscape design	Detailed descriptions of all urban and landscape elements
Chapter 9 Conclusion	Summary of design outcomes
Chapter 10 Bibliography	List of referenced documents

Table 1: Document structure

CHAPTER 2.

COMPLIANCE WITH ENVIRONMENTAL APPROVAL DOCUMENTS

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 Draft 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.

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. Appendix A outlines compliance with relevant environmental mitigation measures related to landscape and urban design specific to Richmond River to Ballina (Sections 10 and 11).

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

MINISTERIAL CONDITION OF APPROVAL FOR URBAN AND LANDSCAPING (D20)	DOCUMENT REFERENCE
<p>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 Roads and Maritime Services urban design and visual guidelines, the design principles outlined in the EIS, and the revegetation principles outlined in the EIS Working Paper—Biodiversity. The Plan shall be prepared by an appropriately qualified expert in consultation with the relevant council and community, to the satisfaction of the Secretary. The Plan shall include, but not necessarily be limited to:</p> <p>(a) identification of design principles and standards based on:</p> <ul style="list-style-type: none"> (i) local environmental values; (ii) heritage values; (iii) urban design context; (iv) sustainable design and maintenance; (v) community amenity and privacy; (vi) relevant design standards and guidelines; and (vii) the urban design objectives outlined in Chapter 4.2 of the EIS Working Paper—Urban Design Landscape Character and Visual Impact 	<p>Refer to Chapter 6, Sub-chapter 6.3 Sub-chapter 6.4 Sub-chapter 6.2 Sub-chapter 6.5 Sub-chapter 6.6 Chapter 4</p>
<p>(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;</p>	<p>Refer to Chapter 5, Sub-chapter 5.4 existing vegetation communities, Chapter 8, Sub-chapters 8.4 and 8.7 Refer to Chapter 6, Sub-chapter 6.7</p>
<p>(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;</p>	<p>Refer to Chapter 6, Sub-chapter 6.7</p>
<p>(d) take into account appropriate roadside plantings and landscaping in the vicinity of heritage items and ensure no additional heritage impacts;</p>	<p>Refer to Chapter 8, Sub-chapter 8.4.5 Refer to Chapter 6, Sub-chapter 6.7</p>
<p>(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 timeframes for rehabilitation works, procedures for monitoring success of regeneration or revegetation, and corrective actions should regeneration or revegetation not conform to the objectives adopted;</p>	<p>Refer to Chapter 8, Sub-chapter 8.2</p>
<p>(f) location and design treatments for any 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;</p>	<p>Refer to Chapter 6, Sub-chapter 6.6 and Chapter 7, 7.8</p>
<p>(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;</p>	<p>Refer to Chapter 7</p>
<p>(h) graphics such as cross sections, perspective views and sketches for key elements of the SSI, including, but not limited to built elements of the SSI;</p>	<p>Refer to Chapter 8</p>
<p>(i) strategies for progressive landscaping and other environmental controls such as erosion and sedimentation controls, drainage and noise mitigation;</p>	<p>Refer to Chapter 8 and Appendix Landscape Management Plan</p>
<p>(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; and</p>	<p>Refer to Chapter 3</p>
<p>(k) evidence of consultation with the relevant council and community on the proposed urban design and landscape measures prior to its finalisation.</p>	

Table 2: Document reference to Ministerial Conditions of Approval - D20 requirements

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 12 in Chapter 7 identifies EIS landscape strategies related to landscape and urban design specific to Richmond River to Ballina (Sections 10 and 11). For locations of the viewpoints please refer to Figure 60.

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 the EIS, comprised of a Mitigation Strategy, a Monitoring Strategy and an Offset Strategy. Appendix B 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. The vegetation and landscape design principles for connectivity measures identified in the Biodiversity Connectivity Strategy are listed in Table 3.

DESIGN PRINCIPLE - VEGETATION/LANDSCAPING	ADDRESSED FOR PORTION BETWEEN RICHMOND RIVER TO BALLINA
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.	Yes - Refer Chapter 8.6 Drainage and Water Quality
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	Yes - Refer Chapter 8.7 Fauna Crossings
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 <i>Gahnia</i> , <i>Lomandra</i> and <i>Dianella</i> spp. represent food plants for emus and may attract them to the road edge and should avoid being planted.	No - No emu habitat identified in Section 10 and 11
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 <i>Acacia</i> or <i>Casuarina</i> . 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	No - No emu habitat identified in Section 10 and 11
Plantings around dedicated and combined underpasses is to ensure that entrances to the structure do not obscure the structure and provide a clear line of sight	Yes - Refer Chapter 8.7 Fauna Crossings
It is important for landscaping at entrances not to intrude / shadow the window of the entrances	Yes - Refer Chapter 8.7 Fauna Crossings

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

2.5 COMPLIANCE WITH THREATENED SPECIES MANAGEMENT PLANS

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

The Threatened Species Management Plans for the Woolgoolga to Ballina project, and their applicability to the section, are outlined in Table 4.

This Draft UDLP addresses the mitigation measures related to landscape and urban design stipulated in the threatened species management plans that are applicable to the area between Richmond River and Ballina (Sections 10 and 11). Appendix C provides further details about compliance with specific urban design and landscape requirements that are included in these management plans.

As part of the Conditions of Approval for the project, the Ballina Koala Plan and Koala Management Plan must be approved before building can start in the area known as section 10, which starts at Broadwater and finishes at Coolgardie, south of Ballina.

THREATENED SPECIES MANAGEMENT PLAN	APPLICABLE TO RICHMOND RIVER TO BALLINA
<i>Coastal Emu Management Plan</i> (Roads and Maritime, 2015)	No
<i>Koala Management Plan</i> (Roads and Maritime, 2016)	Yes
<i>Rainforest Communities and Threatened Rainforest Plants Management Plan</i> (Roads and Maritime, 2015)	Yes
<i>Threatened Flora Management</i> (Roads and Maritime, 2015)	Yes
<i>Flora Translocation Strategy</i> (Roads and Maritime, 2016)	Yes
<i>Threatened Fish Management Plan</i> (Roads and Maritime, 2015)	Yes
<i>Threatened Frog Management Plan</i> (Roads and Maritime, 2015)	Yes
<i>Threatened Glider Management Plan</i> (Roads and Maritime, 2015)	Yes
<i>Threatened Invertebrate Management Plan</i> (Roads and Maritime, 2015)	Yes
<i>Threatened Mammal Management Plan</i> (Roads and Maritime, 2015)	Yes

Table 4: Threatened Species Management Plans for the Woolgoolga to Ballina project, and their applicability to the section

CHAPTER 3. CONSULTATION

Community and stakeholder consultation for the project has been carried out in line with the *Woolgoolga to Ballina Communications and Stakeholder Engagement Strategy*. The strategy identifies the key stakeholders and communities, and the methods by which they would be consulted.

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

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

The key consultation activities for the project are:

- Project notifications
- Variable message signage (VMS)
- Community information sessions
- Staffed information displays
- Stakeholder briefings

- Face-to-face meetings
- Woolgoolga to Ballina information centre
- Community focus groups
- 1800 information line
- Email
- Collaborative map
- Community contact database and complaints handling procedure.

3.1 COMMUNITY CONSULTATION

Limited preliminary draft detailed design concepts for the Draft UDLP were available for community review and comment during community information sessions held in April and May 2016. The Draft UDLP will be placed on public exhibition for the community to provide input. Following the exhibition period all community comments will be collated and where appropriate the Draft UDLP will be revised and finalised in response to community comments.

3.2 STAKEHOLDER CONSULTATION

Agency stakeholders identified in the Woolgoolga to Ballina Communications and Stakeholder Engagement Strategy were invited advised the Draft UDLP would be available for review and comment. Stakeholders who will be provided the Draft UDLP to review include:

- NSW Environment Protection Agency
- NSW Department of Primary Industries – Fisheries
- Ballina Council.

Following agency review all stakeholder comments will be collated and where appropriate the Draft UDLP will be revised and finalised in response to those comments.

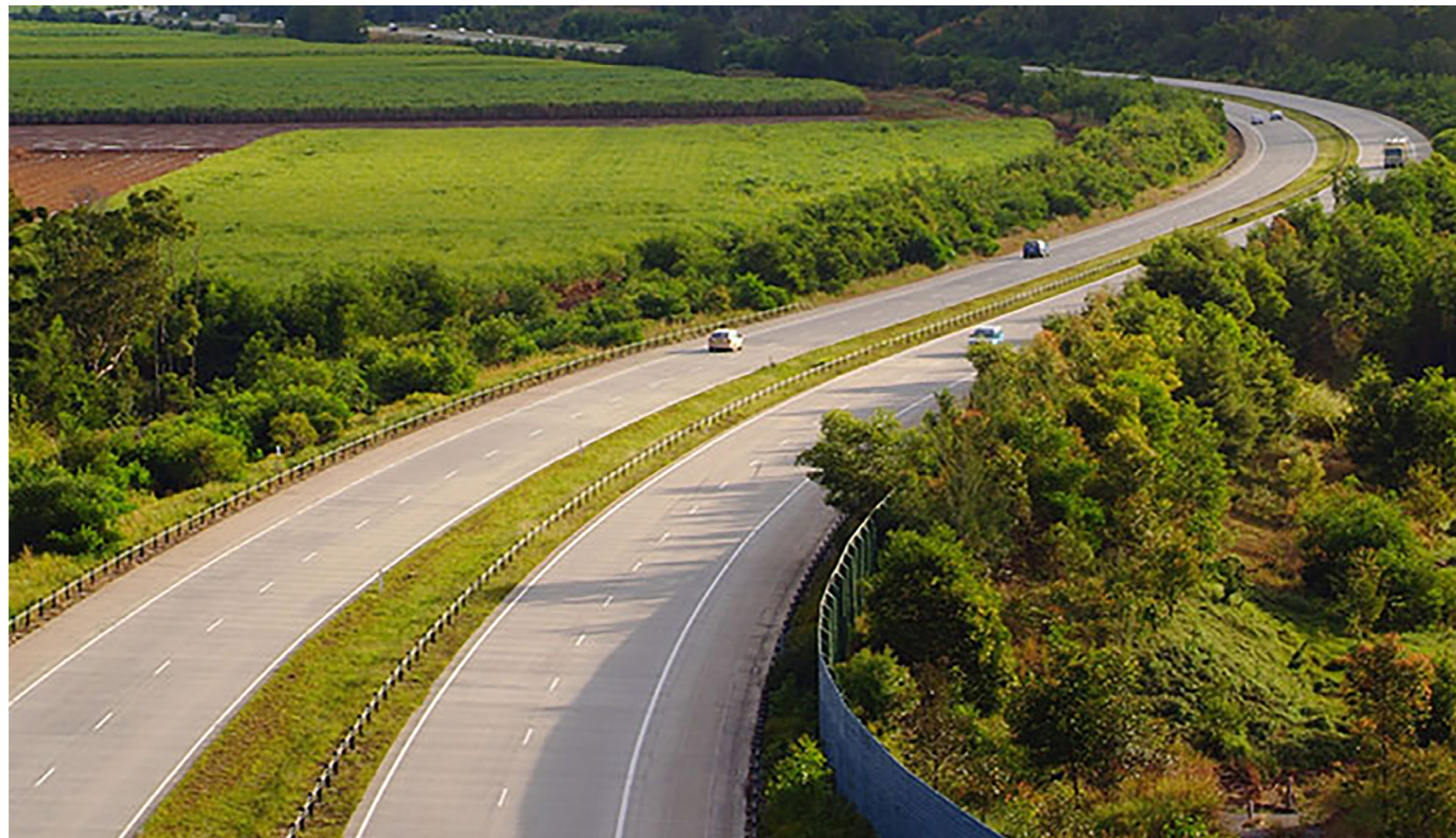


Figure 9: Flowing alignment of the Pacific Highway - Yelgun to Chinderah demonstrates the vision

CHAPTER 4.

PACIFIC HIGHWAY URBAN DESIGN, LANDSCAPE OBJECTIVES AND PRINCIPLES

4.1 VISION

The Pacific Highway Urban Design Framework (Roads and Maritime, 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 URBAN DESIGN OBJECTIVES

In fulfilling the vision a number of key objectives were developed by Roads and Maritime as follows:

- 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.

4.3 URBAN DESIGN AND LANDSCAPE PRINCIPALS

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

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

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

4.4 URBAN DESIGN AND LANDSCAPE STRATEGY

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

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

4.4.1 PROJECT WIDE LANDSCAPE AND URBAN DESIGN STRATEGIES

The project wide landscape and urban design strategies outlined in the project EIS Working paper Urban design report, landscape character and visual impact assessment (Hassell, 2012) are depicted in Figure 10 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.

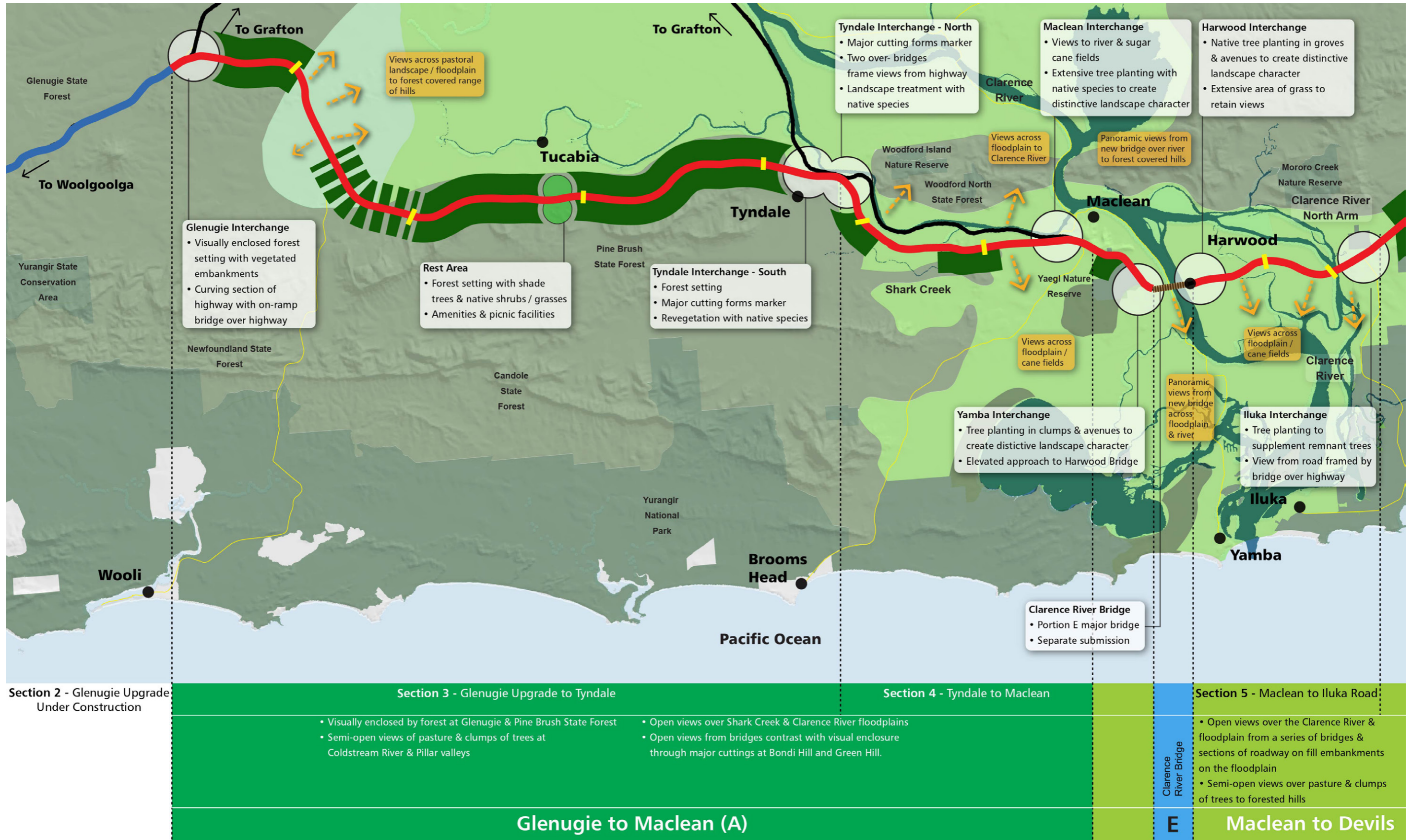
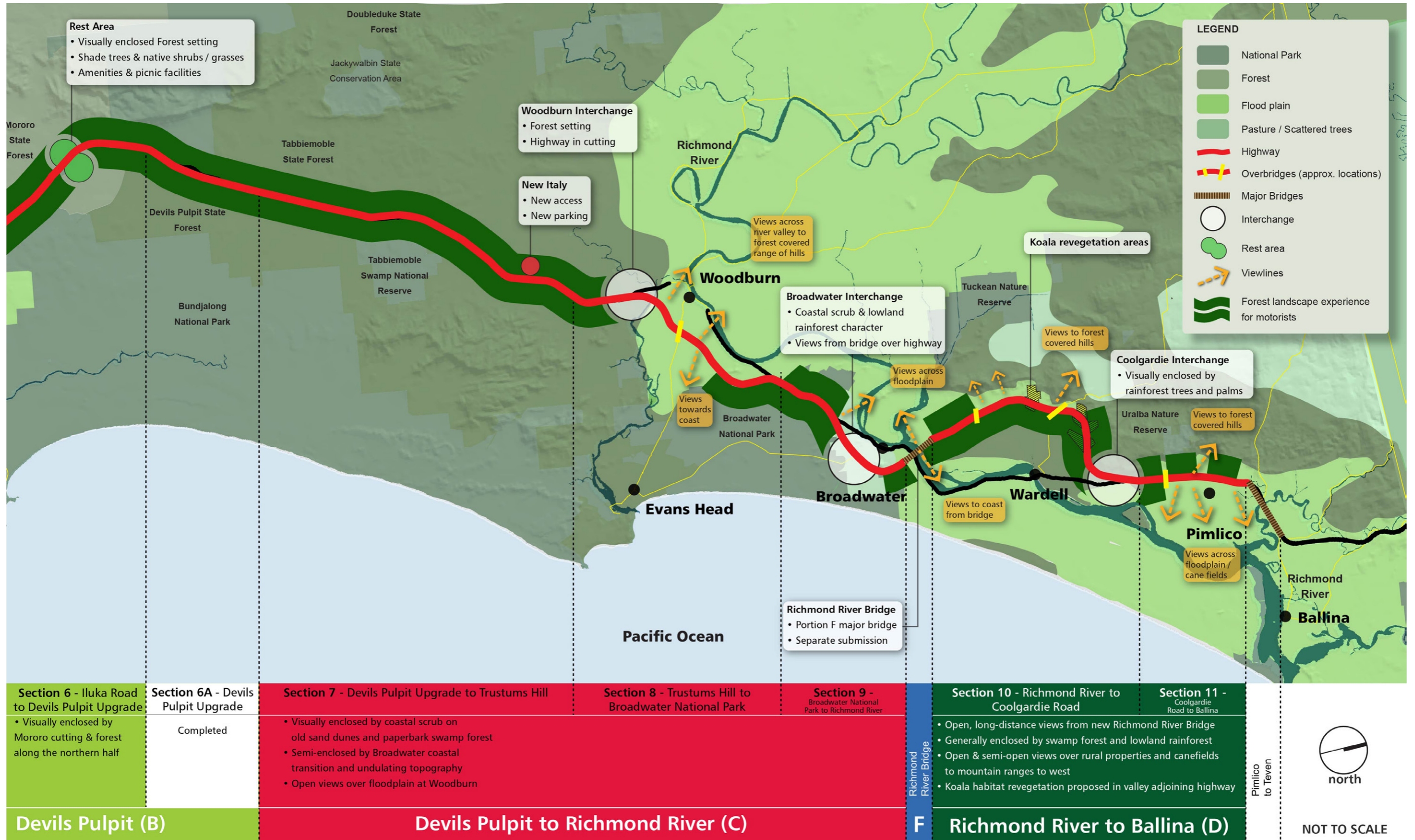


Figure 10: The Strategy Plan for the Woolgoolga to Ballina Pacific Highway upgrade



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
- 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.

Built elements

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

4.4.2 RICHMOND RIVER TO BALLINA (SECTIONS 10 AND 11) SPECIFIC LANDSCAPE AND URBAN DESIGN STRATEGIES

In addition to the overarching urban design objectives for the Pacific Highway, supplementary objectives for the Woolgoolga to Ballina upgrade are outlined within the EIS Chapter 11 - *Urban Design, Landscape Character and Visual Impact Assessment* (Hassell, 2012). These are used as a basis for the development of objectives specific for Richmond River to Ballina (Sections 10 - 11) as follows:

Objective 1: To ensure that the town of Wardell is acknowledged on the Pacific Highway

Design Principles:

- The landscape design of the Coolgardie Interchange provides a distinctive treatment that is place specific, which adds to the suite of legibility indicators and decision points along the corridor
- Elements of the final interchange design are introduced within the alignment on approach to the interchange providing a stronger connection with the township.

Objective 2: To provide consistency in design language through the overall Woolgoolga to Ballina upgrade and the Pacific Highway, and at the same time provide interest through location specific treatments where appropriate

Design Principles:

- Landscape treatments are designed to reflect the character of the precinct through which the projects passes retaining open landscapes where traversing pasture and crop lands, and enclosed landscape treatments where passing through forests
- Interchanges are signalled in the design response both at the interchange and also on its approach reinforcing the signage strategy for these elements
- Landscape palettes while specific to the area are co-ordinated with other Sections to provide consistency in building techniques.

Objective 3: To ensure visual impact to rural houses are minimised

Design Principles:

- Retention of existing vegetation in and around residential properties next to the alignment is maximised
- Focused screen planting is provided where a direct impact is experienced either as part of property work or as part of the overall alignment design
- Shrub as well as tree planting is utilised as a means of achieving screen planting in order to ensure a connection is still maintained to the adjoining landscape context from the alignment.

Objective 4: To maintain key views from the highway

Design Principles:

- Landscape treatments respond to the existing view opportunities, reinforcing the sense of enclosure or responding to panoramic or focused views
- Views across the floodplain at Pimlico are emphasised to highlight the interface between the mountain ranges and the flat of the floodplain.

Objective 5: To ensure major cut batters blend with surrounding landscape

Design Principles:

- Transitional slopes are provided at the start and end of cuttings to ensure an integrated profile
- Rounding to the top of cuttings is provided so a smooth gradual interface is achieved
- If vertical cuttings are used planting is provided at the base of cut to soften the interface.

In delivering these objectives, it is a project requirement to be consistent with the intentions, requirements and approach of the EIS and Submissions Reports/Preferred Infrastructure Report to achieve:

- Building approval from DP&E on-program
- Building deadlines
- Efficient effective landscape outcomes.

CHAPTER 5.

CONTEXTUAL ANALYSIS FOR RICHMOND RIVER TO BALLINA (SECTIONS 10 AND 11)

5.1 CHARACTER PRECINCTS

Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 are located between Broadwater and Pimlico, is bounded by the Richmond River to the east and the Great Diving Range to the west. It sits within the floodplain of the Richmond River which extends parallel to the project in a north-south direction.

These Sections dissect predominantly rural and agricultural land used for grazing and agricultural purposes. They are interrupted by dense areas of forest, rising topography of the Great Diving Range and the wide sweeping form of the Richmond River. The settlements within the area predominantly consist of scattered and small clusters of houses, and a number of small towns which include Broadwater and Wardell with populations around 500-700 people. Broadwater to the south of Richmond River to Coolgardie Road - Section 10 is the centre of the sugar industry and its sugar mill on the Pacific Highway provides a key landmark to the area. Wardell is a small, picturesque town along the existing Pacific Highway and Richmond River. It has a local store, a pub and a few streets with large Fig trees (*Ficus microcarpa* 'Hillii'), and is bypassed by Richmond River to Coolgardie Road - Section 10 works.

As part of the approval requirement (in D20) the design is required to respond to local values and characteristics. This Chapter of the Draft UDLP defines these values which are then used to inform the design response for the project. Landscape Character is defined as, 'The combined quality of built, natural and cultural aspects that make up an area and provide its unique sense of place' in the Guideline for Landscape Character and Visual Impact Assessment (Roads and Maritime, 2013).

The EIS identified a total of 54 landscape character precincts for the entire project. Within the region from Richmond River to Ballina (Sections 10 and 11), eight precincts were identified. These are illustrated in Figure 11 and listed below:

RICHMOND RIVER TO COOLGARDIE ROAD - SECTION 10

- 47 - Tuckean Broadwater
- 48 - Cabbage Tree Island and floodplain
- 49 - Bagotville floodplain & Lumleys Hill
- 50 - Bingal Creek
- 51 - Wardell township
- 52 - Blackwall Range

COOLGARDIE ROAD TO BALLINA - SECTION 11

- 52 - Blackwall Range
- 53 - Pimlico
- 54 - Emigrant Creek

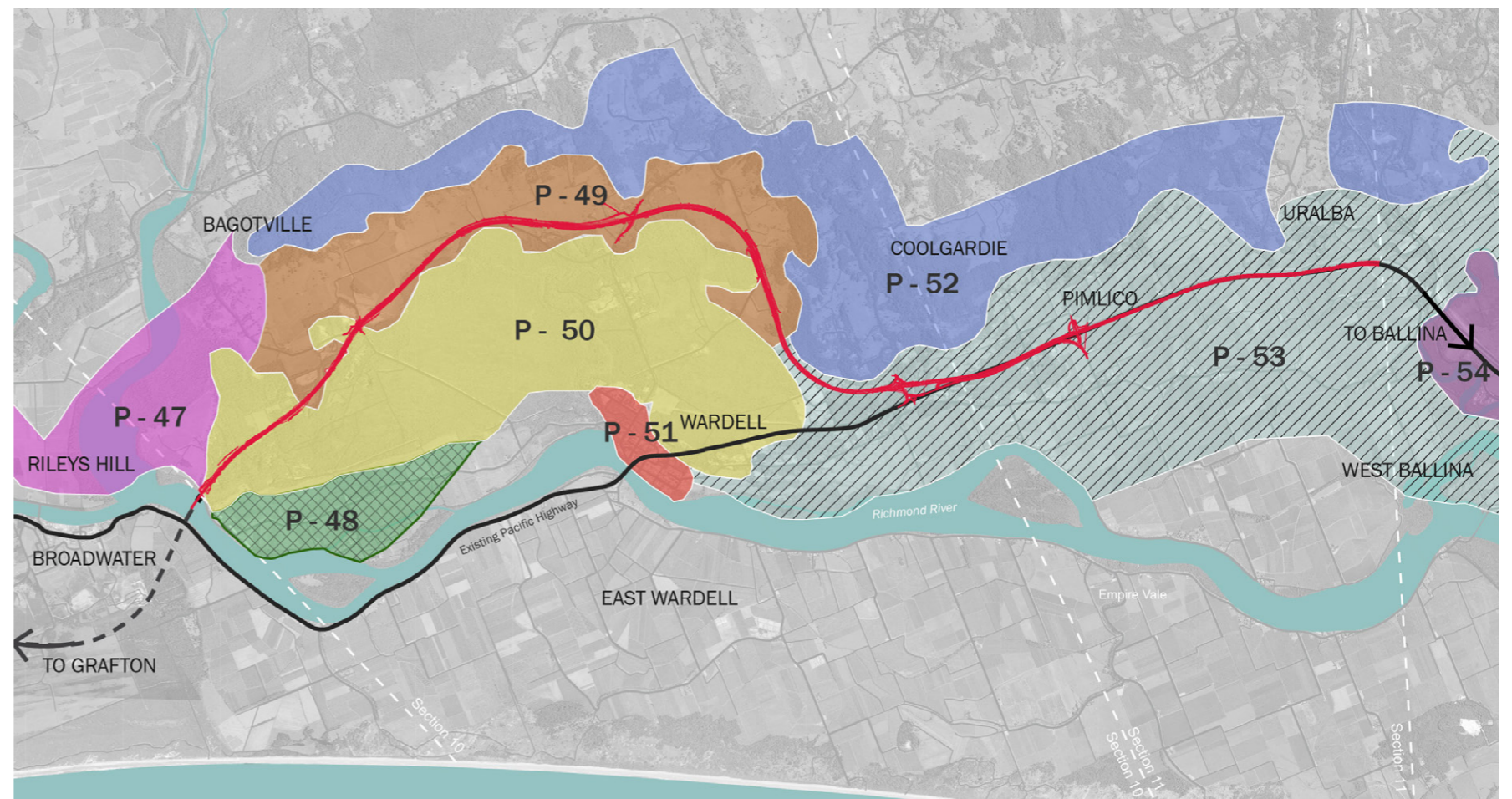


Figure 11: Richmond River to Ballina (Sections 10 and 11) Landscape Character precincts

Key

Section 10 - Richmond River to Coolgardie Road

- P - 47 Tuckean Broadwater
- P - 48 Cabbage Tree Island and floodplain
- P - 49 Bagotville floodplain & Lumleys Hill
- P - 50 Bingal Creek
- P - 51 Wardell township
- P - 52 Blackwall Range

Section 11 - Coolgardie Road to Ballina

- P - 52 Blackwall Range
- P - 53 Pimlico
- P - 54 Emigrant Creek

- Pacific Highway upgrade Richmond River to Ballina (Sections 10 and 11)
- Existing Pacific Highway



5.1.1 CHARACTER PRECINCT 37 - TUCKEAN BROADWATER

This precinct, comprised of an area of the floodplain of the Richmond River, is visually contained by three dominant hills, including part of the Blackwall Mountain Range and Alleys Hill. Dense mangroves along the water's edge contain views beyond the immediate vicinity limiting potential views to the proposal and the sugarcane beyond. An abrupt and strong edge is formed between the sugarcane landscape of the floodplain and the heathland vegetation to the west associated with the elevated lands of the Blackwall Mountain Range and Alleys Hill.

DESIGN CONSIDERATIONS

- Respond to adjoining vegetation communities
- Address topographic impacts and integrate alignment with landform.

5.1.2 CHARACTER PRECINCT 48 - CABBAGE TREE ISLAND AND FLOODPLAIN

Located within the Richmond River, this precinct occurs east of the alignment and is visually disconnected from it by the Bingal Creek woodland and ridge. It occurs on the floodplain of the Richmond River which physically divides the precinct. Despite the rivers presence it is not the visually dominant element. This is largely due to limited views of the river from within the precinct where dense mangroves screen the water on the western side, and on the eastern side intermittent views are soon lost inland to views of sugarcane.

DESIGN CONSIDERATIONS

This precinct is located beyond the alignment with no immediate interface. No specific actions are required to address impacts on the character of the precinct.



Figure 12: Aerial view of the Richmond River and floodplain within Character Precinct 48, looking west

5.1.3 CHARACTER PRECINCT 49 - BAGOTVILLE FLOODPLAIN & LUMLEYS HILL

Located to the west of the proposed alignment and the Bingal Creek Woodland, it runs from Old Bagotville Road through to just north of Lumleys Road. This precinct combines elements of the lower foothills of the Blackwall Mountain Range and the agrarian floodplains. The rolling terrain emphasises the transition from the mountains to the floodplain. The dense woodland of the hills is offset by the lush cane fields and open grasslands of the valley and creates an attractive, high quality landscape.

DESIGN CONSIDERATIONS

- Respond to adjoining vegetation communities
- Retain views across valley to Blackwall Range
- Respond to isolated dwellings by screening alignment and controlling views.

5.1.4 CHARACTER PRECINCT 50 - BINGAL CREEK

Located predominantly to the east of the approved alignment, this precinct consists of a raised vegetated ridge characterised by diverse vegetation communities which range from dense mature forest to Banksia heath forest (Figure 12 to 20) that have experienced limited disturbance. This is a scenic undulating landform with an enclosed landscape character.

A number of shallow quarries are located just off Old Bagotville Road which provide a point of disturbance within the otherwise intact body of this zone. The approved alignment of the road passes through this break in the canopy. Some distant views to Blackwall Range can be gained from the margins and clearings on the higher points within the forested landscape.



Figure 13: View of low grazing land and backdrop of Wardell Mountain from Thurgates Lane within Character Precinct 49

DESIGN CONSIDERATIONS

- Respond to adjoining vegetation communities
- Revegetate quarried sites, acquired as part of the project works
- Maintain and reinforce forested character of precinct.

5.1.5 CHARACTER PRECINCT 51 - WARDELL TOWNSHIP

This precinct is remote from the approved road alignment, being located to its east, and is defined by the extent of urban development of Wardell. The township is divided by the existing Pacific Highway and perhaps because of this historic division there is no one central core to the township. The post office, police station and other emergency services are separate from shops



Figure 14: View of raised vegetated ridge of mature forest within Character Precinct 50



Figure 15: Main street of Wardell with hotel and feature Fig trees in the foreground and Richmond River beyond, Character Precinct 51

and other commercial/retail outlets. To its west the Bingal Creek Woodland defines its limits whereas to the north, forest and sugarcane intermingle creating an informal edge to its limits. The heritage listed Richmond River Bridge on the highway is a landmark within the town as well as a visual marker on the highway.

DESIGN CONSIDERATIONS

This precinct is located beyond the alignment with no immediate interface. Despite this it is the main urban centre adjoining the corridor which should be captured in the design.

- The design of Coolgardie Interchange should signal the entrance into Wardell
- Planting design should capture the landscape character or landscape elements of Wardell
- Respond to adjoining vegetation communities.



Figure 16: Blackwall Mountain range within Character Precinct 52 in the background and the sugarcane fields of Character Precinct 53 in the foreground



Figure 17: Sugarcane fields within Character Precinct 53

5.1.6 CHARACTER PRECINCT 52 - BLACKWALL RANGE

This precinct is located to the west of the alignment, and extends along its length within Richmond River to Ballina (Sections 10 and 11) and is defined by the Blackwall Range. The Blackwall Range forms a clear and distinct limit to the visual catchment transitioning from the floodplain of the valley to steep, wooded slopes. The rolling terrain emphasises the transition from the mountains to the floodplain. The dense woodland of the hills is offset by the lush cane fields and creates an attractive, high quality landscape. This precinct is technically beyond the corridor but within its view catchment.

DESIGN CONSIDERATIONS

- Respond to adjoining vegetation communities
- Retain views across valley to Blackwall Range
- Respond to isolated dwellings by screening alignment and controlling views.



Figure 18: Emigrant Creek within Character Precinct 54

5.1.7 CHARACTER PRECINCT 53 - PIMLICO

This character precinct, part of Coolgardie Road to Ballina - Section 11, dominates the character and feel of this end of the corridor. Its character is defined by the land-uses of the Richmond River, which are dominated by the sugarcane industry. These fields create an attractive high quality landscape which experiences seasonal change with the harvesting of the crops. The landscape, part of the floodplain is flat to slightly undulating terrain, with the ridge of the Blackwall Range located to the west of the alignment (Figure 16). The current alignment of the highway provides expansive views across the floodplain. Isolated houses are located both on the floodplain and within the foot slopes and tops of the adjoining ridgelines.

DESIGN CONSIDERATIONS

- Respond to adjoining vegetation communities, in particular the agricultural focus of the floodplain
- Retain views across the Richmond River floodplain to Blackwall Ranges
- Respond to isolated dwellings by screening alignment and controlling views.

5.1.8 CHARACTER PRECINCT 54 - EMIGRANT CREEK

Located at the northern most end of Coolgardie Road to Ballina - Section 11 and associated with the Pimlico to Teven Works, Emigrant Creek is characterised by the winding path of the creek, which feeds into the Richmond River. The precinct is defined by the heavily vegetated edges of the Creek, which form a transitional landscape between the extensive floodplain of the Richmond River and the township of Ballina.

DESIGN CONSIDERATIONS

This precinct is located beyond the alignment with no immediate interface. No specific actions are required to address impacts on the character of the precinct.

5.2 LAND USE AND COMMUNITIES

5.2.1 RURAL LAND

Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 traverses mainly rural land, which is used for either grazing or agricultural purposes. The southern region of the alignment, Richmond River to Coolgardie Road - Section 10, intersects extensive grazing land, associated with dairy farming and beef production.

The agricultural land largely occurs in the northern region, Coolgardie Road to Ballina - Section 11, and is generally used for sugar production. There are also some small parcels of land in this area being used for horticultural purposes such as avocado, fruit, nuts, coffee and herbal plant production. This crop and horticultural land according to the *Northern Rivers Farmland Protection Project* (Department of Primary Industries, 2005) is identified as regionally significant farmland. Additional land uses close to Richmond River to Ballina (Sections 10 and 11) include extensive forested areas, which although not zoned, comprise land for environmental conservation.

5.2.2 URBAN SETTLEMENT

Wardell is the largest urban settlement between Richmond River to Ballina (Sections 10 and 11), located on the banks of the Richmond River with an approximate population of 650 (Australian Bureau of Statistics, 2011). It has a village character with largely single storey, low density houses and a large number of open space areas for public recreation. The new alignment will bypass Wardell, which will help to improve the amenity of the town by reducing traffic noise and improving local air quality.

Outside of Wardell, there are a number of scattered rural properties located near the project and are generally single storey houses on large blocks ranging from one acre to 100 hectares. There are clusters of houses along Wardell Road, Coolgardie Road and Pimlico Road.

There is an Aboriginal community on Cabbage Tree Island affiliated with the Bundjalung people. It has existed since the 1880s where the community was self-sufficient before it became a reserve and later a station. Today the island is home to a number of families, a school and areas of agricultural land primarily used for sugarcane production.

Furthermore, the project impacts around 10 hectares of land currently used for a quarry, extracting shale (sand) near Old Bagotville Road (NSW Roads and Maritime Services, 2012).

5.2.3 FUTURE DEVELOPMENT

There are no urban release areas identified for future residential or employment land directly impacted by the project. However, the project will support future development across the region through improved access and connectivity to major regional centres such as Coffs Harbour and Ballina as well as areas outside of the region such as south east Queensland.

On a broader level, the *Northern Rivers Regional Plan 2013 - 2016* identifies continued population and economic growth within the region. The major growth industries include tourism, building and property development, wholesale and retail trade, recreational and cultural industries, and health and community services (Regional Development Australia - Northern Rivers NSW, 2013).

5.2.4 ROAD NETWORK

The Pacific Highway is the key transport link of the region connecting Sydney to Brisbane, as well as local residents to Ballina and Byron Bay, neighbouring towns and places of work. After the completion of Richmond River to Ballina (Sections 10 and 11), accessibility and connectivity of the region will be improved. Within the area from Coolgardie Road to Ballina - Section 11, direct access from the highway to some existing local roads will be removed resulting in local residents using the Coolgardie Interchange to access these local roads.

5.2.5 PUBLIC TRANSPORT

A number of regional, local and school bus services operate in the area. Regional buses also operate between Sydney and Brisbane via the Pacific

Highway. There are also bus connections to the railway in Casino operating seven days a week. Two school bus services operate during the week and a local bus route 660 connecting Broadwater to Ballina via Wardell along the Pacific Highway. Furthermore, there is a daily bus service from Cabbage Tree Island to Ballina.

One bus stop within Richmond River to Coolgardie Road - Section 10, will be affected due to its proximity to the building site, therefore, will require relocation after consultation with the bus operator.

After completion of the alignment from Richmond River to Ballina (Sections 10 and 11), it is anticipated the bus operators will update their bus services to use the upgraded Pacific Highway.

5.2.6 CYCLE AND PEDESTRIAN PATHS

There are a number of existing cycle and pedestrian paths within Ballina. In the rural areas, close to the project area, there is an existing on-road cycle path along Pacific Highway though Broadwater and Wardell, which extends almost to Pimlico. There are a number of Roads and Maritime planned cycle paths connecting to the existing paths along Pacific Highway to Ballina and Broadwater.

After the completion of Richmond River to Ballina (Sections 10 and 11), pedestrian and cyclist access and connectivity within Wardell will be improved due traffic separation resulting in a safer cyclist and pedestrian friendly environment.

DESIGN CONSIDERATIONS - LAND USE AND COMMUNITIES

- The landscape design frames and reveals views to rural land uses
- The planting design on the approaches leading to Coolgardie Interchange signal the entry to Wardell township.



Figure 19: View of low agricultural land from Lumley's Lane



Figure 20: Pacific Highway at Pimlico

5.3 LANDFORM AND HYDROLOGY

5.3.1 LANDFORM

Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 traverses the largely flat topography of the coastal plain situated between the Coral Sea to the east and rising topography of the Blackwall Range to the west. The Richmond River and its floodplain run in a similar orientation to the alignment from south to north. Typically within the alignment the elevation varies from one to five metres above sea level with a number of small hills ranging from 10 – 55 metres predominately in the southern region between Broadwater and Wardell. The higher peaks occur on the Great Dividing Range, to the west of the alignment, and range from 170 – 195 metres above sea level.

Slopes are predominantly flat to gently sloping (0 – 2 per cent), however, there are areas of gentle to moderate slopes, such as the foot slopes of the Blackwall Range.

DESIGN CONSIDERATIONS

- Fill embankments are the dominant form of the proposed highway structure. Care is taken to ensure these relate and integrate with the surrounding low lying lands through limiting height
- The design of cuttings is carefully considered and integrated with the form and character of the terrain and to ensure slopes are suitable for revegetation
- Bridges are predominantly underbridges and therefore do not present a visual constraint. Overbridges however occur at Coolgardie Road, Wardell Road and Whytes Lane and have considered their impact on views along the corridor.



Figure 21: The rising topography of the Blackwall Range

5.3.2 HYDROLOGY

The Richmond River and its tributaries dominate the hydrology of the area. Drainage lines generally flow in an easterly direction. There are a number of aquatic environments and receiving waters within the alignment. These include:

Richmond River to Coolgardie Road - Section 10

- Richmond River
- Tuckean Swamp
- Tuckean Broadwater including SEPP 14 Wetland No. 119
- Saltwater Creek
- Bingal Creek and its unnamed tributaries.

Coolgardie Road to Ballina - Section 11

- Randles Creek
- Emigrant Creek including SEPP 14 Wetland No. 95
- Duck Creek including SEPP 14 Wetland No. 108.

Much of the area associated with the floodplain is affected by a relatively high water table. Within this landscape precinct the area is dominated by sugarcane and its associated requirement for cane drains. The drainage design response needs to address the impact on cane drains in line with the overall design strategy for this element.



Figure 22: View of Richmond River and existing bridge at Wardell

DESIGN CONSIDERATIONS

- Flooding within the low lying lands is an issue which is addressed in the setting of the alignment level and the location and number of culverts and bridges
- Three dedicated creek and floodplain bridges and a further seven underbridges which function as both fauna underpasses and drainage structures are provided. These are supported by numerous culverts as part of the upgrade
- The design of the bridges and culverts addresses the hydraulic as well as the ecological requirement of the site
- The waterway crossing(s) is designed with reference to relevant guidelines (including *Why do fish need to cross the road? Fish passage requirements for water way crossings*, Fairfull and Witheridge, 2003) and where feasible and reasonable, is consistent with the guidelines specified under CoA B38. In doing so, the design of the diversions has sought to mimic the characteristics of the original waterway.



Figure 23: Richmond River near Broadwater, looking north

Key

Land uses

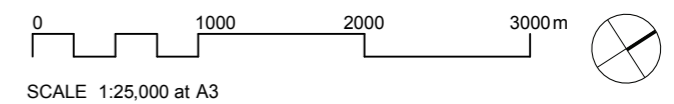
- Urban Area
- Rural/ Low Density Residential
- Tree and Shrub
- Cropping
- Grazing
- Wetland
- River and Drainage
- Conservation
- Horticulture
- Mining and Quarrying
- Special Category

Transport

- Existing School Bus Route
- Existing Bus Route
- B Existing Bus Stop
- Existing Cycle Route
- Pacific Highway upgrade
Richmond River to Ballina
(Sections 10 - 11)



Figure 24: Existing land use and transport routes



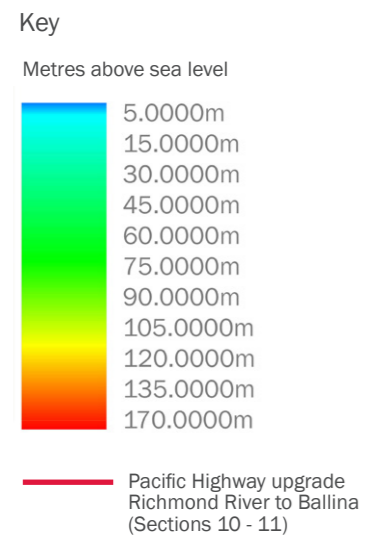
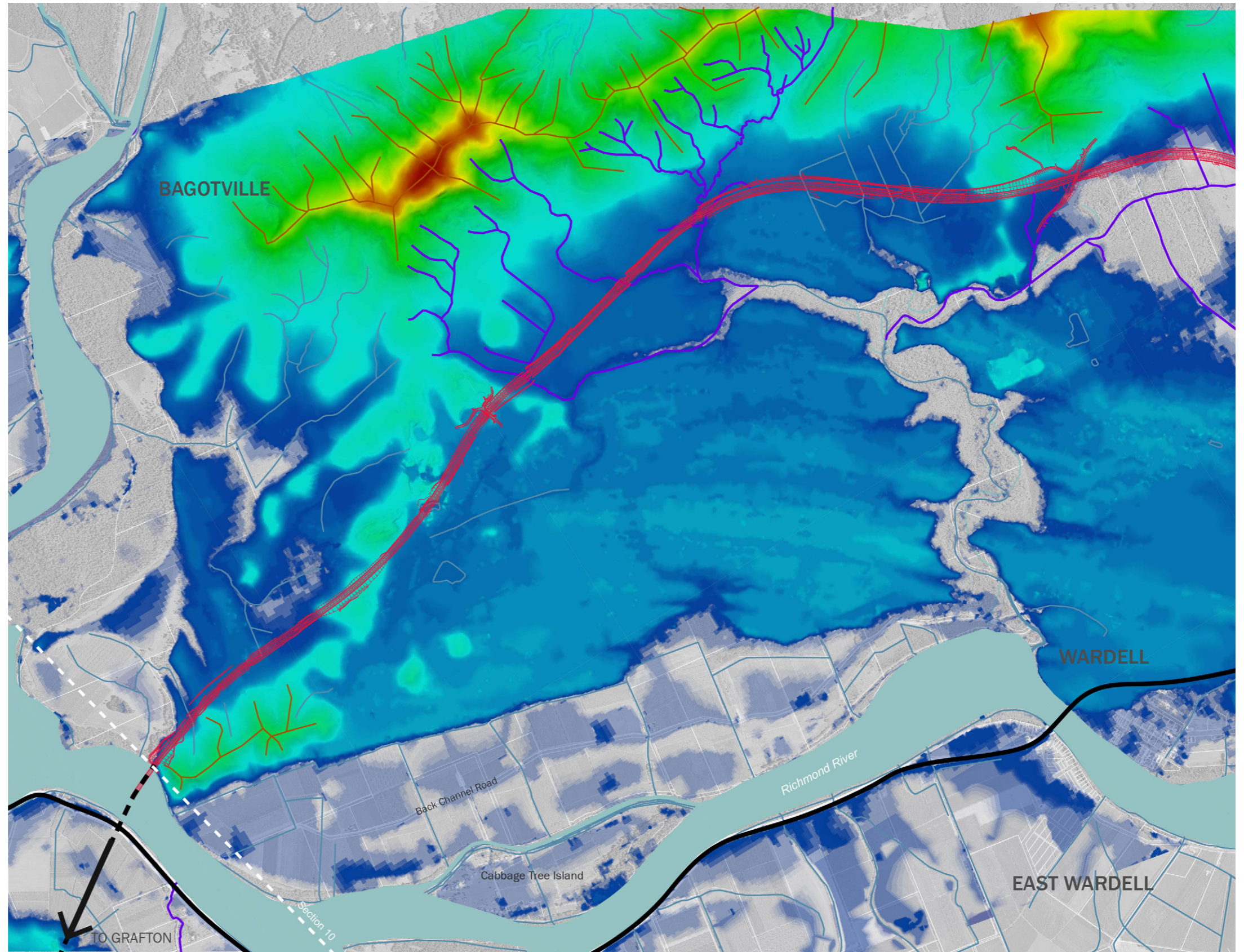
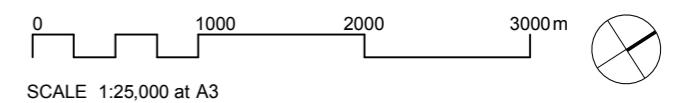
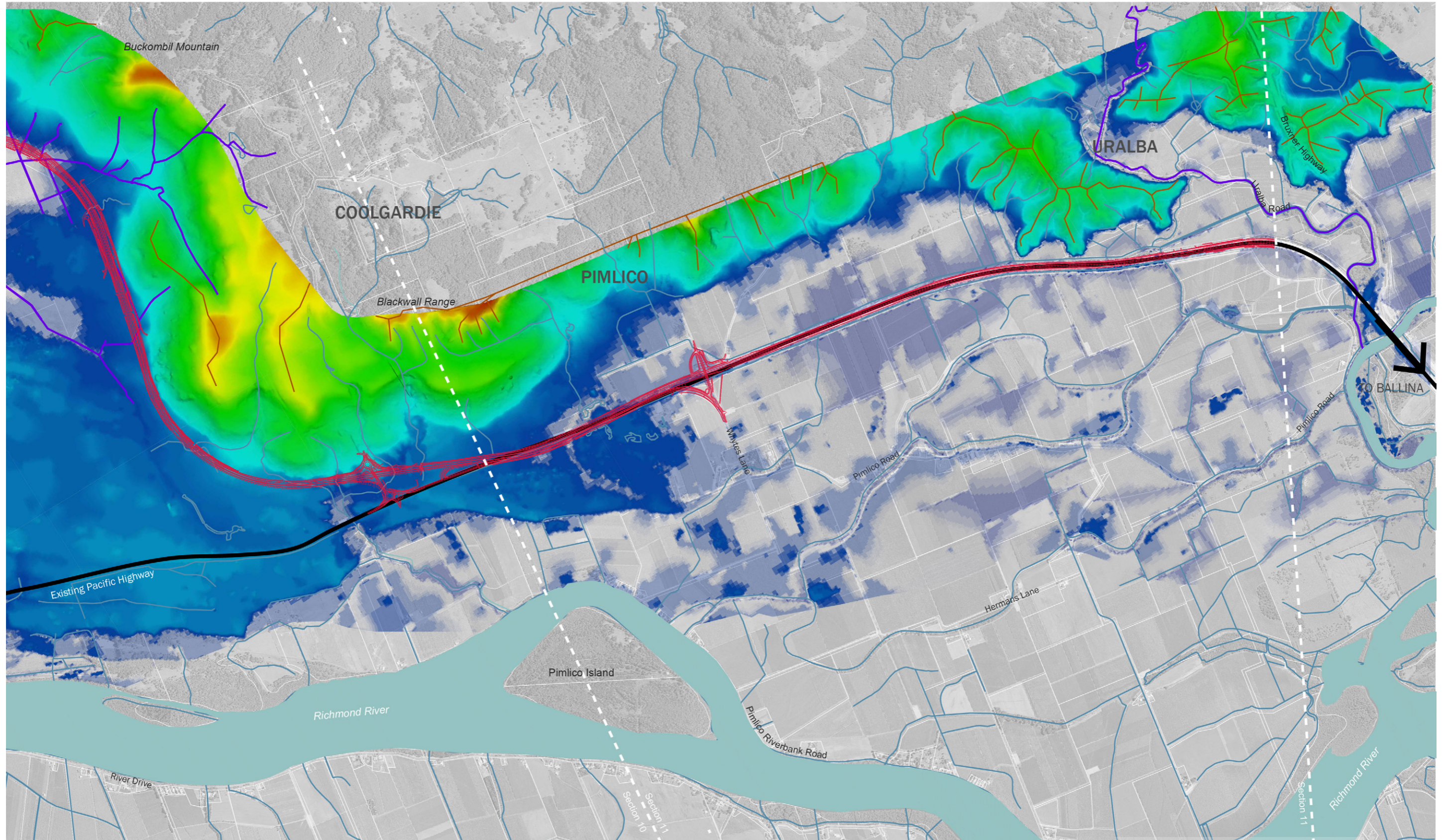


Figure 25: Landform and hydrology



5.4 FLORA AND FAUNA

5.4.1 FLORA

Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 are located in the NSW North Coast Bioregion, which is one of the most ecologically diverse bioregions in NSW. The variety of ecosystems within the bioregion include sub-tropical and warm temperate rainforests, a wide variety of wet and dry sclerophyll eucalypt forests, heathland, paperbark swamps, and freshwater and estuarine wetlands and waterways. According to NSW Office of Environment and Heritage (OEH) it comprises more than 202 flora species. Of these, 108 are endangered, 89 are vulnerable and five are considered extinct in the bioregion (NSW NPWS, 2001).

The nine vegetation types that dominate Richmond River to Ballina (Sections 10 and 11) include:

- Dry sclerophyll open forests and woodlands
- Wet sclerophyll forests
- Swamp forests
- Floodplain forests
- Rainforests
- Freshwater wetlands
- Estuarine wetlands
- Heathlands
- Modified habitats.

These vegetation types are classified into 57 plant communities and 24 bioMetric vegetation types (Gibbons et al., 2008) based on the dominant canopy and understorey flora, landscape position and geographic location.

Of these communities seven are listed under the *Threatened Species Conservation Act 1995* and include:

- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin & South East Corner Bioregions
- Subtropical coastal floodplain forest of the NSW North Coast Bioregion
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions
- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions
- Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion
- Lowland Rainforest of Sub-tropical Australia
- Coast Cypress Pine shrubby open forest of the North Coast Bioregion.

The vegetation communities are summarised in Table 5.

There are a number of national parks and reserves located within the NSW North Coast Bioregion. These are managed by National Parks and Wildlife Services. There are four national parks and reserves within the general region of Richmond River to Ballina (Sections 10 and 11). All are beyond the project but have representative samples of communities that occur within Richmond River to Ballina (Sections 10 and 11). These are identified in Table 6:

The vegetation from Richmond River to Ballina (Sections 10 and 11) is divided into seven fauna habitat types:

- Dry forest
- Wet and riparian forest and floodplain eucalypt habitat
- Swamp forest habitat
- Wetland habitat
- Wet and dry heath habitat
- Lowland Rainforest
- Cleared and modified habitats.

Dominant amongst these habitat types within Richmond River to Ballina (Sections 10 and 11) are – Wet and riparian forest and floodplain eucalypt habitat, Swamp forest, Dry forest, and Lowland Rainforest.

Seven threatened flora species listed under the TSC Act and EPBC Act have been confirmed as occurring within Richmond River to Ballina (Sections 10 and 11) and are detailed in Table 7.



Figure 26: Lowland Rainforest community

VEGETATION COMMUNITY	LISTING		SECTION
	TSC ACT	EPBC ACT	
Swamp Mahogany swamp forest of the coastal lowlands of the North Coast	Swamp sclerophyll forest on coastal floodplains (Endangered)		10 and 11
Paperbark swamp forest of the coastal lowlands of the North Coast	Swamp sclerophyll forest on Coastal floodplains (Endangered)		10
Swamp Oak swamp forest of the coastal lowlands of the North Coast			10
White Booyong – Fig subtropical rainforest of the North Coast	Lowland Rainforest on Coastal Floodplains (Endangered)	Lowland Rainforest of Subtropical Australia (Critically endangered)	10
Blackbean – Weeping Lilly Pilly riparian rainforest of the North Coast	Lowland Rainforest on Coastal Floodplains (Endangered)	Lowland Rainforest of Subtropical Australia (Critically endangered)	10
Forest Red Gum – Swamp box	Subtropical Coastal floodplain forest on coastal floodplains (endangered)		10
Mangrove – Grey Mangrove low closed forest of the NSW coastal bioregion			10
Coastal Cypress pine shrubby open forest of the North Coast Bioregion	Coastal Cypress pine forest in NSW North Coast Bioregion (Endangered)		10
Blackbutt grassy open forest of the Lower Clarence Valley of the North Coast			10

Table 5: Summary of vegetation communities from Richmond River to Ballina (Sections 10 - 11)

Notes: TSC Act – NSW Threatened Species Conservation Act 1995
EPBC Act – Commonwealth Environment Protection and Biodiversity Conservation Act 1999

PROJECT SECTION	NATIONAL PARK OR RESERVE NAME	DESCRIPTION	TOTAL AREA (HECTARES)	APPROXIMATE DISTANCE FROM PROJECT (KM)
10-11	Uralba Nature	Located to the west of the project just south of Ballina, on the Blackwall Range. The reserve protects remnants of sub-tropical rainforest known as 'Big Scrub' - State Heritage Significance	155	1
10-11	Victoria Park Nature Reserve	Located on the Alstonville Plateau to the west of the project/ Also a 'Big Scrub' remnant	17	4
10-11	Little Pimlico Island Nature Reserve	In the Richmond River west of Wardell, the reserve supports wetlands and littoral rainforest of state significance. It also contains rainforest elements representative of the 'Big Scrub' at their southern limit.	6	1.5
11	Richmond River Nature Reserve	Located east of Duck Creek, near Ballina, on the north facing bank of the Richmond River estuary. The reserve contains significant wetland and coastal vegetation communities that provide significant habitat for birds, including those protected under international conservation agreements	253	6.5

Table 6: National Parks in Richmond River to Ballina (Sections 10 - 11) (Source: Roads and Maritime, 2012)

PROJECT SECTION	SCIENTIFIC NAME	COMMON NAME	STATUS	DISTRIBUTION AND ABUNDANCE
10	<i>Arthraxon hispidus</i>	Hairy-joint Grass	Vulnerable (TSC Act) Vulnerable (EPBC Act)	Several large populations between Coolgardie Road and Lumley's Lane. The known area of occupation of the species is 20.8 hectares
10	<i>Archidendron hendersonii</i>	White Laceflower	Vulnerable (TSC Act)	Eleven individuals in subtropical rainforest north of Coolgardie Road
10	<i>Cryptocarya foetida</i>	Stinking Cryptocarya	Vulnerable (TSC Act) Vulnerable (EPBC Act)	A total of 17 individuals were confirmed in and around the project boundary in Section 10 north of Coolgardie Road.
10	<i>Endiandra hayesii</i>	Rusty Rose Walnut	Vulnerable (TSC Act) Vulnerable (EPBC Act)	Confirmed north of Coolgardie Road comprising a total of five larger individuals and three juveniles
10	<i>Endiandra muelleri</i> subsp. <i>bracteata</i>	Green-leaved Rose Walnut	Endangered (TSC Act)	Confirmed to the west of the project boundary at Maclean and in Section 10
10 + 11	<i>Macadamia tetraphylla</i>	Rough-shelled Bush Nut	Vulnerable (TSC Act)	Confirmed to the west of the project boundary at Maclean, in proximity to the project boundary
10	<i>Maundia triglochoides</i>	Maundia	Vulnerable (TSC Act)	Several tributaries that cross the highway north of New Italy





Table 7: Threatened flora species (Source: Roads and Maritime, 2012)



Figure 27: Eucalypt forest off Backchannel Road (Richmond River to Coolgardie Road - Section 10)

Key

General

-  Pacific Highway upgrade Richmond River to Ballina (Sections 10 - 11)
-  Project boundary
-  Endangered Ecological Communities (EEC)
-  SEPP 14 Wetland

Vegetation

-  Blackbutt - Pink Blackwood shrubby open forest of the coastal lowlands of the North Coast
-  Blackbutt grassy open forest of the lower Clearence Valley of the North Coast
-  Narrow-leaved Red Gum woodlands of the lowlands of the North Coast
-  Paperbark swamp forest of the coastal lowlands of the North Coast
-  Scribby Gum - Needlebark Stringbark heathy open forest of the coastal lowlands of the North Coast
-  Swamp Mahogany swamp forest of the coastal lowlands of the North Coast
-  Tuckeroo - Riberry - Yellow Tulipwood littoral rainforest of the North Coast
-  White Booyong - Fig subtropical rainforest of the North Coast
-  Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregions

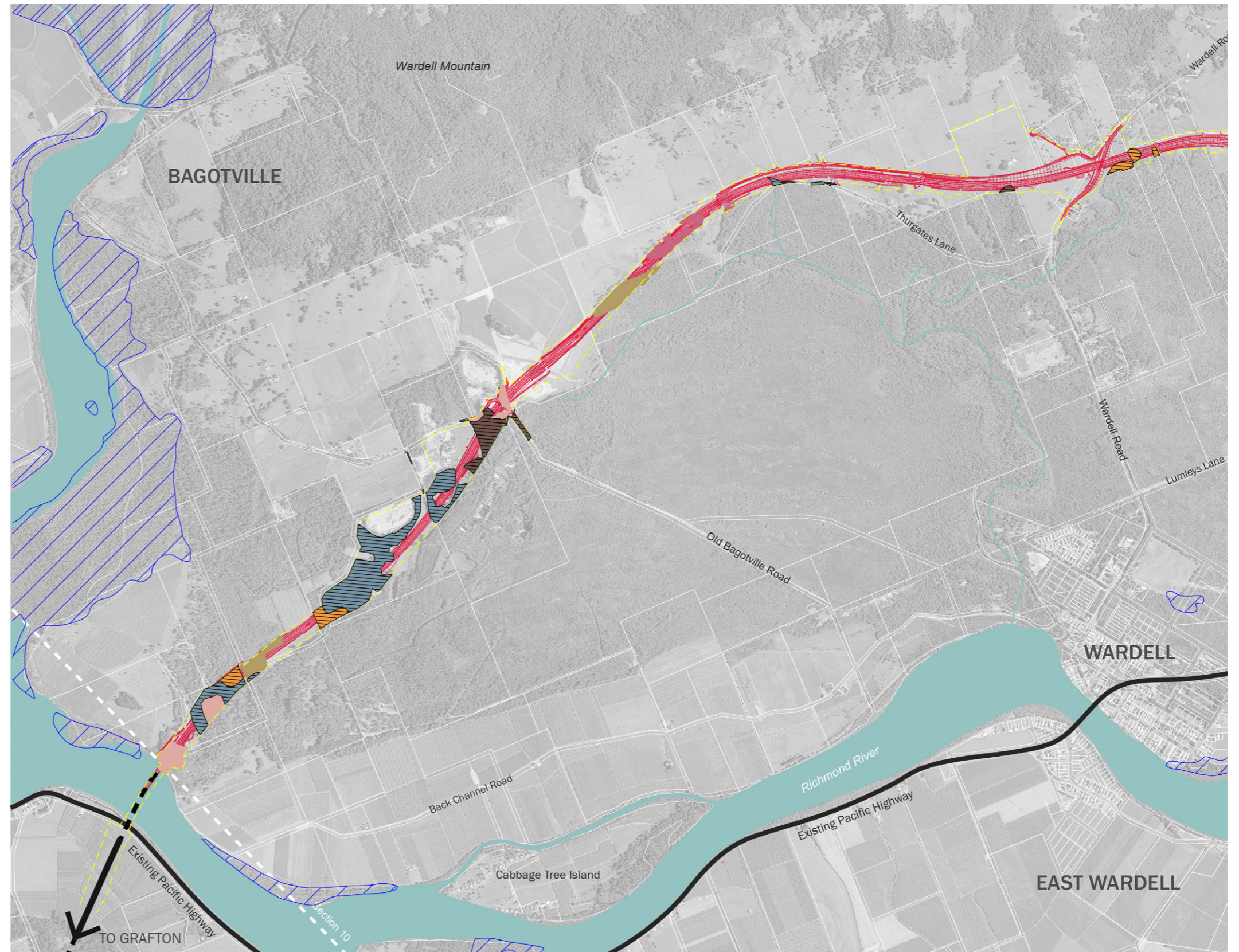
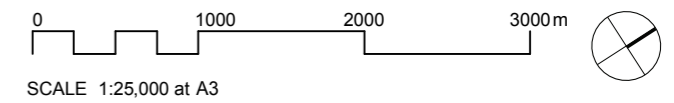
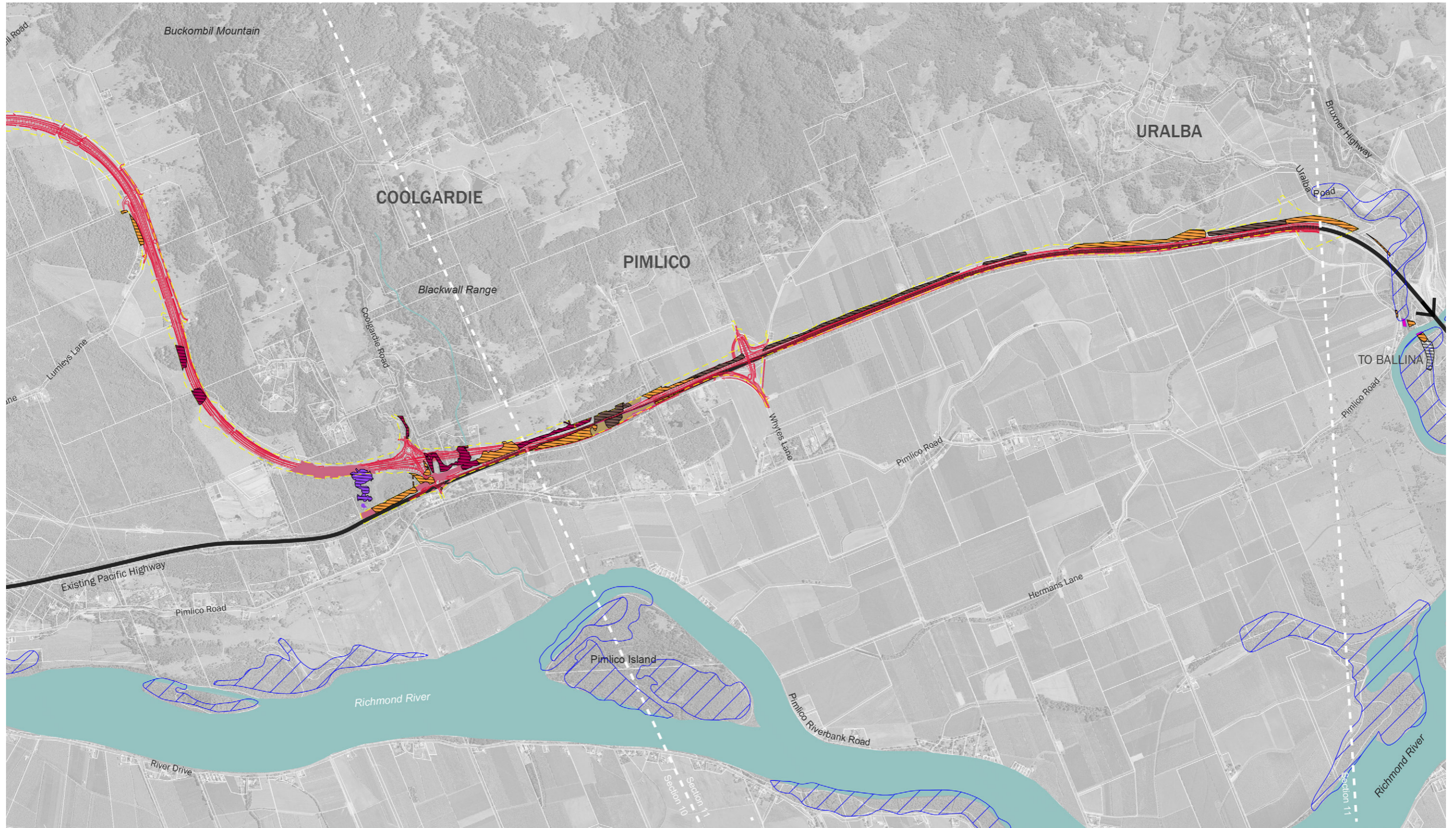


Figure 28: Vegetation communities



5.4.2 FAUNA

From Richmond River to Ballina (Sections 10 and 11) a number of threatened fauna species were identified as occurring in or nearby the alignment. These are divided into Terrestrial and Aquatic species and are as follows.

Terrestrial Species include:

- | | |
|----------------------------------|----------------------------------|
| ▪ Koala* | ▪ Greater Broadnosed Bat |
| ▪ Glossy-black Cockatoo* | ▪ Golden-tipped Bat |
| ▪ Mangrove Honeyeater | ▪ Eastern Cave Bat |
| ▪ Eastern Osprey | ▪ Squirrel Glider* |
| ▪ Rose-crowned Fruit Dove | ▪ Wallum Froglet* |
| ▪ Masked Owl* | ▪ Pink Underwing Moth |
| ▪ Little Bentwing Bat | ▪ Atlas Rainforest Ground Beetle |
| ▪ Eastern Freetail-bat | ▪ Long-Nosed Potoroo* |
| ▪ Southern Myotis | ▪ Pied Oystercatcher |
| ▪ Eastern Longeared Bat | ▪ Olongburra Frog |
| ▪ Common Blossom-bat | ▪ Black Flying-fox. |
| ▪ Yellow-bellied Sheath-tail Bat | |
- Note: Those indicated with an asterisk (*) are considered particularly sensitive to fragmentation within their habitat.*

In addition to the threatened terrestrial species present, three distinct fauna corridors intersecting Richmond River to Ballina (Sections 10 and 11) are identified (Figure 29) as part of the Biodiversity Assessment (Roads and Maritime, 2012) and include:

- Alstonville Plateau Link is a moist corridor west of the alignment, utilised by focal species including Rose-crowned Fruit Dove and Pouched Frog
- Ballina is a coastal corridor, whose focal species include Grey-headed Flying-fox and Rose-crowned Fruit Dove
- Uralba-Tuckean Swamp, a coastal corridor whose focal species comprise the Albert's Lyrebird and Koalas.

The landscape response is cognisant of these crossings and optimises revegetation and treatments to ensure the effectiveness of the crossings in the short to long-term.

Aquatic Species include:

- Three threatened fish species Eastern (Freshwater) Cod, Black Cod and Estuary Cod are potentially in Richmond River to Coolgardie Road - Section 10. These are listed under the *Fisheries Management Act 1994* and/or *Environmental Protection and Biodiversity Conservation Act 1999* and are known to occur in the Richmond River

- From Coolgardie Road to Ballina - Section 11 waterways are generally degraded and consequently the occurrence of threatened freshwater aquatic species is unlikely; however, Eastern (Freshwater) Cod potentially occurs in the upstream estuary of Emigrant Creek (which is outside of Richmond River to Ballina - Sections 10 and 11)
- No suitable habitat was identified for Oxleyan Pygmy Perch in Sections 10 and 11.

DESIGN CONSIDERATIONS

- Clearance of vegetation associated with the highway corridor is minimised to reduce habitat fragmentation and maintain connectivity
- Management of threatened species considers augmentation of habitat as well as translocation of identified plant species
- Vegetation is retained within project corridor between boundary and construction footprint. This is reflected in the clearing and soil plans
- Revegetation mixes that are responsive to the communities through which the alignment passes
- Design responds to the overall proposed koala revegetation strategy for Richmond River to Coolgardie Road - Section 10 by ensuring linkages to fauna structures and compliance with fencing clearances.

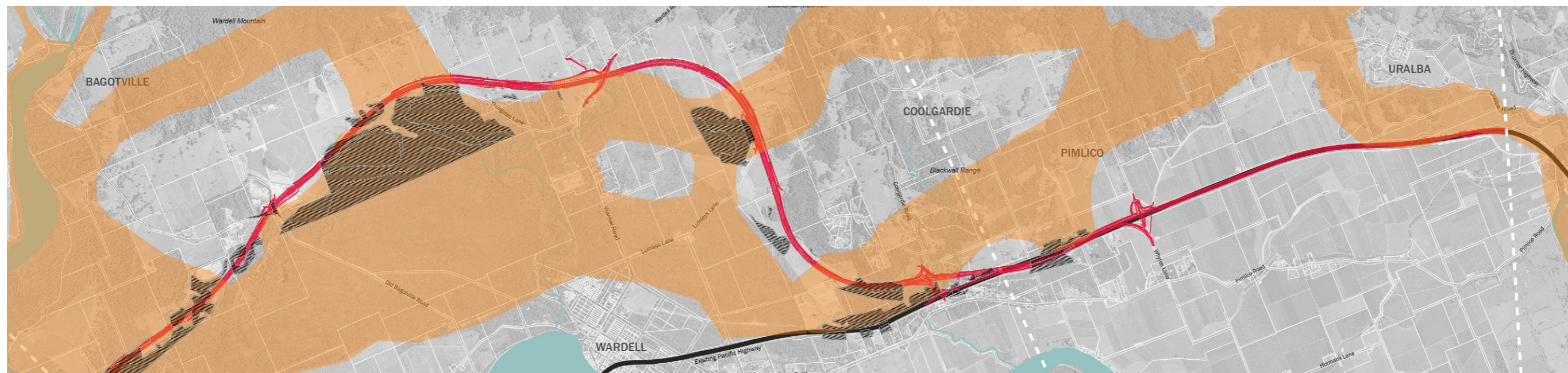


Figure 29: Regional fauna corridors

Key

- Regional fauna corridor
- Key koala habitat



5.5 HERITAGE

5.5.1 ABORIGINAL

Before European colonisation, the lower Richmond area is thought to have supported one of the densest Aboriginal populations in Australia (Collins, 2005). Communities were concentrated along the coast as well as the river. Three Aboriginal language groups are represented between Woodburn (south of Broadwater) and Ballina, which are Bundjalung, Nyangbal and Yaegl (Yaygir).

Eleven Aboriginal cultural places have been identified between Woodburn and Ballina however, their exact locations were not identified due to their cultural sensitivity (Roads and Maritime, 2012). One place involves a massacre of Aboriginal people and is considered to have high significance on a regional scale. Two are also considered to have moderate-high significance involving an area used for camping and ceremonies, and the other a spiritual site inhabited by a vengeful spirit. The remaining eight were classified to have moderate or low-moderate overall significance and include a meeting place, pathway connection point, and a waterhole.

The EIS identified that there are 18 Aboriginal heritage sites recorded close or within the approved project corridor on the Aboriginal Heritage Information Management System (AHIMS) register (Roads and Maritime, 2012). These include seven scarred trees and a number of sites containing stone artefacts (Figure 30).

The impacts on the identified Aboriginal heritage sites have been assessed as part of the overall environmental impact assessment for the project. Mitigation of impact is being undertaken in accordance with all relevant heritage-related management requirements. This includes a clearance process involving further detailed inspection of each site, recording of relevant details and salvage of heritage material where considered appropriate in consultation with Registered Aboriginal Parties. The clearance process includes identification of any specific measures to be established such as temporary exclusion fencing on the Approved Project Boundary during construction for sites that extend beyond the boundary. The clearance process will be completed for all identified sites prior to commencement of construction.

5.5.2 NON-ABORIGINAL

There is one state heritage listed item about one kilometre from Coolgardie Road to Ballina - Section 11 which is Uralba Nature Reserve, stated as High Conservation Value Old Growth Forests. The forests contain ecologically mature eucalypts showing few signs of human disturbance. Closer to the alignment are a number of items which are considered to be of local heritage value, and are not on the State Heritage Register, (Figure 30). These are all located in Wardell and include Meerschaum Vale brickworks, Stonehenge' property and Bamboo stands associated with Chinese gambling and Aboriginal people who lived on Cabbage Tree Island. None of these non-Aboriginal heritage items listed above will be impacted by the project.

DESIGN CONSIDERATIONS

- Design responds to the cultural associations of Wardell at the Coolgardie Interchange to reinforce the presence of this urban centre and its access routes.

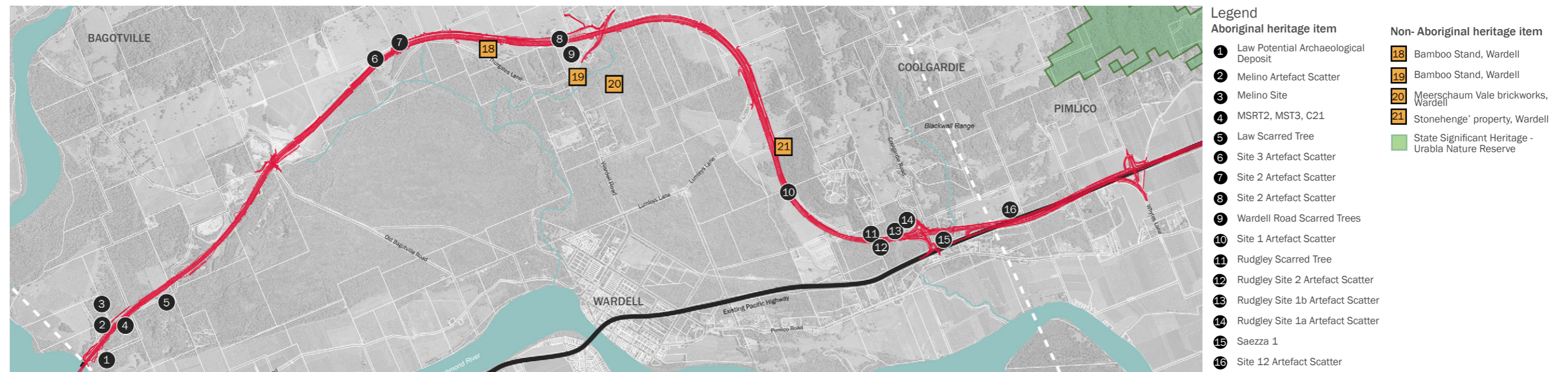
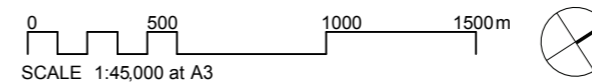


Figure 30: Heritage items



5.6 GEOLOGY AND SOILS

Richmond River to Coolgardie Road - Section 10 and Coolgardie Road to Ballina - Section 11 traverse the Clarence-Moreton Basin, an extensive Mesozoic age sedimentary basin extending from south Queensland to the NSW North Coast and comprising sedimentary rocks 2.5 to four kilometres thick.

The most common soil landscapes from Richmond River to Ballina (Sections 10 and 11) comprise the erosional, transferral and alluvial types. These soils are highly erodible and have low bearing strength.

Within the corridor three main geological types occur. These are

- Undifferentiated alluvial deposits/floodplain and swamp deposits
- Coarse-grained conglomerates
- Dune sand and sand sheets.

The higher western portions of the terrain beyond the alignment are composed of:

- Basalt
- Metabasalt.

The landform from Richmond River to Ballina (Sections 10 and 11) present a predominantly level terrain typified by the Richmond River floodplain between Broadwater and Coolgardie and bounded by the Blackwall Range to the west. In this area, there are some isolated low rises of 20 metres maximum elevation which occur at the southern end of the approved alignment. Slope stability issues are not considered likely from Richmond River to Ballina (Sections 10 and 11) as these areas traverse flat, low lying areas.

Richmond River to Coolgardie Road - Section 10 is a transferral landscape type that is associated with undulating rises, low hills, foot-slopes, drainage plains and fans. Slopes are in the order of 0 – 10 per cent and soils are highly acidic, sodic erodible and of low bearing strength due to seasonal water logging. It has some undulating terrain that has been disturbed by human activity, which can give rise to subsidence, poor drainage and presence of toxic materials.

Coolgardie Road to Ballina - Section 11 is an alluvial landscape that is associated with level to very gently undulating alluvial plains, floodplains and river back plains. Slopes are in the order of 0-6 per cent and soils are typically highly acidic, erodible and of low bearing strength and subject to hazards. Coolgardie Road to Ballina - Section 11 also has some soils that are typically saline and are subject to regular flooding and are also prone to water erosion.

DESIGN CONSIDERATIONS:

- A detailed soil survey is being undertaken to inform the design as to the specific issues and risks associated with soils within the area from Richmond River to Ballina (Sections 10 and 11)
- Topsoil from cleared areas is to be stripped, stockpiled and reused in the revegetation of the corridor. Details of methods for this are discussed in Chapter 8.

5.7 KEY VIEWS

There are a number of significant views, identified in the EIS, from Richmond River to Ballina (Sections 10 and 11). These include wide, sweeping views of the Richmond River and of the flat agricultural floodplain on the north side of the river (Figure 31). Travelling further north along the alignment views open to the west across the rural grazing and cropping lands to the foothills and ridge lines of the mountain ranges beyond. These include Wardell Mountain rising to around 175 metres above sea level, followed by Blackwall Range and Buckombil Mountain located closer to the Richmond River to Ballina and more immediate in view.

The views to the east begin in the south as primarily closed views of densely forested areas. Between Wardell and West Ballina views open to primarily sugarcane plantations on both sides of the alignment. The back drop of mountain ranges on the western side also extends along this northern region.

The impacts of the proposed Koala Management Plan plantations will alter the spatial quality of the valley and limit the distance of views. Despite this the sense of the open valley with the ranges beyond will be maintained along significant portions from Richmond River to Ballina (Sections 10 and 11).

DESIGN CONSIDERATIONS:

- Retention of views from the alignment to the adjoining area is a critical element in achieving a design that relates to the context, providing a sense of progression and identity for each community along the corridor
- Minimisation of views from individual houses is to be considered as part of the alignment development and ensures screening is provided where appropriate
- Responding to the changing spatial qualities of the valley associated with the development of plantations within the valley to address the requirements of the Koala Management Plan.



Figure 31: View of Blackwall Range across agricultural land



Figure 32: Views of Blackwall Range and sugarcane (in foreground)



Figure 33: Typical view of sugarcane within Coolgardie Road to Ballina - Section 11



Figure 34: Artists impression of Coolgardie Interchange looking north-east (Subject to further design development. Landscape shown at maturity. Inclusion of shared path subject to further consultation)

CHAPTER 6.

RICHMOND RIVER TO BALLINA (SECTIONS 10 AND 11) DESIGN PRINCIPLES

This Chapter outlines detailed design principles for Richmond River to Ballina (Sections 10 and 11) in relation to environmental values, heritage values, the urban design context, sustainable design and maintenance, and community amenity and privacy as required in Section D20 of the *Urban Design and Landscaping of the Minister's Conditions of Approval* (October 2015). The design principles outlined here refer mainly to the mitigation measures identified in the various technical reports in the EIS and in *Appendix H – Changes made to the mitigation and management measures of the EIS* (Roads and Maritime, 2015), and the contextual analysis presented in Chapter 5.

6.1 SECTION 10 AND 11 DESCRIPTION

This section of the Woolgoolga to Ballina project covers Richmond River to Ballina (Sections 10 and 11). The alignment traverses a relatively flat to undulating agricultural valley which runs to the west of the township of Wardell before connecting with the existing highway alignment at Coolgardie Road.

6.2 URBAN DESIGN CONTEXT

6.2.1 LAND USE AND PROPERTY

Chapter 16 of the project EIS Main Volume 1B provides a summary of the Land use and Property impact of the project on the area. This is discussed further in Chapters 5.3 and 5.11 of this report.

Urban Design principles in relation to land use and property are:

- The reconfiguration of acquired lands, include grazing, cropping and urban land uses, for reuse is in line with the Remnant Land and Property Strategy (Chapter 5 of Working Paper – Land Use and Property; SKM 2012a. This includes the use of acquired lands as part of the biodiversity offset strategy and in particular the Koala Management Plan

– revegetation strategy. Property adjustments to acquired lands including adjustments to access, fencing, farm infrastructure and relocation of ancillary facilities are to be undertaken in consultation with impacted property owners

- Onsite use of spoil is explored as a preferred option, where possible and appropriate.

6.2.2 TRAFFIC AND TRANSPORT

Chapter 14 of the EIS Main Volume 1B provides a summary of the Traffic and Transport impact of Richmond River to Ballina (Sections 10 and 11) on the area. This is discussed further in Chapter 5.2 of this report.

Urban Design principles in relation to traffic and transport are:

PUBLIC TRANSPORT

- The relocation of the bus stop within Richmond River to Coolgardie Road - Section 10 considers safe and convenient access for school students and other public transport users.

PEDESTRIAN AND CYCLIST CONNECTIVITY

Cyclists are allowed to use the highway shoulders providing cyclist connectivity along the entire Pacific Highway.

- Signposting and crossing points for cyclists are provided at the entry and exit ramps at Coolgardie Interchange as per Pacific Highway Guidelines (subject to further consultation).
- Wayfinding provides an indication of the proximity of the Coastal Cycleway
- Bridges will contain railings for cyclists where shared paths are provided (shared paths are currently subject to consultation). Highway bridges will provide 1300 millimetre high regular performance barriers to provide for cyclist safety.

6.3 LOCAL ENVIRONMENTAL VALUES

6.3.1 HYDROLOGY AND FLOODING

Chapter 8 of the EIS Main Volume 1B provides a summary of the hydrology and flooding assessment of the area. This is discussed further in Chapter 5.3 of this report. While the focus of this is on the hydraulic efficiency and minimisation of extents/impact, there is a component which influences urban design outcomes. Flood modelling studies are subject detailed design development and consultation with communities.

Principles arising from mitigation measures identified are:

- Scour protection and erosion protection measures at temporary and permanent waterway crossings will be provided which address both the physical performance parameters of the site, the requirements for biodiversity including fish passage and the need for visual integration



Figure 35: Artists impression of Coolgardie Interchange travelling north along the alignment (Artists impression subject to further design development. Landscape shown at maturity)

- Waterway diversions will be designed in consultation with the Office of Environment and Heritage, NSW Department of Primary Industries (Fisheries and Water) in a manner so the final diversions mimic the characteristics of the waterway that is being diverted. Characteristics include flow regime, flow velocity, base material, vegetation and habitat for aquatic fauna
- Revegetation of waterway diversions and surrounding areas will be undertaken in line with the principles below:
 - Diversions will be stabilised before the diversion receiving flows
 - Diversions will establish appropriate vegetation communities along the channel bed and banks, using endemic native species able to tolerate a potentially fast-flowing environment
- All work within 40 metres of a permanent watercourse will be undertaken in line with the NSW Office of Water 'Guidelines for Controlled Actions' and industry best practice
- Basin design is to be of natural shape and form where possible within clearance requirements, consistent with Roads and Maritime Landscape Design Guidelines.

6.3.2 SOILS, SEDIMENT AND WATER

Chapter 9 of the EIS Main Volume 1B provides a summary of the Soils, Sediment and Water assessment of the area. This is discussed further in Chapter 5.6 of this report.

Principles arising from mitigation measures identified are:

- Batter slopes are designed using appropriate slope gradients to minimise erosion of selected topsoil
- Where not increasing clearance extents, bench cuttings are diverted onto contours and surface flow drainage paths designed to spread flow at the source in preference to concentrating the flow and treating it further downstream
- Exposed areas will be progressively rehabilitated. Preference will be given to establishment of permanent revegetation
- Topsoil will be stockpiled separately and inspected for noxious weed seedlings at six monthly intervals and controlled with herbicide as required.

These design principles have informed the developed design and are incorporated into the landscape documentation.

6.3.3 BIODIVERSITY

Chapter 10 of the EIS Main Volume 1B provides a summary of the Biodiversity assessment of the area. This is discussed further in Chapter 5.4 of this report.

Principles arising from mitigation are:

- All fauna connectivity structures including the landscape response in association with these structures will be developed in line with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – *Biodiversity, Biodiversity and the Supplementary Biodiversity Report* in Appendix J of the Submissions/Preferred Infrastructure Report
- Opportunities for improved connectivity for Koala and Long-nosed Potoroo will be further investigated between the Richmond River and Bridge D51. The landscape design will form an important part of this response ensuring the appropriate vegetation community is established to reinforce this intent
- Specific details for the re-establishment of native vegetation on batters, cut faces, surrounding sediment basins and other areas disturbed during building will be provided. This will include details for the appropriate removal and restoration of temporary creek crossings
- Opportunities to strengthen threatened communities and species through establishment of appropriate environmental conditions and reuse of soil seed banks are being explored
- Disturbance and clearing of vegetation will be minimised, particularly:
 - Avoiding and minimising vegetation removal wherever possible through the detailed design process. This process will involve review of siting of all elements including: fencing, water quality basins and drainage lines, and optimization of earthworks to reflect the environmental impact
 - Woody debris and bushrock will be re-used on site for habitat improvement where possible and will be detailed in the landscape documentation and relevant management plan in line with the Roads and Maritime *Biodiversity Guidelines* (RTA, 2011a)
 - A Weed Management Plan will be developed as part of the CEMP, in line with the Roads and Maritime *Biodiversity Guidelines* (RTA, 2011) and the *Introductory Weed Management Manual* (Richards, 2004).

6.4 HERITAGE VALUES

6.4.1 ABORIGINAL HERITAGE

Chapter 12 of the EIS Main Volume 1B provides a summary of the Aboriginal heritage of the area. This is discussed further in Chapter 5.5 of this report. The area in general comprises several sites ranging from 'highly sensitive and culturally significant' to places of lesser significance (Roads and Maritime, 2012). The project has to date been refined to avoid or minimise impact on several of these sites and mitigation of impacts is being undertaken in accordance with all relevant heritage-related management requirements. This includes a clearance process involving further detailed inspection of each site, recording of relevant details and salvage of heritage material where considered appropriate in consultation with Registered Aboriginal Parties.

Urban design principles in relation to Aboriginal heritage are:

- Landscape design to respond to Aboriginal heritage sites of high importance through appropriate soft and hard treatments after appropriate consultation with the relevant communities
- Retain and avoid impact to scarred trees through clear identification during the design stage and adequate protection during building
- The Gumi Scarred tree will be removed and the trunk will be relocated to an agreed location. Access to the site is provided for the local Aboriginal people for teaching purposes
- 'Welcome to country' signage is to be located as part of the development of the Business Signage and Tourism Strategy in consultation with the relevant Aboriginal parties.

6.4.2 NON-ABORIGINAL HERITAGE

Chapter 13 of the EIS Main Volume 1B provides a summary of the non-Aboriginal heritage of the area. This is discussed further in Chapter 5.5 of this report.

Urban design principles in relation to non-Aboriginal heritage are:

- Interchanges /intersections should reflect the cultural heritage values of the area.

6.5 SUSTAINABLE DESIGN AND MAINTENANCE

Sustainability in any road project needs to give regard to social, environmental and economic considerations now and for future generations. These considerations include increased asset life, decreased maintenance costs, increased accessibility and reduction in adverse effects on the natural and man-made environments. Cost effectiveness and constructability need to be considered at the same time.

Sustainability aspects are considered throughout the design phase, with regard to the future building and operation in order to identify opportunities for improved performance and avoid problems at the end of the project.

Considerations have included:

- The type, volume, sourcing and application of resources, materials and services
- Climate change, social factors, and environmental impact
- Economic factors, including life-cycle cost and maintenance requirements
- Demolition, waste disposal, reuse and recyclability
- Energy efficiency and reduction in carbon emissions.

Key sustainability opportunities incorporated into the project are:

- Minimising vegetation clearance
- Reducing impact on environmentally sensitive area(s)
- Avoidance, or where this is not practicable, reduction of impact on identified and potential Aboriginal and non-Aboriginal heritage items
- Avoidance/minimising impact on properties and businesses related to both permanent and temporary work
- Minimisation of fill levels
- Reuse of materials.

Landscape and urban design responses in relation to these issues are in Table 8.

MAINTENANCE

Details of maintenance activities are addressed in Chapter 8.4.10. The period of maintenance as part of the contractual work is for three years from completion of construction. After this time maintenance will be handed back to Roads and Maritime and Ballina Shire Council. As part of this process ongoing maintenance and monitoring activities will be required to ensure stability within the vegetation communities and the effectiveness of the infrastructure, including fences, drainage lines etc.

ENVIRONMENTAL SUSTAINABLE INITIATIVES	URBAN AND LANDSCAPE DESIGN RESPONSE	LOCATION WITHIN DRAFT UDLP
MATERIAL SOURCING	Materials considered include: <ul style="list-style-type: none"> Soil salvage and reuse Mulch salvage and reuse Seed and plant materials including reuse for translocation/soil seedbank or local collection of seed 	Addressed in Chapter 8, Sub-chapters 6.3.2, 8.5.2, 8.5.3, 8.4.9
THREATENED SPECIES	Design is responsive to Threatened Species Management Plans including: <ul style="list-style-type: none"> Minimisation of vegetation clearance Revegetation responsive to adjoining communities using indigenous species Vegetation responsive to connectivity initiatives including fauna crossings, fencing, etc 	Addressed in Chapter 6, Sub-chapter 6.3.3 Chapter 8, Sub-chapters 8.4.1, 8.4.2, 8.4.3, and 8.7
PROTECTION OF WATERWAYS	<ul style="list-style-type: none"> Minimisation of disturbance Replication of natural profile characteristics Staged revegetation as part of erosion and sediment control 	Addressed in Chapter 6, Sub-chapter 6.3.1 and Chapter 8, Sub-chapter 8.6
WEED MANAGEMENT	<ul style="list-style-type: none"> Control of weeds during and post construction 	Addressed in Chapter 8, Sub-chapter 8.4.10
PROTECTION OF HERITAGE	<ul style="list-style-type: none"> Minimisation of disturbance Design of interchanges captures part of the cultural heritage identity of the adjoining township 	Addressed in Chapter 8, Sub-chapters 8.4.5 and 8.6.4

Table 8: Landscape and urban design responses to environmental sustainable initiatives

6.6 COMMUNITY AMENITY AND PRIVACY

6.6.1 VISUAL AMENITY, URBAN DESIGN AND LANDSCAPE

Chapter 11 of the project EIS Main Volume 1B provides a summary of the visual amenity, urban design and landscaping of the area. This is discussed further in Chapter 5 of this report.

Principles arising from mitigation measures are:

- Measures to mitigate visual impact to viewpoints are implemented, as identified in Table 11-42 and Working Paper – *Urban Design, Landscape Character and Visual Impact Assessment*. Design development has sought to reduce the number of moderate-high, or high, impact and changes in assessment and are reflected in Chapter 7
- Specific mitigation measures responsive to areas where moderate-high or high impacts are identified include provision of screen planting within the corridor and potentially property adjustments
- Revegetation of the corridor is done progressively to ensure early stabilisation and minimisation of impact of road building
- Urban development and its connection to the highway is highlighted through appropriate strategies at interchanges. Particular emphasis is placed on the use of culturally significant vegetation to act as a marker of this contrasting land use. This includes the use of *Ficus macrocarpa* ‘hillii’ at Coolgardie Interchange and *Araucaria cunninghamii* at Wardell Road.

6.6.2 VISUAL AND PRIVACY IMPACT

Chapter 11 of the project EIS Main Volume 1B provides a summary of the Urban Design and Landscape impact of the project on the area.

- The built form of the project, including consideration of the height, bulk, scale, materials and finishes of structures and road furniture are designed in line with the Pacific Highway Guidelines and the design principles identified in EIS Chapter 11
- The landscape design provides plant screening to mitigate visual and privacy impacts where these are identified. A high level assessment of the potential visibility of the project from houses was undertaken to determine extent of influence of the proposed work and likely need for screening (not presented in this report).

6.6.3 NOISE IMPACT

Chapter 15 of the project EIS Main Volume 1B provides a summary of the noise and vibration impact of the project on the area.

Urban design principles in relation to noise impact are:

- Within Richmond River to Coolgardie Road - Section 10, the majority of receivers potentially requiring noise mitigation are located on high ground overlooking the project and located away from the project corridor, typically 100 meters or so apart. Therefore low noise wearing surfaces and architectural treatments are provided.

Note: Noise modelling studies are subject to detailed design development and consultation with communities

6.6.4 LIGHTING

Urban design principles in relation to lighting are:

- The design of lighting incorporates low light spill fittings to ensure nearby properties are not impacted
- The impact of lighting on sensitive fauna species are considered in terms of the extent and control of light with a focus on minimising spill.

6.7 LOCAL AMENITY AND PUBLIC DOMAIN

6.7.1 REST AREAS

Three new rest areas are provided along the overall Woolgoolga to Ballina Pacific Highway upgrade. Richmond River to Coolgardie Road - Section 10 has a future rest area either side of Old Bagotville Road near Richmond River. There is no immediate requirement for this rest area at the start of operations of the road and therefore the area will be landscaped until a requirement for it is identified.

To ensure the rest area is feasible, a concept is developed and bulk earthworks outlined in order to minimise disruption when it is constructed. The design of the rest area follows the principles as set out in the *Rest Area Best Practice Design Guide* (Roads and Maritime, 2004). Key issues considered are:

- Access and egress
- Provision of facilities
- Environmental considerations in Design
- Rest area layout
- Aesthetics
- Comfort
- Signposting
- Maintenance and lifecycle cost.

6.8 TEMPORARY WORK, ANCILLARY FACILITIES, ACCESS TRACKS AND WATERCOURSE CROSSINGS

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

Ancillary facilities covered by the Management Plan include:

- Office compounds – including the main site compounds, site offices, sheds, workshops and storage, satellite compounds – small site offices
- Minor ancillary facilities - including lunch sheds, office sheds, and portable toilet facilities
- Bridge site compounds – site office to allow for easy access to major bridge sites
- Batch plants – for the production of concrete and asphalt
- Crushing plants and material processing sites – plant and equipment for the processing, crushing and screening of excavated material for use 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 Woolgoolga to Ballina Pacific Highway upgrade include areas that are located within the existing or proposed highway corridor that are directly or indirectly impacted by the construction work, in addition to locations nearby or separate to the

construction activities. As outlined in the MCoA definitions, all ancillary facilities are temporary and can only be used for the Woolgoolga to Ballina Pacific Highway upgrade. 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”.

BORROW SITES

The Woolgoolga to Ballina Pacific Highway project will also require a number of borrow sites to be used to source material for construction of the project. 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 impact 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.

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 nearby 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 Draft UDLP, and as a result are not detailed in the Plan. 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 line with the approved Ancillary Facility Management Plan. It is anticipated that each ancillary facility will be developed and rehabilitated in line with these principles.

Ancillary and borrow site rehabilitation principles are:

- 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 Draft UDLP to ensure an integrated outcome.

COMMITMENT TO SITE REHABILITATION

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

- On Roads and Maritime 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 enhance wildlife habitat values. The rehabilitation work is to include maintenance until the vegetation is well established
- On Roads and Maritime owned sites used for the extraction of construction material the rehabilitation work may include disposal of soil material classified as ‘unsuitable’ generated by the highway work, regrading to create landforms compatible with adjoining areas and establishment of a stable revegetation cover. Reuse of this material is subject to all relevant waste and planning approval requirements
- On privately owned land the rehabilitation work will be in line with an agreement to be reached with the property owner. The rehabilitation work is to meet all relevant environmental requirements.



Figure 36: Aerial view of Wardell Road near the proposed alignment from Richmond River to Coolgardie Road - Section 10, looking west

CHAPTER 7.

RICHMOND RIVER TO BALLINA (SECTIONS 10 AND 11) URBAN DESIGN AND LANDSCAPE DESIGN

7.1 URBAN DESIGN AND LANDSCAPE DESIGN

This chapter describes the urban and landscape design response between Richmond River to Ballina (Sections 10 and 11). This is reflected at a strategic level (Figure 38) and at a detailed concept level in plans Figure 39, 42, 43, and 44.

7.1.1 RICHMOND RIVER TO OLD BAGOTVILLE ROAD: CHARACTER PRECINCTS P-47 AND P-50

Precinct P-47 of the southernmost limit within Richmond River to Coolgardie Road - Section 10 and is the northern bank of the Richmond River - a defined edge of mangrove forest which transitions to agricultural lands beyond. The only work occurring here is the abutment to the Richmond Bridge. This region of the alignment rises quickly from the floodplain and is heavily forested. The design response reflects this forested landscape and seeks to reinforce the sense of enclosure that this community creates.

Key elements include:

LANDSCAPE STRATEGY

- Reflects the forested landscape character of Precinct P-50 as its dominant influence
- Responds to the need to visually minimise the impact on this forested margin
- Addresses the requirements of the biodiversity strategy associated with Threatened Species Management Plans and in particular Koala Management Plan and Strategy.

PROPOSED KOALA REVEGETATION STRATEGY

- The Koala Revegetation Strategy (2015) identifies a number of disturbed sites within this area of the alignment to be reforested to enhance the viability of the population and its connectivity to a broader home range for Koala movement. The design responds to these enhancing connectivity.

CUT AND FILL EMBANKMENTS

- The alignment through this zone is benched into the ridge. As a product of this slightly elevated position the alignment is characterised by a combination of cut and fill embankments. One of the largest within the corridor occurs just north of the Richmond River crossing and is illustrated in Figure 43. These are carefully integrated into the landform and have considered the ability to revegetate in their design.

FAUNA PASSAGEWAYS

- There are several fauna crossings in this zone edged closely by informal dense closed canopy of Wet Sclerophyll Forest. Details of revegetation in response to fauna crossings are discussed in Chapter 8.7.

7.1.2 OLD BAGOTVILLE ROAD TO WARDELL ROAD: CHARACTER PRECINCTS P-49 AND P-50

Extending from Old Bagotville Road through to Wardell Road (Figure 39), the design in this region is responsive to Character Precinct P-49, the broad valley landscape but also to that of Character Precinct P-50. The alignment is located to the western edge of Character Precinct P-50 at the forest / agriculture interface. The design response seeks to establish a balance between screening the alignment from isolated farmhouses and a connection to the scenic qualities of the valley for road users.

Key elements include:

OLD BAGOTVILLE ROAD PRECINCT

- Old Bagotville Road underpass is set largely within a forested landscape typical of Character Precinct P-50
- The landscape associated with this structure adopts the drier forested communities including the native cypress pine, *Callitris columellaris* as a formal planting adjoining the alignment
- Two fauna crossings, located either side of the underpass, are screened by closed canopy forest.

SERVICE ROADS

The design response to service roads on either side of Thurgates Lane:

- Provide a degree of vertical separation and a landscaped visual buffer reducing risk of headlight glare and impact on surroundings. This is achieved by the establishment of a shrub layer with scattered trees (Figure 39)
- Provide the motorist with a connection to the ranges to the west while minimising views from adjoining properties and blocking glare from headlights.

THE WARDELL ROAD PRECINCT

The design is comprised of a number of elements. Including:

- Cutting of the ridgeline at Ch. 152,875 which occurs in close proximity to the houses of Wardell Road. The design response is to revegetate with both canopy and understorey vegetation providing a sense of enclosure and a staged level of visual screening as the landscape develops. This revegetated community also provides the opportunity to enhance connectivity
- Provision of a new service road (off Hill Road) cut behind the ridge offset from the main alignment is screened from view of the alignment and across the valley from Wardell Road by the landscape response which includes shrub and tree seeding and planting

- Wardell Road Overbridge is flanked by a formalised avenue planting of *Araucaria cunninghamii* (Hoop pine). This provides a visual marker along the alignment as well as a clear distinction between the cultural and natural landscapes of the valley (Figure 40).

PROPOSED KOALA REVEGETATION STRATEGY

A number of sites throughout these precincts were acquired as part of the proposed koala revegetation strategy identified in the Ballina Koala Plan (2016). Sites include small clearings adjoining the alignment within the forested lands as well as broader areas of the valley associated with Thurgates Lane and Wardell Road. The later areas reduce the openness of the valley shortening the view field.

The design responds to these plantations by:

- Revegetating cleared area within the alignment adjoining these plantations to expand the resource and provide connections to fauna crossings.

7.1.3 WARDELL ROAD TO COOLGARDIE INTERCHANGE: CHARACTER PRECINCTS P-49 AND P-53

Running from Wardell Road these precincts cover the northern half of Richmond River to Coolgardie Road - Section 10 and start of Coolgardie Road to Ballina - Section 11 as the alignment traverses the valley to the north before crossing over Coolgardie Road. Like the preceding precincts, the alignment follows the edges of landscape units i.e. forest and farmland on a slightly elevated alignment. A critical influence on the character of the alignment is the proposed koala revegetation strategy which proposes significant areas of revegetation around Lumleys Lane to either side of the alignment. The landscape design response has sought to respond both to the sequence of openness and sense of enclosure by responding to these new plantings and the adjoining forest communities.

Key elements include:

PROPOSED KOALA REVEGETATION STRATEGY

- Similar to the preceding section a number of properties are acquired as part of the Koala Management Plan are included in the proposed koala revegetation strategy. The most significant of these areas is just north of Lumleys Road as the valley turns to the east
- Cleared areas within the alignment are being revegetated to integrate with these new forests enhancing the resource available and connectivity to fauna crossings across the highway.

THE COOLGARDIE ROAD INTERCHANGE

The interchange is marked by a number of design responses, including:

- Signalling the arrival of the interchange through the use of small clusters of trees *Ficus Hilli* that will contrast with the natural communities and provide a visual cue as to the approach of the interchange. The use of *Ficus Hilli* is used as a link to Wardell town and its main street plantings
- The spacing of the trees intensifies as one approaches the interchange highlighting the changing character
- The entry and exit ramps create an avenue effect with fig trees lining either side of the ramp. This emphasises the entry/exit ramps as the connection to the urban precinct and the main alignment as part of the broader landscape system
- The design standard of the bridge structure at the interchange is the same as adopted for other highway overpasses on the upgrade. The interchange design utilises the foot-slopes to enable the transition on to the overbridge to reduce the need for filling and better integrate the bridge with its surrounds
- Vegetation communities within the interchange are dominated by the Lowland Rainforest which characterises the steeper foot slopes of the adjoining ranges. Wet Sclerophyll and Floodplain forest occurs to the eastern side of the interchange along the existing Pacific Highway alignment and flatter lands adjoining the corridor
- The vegetation communities contain a diversity of flora and fauna with much of it of environmental significance containing species or communities protected under the TSC and EPBC Acts, to which the landscape design responds. Options for translocation or propagation of this material are being reviewed
- Planting associated with the interchange itself adopts a formal planting to the entry/exit ramps while integrating and celebrating the Lowland Rainforest community within the space between them and the alignment.

7.1.4 COOLGARDIE INTERCHANGE TO END OF SECTION 11: CHARACTER PRECINCT P-53

Covering the northern end of the corridor Precinct P-53 is dominated by the Richmond River floodplain and the agricultural uses of the floodplain i.e. predominantly sugarcane production. This landscape provides expansive views, which extend from the ranges (Precinct P-52) to the west and as far as can be seen to the east towards the coast.

Key elements include:

LANDSCAPE STRATEGY

- The design response is to maintain this landscape character, with revegetation work characterised by the establishment of a grassland community
- Visual screening to the properties to either side of the alignment are considered as part of this response with planting proposed to provide separation from the alignment in response to these views
- Scattered copses of vegetation are to be used to define and frame distinct views across the plains, as well as provide visual screening to adjoining houses.

HEADLIGHT SCREEN

- Headlight screening is required between the highway and a service road between the Coolgardie Interchange south bound exit-ramp and Whytes Lane. This is to consist of a vegetated screen composed of planting installed at a variety of scales to ensure both initial control but also its enhancement over time. The minimum width of this planting is five metres, which the proposed screens achieve for much of its length with a minor non-conformance in an isolated section.

WHYTES LANE OVERPASS AND APPROACH

- The southern approach to Whytes Lane is flanked by swamp forest which screens the adjoining houses from this new elevated structure
- To the north the impact of the bridge is also moderated by copses of swamp forest as the landscape opens up revealing views across the floodplain.



Figure 37: Artist's impression of Coolgardie Interchange looking north-east (Subject to further design development. Landscape shown at maturity. Inclusion of shared path subject to further consultation)

7.1.4 RICHMOND RIVER TO BALLINA (SECTIONS 10 AND 11) STRATEGY PLAN

The Strategy Plan in Figure 38 provides an overview of the design approach and strategies adopted to achieve the above objectives between Richmond River to Ballina (Sections 10 and 11).

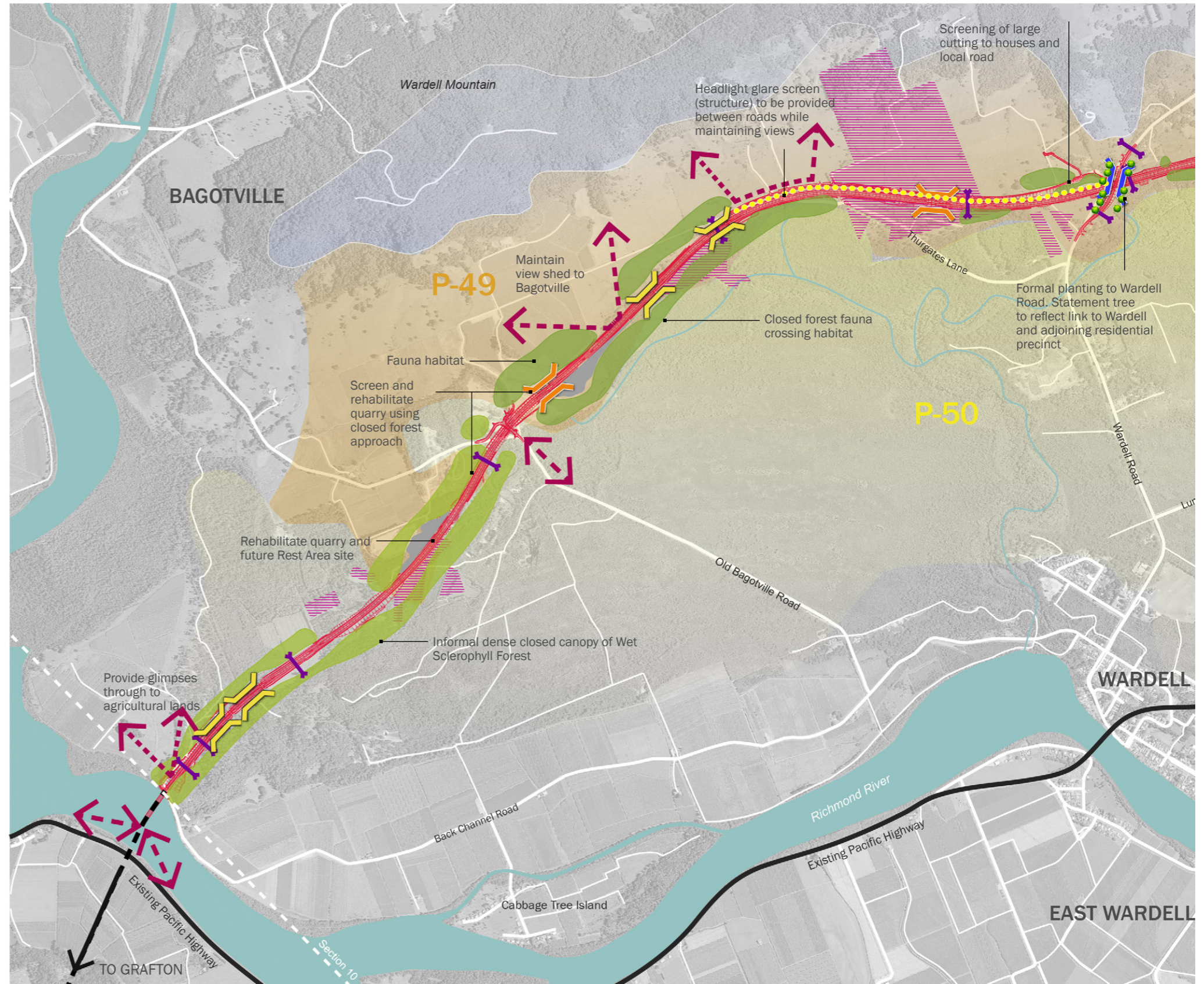
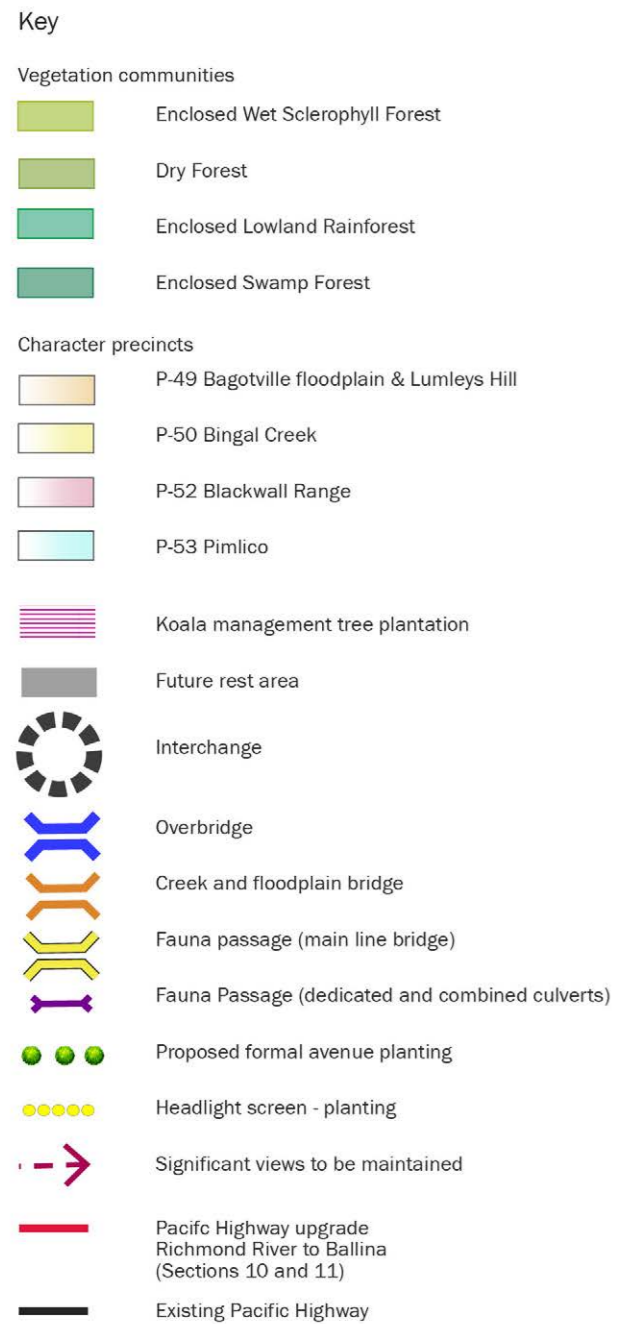
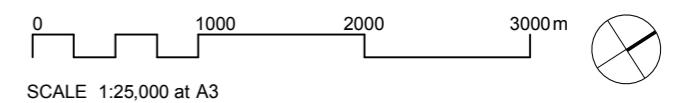
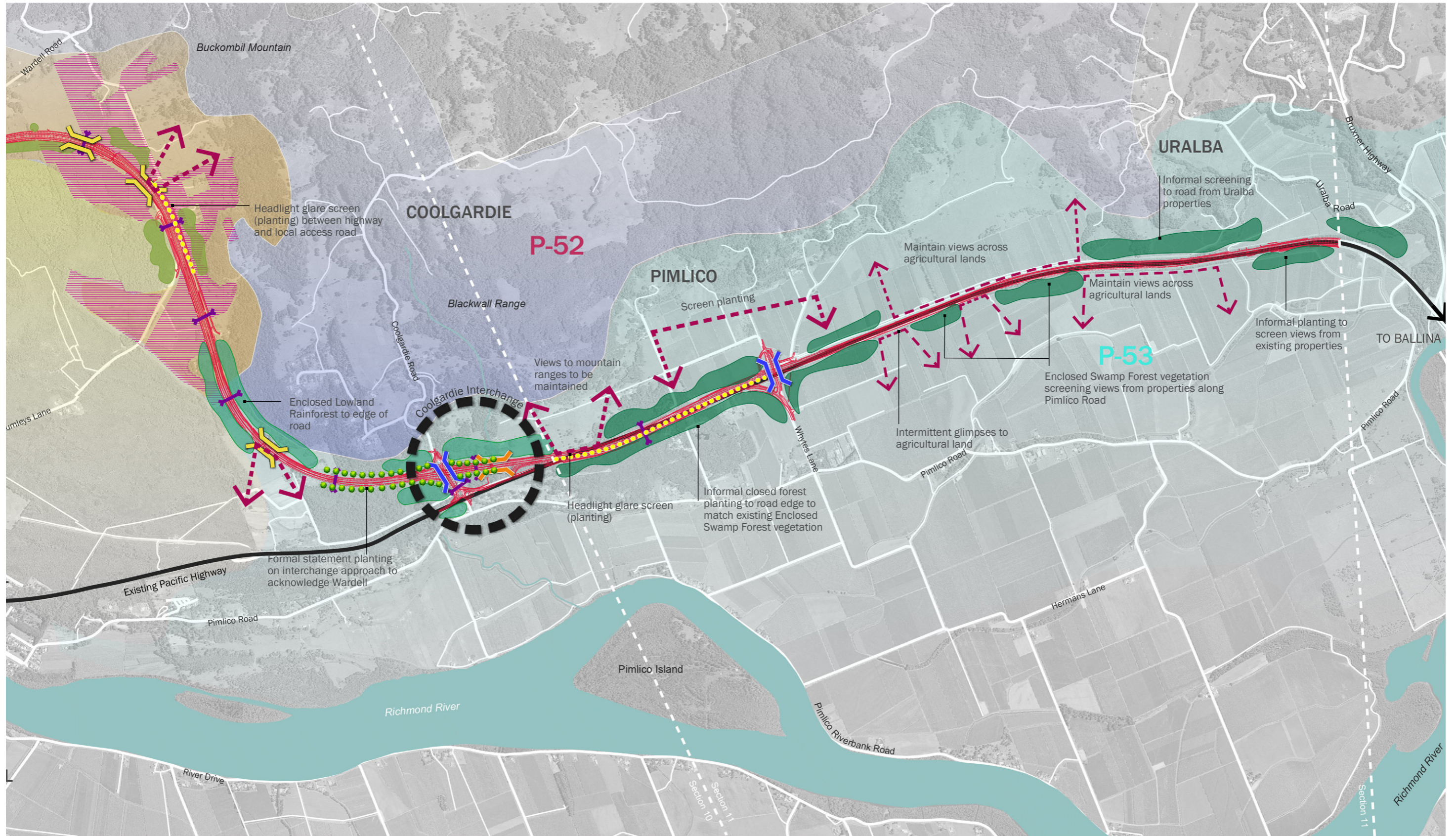
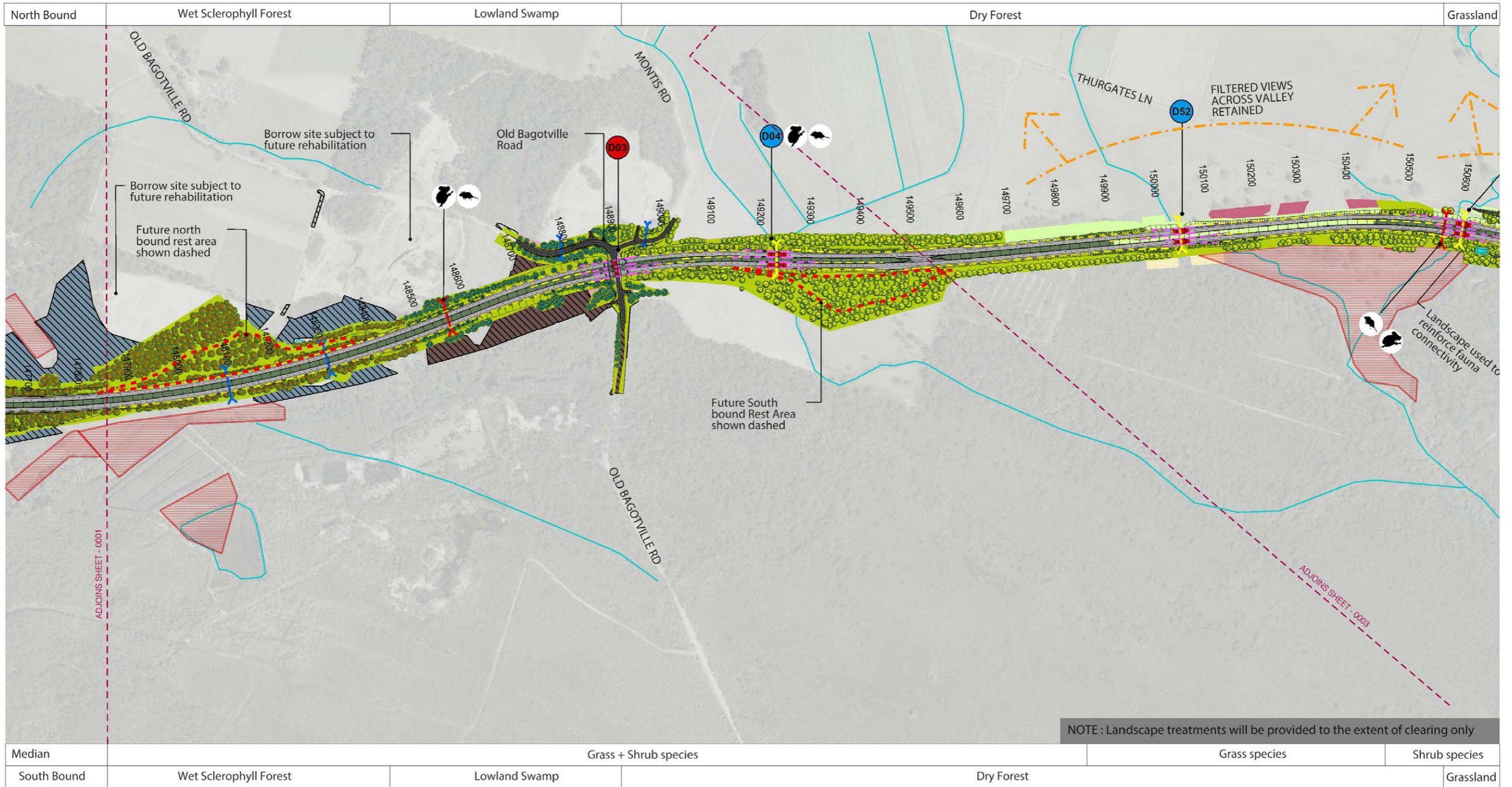


Figure 38: Strategy plan for Richmond River to Ballina (Sections 10 and 11)





NOTE: Landscape treatments will be provided to the extent of clearing only

LANDSCAPE TREATMENTS

VEGETATION COMMUNITY

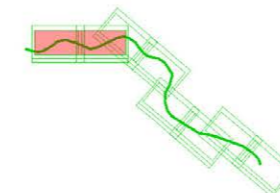
- Swamp Forest
Refer to Appendix B for indicative species list
- Dry Forest
Refer to Appendix B for indicative species list
- Wet Sclerophyll and Floodplain Forest
Refer to Appendix B for indicative species list
- Lowland Rainforest
Refer to Appendix B for indicative species list

REVEGETATION METHOD

- Garden bed - 75mm mulch over improved topsoil over cultivated subgrade
- Hydromulch (mix to reflect vegetation community) over site soil over cultivated subgrade
- Hydromulch Median ripeline planting of medium shrub grass mix over site soil over cultivated subgrade
- Grassland (mix to be native/exotic grasses only) hydromulch over site soil over cultivated subgrade

FEATURE TREES

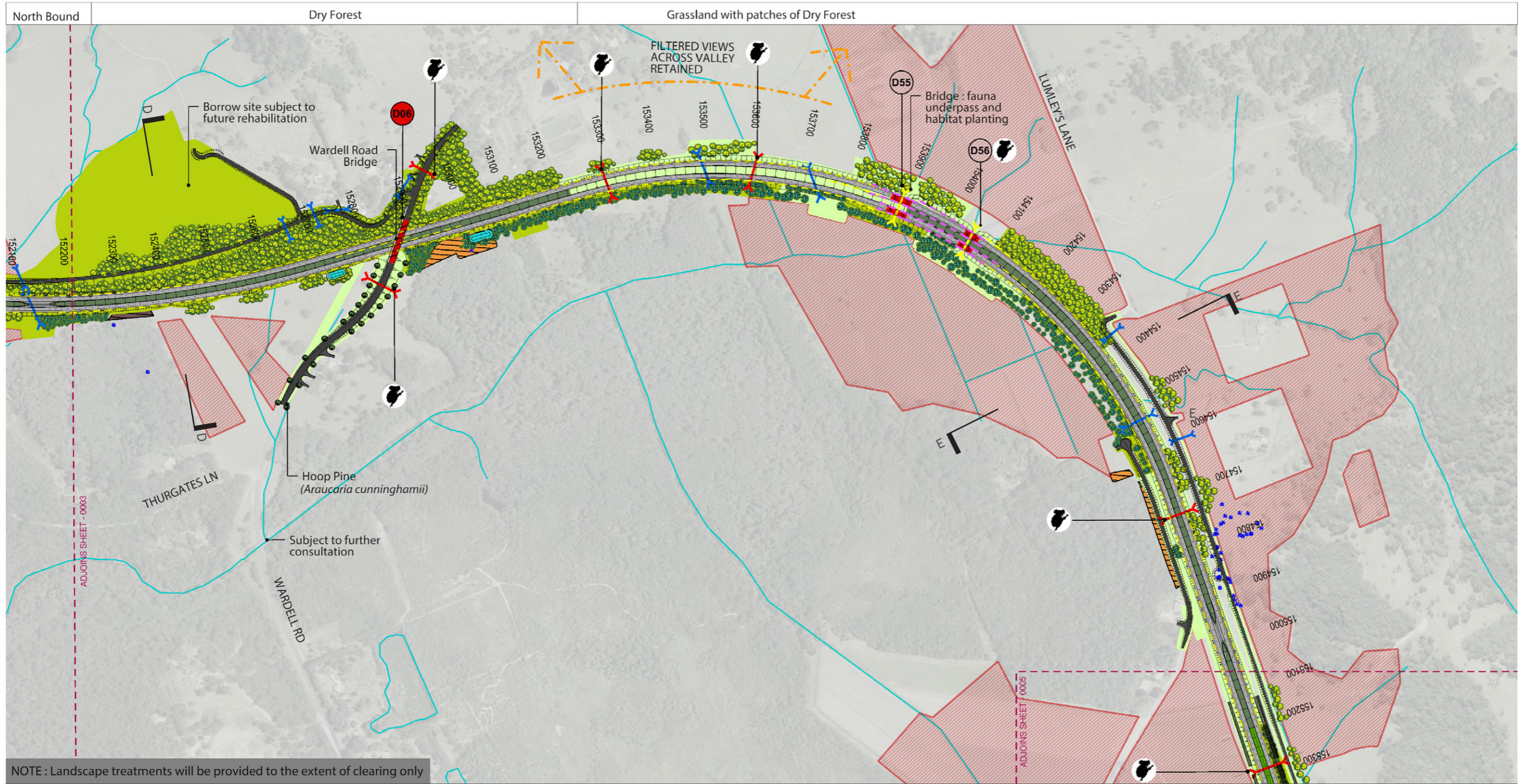
- Feature tree planting
- Relocated cabbage tree palms



Drawing and design subject to further development, number of trees / elements shown is indicative only.



Sheet 1-2 of 8

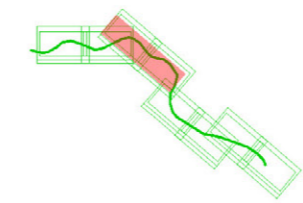


Median	Grass + Shrub species	Grass species	Shrub species
South Bound	Dry Forest	Lowland Swamp	

- LANDSCAPE TREATMENTS**
- VEGETATION COMMUNITY**
- Swamp Forest
Refer to Appendix B for indicative species list
 - Dry Forest
Refer to Appendix B for indicative species list
 - Wet Sclerophyll and Floodplain Forest
Refer to Appendix B for indicative species list
 - Lowland Rainforest
Refer to Appendix B for indicative species list

- REVEGETATION METHOD**
- Garden bed - 75mm mulch over improved topsoil over cultivated subgrade
 - Hydromulch (mix to reflect vegetation community) over site soil over cultivated subgrade
 - Hydromulch Median ripline planting of medium shrub grass mix over site soil over cultivated subgrade
 - Grassland (mix to be native/exotic grasses only) hydromulch over site soil over cultivated subgrade

- FEATURE TREES**
- Feature tree planting
 - Relocated cabbage tree palms



Drawing and design subject to further development, number of trees / elements shown is indicative only.



Sheet 3-4 of 8

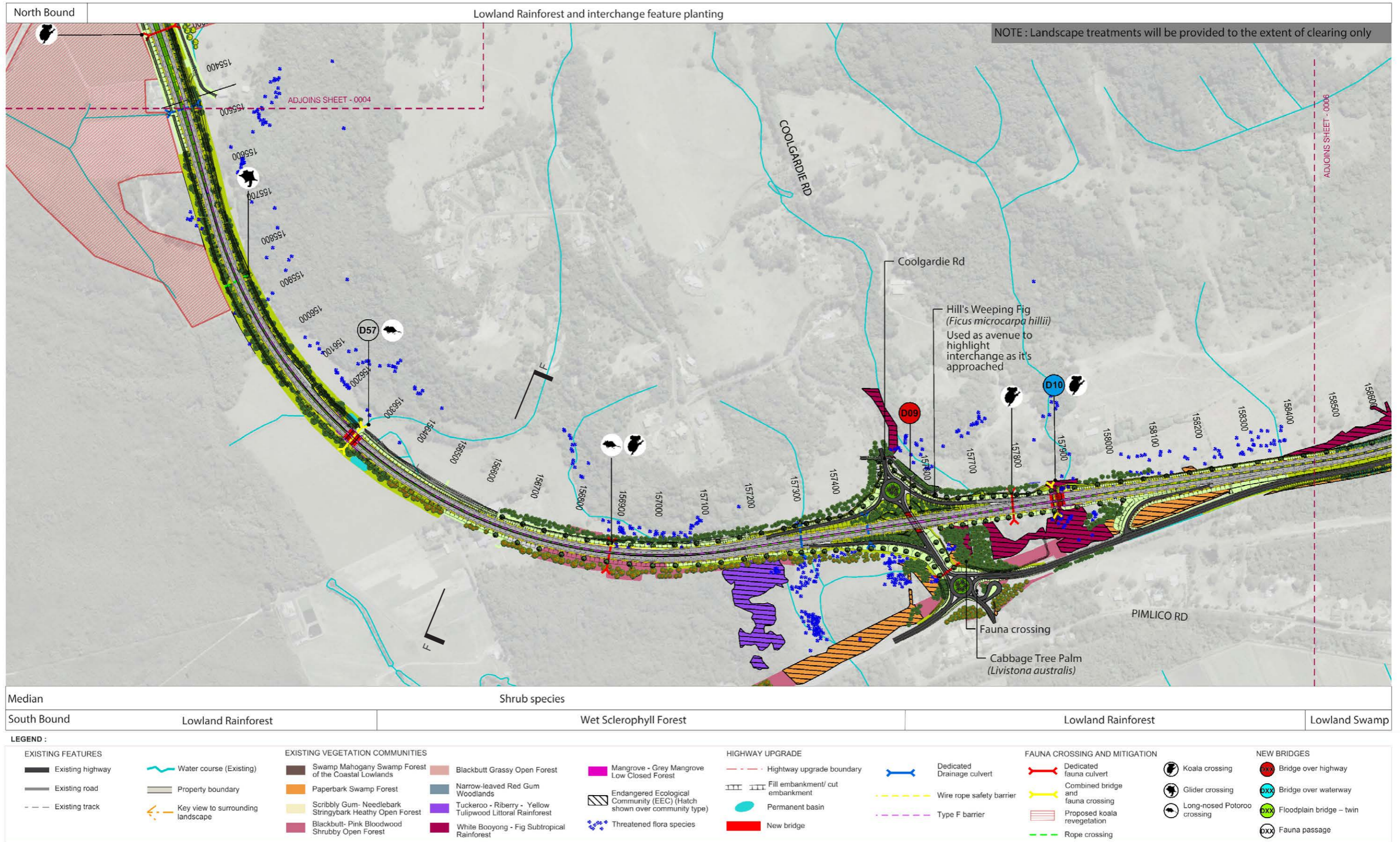


Figure 41: Urban and landscape design plan - Sheets 5 and 6 (Scale 1:8000)






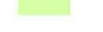
NOTE: Landscape treatments will be provided to the extent of clearing only

LANDSCAPE TREATMENTS



VEGETATION COMMUNITY

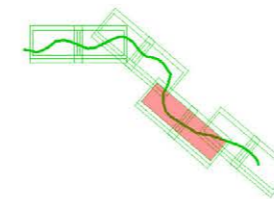
-  Swamp Forest
Refer to Appendix B for indicative species list
-  Dry Forest
Refer to Appendix B for indicative species list
-  Wet Sclerophyll and Floodplain Forest
Refer to Appendix B for indicative species list
-  Lowland Rainforest
Refer to Appendix B for indicative species list

REVEGETATION METHOD

-  Garden bed - 75mm mulch over improved topsoil over cultivated subgrade
-  Hydromulch (mix to reflect vegetation community) over site soil over cultivated subgrade
-  Hydromulch Median ripline planting of medium shrub grass mix over site soil over cultivated subgrade
-  Grassland (mix to be native/exotic grasses only) hydromulch over site soil over cultivated subgrade

FEATURE TREES

-  Feature tree planting
-  Relocated cabbage tree palms



Drawing and design subject to further development, number of trees / elements shown is indicative only.



Sheet 5-6 of 8

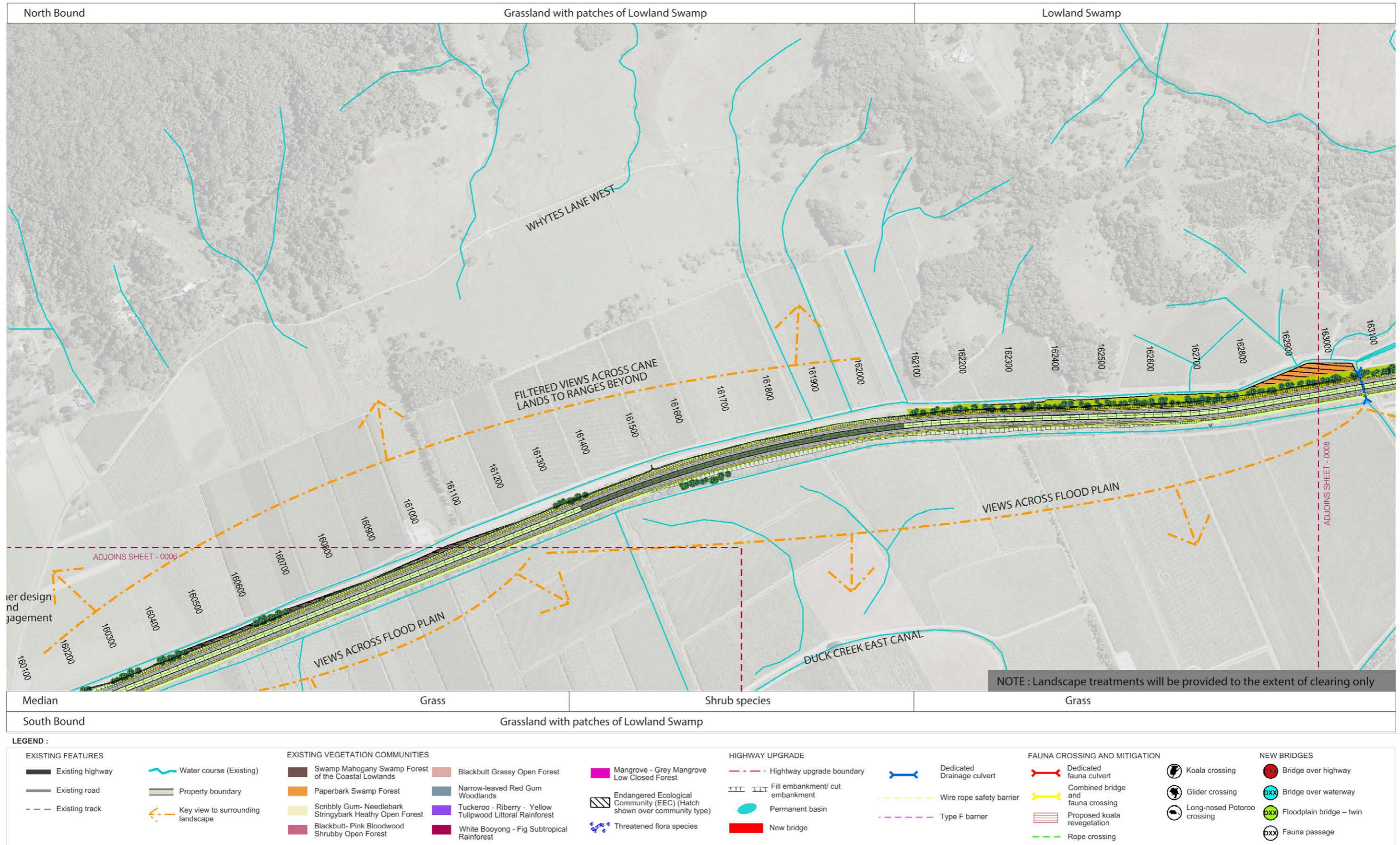
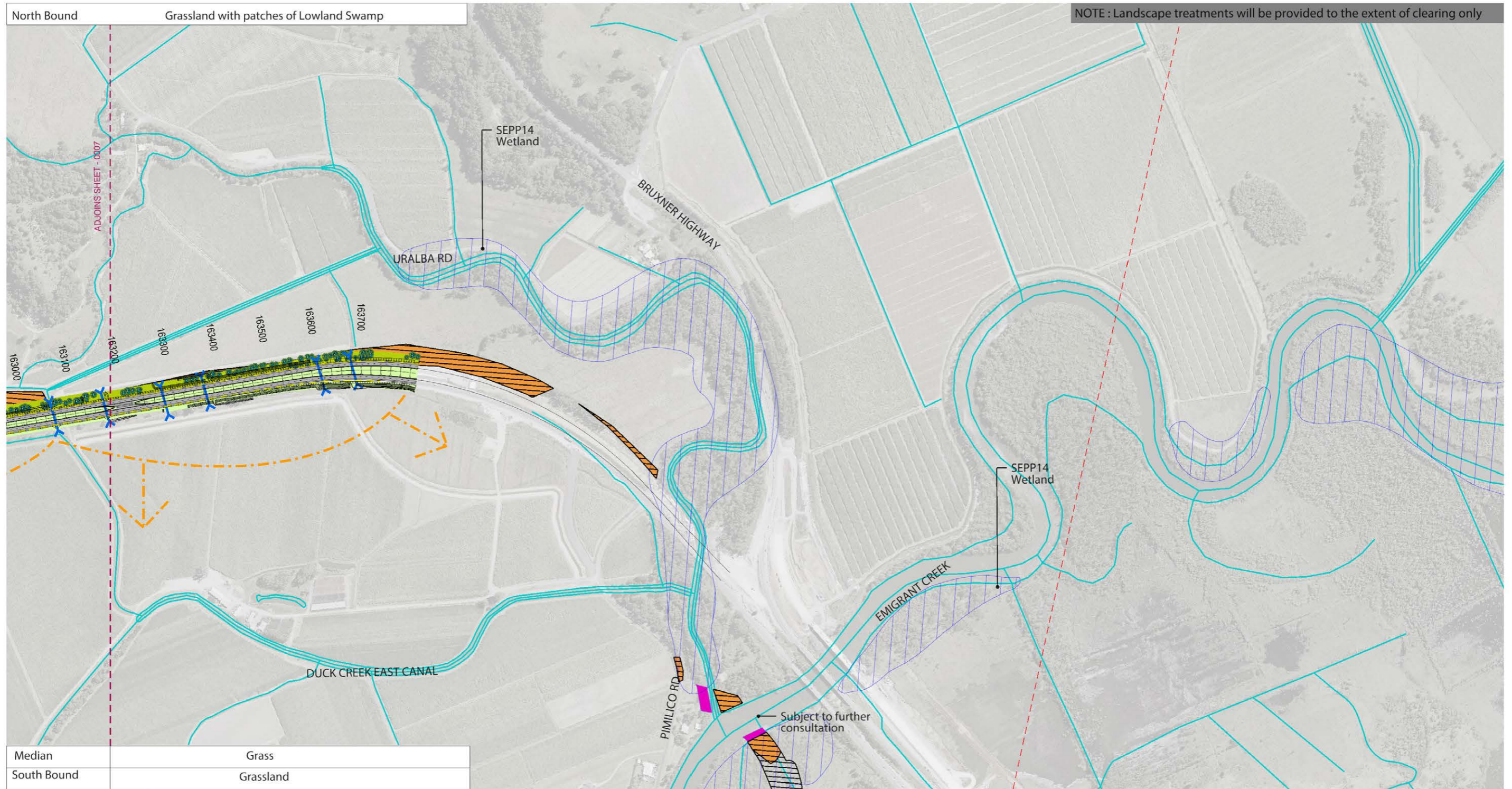






Figure 42: Urban and landscape design plan - Sheets 7 and 8 (Scale 1:8000)







LANDSCAPE TREATMENTS



VEGETATION COMMUNITY

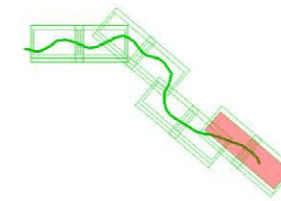
-  Swamp Forest
Refer to Appendix B for indicative species list
-  Dry Forest
Refer to Appendix B for indicative species list
-  Wet Sclerophyll and Floodplain Forest
Refer to Appendix B for indicative species list
-  Lowland Rainforest
Refer to Appendix B for indicative species list

REVEGETATION METHOD

-  Garden bed - 75mm mulch over improved topsoil over cultivated subgrade
-  Hydromulch (mix to reflect vegetation community) over site soil over cultivated subgrade
-  Hydromulch Median ripeline planting of medium shrub grass mix over site soil over cultivated subgrade
-  Grassland (mix to be native/exotic grasses only) hydromulch over site soil over cultivated subgrade

FEATURE TREES

-  Feature tree planting
-  Relocated cabbage tree palms



Drawing and design subject to further development, number of trees / elements shown is indicative only.



Sheet 7-8 of 8



Figure 43: Cross section A-A in Bagotville (Scale 1:400) Note: Note: Fence locations and types are to be confirmed, and subject to further design development

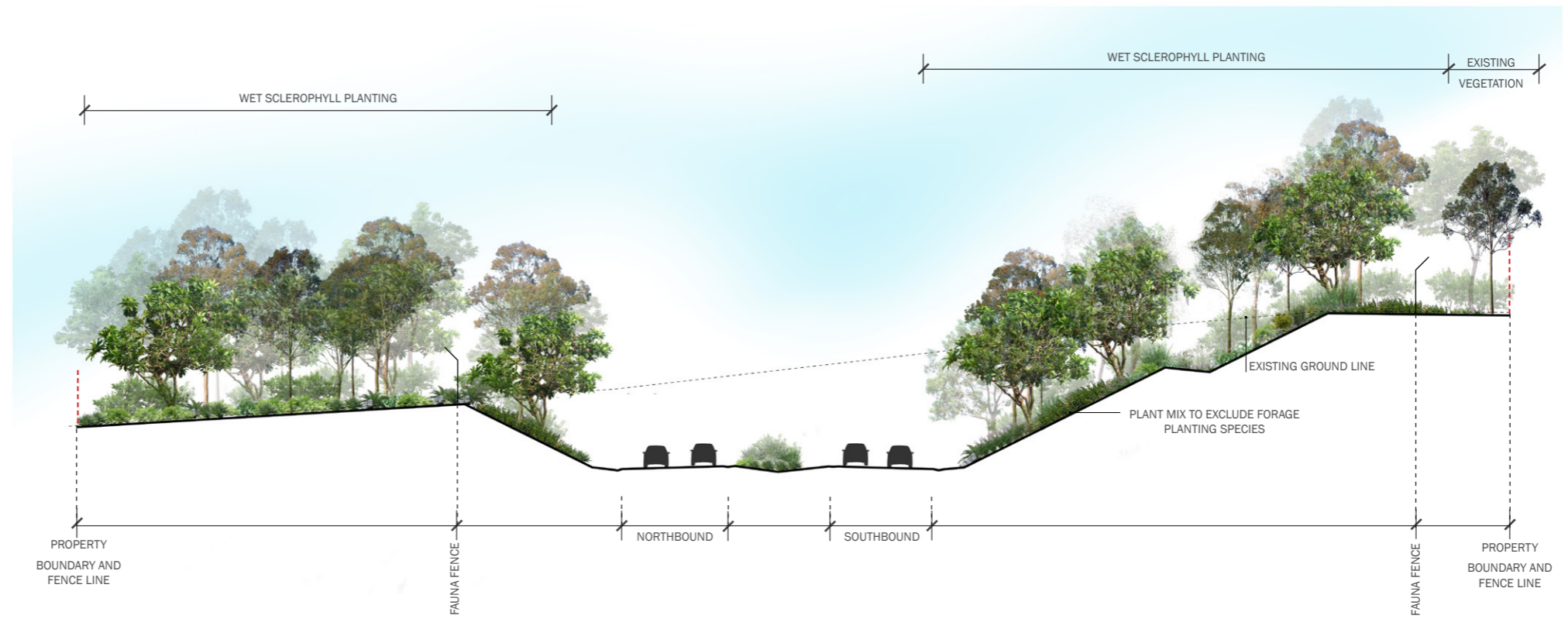


Figure 44: Cross section B-B in Bagotville (Scale 1:400) Note: Fence locations and types are to be confirmed, and subject to further design development

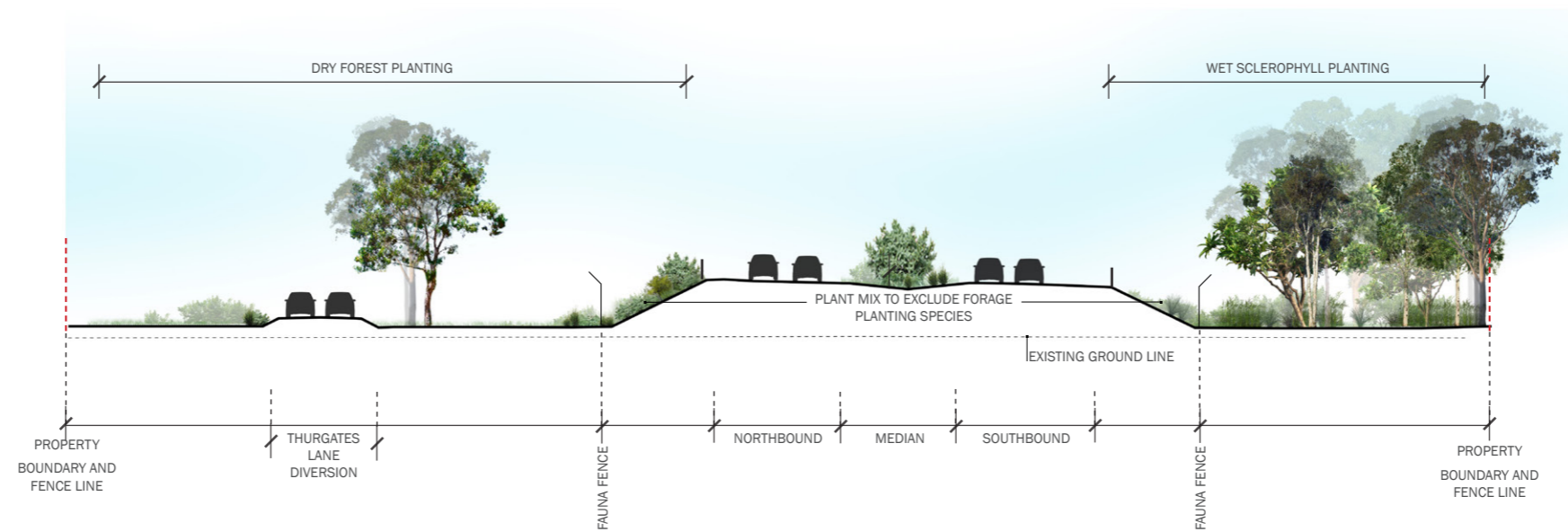


Figure 45: Cross section C-C in Wardell (Scale 1:400) Note: Fence locations and types are to be confirmed, and subject to further design development

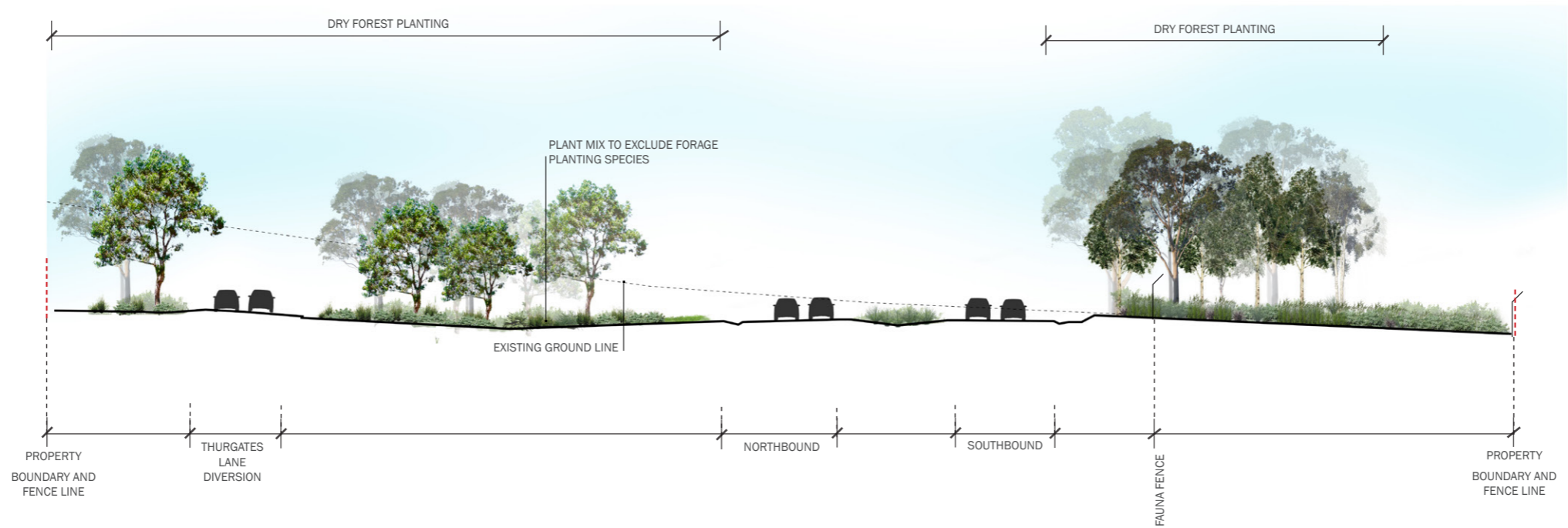


Figure 46: Cross Section D-D in Wardell (Scale 1:400) Note: Fence locations and types are to be confirmed, and subject to further design development

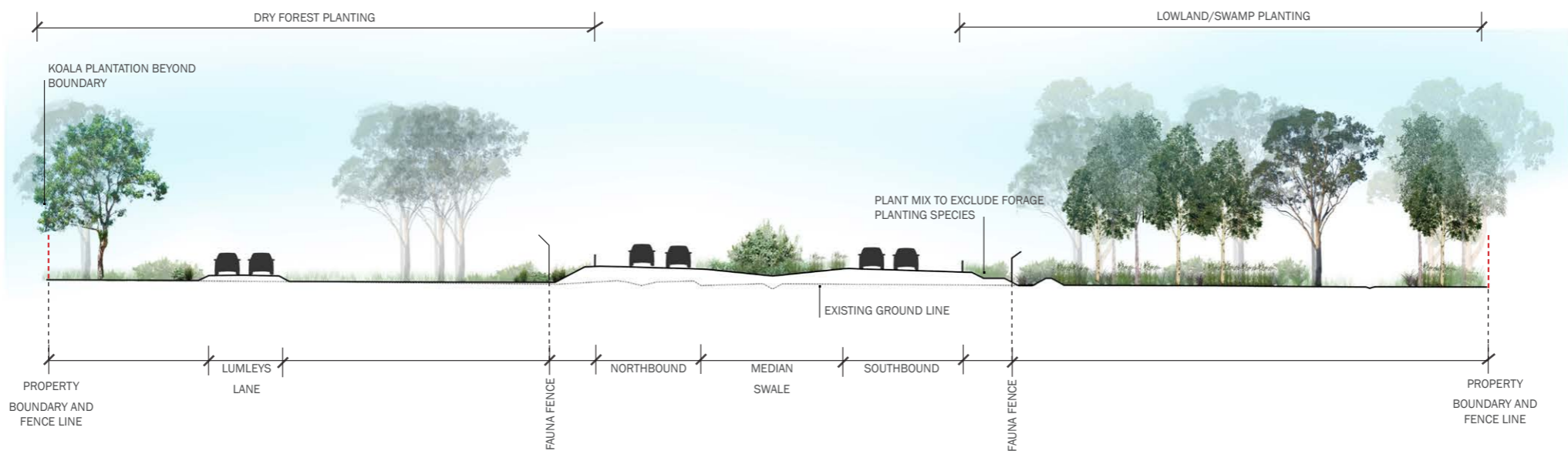


Figure 47: Cross section E-E in Wardell (Scale 1:400) Note: Fence locations and types are to be confirmed, and subject to further design development

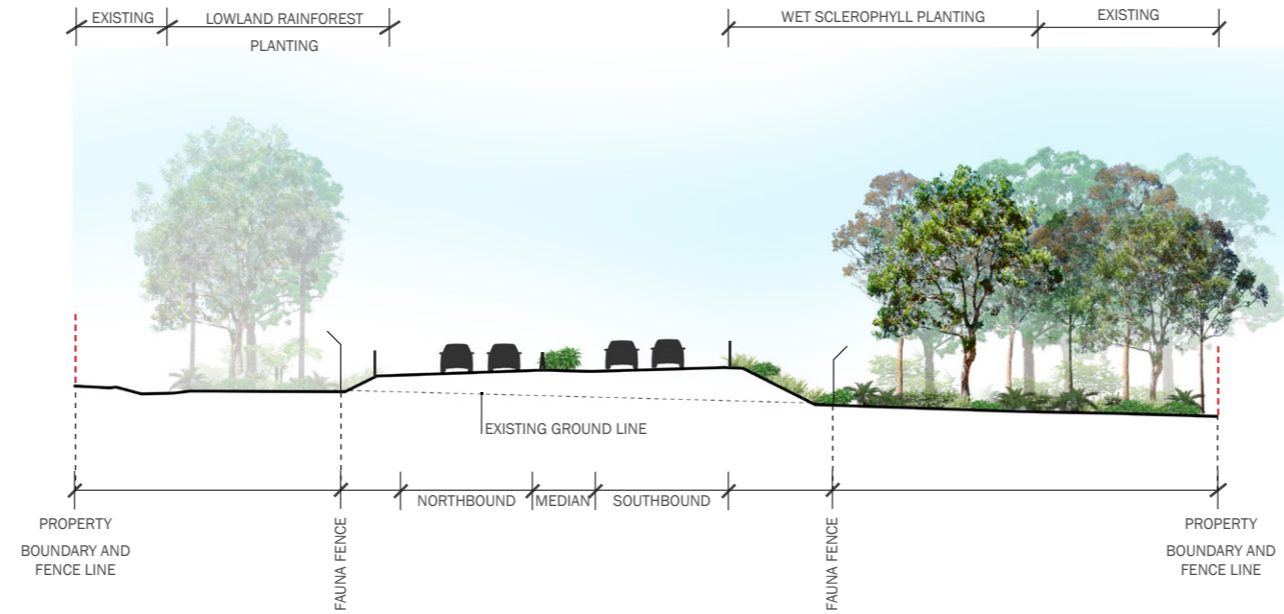


Figure 48: Cross section F-F in Wardell (Scale 1:400) Note: Fence locations and types are to be confirmed, and subject to further design development

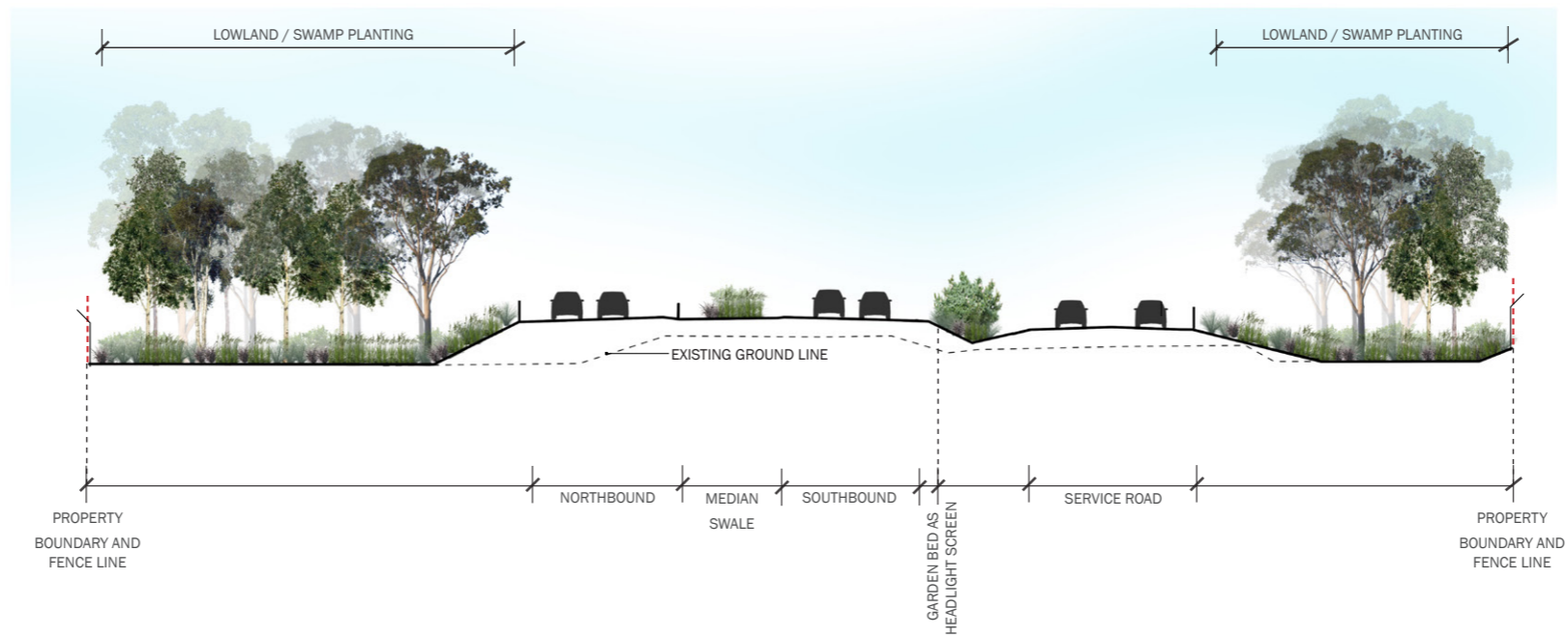


Figure 49: Cross section G-G in Pimlico (Scale 1:400) Note: Fence locations and types are to be confirmed, and subject to further design development

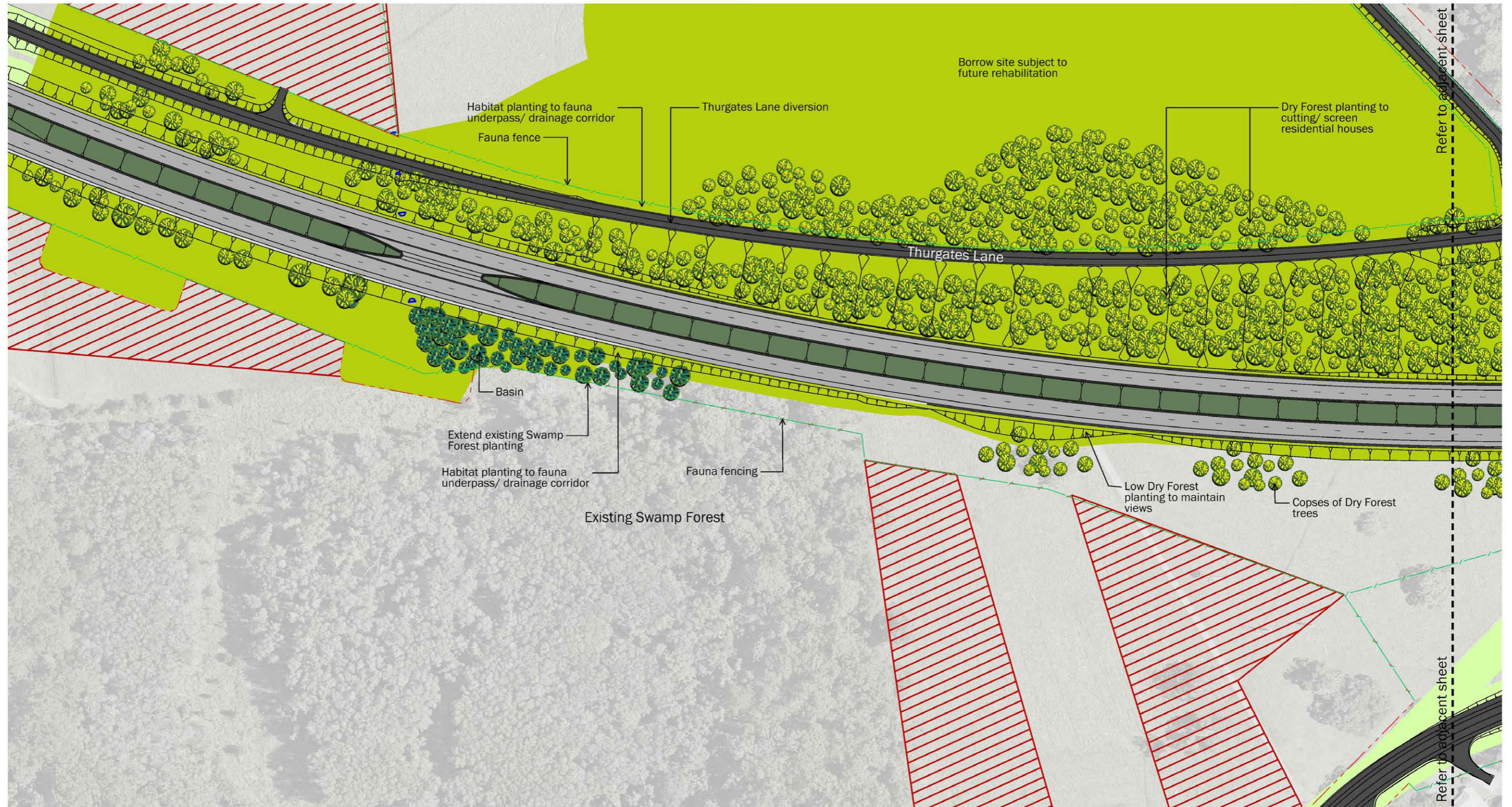
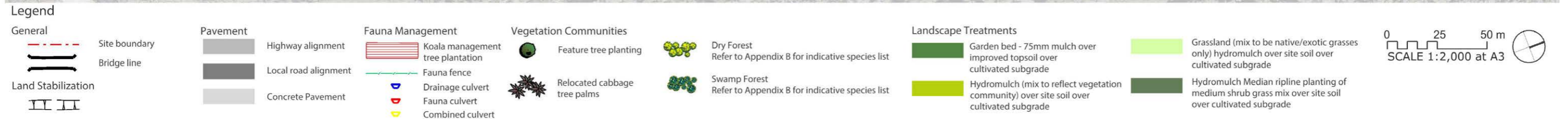


Figure 50: Urban and landscape detail plan - Wardell Road overbridge (Scale 1:2000) Note: Shared path subject to further consultation



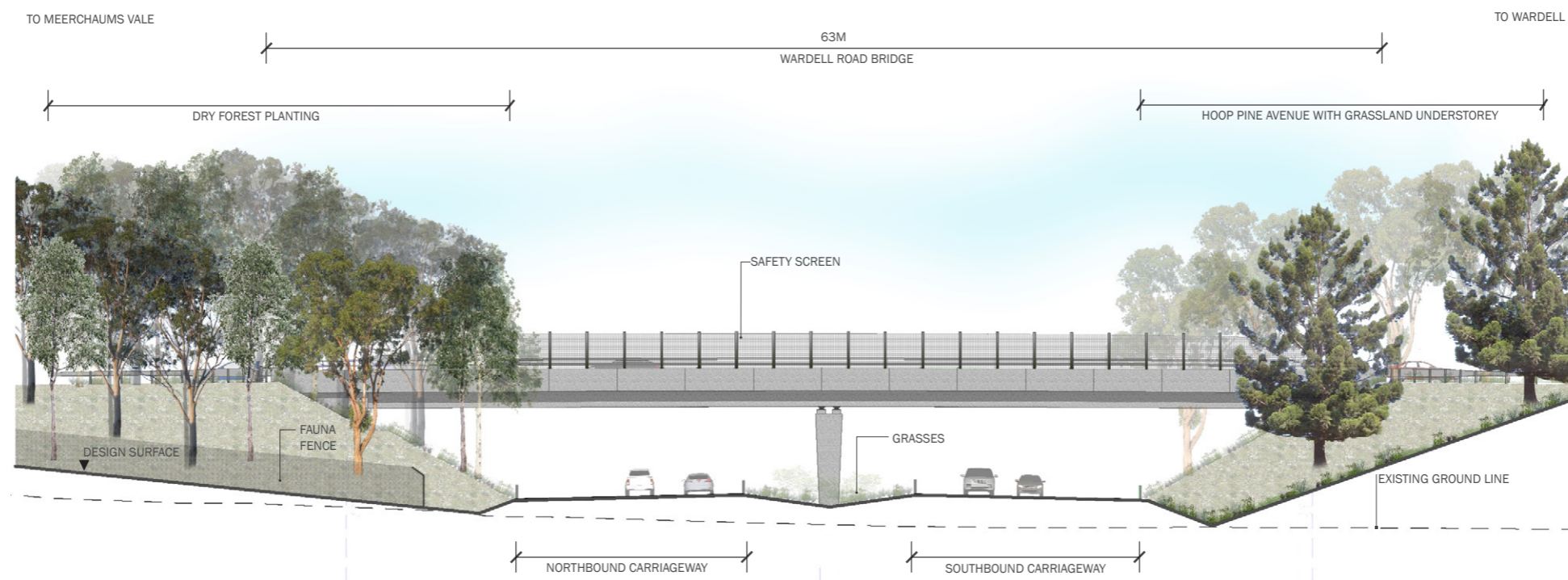


Figure 51: Wardell Road overbridge elevation (Scale 1:400) Note: Fence locations and types are to be confirmed, and subject to further design development

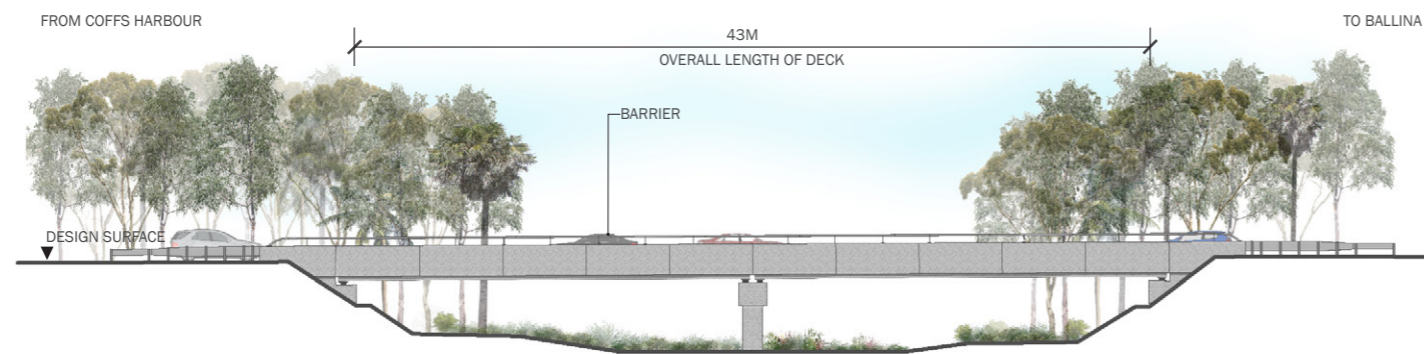


Figure 52: Floodway bridge (Wardell Bridge) - elevation (Scale 1:400)

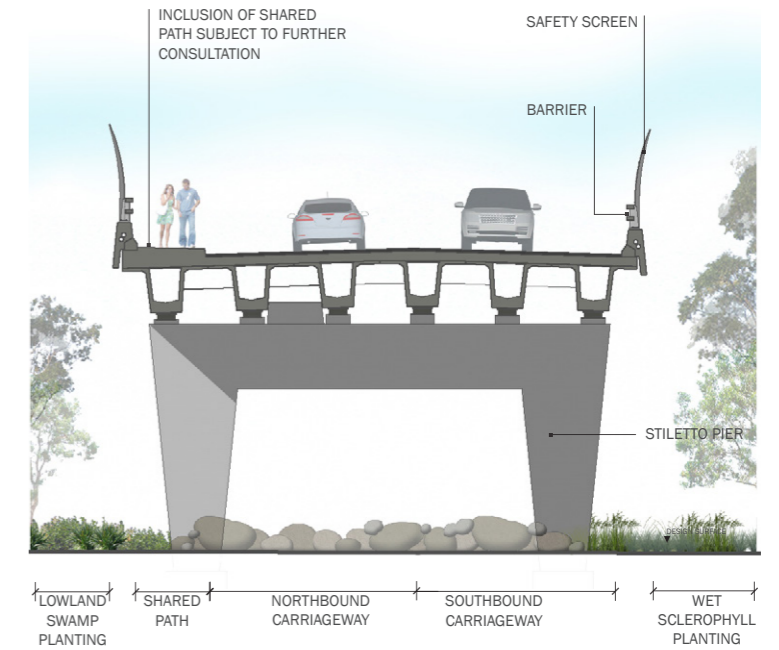


Figure 54: Typical cross section of overpass bridges (Scale 1:200)



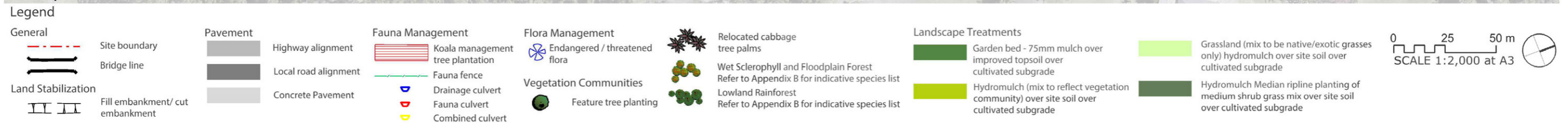
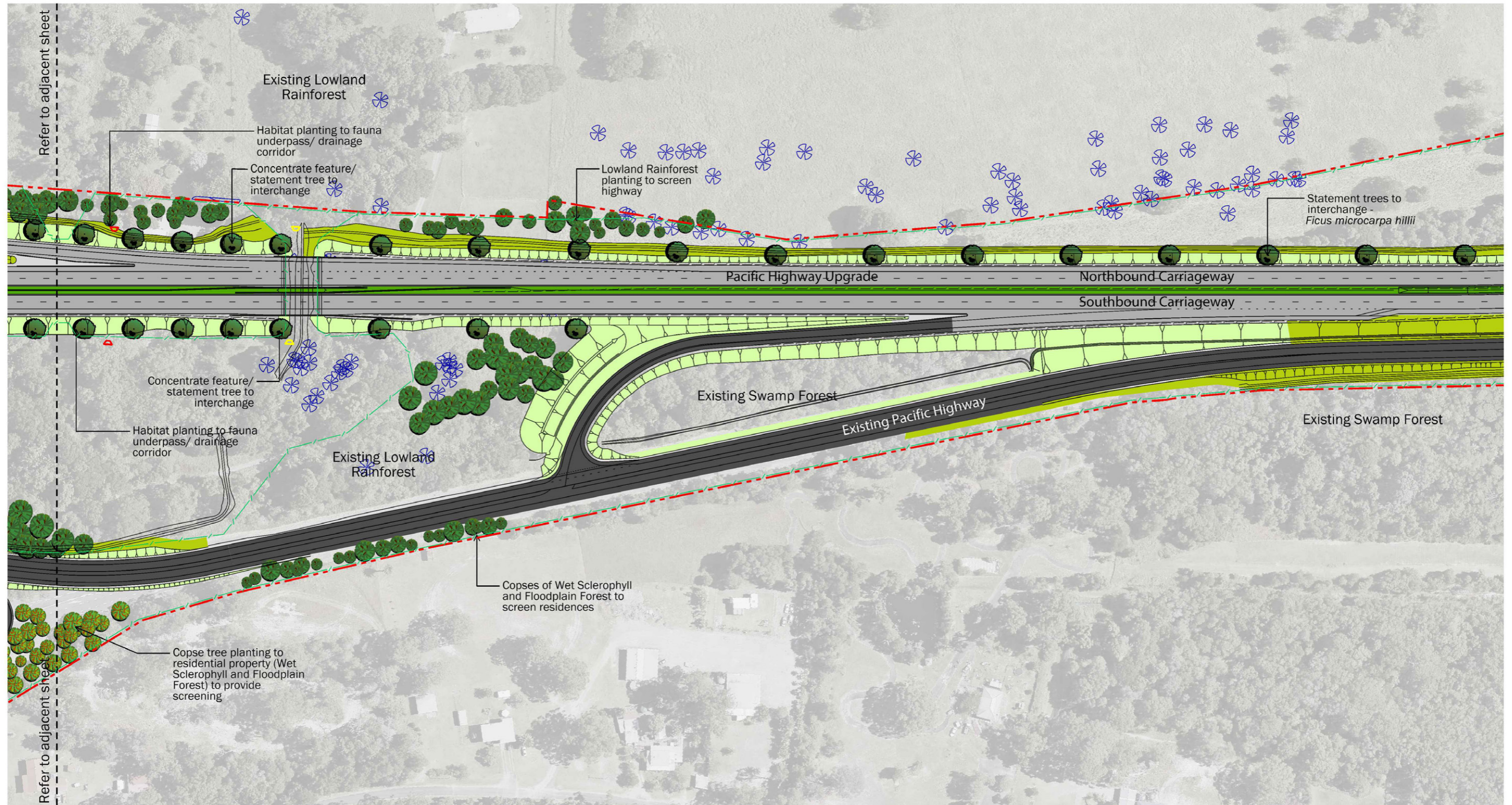
Figure 53: Typical floodway bridge (Wardell Bridge) - cross section (Scale 1:200)



Legend

<p>General</p> <ul style="list-style-type: none"> Site boundary Bridge line <p>Land Stabilization</p> <ul style="list-style-type: none"> Fill embankment/ cut embankment 	<p>Pavement</p> <ul style="list-style-type: none"> Highway alignment Local road alignment Concrete Pavement 	<p>Fauna Management</p> <ul style="list-style-type: none"> Koala management tree plantation Fauna fence Drainage culvert Fauna culvert Combined culvert 	<p>Flora Management</p> <ul style="list-style-type: none"> Endangered / threatened flora <p>Vegetation Communities</p> <ul style="list-style-type: none"> Feature tree planting 	<ul style="list-style-type: none"> Relocated cabbage tree palms Wet Sclerophyll and Floodplain Forest Refer to Appendix B for indicative species list Lowland Rainforest Refer to Appendix B for indicative species list 	<p>Landscape Treatments</p> <ul style="list-style-type: none"> Garden bed - 75mm mulch over improved topsoil over cultivated subgrade Hydomulch (mix to reflect vegetation community) over site soil over cultivated subgrade Grassland (mix to be native/exotic grasses only) hydromulch over site soil over cultivated subgrade Hydomulch Median ripeline planting of medium shrub grass mix over site soil over cultivated subgrade
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Figure 55: Urban and landscape detail plan - Coolgardie Interchange (Scale 1:2000) Note: Shared path subject to further consultation



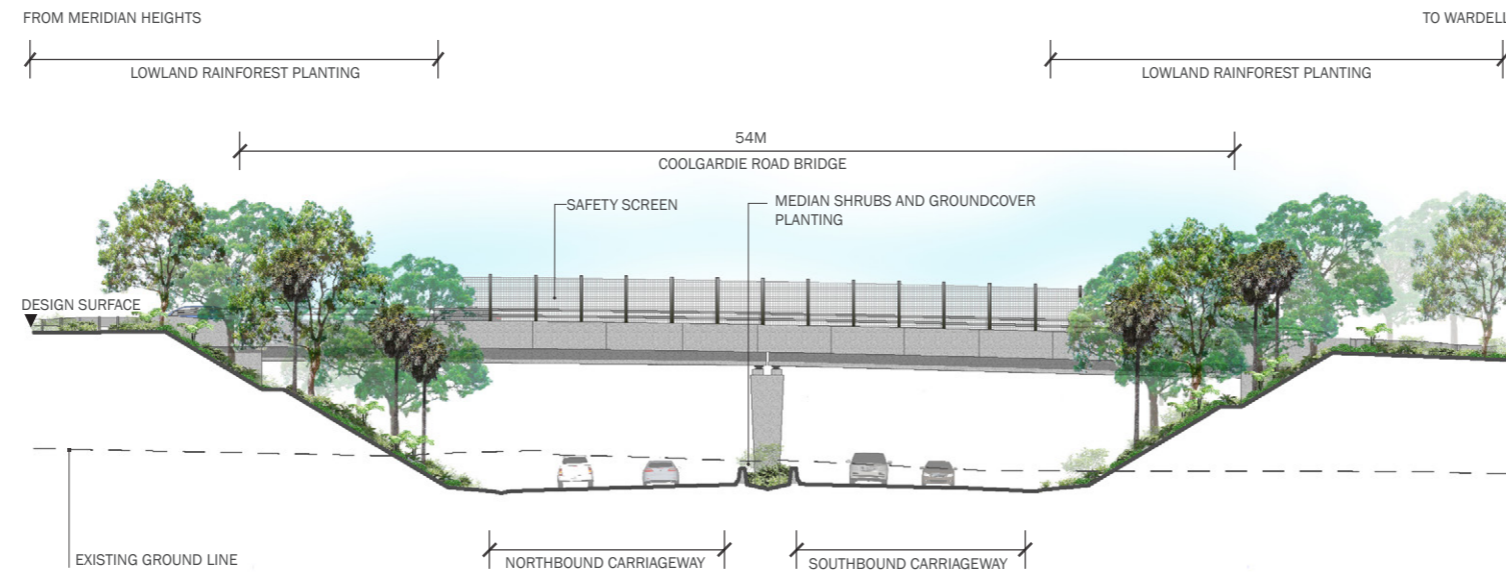


Figure 56: Coolgardie overpass - elevation (Scale 1:400)

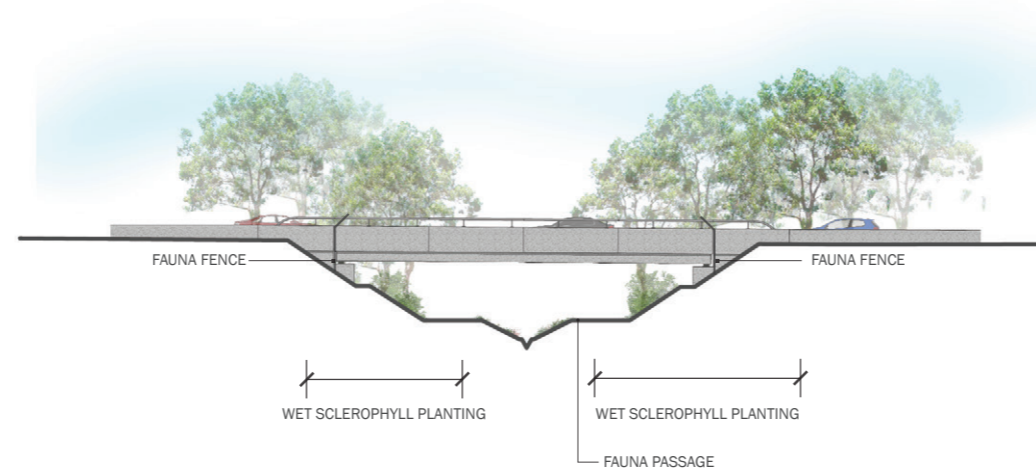


Figure 57: Elevation of typical fauna passage (Scale 1:400) Note: Fence locations and types are to be confirmed, and subject to further design development



Figure 58: Artist's impression of Coolgardie Interchange from the north bound carriageway (Artists impression subject to further design development. Landscape shown at maturity)

7.2 SUMMARY OF LANDSCAPE MONITORING AND MANAGEMENT

As part of the delivery of the landscape design and its intent, there is a requirement for ongoing landscape monitoring and management. This ensures the landscape achieves its final intent in relation to:

- Screening of views from impacted properties
- Establishment/reinforcement of the character of the adjoining vegetation community
- Enhanced connectivity of fauna corridors
- Provides a safe environment for those using, as well as those maintaining, the work
- Manages and controls the spread of noxious weeds.

As part of this process a structure is established for the implementation and establishment period which is reflected in the Landscape Documentation.

The objectives of the monitoring are to provide:

- Progressive review of environmental conditions including:
 - Rate of vegetation establishment
 - Issues in diversity development
 - Presence of weeds
 - Compliance with sightline requirements
 - Compliance with clearance requirements to fences and carriageways with a view to establishment of maintenance requirements and additional work.

The objectives of management work is to ensure the observations made as part of the monitoring process are taken forward into field operations to ensure that the landscape achieves its environmental objectives and design intent. The works will be responsive to changing seasonal demands and the degree of establishment achieved. Critical periods for weed management will be the hot/wet periods in which growth can be rapid and infestations can become established and set seed.



Figure 59: View of the project area from Lumleys Lane within Richmond River to Coolgardie Road - Section 10

7.3 VISUAL IMPACT ASSESSMENT AND MITIGATION

This chapter provides a reassessment of the impact of the highway on landscape character and views, using the Environmental Impact Assessment Practice Note: *Guidelines for Landscape Character and Visual Impact Assessment* (“EIA No. 4 Guidelines”, Roads and Maritime, March 2013), compared to the EIS design.

7.3.1 LANDSCAPE CHARACTER AND IMPACT ASSESSMENT

To assess landscape character the local context of the site is broken up into a number of units to help understand the local context and the implications of the proposal. These include defining the landscape character precincts (precincts of similar spatial or character properties), and the analysis of changes to these precincts as a result of the proposed project.

Landscape character is defined as:

“The combined quality of built, natural and cultural aspects that make up an area and provide its unique sense of place.” (EIA No.4 Guidelines, 2013).

The proposal is assessed in terms of its impact on these character zones and the impact ranked in terms of sensitivity to change. This assessment differs from a visual assessment in that it assesses the overall impact of a proposal on an area’s character and sense of place.

7.3.2 VISUAL IMPACT ASSESSMENT

7.3.2.1 VISIBILITY

The view fields of a road corridor or object are composed of static receptors i.e. those that adjoin the corridor and mobile receptors include those that travel along the corridor. The impact of the two groups are unique in that the time and frequency of the exposure differ. The extent to which views can be obtained is referred to as the view catchment.

STATIC RECEPTORS

Static receptors occur within the visual catchment of the project alignment i.e. they are points, which have a view of or can be viewed from the alignment. The visual envelope of the proposal is visually defined by both the topography and vegetation, which adjoins the proposal.

MOBILE RECEPTORS

Mobile receptors are the users of the project alignment and the adjoining streets. Their experience of the space is short term.

7.3.3 LANDSCAPE CHARACTER AND VISUAL ASSESSMENT MATRIX

Landscape character and visual assessment are equally important. Landscape character assessment helps determine the overall impact of a proposal on an area’s character and sense of place including all

built, natural and cultural aspects, covering towns, countryside and all shades between. Visual impact assessment helps define the day to day visual effects of a proposal on people’s views.

To quantify these impacts it is important to assess two qualities in relation to landscape character or view point. These are: Sensitivity and Magnitude

“Sensitivity refers to the qualities of an area, the number and type of receivers and how sensitive the existing character of the setting is to the proposed change. For example a pristine natural environment will be more sensitive to change than a built up industrial area”.

Magnitude refers to the nature of the project. For example a large interchange will have a very different impact on landscape character than a localised road widening in the same area”(Roads and Maritime, 2013).

As part of the assessment, Roads and Maritime, has adopted a matrix which combines sensitivity rankings with magnitude to determine the proposal’s overall impact. This is used to inform the Landscape Character and Visual Impact Assessment. Refer Table 9.

Note: The EIS referenced an earlier edition of the Impact Assessment Grading Matrix produced in the Guideline for Landscape Character and Visual Impact Assessment (Roads and Maritime, 2013).

		MAGNITUDE			
		HIGH	MODERATE	LOW	NEGLIGIBLE
SENSITIVITY	HIGH	High Impact	High - Moderate	Moderate	Negligible
	MODERATE	High - Moderate	Moderate	Moderate - low	Negligible
	LOW	Moderate	Moderate - low	Low	Negligible
	NEGLIGIBLE	Negligible	Negligible	Negligible	Negligible

Table 9: Impact assessment grading matrix

7.3.4 LANDSCAPE CHARACTER IMPACT

Chapter 5 reviewed the eight precincts impacted by the project and described their character. The EIS findings the changes in design and consequent impact on assessment are below. These findings are summarised in Table 10.

7.3.4.1 PRECINCT P-47: TUCKEAN BROADWATER

EIS ASSESSMENT

The precinct was assessed as of moderate sensitivity due to the proximity of the Blackwall Range and its unique scenic quality. The scale of impact was assessed as negligible as the area is outside the road corridor. The overall impact was consequently assessed as negligible.

CHANGES IN DESIGN

No changes in design impact this character precinct.

LANDSCAPE CHARACTER ASSESSMENT

The are no changes in design which impact the sensitivity of the character of the precinct and consequently no change in assessment. Overall change in landscape character is assessed as negligible.

7.3.4.2 PRECINCT P-48: CABBAGE TREE ISLAND AND FLOODPLAIN

EIS ASSESSMENT

The precinct is visually removed from the alignment by a ridge and vegetation cover. Its sensitivity was assessed as low and its magnitude of change as negligible.

CHANGES IN DESIGN

No changes in design impact this character precinct.

LANDSCAPE CHARACTER ASSESSMENT

There are no changes impacting the character precinct and so assessment is unchanged with negligible impact.

7.3.4.3 PRECINCT P-49: BAGOTVILLE FLOODPLAIN & LUMLEYS HILL

EIS ASSESSMENT

The precinct was assessed as of moderate sensitivity as the alignment is set to the edge of open agricultural lands with views to the Blackwall Range at the interface with Character Precinct 50 providing an enclosed landscape character. The magnitude of change was assessed as moderate reflecting the introduction of the new road infrastructure and the relatively low scale of embankments. Its overall impact was assessed as moderate.

CHANGES IN DESIGN

Refinements to the design since the EIS include:

- Rest area is to be provided as a future provision and not constructed as part of the initial work
- Koala Plantation Strategy is developed proposing revegetation of 130 hectares of cleared land within the valley
- Changes in provisions for fauna crossing including number and type of structures
- Refinement in alignment with minor changes in embankment scale and geometry
- Wardell Road realigned at the eastern side of the main carriageway
- Wardell Road bridge raised western side to achieve safe sight distances.

LANDSCAPE CHARACTER ASSESSMENT

The proposed changes do not change the sensitivity rating and this will remain moderate. The changes in form are not sufficient to change the magnitude rating and this will remain as moderate. The overall landscape character impact remains as moderate.

7.3.4.4 PRECINCT P-50: BINGAL CREEK

EIS ASSESSMENT

The precinct adjoins the eastern edge of the alignment and consists of woodland forest lands with some agricultural use. The area is assessed as of moderate sensitivity with its character assessed to have the ability to absorb impact and the alignment set to the edge of the character precinct minimising physical change. The magnitude of change involves the construction of the new highway corridor predominantly on embankment but including some minor cuttings. It was assessed as moderate to high.

CHANGES IN DESIGN

Refinements to the design since the EIS include:

- Rest area is to be provided as a future provision and not constructed as part of the initial work
- Changes in provisions for fauna crossing including increase in number and type of structures
- Refinement in alignment with minor changes in embankment scale and geometry.

LANDSCAPE CHARACTER ASSESSMENT

The proposed changes do not change the sensitivity rating and this will remain moderate. The changes in form are not sufficient to change the magnitude rating and this will remain as moderate - high. The overall landscape character impact remains as moderate - high.

7.3.4.5 PRECINCT P-51: WARDELL TOWNSHIP

EIS ASSESSMENT

This precinct is removed from the alignment and characterised by the built form of the township of Wardell. The realignment of the highway will remove the through traffic from cutting the town in two. The sensitivity of the precinct was assessed as moderate reflecting its urban nature and the magnitude of physical change assessed as negligible due to its removal from the project alignment.

CHANGES IN DESIGN

- Refinements to the extent of fauna fencing extending this facility along both Wardell Road and the existing Pacific Highway alignment.

LANDSCAPE CHARACTER ASSESSMENT

The magnitude of change remains negligible. The proposed changes do not change the sensitivity rating and this will remain moderate. The overall landscape character impact remains negligible.

7.3.4.6 PRECINCT P-52: BLACKWALL RANGE

EIS ASSESSMENT

The precinct is removed from the impact of the project alignment being located to its west. Associated with the Great Dividing Range, it consists of steeper, heavily vegetated topography and is of unique scenic quality. Its sensitivity is assessed as high. The magnitude of impact is assessed as negligible as the work is outside the precinct. The overall impact is consequently negligible.

CHANGES IN DESIGN

There are no changes impacting this precinct

LANDSCAPE CHARACTER ASSESSMENT

The magnitude of change remains negligible. The proposed changes do not change the sensitivity rating and this will remain high. The overall landscape character impact remains negligible.

7.3.4.7 PRECINCT P-53: PIMLICO

EIS ASSESSMENT

Pimlico is a precinct that primarily includes the agrarian floodplains east to the Richmond River. The proposal sees the introduction of new and expanded highway infrastructure. The sensitivity of the alignment was assessed as moderate reflecting the existing road corridor and the limited number of houses within a highly altered agricultural landscape. The magnitude of change was assessed as moderate.

CHANGES IN DESIGN

Refinements to the design since the EIS include:

- Revisions to geometry of the Coolgardie Interchange.

LANDSCAPE CHARACTER ASSESSMENT

The proposed changes do not change the sensitivity rating and this will remain moderate. The changes in form are not sufficient to change the magnitude rating and this will remain as moderate - high. The overall landscape character impact remains as moderate.

7.3.4.8 PRECINCT P-54: EMIGRANT CREEK

EIS ASSESSMENT

Located to the east of the alignment, Emigrant Creek is characterised by the winding path of the creek, which feeds into the Richmond River. This landscape forms a transition between the productive floodplain and the creek edges which are heavily vegetated.

CHANGES IN DESIGN

There are no work proposed in this precinct.

LANDSCAPE CHARACTER ASSESSMENT

As no work is occurring within the precinct, the sensitivity and magnitude are both considered negligible.

LANDSCAPE CHARACTER PRECINCT	EIS SENSITIVITY	DESIGN SENSITIVITY	EIS MAGNITUDE	DESIGN MAGNITUDE	EIS IMPACT RATING	DESIGN IMPACT RATING
PRECINCT 47	Moderate	No change	Negligible	No change	Negligible	No change
PRECINCT 48	Low	No change	Negligible	No change	Negligible	No change
PRECINCT 49	Moderate	No change	Moderate	No change	Moderate	No change
PRECINCT 50	Moderate	No change	Moderate - High	No change	Moderate - High	No change
PRECINCT 51	Moderate	No change	Negligible	No change	Negligible	No change
PRECINCT 52	High	No change	Negligible	No change	Negligible	No change
PRECINCT 53	Moderate	No change	Moderate	No change	Moderate	No change
PRECINCT 54	Negligible	No change	Negligible	No change	Negligible	No change

Table 10: Precinct sensitivity summary

7.3.5 IMPACT ON KEY VIEWS

The EIS determined the visual impact of 75 key viewpoints along the corridor. Of these 15 views are located within Richmond River to Ballina - (Sections 10 and 11) (Figure 60). These views are as follows:

Section 10- Richmond River to Coolgardie Road

- 48B - Backchannel Road
- 50 - Old Bagotville Road
- 51 - Thurgates lane
- 52 - Wardell Road
- 53 - Lumleys Lane, Wardell
- 54 - Lumleys Lane, Wardell
- 55 - Lumleys Lane, Wardell
- 56 - Coolgardie Road, Coolgardie
- 57 - Pimlico Road, Pimlico
- 58 - Pimlico Road, Pimlico

Coolgardie Road to Ballina - Section 11

- 59 - Whytes lane (East), Pimlico
- 60 - Whytes Lane, Pimlico
- 61 - Pimlico Road, Pimlico
- 62A - Whytes Lane (West) Pimlico
- 62B - 110 Sartories Lane, Pimlico

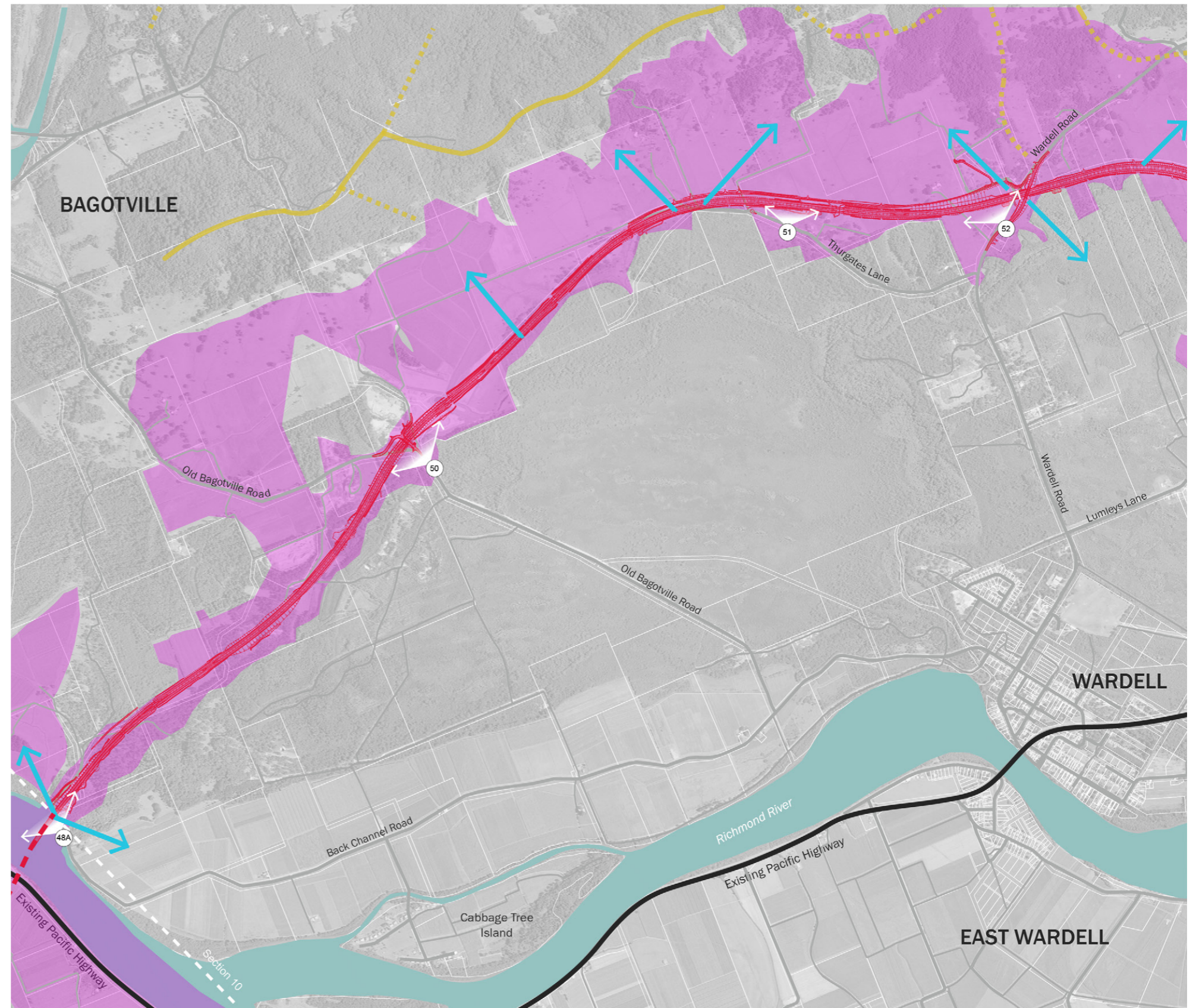
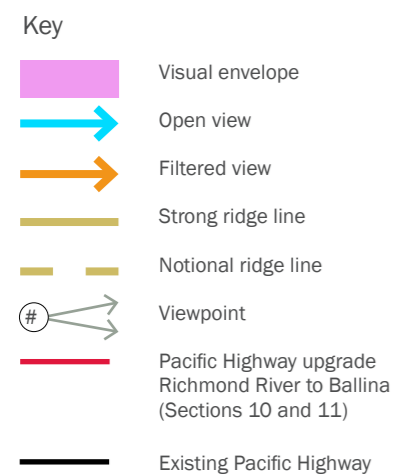
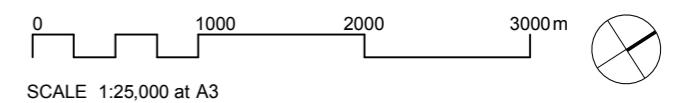
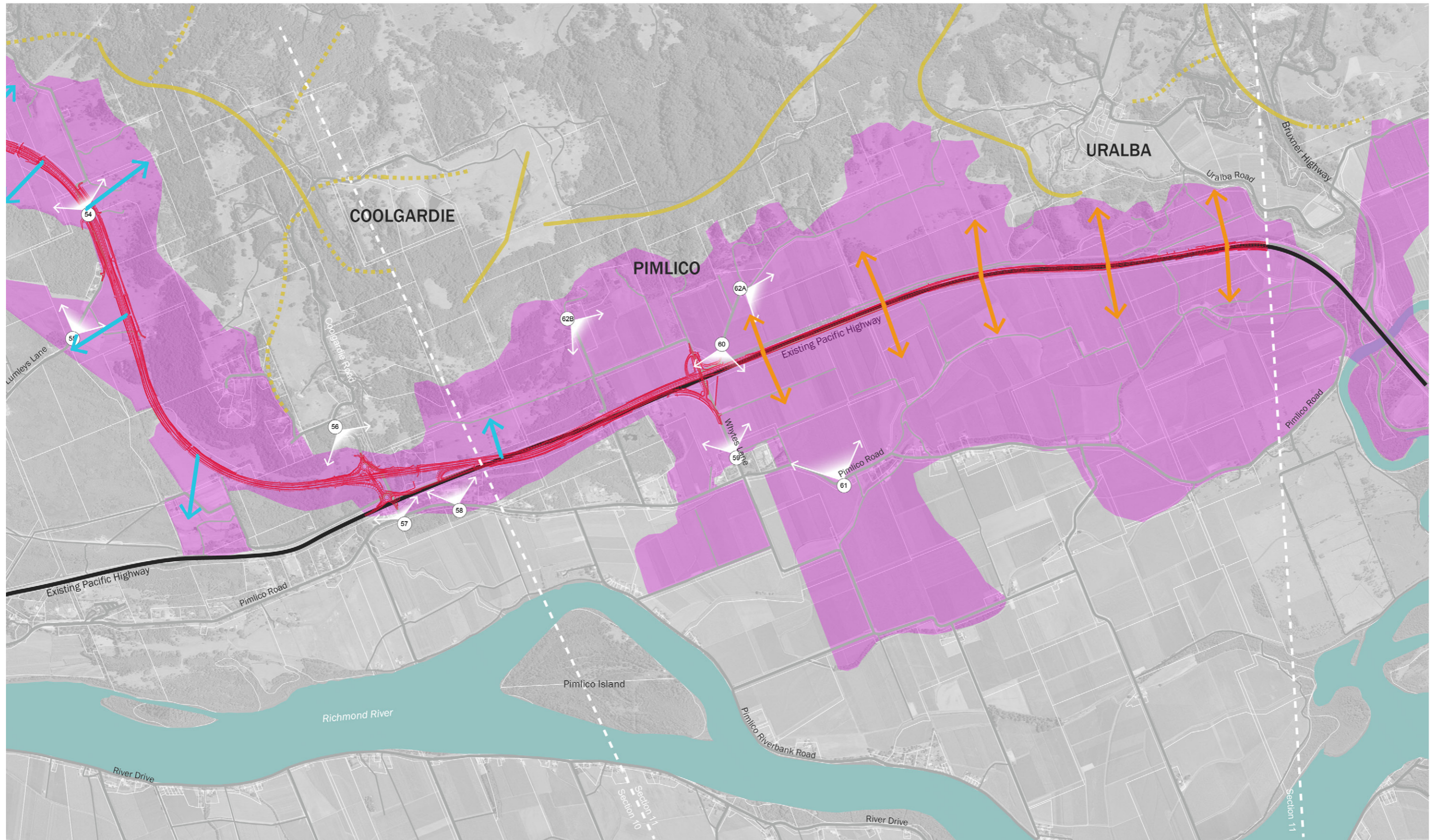


Figure 60: Visual Impact Assessment key plan showing viewpoints





7.3.5.1 VIEW POINT 48B: BACKCHANNEL ROAD (NOTED IN EIS PLAN AS 48A)

DESCRIPTION:

Foreground view looking west from the end of Backchannel Road, next to the Richmond River. View point is located just east of the project alignment.

EIS ASSESSMENT

The viewpoint was assessed to have low sensitivity due to the low number of viewers and its magnitude assessed as high. The magnitude reflected the construction of a major new bridge built over a natural setting. The overall visual impact was assessed as moderate.

VISUAL IMPACT ASSESSMENT

The sensitivity of rating of the EIS will not change as a result of the development of the design. The bridge design is not part of the Richmond River to Coolgardie Road - Section 10 design package but will form part of the overall project work and will be subject to its own assessment in another document. The scale of the new bridge will remain similar to the EIS concept and so the magnitude rating is considered to remain high. The visual assessment impact will remain moderate.



7.3.5.2 VIEW POINT 50: OLD BAGOTVILLE ROAD

DESCRIPTION

Foreground view looking west from Old Bagotville Road (in the location of the proposed Old Bagotville Road Underpass) overlooking the existing quarries.

EIS ASSESSMENT

The viewpoint was assessed to have moderate - low sensitivity due to the low number of viewers and its magnitude was assessed as high to moderate. The magnitude reflected the construction of a major new overbridge within a disturbed quarry area. The overall visual impact was assessed as moderate.

VISUAL IMPACT ASSESSMENT.

The change in design from an overpass bridge to an underpass structure for Old Bagotville Road will see changes in impact as a result of an increase in scale of the main alignment formation and changes to the alignment of Old Bagotville Road. The sensitivity of rating of the EIS will not change as a result of the development of the design. The scale of the formation is similar to the existing but has seen the removal of the overbridge and its associated formation. The magnitude is consequently considered to be reduced to moderate. The visual assessment impact will be reduced to moderate to low.



7.3.5.3 VIEW POINT 51: THURGATES LANE

DESCRIPTION

Foreground view looking west from Thurgates Lane to the Blackwall Range.

EIS ASSESSMENT

The viewpoint was assessed to have moderate sensitivity, with a small number of houses identified as having direct views of the project. The magnitude was assessed as high due to the scale of infrastructure introduced to the peaceful agricultural setting. The overall visual impact was assessed as moderate to high.

VISUAL IMPACT ASSESSMENT

Four residential properties are identified as overlooking this view. Two of these properties fall within the proposed koala revegetation strategy and will incorporate plantation work within the lots between the highway and Thurgates Lane. The overall sensitivity has therefore been considered to be moderate reflecting distance of views and screening of the closest properties as part of the Koala Strategy. The magnitude is assessed as moderate reflecting the establishment of a plantation between the highway and the lane reducing the visual impact.

Overall the visual impact rating is assessed as reduced to moderate.



7.3.5.4 VIEW POINT 52: WARDELL ROAD

DESCRIPTION

Foreground to mid-ground view looking west from Wardell Road to the Blackwall Range.

EIS ASSESSMENT

The view point was assessed to have moderate sensitivity due to the low number of people viewing the change. The magnitude of the change was assessed as high, reflecting the introduction of a major highway within the agricultural setting. The overall rating was assessed as moderate to high.

VISUAL IMPACT ASSESSMENT

The detailed design development will not change the sensitivity rating of the EIS with the site remaining moderate. The developed design has an area of plantation revegetation proposed as part of the proposed koala revegetation strategy which will reduce the level of exposure of the proposal along with the proposed revegetation work within the proposed landscape design. The magnitude of change is consequently considered to be reduced to moderate. This sees an overall reduction of impact to moderate.



7.3.5.5 VIEW POINT 53: LUMLEYS LANE, WARDELL

DESCRIPTION

View from the intersection of Lumleys Lane and Wardell Road looking south east. This presents a mid-ground view of the alignment within the valley.

EIS ASSESSMENT

The sensitivity of the proposal is assessed as moderate reflecting the visibility of the highway from the local road network. The magnitude of change is assessed as high to moderate in response to the introduction of a major highway within the agricultural setting. The overall rating is moderate to high.

VISUAL IMPACT ASSESSMENT

The detailed design development will not change the sensitivity rating of the EIS with the sensitivity remaining moderate. The magnitude of the impact has however been altered by the plantation revegetation work proposed as part of the proposed koala revegetation strategy. This strategy will reduce the level of exposure of the proposal with plantation proposed both behind and in front of the alignment. The impact has consequently been reassessed as moderate.



7.3.5.6 VIEW POINT 54: LUMLEYS LANE, WARDELL

DESCRIPTION

Foreground view looking west along the alignment from where Lumleys Lane intersects with it. The view is similar to that of the proposed service road.

EIS ASSESSMENT

The sensitivity of the proposal is assessed as moderate reflecting the visibility of the highway from the local road network. The magnitude of change is assessed as high in response to the introduction of a major highway within the agricultural setting and the proximity of viewer. Overall impact was assessed as moderate to high.

VISUAL IMPACT ASSESSMENT

The detailed design development will not change the sensitivity rating of moderate in the EIS. The magnitude of the impact also will not change and has been assessed as high. Overall impact is unchanged and is assessed as moderate to high.



7.3.5.7 VIEW POINT 55: LUMLEYS LANE, WARDELL

DESCRIPTION

Mid-ground view looking, north along the Lumleys Lane, towards the proposed alignment.

EIS ASSESSMENT

The sensitivity of the proposal is assessed as moderate reflecting the visibility of the highway from the local road network and low number of adjoining houses. The magnitude of change is assessed as moderate to high in response to the introduction of a major highway within the agricultural setting and the proximity of viewer. Overall impact was assessed as moderate to high.

VISUAL IMPACT ASSESSMENT

The detailed design development sees the view largely located within an area of plantation revegetation as part of the proposed koala revegetation strategy. This will result in a reduction in both the sensitivity and magnitude of the proposal as the views will ultimately be concealed. Sensitivity has consequently been assessed as moderate to low. The magnitude of the impact will also change and is assessed as moderate to low. Overall impact is assessed as moderate to low.



7.3.5.8 VIEW POINT 56: COOLGARDIE ROAD, COOLGARDIE

DESCRIPTION

Foreground view from Coolgardie Road looking east across the proposed interchange.

EIS ASSESSMENT

The viewpoints sensitivity was assessed as moderate as part of the EIS reflecting the relatively low number of adjoining houses and the otherwise well-screened nature of the site. The magnitude of the impact was assessed as high, reflecting the scale of the infrastructure proposed and the extent of clearing.

VISUAL IMPACT

As part of the design development the visual sensitivity of the view has not changed and is considered moderate. The design however has seen the realignment of the bridge resulting in a reduced level of exposure of the infrastructure when travelling along Coolgardie Road. The nearest dwelling is 350 metres from the interchange and will be screened by the existing vegetation cover. The magnitude of impact has been revised to moderate. The overall impact is considered to have a reduced visual impact which has been assessed as moderate.



7.3.5.9 VIEW POINT 57: PIMLICO ROAD, PIMLICO

DESCRIPTION

View looking west from Pimlico Road towards the existing highway and proposed Coolgardie Interchange beyond.

EIS ASSESSMENT

The view point is assessed to have a moderate to low sensitivity with a number of residents noted as having changed foreground views but views generally being screened by existing vegetation. Its magnitude is assessed as high to moderate reflecting the scale of the new infrastructure.

VISUAL IMPACT ASSESSMENT

The view from Pimlico Road is substantially screened from the existing highway and the proposed highway beyond. The realignment of the bridge since EIS has moved the roundabout further west, further limiting clearance of vegetation east of the highway. The sensitivity of the view is considered to remain unchanged however the magnitude is considered to be reduced to moderate to low. Overall assessment is considered to be moderate to low.



7.3.5.10 VIEW POINT 58: PIMLICO ROAD, PIMLICO

DESCRIPTION

Middle ground view looking west from Pimlico Road to the existing highway and the proposed highway alignment beyond.

EIS ASSESSMENT

The view point was assessed to have a moderate sensitivity reflecting the presence of a number of houses overlooking the general alignment and acknowledging its well screened nature. The magnitude of the change was assessed as low due to screening provided by existing vegetation between the existing highway and the proposed. The overall rating was moderate to low.

VISUAL IMPACT ASSESSMENT

The view from Pimlico Road is substantially screened from the existing highway and the proposed highway beyond. The sensitivity and magnitude of changes to the view are considered to remain unchanged. The overall assessment is considered to remain as moderate to low.



7.3.5.11 VIEW POINT 59: WHYTES LANE (EAST), PIMLICO

DESCRIPTION

Middle ground view looking west from Whytes Lane East across the sugarcane fields towards the scenic hills of the Blackwall Range.

EIS ASSESSMENT

The EIS assessment has assessed the sensitivity as moderate to low due to the relatively low number of viewers. The EIS concept assessed the magnitude of impact as moderate, reflecting the elevated highway and introduction of the Whytes Lane Bridge structure. The overall rating was assessed as moderate.

VISUAL ASSESSMENT IMPACT

Whytes lane is substantially exposed within the sugarcane landscape of the Richmond floodplain. Sensitivity is considered moderate due to the number and distance of viewers. The magnitude of the impact of construction of the bridge is considered to be moderate. The overall rating has not changed and remains as moderate.



7.3.5.12 VIEW POINT 60: WHYTES LANE, PIMLICO

DESCRIPTION

View looking south-east from Whytes Lane, Pimlico with the Blackwall Range visible to the west. The area is cleared as part of the early works package resulting in vegetation loss between Whytes Lane and the Pacific Highway.

EIS ASSESSMENT

The viewpoint was assessed as having moderate sensitivity reflecting the relatively limited usage of the local road. The EIS concept was assessed to have a high impact due to the possible removal of vegetation between Whytes Lane and the Highway. The overall rating was assessed as moderate to high.

VISUAL IMPACT ASSESSMENT

The detailed design has not changed the sensitivity rating from the EIS with its assessment remaining as moderate. The detailed design has remained relatively unchanged compared to the EIS concept with the exception of the site clearance that has occurred as part of the early works package. This confirms the magnitude assessment as being high. The overall assessment remains unchanged as is rated moderate to high.



7.3.5.13 VIEW POINT 61: PIMLICO ROAD, PIMLICO

DESCRIPTION

Middle ground view looking west from Pimlico Road towards the existing Pacific Highway and the scenic Blackwall Range beyond.

EIS ASSESSMENT

The view point was assessed as having moderate to low sensitivity reflecting the limited number of viewers and distance from the proposal. The EIS concepts magnitude of change was assessed as moderate to low reflecting the existence of similar infrastructure already in this general location. The overall impact was assessed as moderate to low.

VISUAL IMPACT ASSESSMENT

The detailed design has not changed the sensitivity rating assessed in the EIS and remains as moderate to low. The developed design is relatively unchanged compared to the EIS from this view with the foreground dominated by the changing landscape of sugarcane crops. The magnitude therefore remains as moderate to low with an overall impact rating remaining the same as moderate to low.



7.3.5.14 VIEW POINT 62A: WHYTES LANE (WEST) PIMLICO

DESCRIPTION

Middle ground view looking east from Whytes Lane West, Pimlico, providing views across sugarcane paddocks to both the existing and proposed alignment.

EIS ASSESSMENT

The view point was assessed to have a moderate to low sensitivity reflecting the distance and limited number of viewers within the landscape. The magnitude of the EIS concept was assessed to be of moderate to low magnitude reflecting the shallow height of the proposal and its augmentation of the existing Pacific Highway infrastructure. Its overall impact was assessed as moderate to low.

VISUAL IMPACT ASSESSMENT

The detailed design is relatively unchanged and has not changed either the sensitivity (moderate to low) or magnitude (moderate to low). The overall assessment therefore remains unchanged.



7.3.5.15 VIEW POINT 62B: 110 SARTORIES LANE, PIMLICO

DESCRIPTION

Middle ground view looking east from Sartories Lane, Pimlico, providing views across agricultural lands from adjoining a cluster of housing.

EIS ASSESSMENT

The view point was assessed to have moderate sensitivity as any change impacts a small number of houses. The magnitude of the EIS concept was assessed as moderate, reflecting the intensification of infrastructure traversing the agricultural floodplain. This gave an overall visual impact rating as moderate.

VISUAL IMPACT ASSESSMENT

The detailed design remains largely unchanged in terms of scope of works from the EIS. The sensitivity rating assessed will remain unchanged. The magnitude of change likewise is largely unchanged and so is assessed as moderate. The overall visual impact rating remains as moderate.

7.3.5.16 VIEWPOINT SUMMARY

Table 11 summaries and compares the viewpoint assessment of the EIS and the changes that have occurred as part of design development.

7.3.6 MITIGATION STRATEGY

The landscape character and visual impact assessment report (Hassell, 2012) undertaken during the EIS outlined specific mitigation measures to be provided at every vantage point to ensure that impacts were minimised and addressed as part of the design process. As part of the design development the design intent has been modified as a result of the Biodiversity Strategy, and consequently amendments to the mitigation strategy have been made. Table 12 summarises the measures defined in the EIS and the additional or new actions proposed as part of the revised concept. We have addressed the requirements in the MCoA D20 (Clause G) as outlined in Chapter 1.3.

VIEWPOINT	EIS SENSITIVITY	DESIGN SENSITIVITY	EIS MAGNITUDE	DESIGN MAGNITUDE	EIS IMPACT RATING	DESIGN IMPACT RATING
VIEW POINT 48B	Low	No change	High	No change	Moderate	No change
VIEW POINT 50	Moderate - Low	No change	High - Moderate	Moderate	Moderate	Moderate-Low
VIEW POINT 51	Moderate	No change	High	Moderate	Moderate - High	Moderate
VIEW POINT 52	Moderate	No change	High	Moderate	Moderate - High	Moderate
VIEW POINT 53	Moderate	No change	High - Moderate	Moderate	Moderate - High	Moderate
VIEW POINT 54	Moderate	No change	High	No change	Moderate - High	No change
VIEW POINT 55	Moderate	Moderate - low	High -Moderate	Moderate - Low	Moderate - High	Moderate - Low
VIEW POINT 56	Moderate	No change	High	Moderate	Moderate - High	Moderate
VIEW POINT 57	Moderate - Low	No change	High - Moderate	Moderate -Low	Moderate	Moderate - Low
VIEW POINT 58	Moderate	No change	Low	No change	Moderate - Low	No change
VIEW POINT 59	Moderate - Low	Moderate	Moderate	No change	Moderate	No change
VIEW POINT 60	Moderate	No change	High	No change	Moderate - High	No change
VIEW POINT 61	Moderate - Low	No change	Moderate -Low	No change	Moderate - Low	No change
VIEW POINT 62A	Moderate - Low	No change	Moderate -Low	No change	Moderate - Low	No change
VIEW POINT 62B	Moderate	No change	Moderate	No change	Moderate	No change

Table 11: Viewpoint sensitivity summary

MITIGATION MEASURE	VP 48B	VP 50	VP 51	VP 52	VP 53	VP 54	VP 55	VP 56	VP 57	VP 58	VP 59	VP 60	VP 61	VP 62A	VP 62B
Minimise the loss of existing riparian vegetation	x														
Minimise loss of existing trees		x	x	x	x	x	x	x	x	x		x			
Plant local forest trees on cut/fill batters		x		x				x	x	x		x			
Reinstate local forest vegetation where applicable		x	x												
Plant dense low grasses/ground covers on fill batters			x		x	x	x				x		x	x	
Reinstate agricultural land where possible			x		x	x	x				x		x	x	
Reinstate local forest vegetation where applicable					x	x		x	x	x		x			
Provide new screen planting buffer to existing homes and landscape treatment generally in accordance with the concept design				x				x							
Provide intermittent screen planting on batters to screen the project from individual homes in accordance with the concept design									x	x	x	x	x	x	
Replace existing roadside screen vegetation where it provides a screen between the highway and local homes along Sartories Road and other local streets															x
Provide vegetation planting consistent with Koala revegetation strategy			x	x	x	x									
Provide landscape character which relates to the township of Wardell to signify connection								x							
Lay back and feather top cut of large batters to blend with natural landform				x											
Minimise the depth of the bridge deck	x	x													
Provide a high quality bridge design	x	x													

Table 12: EIS mitigation measures summary

Notes:

X – mitigation recommended as part of EIS and adopted in design response

X – mitigation recommended as part of EIS and no longer applicable

X – mitigation measures adopted as part of design development to reflect changes to biodiversity strategy



Figure 61: Aerial view of project area near Bagotville within Richmond River to Coolgardie Road - Section 10, looking north-east

CHAPTER 8.

DETAILED RESPONSES FOR THE URBAN AND LANDSCAPE DESIGN

8.1 STRUCTURES

8.1.1 INTERCHANGES

The interchange design reflects the local context and provides identity, which relates to the urban centre it serves. There is only one interchange in this portion of the work - Coolgardie Road Interchange. This interchange provides access from the Pacific Highway to the township of Wardell, which is bypassed by the new alignment.

The configuration of the interchange consists of:

- A diamond shaped arrangement with entry and exit ramps located either side of the bridge. An early south bound exit lane breaks this form
- The bridge has roundabouts at either end to facilitate full turning movements and is typical of this form of interchange arrangement along the Pacific Highway.

The landscape design -

- Consists of Fig trees, *Ficus hillii*, as its signature tree. These flank the on and off ramps of the interchange
- *Ficus hillii* trees are extended into the landscape beyond as copses and serve as markers of an impending exit and part of the visual language of the road corridor working in association with signage to reinforce awareness of this connection
- The Lowland Rainforest Community is used to line the corridor providing a back-drop to the more structured planting of fig trees
- Salvaged palm trees supported by a garden bed of feature plants are used within the roundabouts marking this decision point.

8.1.2 BRIDGES AND THEIR ELEMENTS

The design of bridges on the project follows the guidelines described in the *Bridge Aesthetics* (Roads and Maritime, 2013) document and the

requirements as set out in the *Upgrading the Pacific Highway Design Guidelines* (Roads and Maritime, 2015).

The key principles adopted in the design of the bridges are:

- Uniformity across the entire upgrade is achieved through the agreement of key design features across the project
- The main bridge elements have a simple design with a smooth finish and clean lines producing an elegant outcome in keeping with the overall language for the Pacific Highway. All bridge elements including piers, parapets, headstocks, abutments, transition panels, road traffic barriers and leading edges are fully integrated in the design.

From Richmond River to Ballina (Sections 10 and 11) there are a total of 14 bridge structures comprised of overpasses, fauna passages, and creek and flood plain bridges. Table 13 provides a brief description of each.

8.1.2.1 BRIDGE ELEMENTS

BRIDGE PARAPETS AND BARRIERS

- Twin steel rail and post system traffic barriers are used on all overpasses to allow through views to the surrounding landscape and to reduce the height of the concrete portion of the structure in elevation
- Regular performance barriers are used on all floodplain bridges
- Bridge parapets are precast concrete units
- Parapets incorporate a skirt to provide a drip edge and conceal drainage/service pipes where required.

ABUTMENT FINISH AND MAINTENANCE ACCESS

- All spill-through bridge abutments are finished as rock pitched/or rock armoured depending on the location. The rock will be sourced from site or local quarries
- Maintenance access steps are completed in concrete and have handrails.

THROW SCREENS

- The design of the safety screen is integral with the bridge parapet design and barrier transition panel
- The safety screen tapers down over two panels at either end of the bridge.

LIGHTING ON BRIDGES

- Road lighting is provided at interchanges only. There is no lighting on bridge structures.

LANDSCAPE ADJOINING BRIDGES









The landscape design at bridges is responsive to the nature and context of the bridge, and has adopted these key strategies:

- A 10 metres offset for trees is adopted. The offset of trees is an important consideration, which needs to be considered in order to minimise ongoing maintenance inputs and not compromise safety during maintenance activities and future damage to structures
- Interchange and overpass bridges have the potential to add to the story of progress along the corridor. They are to be developed with a unique and distinctive character which provides some insight into the setting
- Fauna bridges are developed with a particular function being the movement of fauna under and across the alignment. The landscape design needs to facilitate this movement through appropriate revegetation works which enables and encourages the movement of the prescribed fauna for which the bridge is developed.
- Creek bridges provide the opportunity to express the purpose of the crossing through the revegetation utilising the community which adjoins them. The crossing of creeks is associated with the wetter swampland communities and this is reflected in the revegetation utilising this community in the design.

BRIDGES

- D50. Fauna Passage 1 (Main line bridge)
- D51. Fauna Passage 2 (Main line bridge)
- D57 Fauna Passage 7 (Main line bridge)
- D03. Old Bagotville Road Underbridge
- D04. Bingal Creek
- D52. Fauna Passage 3 (Main line bridge)
- D53. Fauna Passage 4 (Main line bridge)
- D05. Wardell Floodway 6
- D06. Wardell Road Overbridge
- D55. Fauna Passage 5 (Main line bridge)
- D56. Fauna Passage 6 (Main line bridge)
- D09. Coolgardie Overbridge
- D10. Randle's Creek
- D11. Whytes Lane Overbridge

Key

-  Interchange
-  Overbridge
-  Creek and Floodplain Bridge
-  Fauna Passage (Main line bridge)
-  Fauna Passage (Dedicated and combined culverts)
-  Bridge I.D.
-  Pacific Highway upgrade Richmond River to Ballina (Sections 10 and 11)
-  Existing Pacific Highway

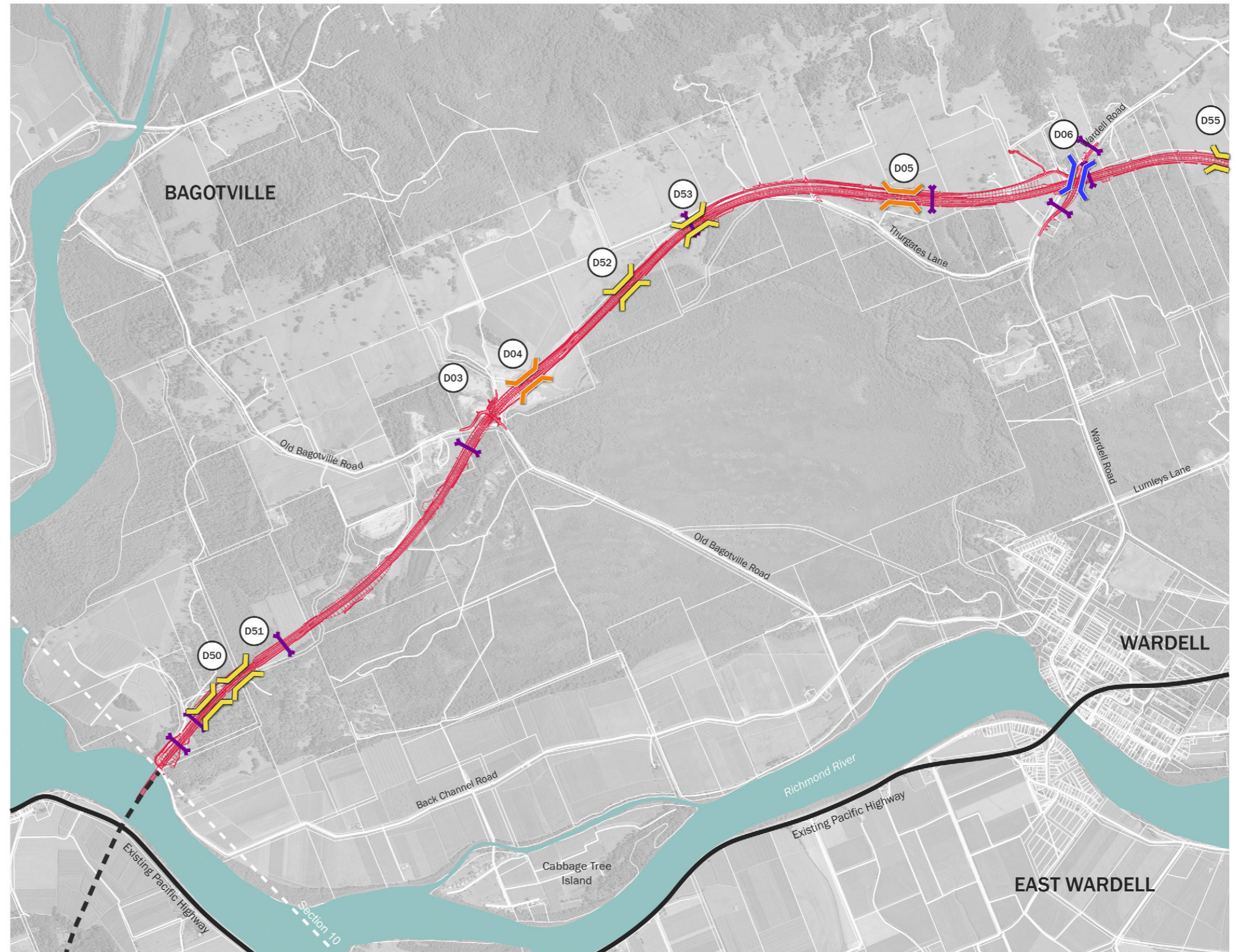
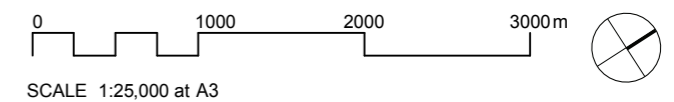
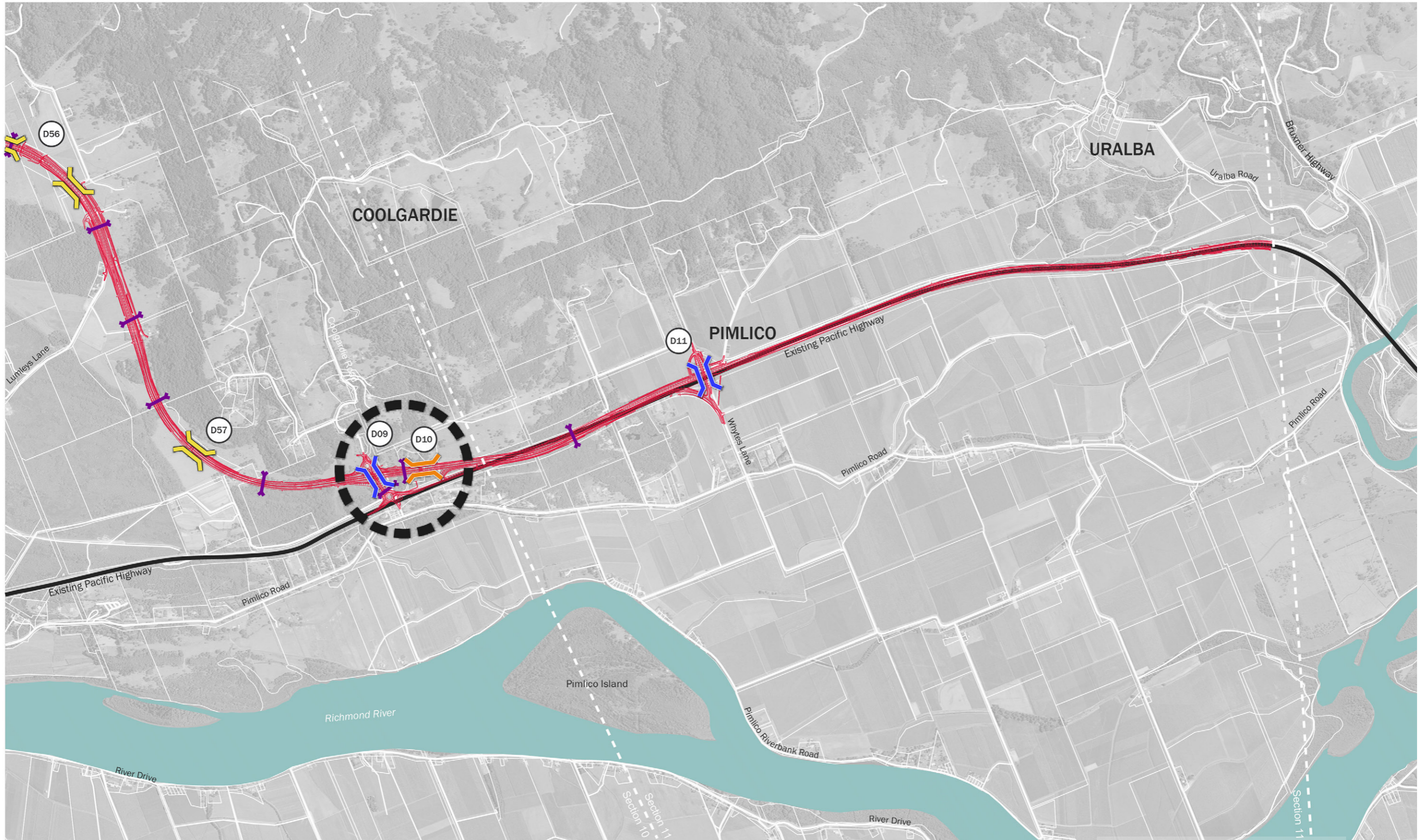


Figure 62: Location of structures



ID	BRIDGE REFERENCE	EIS PRECINCT	BRIDGE LOCATION (CHAINAGE)	PIER TYPE	GIRDER TYPE	MEDIUM PERFORMANCE BARRIER WITH TWIN RAILS	REGULAR PERFORMANCE BARRIER WITH CYCLIST GRAB RAIL (NEARSIDE)	FAUNA PASSAGE	VISIBILITY OF THE BRIDGE (1-3)
D03	Twin bridges over Old Bagotville Road	P-50	148900	Rectangular	3 Span Plank		•		1
D04	Twin bridges over Bingal Creek	P-50	149216	N/A	Super-T		•		3
D05	Twin bridges over Wardell Viaduct 6 – Northbound	P-49	151795	Rectangular	Winged PSC Plank		•		2
D06	Wardell Road Overbridge	P-49	152878	Stiletto Pier	Super-T	•			1
D09	Coolgardie Road Interchange Overbridge	P-53	157556	Stiletto Pier	Super-T	•			1
D10	Twin bridges over Randals Creek Northbound	P-53	157833	N/A	Winged PSC Plank		•		3
D11	Whytes Lane Overbridge	P-53	159874.4	Stiletto Pier	Super-T	•			1
D50	Twin Bridges over fauna passage 1	P-49	146603	N/A	Winged PSC Plank		•	•	3
D51	Twin Bridges over fauna passage 2	P-49	146838	N/A	Winged PSC Plank		•	•	3
D52	Twin Bridges over fauna passage 3	P-49	150034	N/A	Winged PSC Plank		•	•	2
D53	Twin Bridges over fauna passage 4	P-49	150603	N/A	Winged PSC Plank		•	•	2
D55	Twin Bridges over fauna passage 5	P-49	153872	N/A	Winged PSC Plank		•	•	3
D56	Twin Bridges over fauna passage 6	P-49	154020	N/A	Winged PSC Plank		•	•	3
D57	Bridge over fauna passage 7	P-53	156263	N/A	Winged PSC Plank		•	•	3

Table 13: Richmond River to Ballina (Sections 10 and 11) bridge urban design summary

Note: Visibility assessment methodology

The assessment of visibility was based on a review of the location of each structure in relation to the highway, local roads, public places, urban areas and houses. Factors affecting visibility such as topography, landscape, and the distance of the structure in relation to these receiving points (and therefore the magnitude of impact) are considered. A rating of one to three is assigned to each bridge, with a rating of one indicating structures that are highly visible to the public and three indicating structures that are not visible to the public.

8.1.3 GANTRY AND OVERHEAD STRUCTURES

Not applicable for Richmond River to Ballina (Sections 10 and 11).

8.1.4 RETAINING WALLS

Not applicable to Richmond River to Ballina (Sections 10 and 11).

8.1.5 CUTTINGS, EMBANKMENTS AND STABILISATION STRATEGY

The landscape and topography of the alignment have a strong influence on its character. The response to the design of cuttings and embankments forms an integral part of the stabilisation of the road corridor and its management of erosion control in response to the conditions of consent and the statement of commitments as part of the submissions report.

The scale and nature of the work from Richmond River to Ballina (Sections 10 and 11) are relatively minor with cut and fill embankments typically less than five metres in height. This relatively small scale reflects the nature of the landscape through which the alignment passes, i.e. low lying slightly undulating topography.

8.1.5.1 CUTS

A cutting is an excavation into the natural ground profile, its form and treatment is influenced by the differing layers of soil and geology through which it passes. Harder materials enable the adoption of steeper batter profiles and reduced footprint but limits the potential for revegetation, whereas softer, less stable material requires a broader footprint due to a shallower profile but is more readily revegetated.

Cuttings are shaped to integrate with the local landform. This involves the use of a number of strategies including:

- The feathering of the edges of the cuts so they transition and move gradually into the steeper form of the cutting. The length and nature of the extent of feathering is responsive to the adjoining natural slopes
- The laying back of the cut as it reaches the leading edges of the existing ground/cut face interfaces provided by the use of a transitional slope, which smoothly rounds the batter into the adjoining surface
- The revegetating of batter slopes and benches must occur unless within hard stable rock. Revegetation involves the respreading of topsoil on to the batter slope and seeding/planting. Topsoil will only be respread on slopes equal to or flatter than 2H:1V

- The maintenance of cutting benches at a consistent profile and in parallel with the vertical geometry of the highway
- The provision of a smooth, rounded edges at the top of the cutting and re-establishment of the natural vegetation community
- Provide visual integration with the nearby landscape and to satisfy environmental requirements for fauna connectivity.

8.1.5.2 EMBANKMENTS

Embankments play a significant role within the landscape, particularly in the valley floors where the road needs to be nestled in the landscape with slopes transitioned and manipulated so the views of it flow over the formation rather than being stopped by it. Key to addressing the integration of embankments is the:

- Revegetation of embankment batter slopes so they present a consistent vegetation cover to the landscape to which they adjoin
- Addressing of the existing ground/batter interface to avoid obvious junctions between the embankment and the existing ground
- Development of slopes is responsive to the adjoining natural terrain
- The use of surplus material is part of an overall surplus material management plan.

8.2 ROAD CORRIDOR

8.2.1 MEDIAN AND VERGE TREATMENTS

Medians widths are designed to enable the future expansion of the corridor from the current four lane proposal to six lanes. The landscape design of the median is responsive to the context and seeks to provide separation between the carriageways. No tree planting is within the medians due to their standardised widths and the inability to achieve clear zone requirements. As part of this process a number of differing strategies are adopted to reflect the context.

- Forested areas – the design has sought to establish a frangible shrub lined median, which provides distinct separation between the two carriageways
- Agricultural landscapes - the design has sought to retain an open character with shrubs used only on bends where headlight control is considered important.

8.2.2 PROVISION OF FUTURE REST AREA

The concept design of the rest area is undertaken to facilitate the preliminary bulk earthwork and material optimisation for the project including the winning of material from these disturbed areas within the corridor. The construction of the final Rest Area does not form part of the initial project delivery for Richmond River to Ballina (Sections 10 and 11). The time of delivery of the final Rest Area has not yet been determined other than it will be future work dependant on the need for such a facility.

The development of the concept design of the Rest Area is in line with Roads and Maritime Rest Area Guidelines and the scope defined for the project. The design seeks to provide an environment that is attractive and encourages motorists to take breaks for both light and heavy vehicles as they move along the Pacific Highway.

As the final concept design is not to be delivered as part of this project an interim landscape design scenario is developed on this land with:

- The design responsive to the natural vegetation context and sees the bulk earthworks stabilised with the nearby natural community
- A landscape buffer is established to protect the future rest area from passing traffic.

8.2.3 PEDESTRIAN AND CYCLIST NETWORK

The project provides pedestrian and cyclist facilities at these locations:

- Allowance for cyclists on the shoulders of the highway including highway bridges
- Shared path connections on local road bridge overpasses.

8.2.4 BUS STOPS

There is one bus stop in Richmond River to Coolgardie Road - Section 10 near Coolgardie Interchange that is relocated. Any existing provision at Whytes Lane will be maintained.

8.2.5 HEAVY VEHICLE STOPPING BAYS

General heavy vehicle stopping bays are provided at several cross over locations along the main alignment.

8.3 FURNITURE

8.3.1 FENCES

8.3.1.1 BOUNDARY FENCING

Fencing is required to the road corridor as a means of defining the boundary, restricting fauna movements, and restricting pedestrian access to water quality basins. Boundary fencing will adopt Roads and Maritime standards for fencing. This is responsive to the adjoining land use. Key features of the design are:

- The typical fence for the corridor is a five strand stock fence consistent with the agricultural context of the alignment
- Posts are to be concrete with a design life as required
- No corridor fencing is provided within the areas immediately next to cane farms consistent with the farming practices of this land use.

8.3.1.2 FAUNA FENCE

Fauna fences are used in identified fauna movement corridors to encourage the use of fauna connectivity structures and to reduce the potential for conflicts with motorists. Fauna fencing adopts the Roads and Maritime Services standard floppy top fence. Key features of the design are:

- Fauna fences are set back from the road edge to minimise impact of these fences on the visual environment of the road corridor
- As identified in the Ballina Koala Plan fauna fencing is provided for the entire alignment and on parts of the adjoining road network including parts of Wardell Road and the existing Pacific Highway alignment.

8.3.1.3 OTHER FENCING

Other fencing such as fencing at basins have these features:

- Other strategies adopted to reduce the impact of this element include the use of strategically placed vegetation to minimise the visual prominence. Care however needs to be taken particularly on the floodplain where such a strategy could emphasise the element as much as conceal it.

8.3.2 NOISE WALLS

There are no noise walls from Richmond River to Ballina (Sections 10 and 11).

8.3.3 HEADLIGHT SCREENS

All headlight screens from Richmond River to Ballina (Sections 10 and 11) are planted. Where planting is to be used as a headlight screen it is to achieve a minimum garden bed of five metres width. The proposed screen achieves this for much of its length with a minor non-conformance in an isolated section. Dispensation has been requested for this. Planting within the bed is to incorporate a portion of shrubs species of an initial height of 1.5 metres at time of road opening with a final height greater than 2.5 metres in order to control headlight glare. Species selection considers the density of canopy and longevity to ensure a robust and effective screen.

8.3.4 LIGHTING

The project is typically an unlit highway. Lighting is provided at Coolgardie Interchange at the roundabouts and intersection of the new southbound exit ramp and the existing Pacific Highway.

The design of lighting ensures that light spillage into residential properties and other sensitive areas is minimised or avoided. The management of light on entry into the Wardell township from the Coolgardie Interchange is critical in both establishing legibility of the town from the highway and at the same time minimising impact on the adjoining residences and potential breeding habitat for Southern Pink Underwing Moth and Atlas Rainforest Ground Beetle. No provision is made for street lighting on footpaths or shared pathways.

The Project is typically an unlit highway. Standard Pacific Highway lighting is provided at grade-separated interchanges and local road intersections.

The design of lighting ensures that light spillage into residential properties and other sensitive areas is minimised or avoided. The management of light on entry into the Wardell township from the Coolgardie Interchange is critical in both establishing legibility of the town from the highway and at the same time minimising impact on the adjoining houses and potential breeding habitat for Southern Pink Underwing Moth and Atlas Rainforest Ground Beetle. No provision is made for street lighting on footpaths or shared pathways.

8.3.5 SAFETY BARRIERS

Safety barriers including bridge barriers are precast elements.

8.3.6 SIGNAGE

Signage will be standard for highways and will include both regulatory and wayfinding signage. The signage of greatest impact is the wayfinding signage which marks the exit points such as Coolgardie Road Interchange. These are large scale signs will be integrated with the landscape to provide clear visual cues on approach to the interchange.



Figure 63: Fauna fence



Figure 64: Headlight screening planting

8.4 REVEGETATION

8.4.1 EXISTING VEGETATION AND LANDSCAPE DESIGN

8.4.1.1 PROPOSED LANDSCAPE DESIGN

With respect to the bioregion's ecological communities, habitats, existing vegetation and flora and fauna, the landscaping strategies below are put forward to minimise the impact of the highway upgrades on the environment.

The landscape design will provide a strong emphasis on creating a well-vegetated corridor with lush and distinctive intersections, interchanges and rest areas. Where planting is used the mix must contain tube stock for indigenous ground cover species and larger stock for feature trees.

RE-VEGETATION STRATEGY

The revegetation strategy provides:

- An attractive approach and departure from developed areas
- A planting/seeding palette based on key local vegetation patterns to ensure the visual and ecological integrity of the journey. It reinforces enclosure when passing through forest and woodland areas, provide long distance views for road users when they are available, and retains existing district views for residents
- Screening to minimise the visibility of the project from townships, farms and homesteads
- A varied sequence of views along the journey to reduce the linear effect of the highway, providing visual interest and enjoyment and reducing the potential from driver fatigue
- Semi-mature tree plantings, of locally significant/ characteristic trees are used to emphasise junctions to local towns and rest areas, or to provide character along the route and to rest areas
- Mitigation measures to address the visual impact of fauna fencing and overhead power lines where they occur
- Revegetation to cuttings and embankments to maintain the character of undulating green hills against the horizon line
- A range of frangible low shrubs, grasses, or ground covers in medians
- Non- frangible planted and seeded areas conforming to clear zone requirements and roadside furniture requirements
- Safe sight distances and signage which is not obscured by planting and revegetation areas
- Setbacks for structures, roadside furniture and pathways enable clear access for maintenance and visual inspections when the landscape matures

DESIGN COMMUNITIES	EQUIVALENT CMA BIOMETRIC VEGETATION TYPE	EQUIVALENT VEGETATION ASSOCIATION MAPPED IN THE PREFERRED ROUTE CORRIDOR STUDIES	THREATENED ECOLOGICAL COMMUNITY TYPE
Wet Sclerophyll and Floodplain Forest	Blackbutt grassy open forest of the lower Clarence Valley of the North Coast	Sections 1, 9-10 Equivalent associations of Blackbutt/Tallowwood Lower Slopes and Gully Forest (Ecotone 2007) and Mahogany - Blackbutt Forests (Geolyse 2005)	
Dry Forest	Coast Cypress Pine shrubby open forest of the North Coast Bioregion	Sections 9-11 Equivalent associations of Banksia - Callitris Dry Heathy Woodlands & Heaths (Geolyse 2005)	Coastal Cypress Pine Forest in NSW North Coast Bioregion (E)
Wet Sclerophyll and Floodplain Forest	Forest Red Gum - Swamp Box of the Clarence Valley lowlands of the North Coast	All Sections Equivalent association of Riparian Forest (SKM 2010), Moist Floodplain Eucalypt Forest and Riparian Forest (Ecotone 2007), Forest Red Gum Forest and Mixed Floodplain Forest (SKM 2009), Red Gum - Tuckeroo Forests and Paperbark - Blackbutt Closed Forest (Geolyse 2005), and Red Mahogany (floodplain), Forest Red Gum, Wet Heath - Sedgeland and Stringybark-Ironbark-White Mahogany (Floodplain) (Ecos Environmental 2005)	Sub-tropical Coastal Floodplain Forest of the NSW North Coast bioregion (E)
Dry Forest	Grey Gum - Grey Ironbark open forest of the Clarence lowlands of the North Coast	Section 3, 6-8 and 10 Equivalent association of Grey Ironbark - Bloodwood Forest and Grey Gum - Tallowwood Forest (Early works sites SKM 2010), Tallowwood - Ironbark Open Forest (SKM 2009), Stringybark- Ironbark-White Mahogany (Ecos Environmental 2006)	
Lowland Rainforest	Hoop Pine - Yellow Tulipwood dry rainforest of the North Coast	Section 10 Equivalent association of Closed Forests (Geolyse 2005)	Lowland Rainforest on Coastal Floodplains (E) Lowland Rainforest of Subtropical Australia (CE)
Estuarine Wetland	Mangrove - Grey Mangrove low closed forest of the NSW Coastal Bioregion	Sections 5, and 10-11 Equivalent associations of Mangrove Forest (SKM 2009, 2010) and Mangrove Closed Forest (Geolyse 2005)	
Swamp Forest	Swamp Mahogany swamp forest of the coastal lowlands of the North Coast	Sections 1-6, and 8-10 Equivalent associations of Swamp Forest - Swamp Mahogany/Forest Red Gum (Ecotone 2007), Swamp Mahogany - Paperbark Forest (SKM 2009), Wet Heath - Sedgeland (Ecos Environmental 2006), and Paperbark - Mahogany Wet Heathy Woodlands and Paperbark - Swamp Mahogany Forest (Geolyse 2005)	Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (E)
Swamp Forest	Swamp Oak swamp forest of the coastal lowlands of the North Coast	Sections 1, 3, 4, 5, and 8-11 Equivalent associations of Swamp Oak Forest and Paperbark - Swamp Oak Forest (SKM 2009, 2010), Swamp Oak Forest (Ecotone 2007), Swamp Oak (Ecos Environmental 2006), and Paperbark - Swamp Oak Emergent Closed Forest and Paperbark - Swamp Oak Swampy Forests (Geolyse 2005)	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (E)
Lowland Rainforest	White Booyong - Fig subtropical rainforest of the North Coast	Sections 8, 10 and 11 Equivalent association of Closed Forests (Geolyse 2005)	Lowland Rainforest on Coastal Floodplains (E) Lowland Rainforest of Subtropical Australia (CE)

Table 14: Design communities in relation to structure and floristics (Source: Roads and Maritime, 2012)

- In disturbed areas within the project work zone revegetation treatment will augment the existing indigenous vegetation communities
- The use of the local seed bank and soils is adopted.
- Retention of existing vegetation (including root and above ground plant mass) is maximised.

In areas where the possibility of weed invasion is high, revegetation of disturbed areas includes planting, seeding, and the establishment of a clean weed free layer of topsoil as the foundation for revegetation work. Weed free topsoil or other growing medium is used in all landscape works.

LOCAL ACCESS ROADS

- Where local access roads are located within close proximity to the upgrade, screen planting and seeding on batters is provided.

CREEK CROSSINGS AND RIPARIAN ZONES

- Where bridges and road structures cross creeks and interrupt riparian zones, revegetation strategies will endeavor to reconnect the riparian patterns. indigenous species are utilised to revegetate the affected areas and reconnect local habitat
- Topsoil or other growing medium used in landscape work must be free of weeds as defined in Roads and Maritime W2B project specific specification R178 or other unintended or undesirable species
- Maximise riparian vegetation under creek crossings to encourage fauna connectivity along creek lines.

8.4.2 VEGETATION COMMUNITIES

Chapter 5.7 identifies the key vegetation communities of the corridor. In order to address the slightly varying structure of the vegetation communities along the alignment a simplified response is developed based on the dominant structural forms. Table 14 identifies the design communities and their relationship to the floristics of each vegetation type identified from Richmond River to Ballina (Sections 10 and 11). As part of the analysis and design process four dominant natural communities are identified. These are:

- The Lowland Rainforest – dominates the foot slopes of the transition between Sections 10 and 11 around Coolgardie Interchange
- Swamp forest – occurs on the floodplain where drainage is impeded or in association with creeklines
- Dry Forest - Located within Character Zone B on dry raised grounds and sandy soils, and
- Wet sclerophyll and floodplain forest – located on the raised area of Character Zone B or at the interface between lowland rainforest

A fifth community is an open grassland community, which will be comprised of a robust mix of native and exotic grasses common within the corridor.

The make-up of these communities is reflected in Appendix E.

Median treatments are responsive to the adjoining vegetation. Typically a shrub treatment related to the adjoining vegetation will be established to reinforce the sense of enclosure and to help in the control of headlight glare. In more open zones the grassland community will be continued to provide a connection with the broader landscape.

Interchange landscape design is responsive to the cultural setting of these environments and introduces a level of structure to the landscape. A dominant species is selected which relates to this setting and is discussed in Chapter 7.

8.4.3 IMPACTED LANDSCAPE

As identified in Chapter 3 - Part 2 of the Biodiversity Assessment Prepared by Roads and Maritime, Aurecon and SKM, the list below summarises the vegetation communities and threatened ecological communities that are impacted from Richmond River to Ballina (Sections 10 and 11) of the highway upgrade.

Richmond River to Coolgardie Road - Section 10 vegetation communities include:

- Blackbutt grassy open forest
- Swamp Box, Swamp Mahogany. Grey Gum, Paperbark swamp forest
- White Booyong
- Swamp Oak.

The Section also has a number of endangered ecological communities including:

- Swamp Sclerophyll Forest
- Coastal Cypress Pine
- Lowland Rainforest
- Subtropical Coastal Floodplain Forest.

Coolgardie Road to Ballina - Section 11 comprises similar vegetation communities including:

- Hoop Pine
- Blackbutt and grassy open forest and
- Mangrove forests.

Endangered ecological communities including

- Lowland Rainforest on Coastal Floodplains.

Details of native species including key representative plants and weed species present within the corridor are summarised in Appendices E and F.

8.4.4 LANDSCAPE AND VISUAL SCREENING

A number of key areas of visual screening are identified as part of the environmental assessment process. The focus of visual screening identified is associated with views of local residents and those using local roads and is recommended in order to minimise the degree of visual change.

As part of this process the strategies below are adopted.

- Minimise loss of existing trees
- Planting and seeding of local native trees to blend with the existing landscape and screen views
- Planting and seeding of dense low grasses, ground covers on fill batters within agricultural landscapes
- Reinstate agricultural land where possible.

In addition to these requirements planting and/or seeding will be of:

- Small to moderate height shrubs to screen local roads from the alignment and minimise risk of headlight glare issues
- Small to moderate height shrubs within the median to reduce the visual scale of the alignment to road users and to mitigate headlight glare.

8.4.5 HERITAGE ZONES

The landscape response to heritage is still being developed. Many of the sites relate to Aboriginal heritage and occur within the more forested sites. It is not intended that these will be interpreted as part of the broadscale landscape strategy as the scale of any interpretation will impact the biodiversity objectives. Any interpretation will consequently happen off site.

Heritage however also has the potential to limit revegetation work through the limitations on excavation which may be imposed in relation to certain sites. In such instance planting of trees would be excluded.

8.4.6 DISTURBED LANDSCAPE

The alignment of the corridor goes through a variety of modified and disturbed landscapes. In all instances these disturbed landscapes are productive and include, pasture lands, crop lands and quarry lands. The alignment of the corridor to some degree has kept to these areas where possible to minimise its impact on the natural systems. Pasture and crop lands are the dominant of these modified communities and are managed vegetated landscapes, for the purpose of this section as they are excluded from the discussion, as they are perceived as part of the everyday landscape of the region.

For the purposes of this section disturbed land is interpreted as the quarry sites which have impacted both landform and vegetation cover and resulted in a landscape which is considered to be degraded in visual and physical form.

The alignment passes through a number of degraded sites, which are concentrated around the area of Old Bagotville Road. These quarried areas fall largely within the corridor and are to be revegetated as part of the project work. Where these areas are used as borrow sites they will be revegetated in accordance with requirements of ancillary sites as discussed in Chapter 6.8. The purpose of this revegetation is to both rehabilitate and stabilise the damaged areas within the corridor enabling the reinforcement of the closed dry forest character on the higher grounds and swamp forest in the lower region of this portion of the alignment, as well as providing improved fauna connectivity.

8.4.7 BATTER STABILISATION

Vegetation is used to stabilise the disturbed soil profile of the corridor after completion of engineering work. Stabilisation encompasses both a combination of seeding and planting. Seeding is discussed below in 8.8.

Trees are only to be planted to ensure appropriate distribution and cover as required in response to vegetation communities and compliance with sightlines and clear zones. The use of trees within seed mixes is typically not used in order to avoid conflicts. Tree seeding may be incorporated on upper or lower batters or where barriers are required as part of the alignment design.

All plants species with the exception of interchanges are selected from plants known to grow naturally within the project area. Plant selection of these species has sought to use these species due to the suitability to the climatic and site conditions but also their contribution to biodiversity.



Figure 65: Batter stabilisation

8.4.8 SEED APPLICATION AND ESTABLISHMENT

Seeding Mixes are consistent with Roads and Maritime landscape design guidelines for the region and consist of a cover crop – short lived non-native pasture grasses to provide quick establishment and minimise erosion, and \ or native seed - comprised of a mix of native grasses, shrubs and potentially trees.

A number of different mixes are to be developed to reflect the various vegetation communities/associations along the route, refer Appendix E Proposed Seed Mixes. These mixes are to be based around the core mix parameters defined above.

Seeding techniques to be used are:

- Hydroseeding – Hydraulically application of seed, seed carrier and soil ameliorants
- Hydromulching – Hydraulically application of seed and mulch matrix, sprayed onto the soil as a slurry which sets to form a layer of protection from erosion
- Direct Drill Seeding - a form of mechanical seeding to be used on slopes flatter than 1:4
- Compost blanket - High quality compost incorporating organic tackifiers, biological stimulants, wetting agents, soil ameliorants and incorporates seed mix applied pneumatically to slope - may be used on steeper cuttings.



Figure 66: Revegetation

8.4.9 SEED COLLECTION

Seed collection is to be undertaken in line with Roads and Maritime W2B project specific specification R176.

Soil reuse strategies, such as direct return, are being considered for forested lands, where by the site soil containing a seedbank of indigenous species is stripped and replaced. This process reduces the seed required for revegetation and enables natural regeneration to occur.

8.4.10 ECOLOGICAL ESTABLISHMENT AND MONITORING

In order to ensure complete coverage of the corridor is achieved in a timely and effective manner and provides ongoing protection and biodiversity benefits, it is important to have a focused maintenance program.

To ensure this a Landscape Management Plan (LMP) has been prepared. This document details landscape maintenance actions for the upgrade and covers the first 36 months from construction completion from Richmond River to Ballina (Sections 10 and 11). Key elements covered in this plan include:

- Weed control
- Review of clearances to fencing - in particular fauna fencing to ensure this is not breached in any way
- Landscape management – including appropriate establishment procedures, fertiliser, pest and disease management.

SEED TYPE	QUANTITY (KG/HA)
COVER CROP	
Japanese Millet (Sep-Mar)	35
Rye Corn (Apr-Aug)	35
Eclipse/Crusader Rye	25
Red Clover	5
NATIVE SEED MIX	
Microlaena stipoides "Griffin" pelleted seed	2
Themeda "Tangara" pelleted seed	3
Native trees, shrubs & ground covers	5
Organic Fertilizer	250

Table 15: Details of seed quantities

WEED CONTROL

Weed control adopts a systematic approach in order to reduce potential weed impacts in the future. Key to this is ensuring weed control is:

- An integral part of the build process, with weed assessment and management actions undertaken before site clearance and an ongoing throughout the work period in line with the Weed Management Plan (WMP) part of the Construction Environmental Management Plan (CEMP)
- Carried out by the contractor in all areas of the corridor including revegetated and planted areas for a period of 36 months beyond practical completion of the work
- The adoption of a strategy which addresses structural weed issues as a focus as opposed to general weed issues. Critical to this process is the acceptance of revegetation as a gradual process which has numerous interactions which influence the landscape response in varying ways. Weed strategies will need to evolve to the various issues that arise from season to season and year to year as the landscape develops.

CLEARANCE TO FENCING

Fencing will be maintained in order to exclude cattle and other stock from entering the road corridor. Critically it is important to ensure offsets and integrity is maintained for fauna fences to ensure they are not breached in any way. Breaching of fauna fence may occur when seeded material establishes next to fence lines providing the opportunity for fauna to cross the fence. It may also be facilitated by falling trees or limbs.

LANDSCAPE MANAGEMENT

SUPPLEMENTARY WATERING AND MULCHING

The plan requires that revegetated areas are watered and maintained until plants have become established. If extended periods without rain are experienced during the establishment period then watering will be required to supplement natural rainfall.

FERTILISER

Fertilising post landscape installation may be required where specific nutrient deficiencies are identified. The need for additional fertiliser is minimised by the use of slow release fertiliser. Fertiliser may be required to address specific soil/vegetation responses of the build process. This may include nitrogen draw down as a result of mulch in soil media etc. These issues are addressed as part of the soil amelioration process defined as a result of site soil testing in both the design and construction phases.

PRUNING AND THINNING

Pruning and thinning is likely to form a minor component of maintenance. Pruning may be required to ensure retention of sightlines where seeded shrubs have grown obscuring signage or views around bends.

PESTS AND DISEASES

Generally pest/disease management are not viable for large areas. Landscape establishment will rely on developing an environmental balance through the establishment of improved habitat conditions. If an outbreak is identified which will impact on the establishment of landscape outcomes an appropriate action plan will be determined.

PLANT REPLACEMENTS

As part of the monitoring requirements, diseased or dying plants are to be replaced to ensure 90 per cent of planting has established after 12 months.

8.5 TOPSOIL MANAGEMENT

8.5.1 TREATMENTS

Topsoil treatments include:

- Ripping the subsoil or sub base (depth varies)
- Application of the site topsoil/composted mulch mix (depth varies)
- Application of seed mixes by hydroseeding or hydromulching or planting
- Application of rice straw mulch to a minimum 25 millimetres thickness over seeding (where hydroseeded)
- Application of 75 millimetres thick site-won or hardwood woodchip mulch (or rice or sugarcane straw mulch in riparian areas) where planting occurs.

Three main topsoil treatments are used, which include:

Topsoil treatment 1: For bushland topsoil containing seed bank placed over cut/fill slopes

- Prepare batter slopes by ripping or roughening the surface to a depth of 100 millimetres using the tynes on a swivelling head excavator bucket, or by some other means to form a loosened or roughened surface suitable for the application of topsoil
- During ripping, mix in any materials required by the soil testing into the upper 100 millimetres layer to the rates specified within the soil testing recommendations or geotechnical advisor. This may include the mixing of gypsum or any other suitable agent to prevent erosion of subsoil, if dispersivity is identified as an issue for the materials on the cut batter faces to be vegetated. Provide 'cleatmarks', 'dimples' or horizontal scores to cut and fill batters prior to topsoil application;
- Apply A1 horizon site-won topsoil mixed with composted site mulch (as directed by the soil test results), to a minimum depth of 100 millimetres, but not more than 200 millimetres. (topsoil and mulch should have been previously ameliorated and any additional materials required by soil testing mixed at the stockpile

- Alternatively, apply A1 horizon topsoil to a minimum depth of 100 millimetres, but not more than 150 millimetres. Mix with windrowed composted site mulch by pushing up and down the prepared slope in order to achieve a reasonable mixing of the two and to achieved a minimum depth of 100 millimetres but not more than 200 millimetres
- Spread out the topsoil/composted mulch mix to an even surface but do not otherwise smooth or compact the surface
- Apply appropriate hydromulch seed mix (if no soil borne seed has germinated)
- For slopes steeper than 2H:1V and up to 1.5H:1V (eg transitions from bridge abutments to 2H:1V slopes) and for basins, vegetated swales and channels install organic fibre mesh as per the specification over final topsoil preparation and prior to seeding.

Topsoil treatment 2: For planting and seeding areas

- Rip the subsoil to a depth of 300 millimetres. Do not smooth or compact the roughened subsoil surface prior to the application of topsoil
- Apply A1 horizon topsoil to a minimum depth of 150 millimetres
- Spread the topsoil but do not otherwise smooth or compact the surface except where pasture/native grass is to be applied
- Level and trim the surface flush with adjacent surfaces and roll to lightly compact
- Apply appropriate hydromulch seed mix or plant;
- For tubestock: prepare 200x200x200 millimetres deep hole
- For advanced tree: prepare 600x600x450 millimetres deep hole
- For super advanced trees: prepare 600x600x600 millimetres deep hole
- Apply fertiliser at the rates as shown on the landscape drawings
- Install advanced trees/tubestock and backfill with topsoil to finish flush with ground level
- Apply mulch to a depth of 75 millimetres.

Topsoil treatment 3: For pasture grasses and native grass seeding on medians, verges and cut/fill slopes

- Cultivate all areas to a depth of 150 millimetres. Do not smooth or compact the roughened subsoil surface prior to the application of topsoil
- Apply site-won topsoil to a minimum depth of 50-100 millimetres. Do not use composted site mulch.
- Spread the topsoil, level and trim the surface flush with adjacent surfaces to provide an even finish and roll to lightly compact
- Apply appropriate grass seed mix via hydroseeding or hydromulching with fertiliser as shown on the landscape drawings and Specification.

8.5.2 TOPSOIL MANAGEMENT

Richmond River to Ballina (Sections 10 and 11) traverses a combination of forested areas, and agricultural land used for grazing and sugarcane production. The topsoils stripped from the formation in the forested areas will contain a seed bank species diversity that cannot be replicated by seeding due to limitations on availability.

The best landscape outcome is to be achieved by re-applying site topsoil containing this intact soil-borne seed bank back to the locations from which it was stripped within a time frame which ensures that most of the seed remains viable.

Natural regeneration ensures that foreign genotypes are not introduced to the existing vegetation communities and also that the species mix is maximised. Other benefits include reduced fertiliser requirements (excess fertiliser can run off and cause algal blooms and fish death in waterways). It also introduces indigenous species which are impractical to establish by other means, either because their seed is difficult to collect in quantity or to apply (Terrestrial Orchids, ferns and native lilies) or because they are opportunistic colonisers that will persist or colonise rapidly where conditions are favourable (Bracken Ferns, Blady Grass and Geebung species). These types of plants can be expected to re-colonise disturbed areas of the corridor rapidly with the application of correct topsoil management procedures.

There are five key aspects to the management of existing topsoil:

- Topsoil stripping to maintain the integrity of the topsoil from the existing vegetation communities
- Direct return of topsoil (where feasible)
- Topsoil management zones and stockpile management procedures
- Topsoil testing
- Topsoil and composted mulch amelioration.

Where the topsoil is to be stripped from intact bushland areas, it is to be separated by vegetation community type and referred to as Bushland Topsoils. Topsoil stripped from pasture areas and referred to as Landscape Topsoil, is to be stripped and stockpiled separately and quarantined from Bushland topsoils in order to prevent the spread of weeds.

Direct return is the procedure whereby site topsoil is returned to the batter location from which it was stripped either immediately or soon after formation. It is dependent on the construction staging and the full commitment of construction staff to the re-vegetation process. Direct return will be implemented where construction staging allows.

Topsoil stockpile management and storage procedures are designed to ensure the survival of soil seedbank, microflora and microorganisms in the stockpile for the duration of the stockpile period and until it is returned to re-vegetation areas.

The stockpiles will be sized to maintain the viability of native seed with 2H:1V batter slopes. Large, clearly legible signs will be placed and maintained on each stockpile, nominating vegetation community type, soil horizon, collection area (eg by station) and date of stockpiling. No soils should be stockpiled for greater than 18 months where possible.

Topsoils will be tested in situ prior to stripping in accordance with Roads and Maritime specification R44 and within the stockpiles in accordance with Roads and Maritime W2B project specific specification R178. Amelioration is to be carried out in accordance with the test result recommendations, prior to installation.

Topsoil management zones are derived from the vegetation community boundaries shown on the landscape plans to ensure that the topsoil with stored seed from each vegetation community is returned to a location with the same vegetation community. In some instances the exact extent of a zone is rationalised in order to assist the stripping and reapplication. For instance a zone may be extended to the end of a batter if the distance to the end of a batter does not warrant a change in soil type.

For the purposes of stockpile management for this project, soils have been classified into two types.

Bushland topsoil

This includes topsoil stripped within mapped vegetation communities that have been cleared. Striped bushland topsoil is to be stockpiled and managed to retain their environmental integrity and preserve the soil seed bank. Topsoil from different vegetation communities is to be stockpiled separately where feasible.

Bushland topsoil is for reuse where native seeding and planting is specified on the landscape drawings and within vegetation community boundaries.

Landscape topsoil

This includes topsoil stripped from existing pasture grass areas or where mapped in the Weed Management Plan as having a High Weed Density Abundance. Landscape topsoil may contain weed seeds and must be quarantined from Bushland Topsoils

Landscape topsoil is for re-use where pasture grasses are shown on the landscape drawings or where there is insufficient bushland topsoil and the area being revegetated has been former pasture lands.

8.5.3 MULCH TREATMENT

All planted areas are to have a surface layer of hardwood mulch sourced from site applied to a nominal minimum depth of 75mm. Mulch is to be stockpiled for 6 months prior to use in order to reduce the impacts of nitrogen draw-down on soils and its effect on plantings.

Composted mulches

Composted mulches, derived from site-won mulch that has been windrowed for a minimum of six months in a manner to accelerate composting, will be mixed with site topsoil as shown on the landscape drawings. At a minimum, site topsoil mixed with composted site mulch is to be spread on batter slopes receiving runoff in order to increase its organic (carbon) content and to aid in erosion resistance on batters. The component of composted site mulches mixed with topsoils will be considered during the detailed design phase and will form part of the soil testing procedures with advice from the soil scientist conducting the testing. The general ratio of 75 per cent topsoil to 25 per cent composted site mulch will be applied but may be varied as advised by the soil scientist.

Composted site mulch is required to be ameliorated to raise the pH, improve the composting processing to reduce the nitrogen drawdown effect of the mulch, and to counter any major nutrient deficiencies that would inhibit germination. The soil scientist will provide advice as to soil and compost additives to render the mix suitable for growth of the proposed plant species.

Around riparian zones Straw Mulch (rice or sugarcane) will be used in lieu of site won mulch to prevent tannins from leaching into waterways.

8.6 DRAINAGE & WATER QUALITY

Drainage work can potentially have a significant influence on the character and appearance of the road corridor and its landscape treatments. Care is being taken to ensure the drainage design is considered and integrated with both the formation and structures associated with the road. As part of the drainage response the use of concrete lined drainage channels and rock mattresses is minimised in favour of vegetated drains or rock armoured channels. Drains with grades flatter than 5 per cent use jute webbing installed as erosion matting. Design solutions for drains with grades steeper than 5 per cent is being reviewed. The use of this erosion matting systems, in association with revegetation treatments is considered to provide an appropriate solution to the management of the stormwater and its quality. The alignment of channels will be informal and not rigid, responding to the topography and interfacing with the road formation.

8.6.1 WATER QUALITY CONTROL SYSTEMS

Water quality control systems consist of two phases:

Construction Phase – consisting of temporary erosion and sediment controls for construction

Operational Phase - consisting of permanent water quality treatments which address the ongoing operation of the highway.

As part of this process a range of water quality systems are adopted as part of the drainage design. This includes:

- Vegetated swales and channels
- Concrete lined channels and gutters
- Basins.

8.6.1.1 VEGETATED SWALES AND CHANNELS

Vegetated swales and channels are used wherever water velocities permit. The design has maximised the use of vegetated channels, helping to clean the water but also integrate the drainage with its landscape context. The vegetated nature of these drains ensures velocities are reduced and the potential for sediment to be removed from the water column is maximised.

8.6.1.2 CONCRETE LINED CHANNELS AND GUTTERS

Concrete lined channels are to be used where other drainage forms are unsuitable due to:

- Steepness of slope
- Velocity and concentration of flows.

Channels located in highly visible areas are coloured, using dark unobtrusive colours consistent with the natural rock colour and recede into the landscape. Embankment scupper drains are likely to fall into this category. Landscape will be used to help reduce the visual prominence of drains where possible by providing screening or visual foil to the drain.

8.6.1.3 BASINS

Basins form a significant component of the water treatment chain. The final form of a basin is determined by its context and grading so the visual impact of the basin is minimised.

As part of the ongoing design process basins will:

- Adopt shapes which are natural in appearance and not geometric or rectangular in form
- Use landscape which moderate the visual impact by adopting a strategy that either screens the leading edge of the basin or expresses the basin as part of the landscape setting
- Limit the use of fencing where possible.

8.6.2 CULVERTS

8.6.3 CREEK REHABILITATION

8.6.3.1 CREEK REALIGNMENT

The realignment of a number of creeks requires an approach which maintains the creek character while providing a channel alignment compatible with the alignment constraints in both the short to long term.

To this end a combination of rock armouring and vegetated treatments is used so the overall feel of the creekline remains a vegetated creek corridor. This will ensure visual continuity, the maintenance of the creekline as a wildlife corridor, and stability of the channel in relation to bridge or culvert structures.

Creeklines revegetation is with riparian vegetation indigenous to the corridor. Species selection will reflect the ephemeral or permanent nature of the creekline.



Figure 67: Wetland basin



Figure 68: Creek drainage

8.7 FAUNA CROSSINGS

8.7.1 FAUNA CONNECTIVITY

Fauna connectivity is an important part of the assessment and subsequent mitigation strategy for the corridor. As a result of broad-scale native vegetation clearing and development, there is currently a high degree of habitat fragmentation from Richmond River to Ballina (Sections 10 and 11). The project has the potential to isolate native fauna on both a local and regional population level. To inform the design development of the project, key movement corridors are identified and specific measures for each section of the alignment identified (Figure 69).

From Richmond River to Coolgardie Road - Section 10 and to a lesser degree Coolgardie Road to Ballina - Section 11 a critical component of the design and its mitigation measures is the consideration of the Ballina Koala population. The design of fauna underpasses and fencing for koalas is a critical aspect

- Regional fauna corridor
- Key koala habitat
- Dedicated fauna culvert
- Combined bridge and fauna crossing

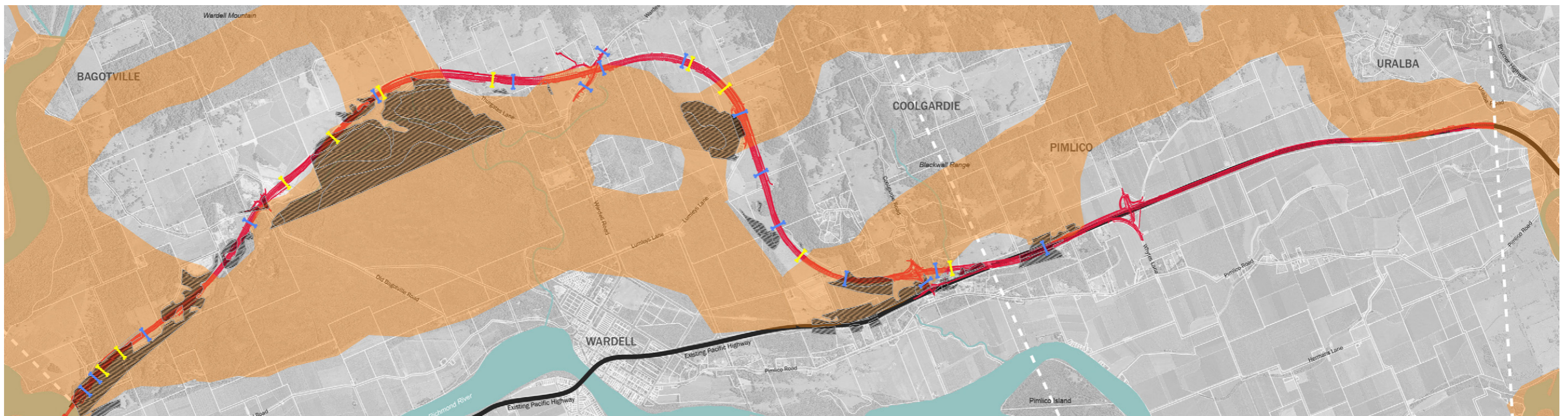
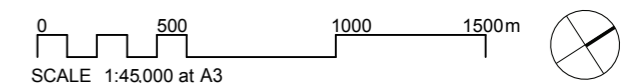


Figure 69: Proposed fauna connectivity



of the mitigation measures adopted. Several long-term studies undertaken by Roads and Maritime to track Koalas pre, during, and post major work to investigate effectiveness of various underpasses, overpasses and exclusion fencing is incorporated within the proposed strategies for this Pacific Highway Upgrade. A critical component of the response for Koala movement and habitat impacts is identified in the Koala Habitat Strategy (2015). This requires the provision of 130 hectares of tree planting adjoining the highway and focussed on existing movement corridors.

8.7.1.1 REVEGETATION FOR FAUNA CONNECTIVITY

Upgrading the Pacific Highway Design Guidelines (2015) sets out the requirements for revegetation for fauna connectivity. This includes:

REVEGETATION NEAR FAUNA CONNECTIVITY STRUCTURES

Vegetation planted or seeded within an approach to a fauna crossing is provided in such a way as to:

- Be complete as soon as practicable after clearing of existing vegetation, and within three months of completion of construction of the fauna crossing

- The density of vegetation planting or seeding will match the surrounding natural habitat.
- Not obstruct access to the underpass or bridge
- Be indigenous species and representative of the surrounding natural habitat
- Be designed to attract native fauna species to the structure, except where fauna exclusion fences are not present
- Not obstruct the views through, or disguise, the entrance to the underpass or bridge.

REVEGETATION NEAR FAUNA/FROG FENCING

Native tree and shrub seeding and planting stock must not be used within three metres of fauna fences or one metre of frog fences during the revegetation process. The growth of vines and heavy vegetation / grass growth in and next to fauna fences must be reduced.

KOALA SPECIFIC REVEGETATION

As identified above the provision of 130 hectares of tree planting will be provided to enhance connectivity beyond the project boundary. Within the project boundary the revegetation work will include primary and secondary koala food trees in areas that will not cause a road safety traffic hazard and will encourage the use of fauna underpasses. This includes revegetation of lands disturbed by the work and land within the corridor cleared as part of the previous land use where outside the limits of fauna fencing. If planting occurs within fauna fencing species selection will avoid those attractive to koalas. All work will be consistent with proposed koala revegetation strategy.

8.7.2 FAUNA CROSSING STRUCTURES

Fauna structures are to be standardised across the Woolgoolga to Ballina project in order to provide efficiencies in the provision and delivery of these structures. A number of bridges as well as culverts with fauna furniture beneath, are provided from Richmond River to Ballina (Sections 10 and 11).

Crossing structures are designed in line with the Conditions of Approval. These include preparing a Connectivity Strategy, detailing crossings for terrestrial and aquatic fauna including land bridges, bridge, arch and culvert crossings. Crossing for arboreal fauna is considered in the development of the strategy.

A summary of the key fauna structures is in Appendix G.

Further resolution and design is occurring to finalise the location of these elements as the design develops.

The landscape design is being developed with the help of ecologists and is composed of plant species which encourages the movement of fauna through these elements by the utilisation of plants attractive to the relevant fauna species, but which do not obstruct or disguise the entrance.

8.7.3 FISH CROSSINGS

Fish crossings are required to any class 3 or above water way, which occur within this portion. The allowance for fish passage is incorporated in the design of the drainage culverts and is in line with:

- Why do fish need to cross the road – *Fish Passage Requirements for waterway crossings*, Department of Primary Industries, 2003
- *Policy and Habitat Guidelines for Fish Habitat*, Department of Primary Industries, 2013.

8.7.4 FROG MANAGEMENT

From Richmond River to Coolgardie Road - Section 10 the presence of the Wallum Sedge Frog is identified one kilometre north of the Richmond River and between 200 to 500 metres south of Old Bagotville Road. Management of its environment and the frog itself is addressed as part of the Project Threatened Frog Management Plan. As part of this plan the use of Frog Fencing to limit access to the alignment is recommended. Landscape response relates to revegetation with community relevant to the sites natural characteristics and the maintenance of minimal vegetation cover within the immediate limits of the fencing in order to discourage movement next to fencing.

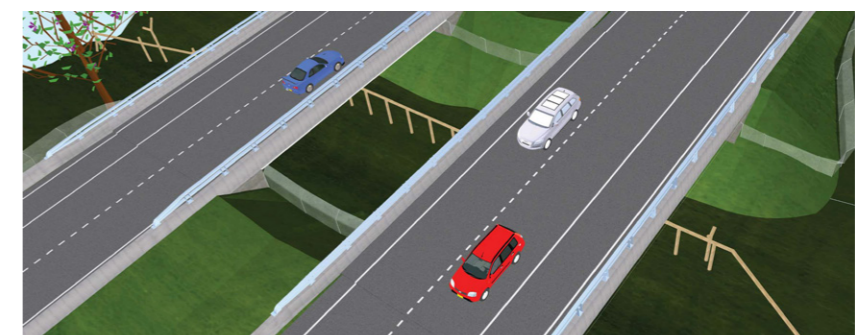
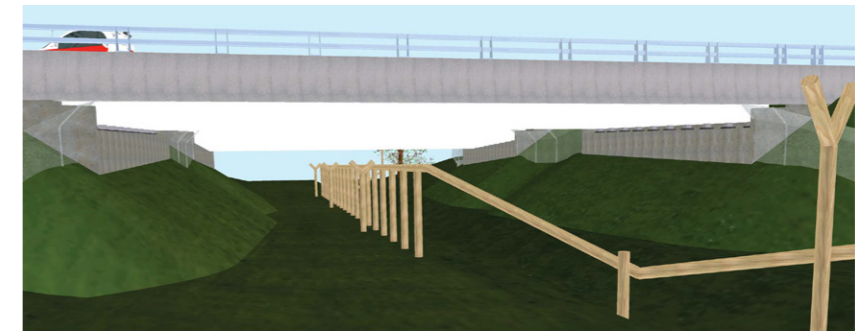
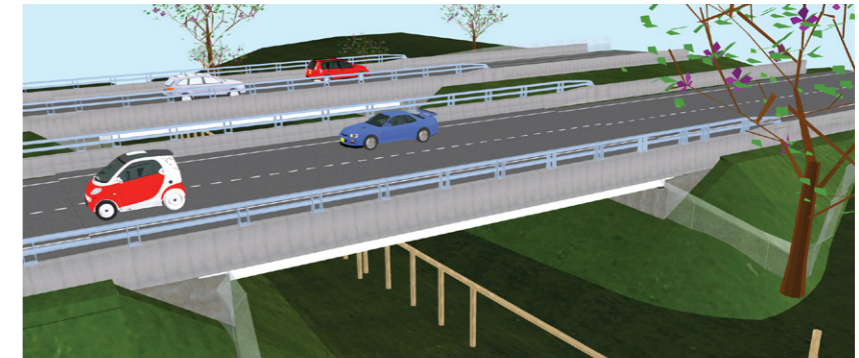


Figure 70: A series of artists impressions of a proposed fauna underpass (subject to further design development)

CHAPTER 9.

CONCLUSION

The document is prepared to address the Minister's Condition of Approval (D20) for Richmond River to Ballina (Sections 10 and 11) of the Pacific Highway Upgrade – Woolgoolga to Ballina. As part of this process the key conditions and approval requirements are identified and the design developed to respond and address these.

The detailed design is a development of the original EIS design. In order to ensure that the project is consistent with the approval and to assist in the refinement of mitigations measures a revised assessment is undertaken of both the landscape character and key viewpoints to confirm/validate or revise the assessment to reflect any changes which have occurred since the granting of approval.

As part of the Conditions of Approval for the project, the Ballina Koala Plan and Koala Management Plan must be approved before building can start in the area known as section 10, which starts at Broadwater and finishes at Coolgardie, south of Ballina.

The character assessment revealed no change in the overall findings for the eight precincts identified. The visual assessment on the other hand revealed some improvement in the overall impact. Of the 15 sites assessed six were identified as having been improved by the proposed design. This improvement reflected the impact of the commitment to revegetate 130 hectares of the valley adjoining the road alignment in order to strengthen the connectivity as part of the proposed Koala Revegetation Strategy and Ballina Koala Plan. The impact of this has seen a reduction of either the overall sensitivity, or magnitude, of the proposal on a number of viewpoints. This has removed five of the seven 'moderate to high' impact rankings within this portion of works. All other impacts are either 'moderate' or 'moderate to low'.

The report presents a plan, cross sections, illustrative perspectives and supporting text to illustrate the compliance and addressing of the key environmental conditions of the project. In doing so it:

- Clearly identifies the principles and standards adopted for the projects' urban and landscape design response
- Defines the vegetation communities which occur within the corridor and the revegetation strategies to be adopted in response to these
- Details the approach to the management and revegetation of ancillary facilities
- Addresses planting in relation to heritage constraints
- Integrates the revegetation of disturbed sites within the overall revegetation strategy
- Addresses the issue of local access including lighting and signage and path connectivity
- Address the visual impacts of the project through the adoption of a range of mitigation measures consistent with the EIS
- Defines the ongoing maintenance of the works to ensure it establishes and achieves the design intent
- Illustrates the involvement of community and Councils in the development of the plan.

The Draft UDLP therefore is considered to comply with the conditions of consent as stipulated in D20 of the Minister's Conditions of Approval.

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CHAPTER 10.

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CHAPTER 11.

APPENDICES

- A EIS & SPIR ENVIRONMENTAL MITIGATION MEASURES DOCUMENT REFERENCES
- B BIODIVERSITY WORKING PAPER COMPLIANCE
- C THREATENED SPECIES MANAGEMENT PLAN COMPLIANCE
- D SCHEDULE OF FINISHES AND MATERIALS
- E PLANTING AND SEEDING SCHEDULES
- F WEED SPECIES LIST
- G FAUNA CONNECTIVITY SCHEDULE

APPENDIX A EIS & SPIR ENVIRONMENTAL MITIGATION MEASURES COMPLIANCE

SPIR REQUIREMENT	DOCUMENT REFERENCE
HYDROLOGY AND FLOODING	
<p>Operational impacts on cane drains - HF3</p> <p>Cane drain diversions will be designed and constructed in consultation with the relevant cane industry stakeholders and impacted landowners and in consideration of the potential diversions detailed in the Working Paper – Hydrology and flooding, and the additional assessment provided in Chapter 3 of the Submissions / Preferred Infrastructure Report</p>	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
<p>Permanent road fencing - HF4</p> <p>Any permanent fencing at culvert and bridge crossings will consider the potential for blockage and be designed and operated to maintain the existing flood regime.</p>	Detail Fencing design documentation and Chapter 8, Sub-chapter 8.3.1
<p>Scour protection - HF6</p> <p>Scour and erosion protection measures at temporary and permanent waterway crossings will be provided upstream and downstream of the highway, particularly within 50 metres of Class 1 waterways or within the range of the Oxleyan Pygmy Perch as identified in section 3.9.6 of the Working paper – Biodiversity and the supplementary biodiversity report in Appendix J of the SPIR. This will be undertaken in consultation with the Department of Primary Industries (Fisheries)</p>	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
<p>Water way diversions - HF7</p> <p>Waterway diversions will be designed in consultation with Office of Environment and Heritage, NSW Office of Water and Department of Primary Industries (Fisheries so that the final diversion, where feasible and reasonable, the characteristics of the waterway that is being diverted. Characteristics include flow regime, flow velocity, base material, vegetation and habitat for aquatic fauna.</p>	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
<p>Water way diversions - HF8</p> <p>Revegetation of waterway diversions and surrounding areas will be undertaken in accordance with the following principles:</p> <ul style="list-style-type: none"> ▪ Diversions will be stabilised prior to the diversion receiving flows, in conjunction with the establishment of other scour and erosion control measures ▪ Diversions will establish of appropriate vegetation communities along the channel bed and banks, using endemic native species. 	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
<p>Management of flows for aquatic habitat and movement - HF19</p> <p>All work within 40 metres of a permanent watercourse, crossed by the project, will be undertaken in accordance with the NSW Office of Water 'Guidelines for Controlled Actions' and industry best practice including maintaining where feasible and reasonable the geomorphic integrity and natural hydrological flow regime</p>	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
SOIL , SEDIMENT AND WATER	
<p>Design of cut and fill batters - SSW1</p> <p>Batter slope gradients will be designed to minimise erosion of select topsoil.</p>	Detailed Alignment design and Chapter 8, Sub-chapter 8.1.5
<p>Design of cut and fill batters - SSW2</p> <p>Where feasible, bench cuttings will be diverted onto contours and surface flow drainage paths designed to spread flow at the source in preference to concentrating the flow and treating it further downstream.</p>	To be reviewed as part of detailed design with the alignment team and drainage team
<p>Management of soils, sediment and water issues - SSW7</p> <p>Exposed areas will be progressively rehabilitated. Methods will include permanent revegetation, or temporary protection with spray mulching or cover crops.</p>	Chapter 8, Sub-chapter 8.4

SPIR REQUIREMENT	DOCUMENT REFERENCE
Stockpile management - 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, 2011a) and the "Management of Surplus Material" in Section 3.9 of the SPIR.	Chapter 8, Sub- chapter 8.5
Stockpile management - SSW13 Topsoil will be stockpiled separately and inspected for noxious weed seedlings at six monthly intervals and controlled with herbicide as required.	Chapter 8, Sub-chapter 8.5
Soil erosion and sediment control - SSW27 Works within waterways will consider the need to maintain fish passage, in consultation with the Department of Primary Industries (Fisheries).	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Soil erosion and sediment control - SSW28 Flow discharge points will be designed with erosion controls to manage the flow velocities.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Protection of groundwater impacts at type A and Type B cuttings and embankments - SSW49 Major embankments will be designed to enable distributed flow of surface waters.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Protection of Water Quality - SSW59 All permanent water quality basins will incorporate measures to contain accidental fuel and chemical spills resulting from vehicle accidents on the highway. Basins will be designed to accommodate a spill volume of up to 40,000 litres.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Protection of Water Quality - SSW60 For water quality treatment in floodplains and other locations with minimal changes in gradient, grassed swales will be considered during detailed design.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Protection of Water Quality - SSW61 Appropriate scour protection for drainage measures will be determined during detailed design.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
BIODIVERSITY	
Interchange at Wardell - B56 Street lighting on the roundabouts at the interchange at Wardell will be designed to reduce light spill during detailed design. This could include using deflection shields around the lights or using a UV light, with reduced UV light emissions.	Street Lighting documentation Chapter 8, Sub-chapter 8.3.4
Monitoring strategy - B1 The Ecological Monitoring Program (Appendix K of the PIR) and will be finalised in consultation with relevant State and Commonwealth agencies and incorporate any specific conditions of consent approval and feedback from the expert review.	Ecological monitoring would occur principally via the individual targeted flora/ fauna management plans already prepared by Roads and Maritime.
Fauna connectivity - B2 The Connectivity Strategy will be further developed during detailed design, in consultation with relevant State and Commonwealth agencies, building upon the Connectivity Strategy in Appendix A of the Working paper – Biodiversity and the Supplementary Biodiversity Report in Appendix J of the S/PIR.	Development of the Connectivity Strategy for Section 10 and 11 is at Draft Report. Further development will occur during FDD. Items related to landscape and urban design are discussed Chapter 8, Sub-chapter 8.7.1

SPIR REQUIREMENT	DOCUMENT REFERENCE
Fauna connectivity - 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, Biodiversity and the Supplementary Biodiversity Report in Appendix J of the Submissions / Preferred Infrastructure Report.	This has occurred and is documented in the Connectivity Strategy for Section 10 and 11. Items related to landscape and urban design are discussed Chapter 8, Sub-chapter 8.7.1
Fauna connectivity - B4 Opportunities for improved connectivity for Koala and Long-nosed Potoroo will be further investigated at between station 144.2 and station 146.6.	Chapter 8, Sub-chapter 8.7
Fauna exclusion fencing - 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,	Detailed Fencing documentation and Chapter 8, Sub-chapters 8.3.1 and 8.7
Minimise loss of vegetation and habitat - B13 Disturbance and clearing of vegetation will be minimised, particularly: <ul style="list-style-type: none"> 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. 	Detailed Clearing and stripping documentation and Chapter 8, Sub-chapters 8.6
Reuse of woody debris and bushrock - 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, 2011a).	To be detailed in CEMP and co-ordinated with landscape documentation
Weed management - B27 A weed management plan will be developed as part of the CEMP, in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and the Introductory Weed Management Manual (Richards, 2004).	Detailed CEMP and Chapter 8, Sub-chapter 8.5 and Appendix Landscape Management Plan
Riparian and aquatic habitat management - B35 The bed and banks are to be reinstated to a condition similar to or better than the original condition ensuring that there are no adverse impacts on the aquatic values (different measures may be required for each crossing) and where feasible and reasonable, avoid impacts on geomorphic processes.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Riparian and aquatic habitat management - B40 Appropriate plant species will be incorporated into the rehabilitation of disturbed aquatic habitats and drains as a result of construction.	Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6
Stockpile and ancillary facility management - B52x Ancillary facility - Section 10 site 3b: <ul style="list-style-type: none"> Map and avoid stripping of trees along northern boundary 	Detailed in Chapter 6, Sub-chapter 6.7
Stockpile and ancillary facility management - B52y Ancillary facility - Section 10 site 4: <ul style="list-style-type: none"> Revegetate site post-construction, focus on approaches to land bridge and avoid Arthraxon hispidus. 	Deletion of land bridge has altered this response. Response will seek to achieve objectives of Ballina Koala Plan 2016

SPUR REQUIREMENT	DOCUMENT REFERENCE
URBAN AND LANDSCAPE DESIGN	
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).	Noted in case of change to noise attenuation strategy.
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.	Not part of package
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.	Chapter 7 and Chapter 8, Sub-chapter 8.4
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: <ul style="list-style-type: none"> ▪ Bridges. ▪ 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.	Chapter 8, Sub-chapter 8.1.2 Sub-chapter 8.1.5 Sub-chapter 8.3.5 Sub-chapter 8.3.6 Sub-chapter 8.3.1 Sub-chapter 8.5 Sub-chapter 8.6 Sub-chapter 8.7 Sub-chapter 8.8
Visual impacts from 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 also be considered.	Chapter 5, Sub-chapter 5.7
Construction visual impacts - UD7 Disturbed areas will be progressively revegetated throughout the construction period.	Chapter 8, Sub-chapter 8.4

SPUR REQUIREMENT	DOCUMENT REFERENCE
Visual impacts of ancillary facilities - UD8 Where required, typical landscape treatments for ancillary facilities in forest areas will include: <ul style="list-style-type: none"> ▪ 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.	Chapter 6, Sub-chapter 6.7
Visual impacts of ancillary facilities - UD9 Typical landscape treatments for ancillary facilities in agricultural areas will include: <ul style="list-style-type: none"> ▪ 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.	Chapter 6, Sub-chapter 6.7
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.	To be undertaken on a case by case basis. Details of borrow sites to be provided by PC. Refer Chapter 6, Sub-chapter 6.8
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.	Noted
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).	Noted.
Monitoring of landscaping and rehabilitation - UD13 Landscape and rehabilitation works will be monitored and remedial measures implemented where required until vegetation has stabilised.	Chapter 8, Sub-chapter 8.4 and Appendix Landscape Management Plan
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 minimum 150 millimetres to ensure suitable planting conditions are achieved.	Chapter 8, Sub-chapter 8.5

SPIR REQUIREMENT	DOCUMENT REFERENCE
ABORIGINAL HERITAGE	
<p>Awareness of Aboriginal heritage - AH12 An Aboriginal heritage interpretation strategy will be prepared as part of the Aboriginal heritage management plan. Measures will include opportunities for promoting salvage and investigation, the recovery of information, permanent installations and ways of marking the presence of Aboriginal people in the landscape, including, signage, interpretation products such as written materials, and through place naming.</p>	Opportunities to incorporate recommendations within the Aboriginal Heritage Management Plan will be investigated. (Note: There is no SPIR Management commitment to the preparation of this plan.)
<p>Impacts on the Gumi Site - AH30 For the Gumi site (O4-4-0180):</p> <ul style="list-style-type: none"> The tree (registered on AHIMS database) will be removed and the trunk will be relocated to an area agreed to with the registered stakeholder groups and Roads and Maritime – an arborist will be consulted to guide in the removal of the tree. The final tree location will be visually protected with culturally sensitive plantings or by existing vegetation. <p>Access to the tree will be provided for local Aboriginal people to enable them to be able to use the tree as a teaching site.</p>	Access to the site of the relocated tree will be provided.
<p>Direct impact on culturally significant places - AH41 Place D: Welcome to country signage will be installed within the highway corridor between Woodburn and Wardell and information on culture installed at the rest area in Section 10, as agreed with the registered Aboriginal parties.</p>	Welcome to Country Signage will be addressed as part of the Business Signage and Tourism Strategy in consultation with relevant Aboriginal parties. Rest area signage is to be addressed as part of the design of future elements and is not delivered as part of this design.
NON- ABORIGINAL HERITAGE	
<p>Impacts on item 29: 'Stonehenge' Property, Wardell Architectural noise treatment to the house will be investigated and provided where reasonable and feasible and in consultation with a qualified heritage consultant. Consideration will be given for the need to revise the SOHI for this item when the specific architectural noise treatment options are identified.</p>	Noted. Dependant on outcomes of operational noise review currently in preparation
TRAFFIC AND TRANSPORT	
N/A	
NOISE AND VIBRATION	
<p>Road traffic noise - ONV1 Architectural treatments will be considered for noise-affected receivers identified in the EIS and Submissions / Preferred Infrastructure Report (Appendix F), subject to confirmation at the detailed design stage.</p>	Noted. Dependant on outcomes of operational noise review currently in preparation
LAND USE AND PROPERTY IMPACTS	
<p>Fencing Strategy - LU4 The Fencing Strategy will be further developed during detailed design, in consultation with relevant stakeholders. This will build upon the principles of the strategy described in Chapter 3 of the Submissions and Preferred Infrastructure Report (Roads and Maritime, 2013).</p>	Refer fencing package Chapter 8, Sub-chapter 8.3.1

SPIR REQUIREMENT	DOCUMENT REFERENCE
<p>Construction impacts to primary industry, including forestry, and agriculture uses - LU12 Where possible, onsite reuse of any spoil is the preferred solution for managing the impacts, although alternative options for the reuse or disposal of spoil will be identified in the surplus material management plan.</p>	Noted to be incorporated in design development. Chapter 8, Sub-chapter 8.5.2
<p>Construction impacts to primary industry, including forestry, and agriculture uses - LU13 The management of surplus material will be further developed during detailed design, in consultation with relevant stakeholders. This will build upon the principles of the strategy described in Chapter 3 of the Submissions and Preferred Infrastructure Report (Roads and Maritime, 2013).</p>	Topsoil in Chapter 8, Sub-chapter 8.5.2
<p>Construction impacts to primary industry, including forestry, and agriculture uses - LU16 Where pesticides are required during construction, implement appropriate environmental management measures to avoid potential impacts on adjoining agricultural properties.</p>	Addressed as part of Construction Environmental Management Plan
<p>Construction impacts to primary industry, including forestry, and agriculture uses - LU27 The Cane Farm Strategy will be further developed during detailed design, in consultation with relevant stakeholders. This will build upon the principles of the strategy described in Chapter 3 of this Submissions and Preferred Infrastructure Report.</p>	Noted
SOCIAL AND ECONOMIC	
<p>By-passed towns - SE4 Signage will be implemented for bypassed towns in accordance with Roads and Maritime signage guidelines and in consultation with relevant councils. Signage on the project will identify bypassed townships (Grafton, Ulmarra, Tyndale, Maclean, New Italy, Woodburn, Broadwater and Wardell) as places for 'stopovers' for fuel, supplies and short term accommodation, to support demand for goods and services within these townships.</p>	Advised as not required by Pacific Complete
<p>By-passed towns - SE5 Roads and Maritime will work with Councils affected by the upgrade, where relevant, to support strategies by local councils and/or chamber of commerce and industry to promote townships and villages as stopovers for tourist.</p>	Noted
GREEN HOUSE GAS EMISSIONS AND AIR QUALITY AND WASTE IMPACTS	
<p>Energy consumption: operation - GHG6 Roads and Maritime will investigate the use of LED lighting in place of incandescent lamps as part of the project's detailed design, and use them where practicable to reduce electrical energy consumption. Any energy-efficient alternatives will have to meet lighting standards for major roads.</p>	Addressed as part of the Lighting design package
<p>Minimising construction Waste - WM6 Sediment removed from sedimentation basins will, where appropriate, be used on-site in landscaping and/or flattening of batters.</p>	To be investigated as part of landscape management plans refer Appendix D
<p>Management of operational waste Green waste from highway maintenance activities will be collected and, where possible, recycled for mulch within the road reserve.</p>	To be investigated as part of landscape management plans refer Appendix D

APPENDIX B BIODIVERSITY WORKING PAPER COMPLIANCE

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
(Note: Based on EIS Biodiversity Mitigation Measures)	
B2. The Connectivity Strategy would be further developed during detailed design, in consultation with relevant state and Commonwealth agencies, building upon the Connectivity Strategy in Appendix A of the Working paper – Biodiversity.	Development of the Connectivity Strategy for Section 10 and 11 is at Draft Report. Further development will occur during Final Report. Items related to landscape and urban design are discussed in Chapter 8, Sub-chapter 8.7.1
B3. All fauna connectivity structures would be developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity, building upon the current concept design structures.	This has occurred and is documented in the Connectivity Strategy for Portion. Items related to landscape and urban design are discussed Chapter 8, Sub-chapter 8.7.1
B4. Fauna exclusion fencing locations and design would be further developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity, building upon the current concept design.	Fencing Detailed documentation and Chapter 8, Sub-chapter 8.7
B8. An overall project Flora and Fauna Management Plan would be prepared to detail consistent guidance on the general management measures required for flora and fauna across all stages of the project. The management plan would cover: <ul style="list-style-type: none"> Pre-clearing process Exclusion zones Re-establishment of native vegetation Clearing of vegetation and removal of bushrock Re-use of woody debris and bushrock Weed management Pathogen management Nest boxes Fauna handling Aquatic habitats and riparian zones. 	Threatened Species Management Plans
B.9 A threatened flora management sub plan would be prepared to specifically address project sections where populations of threatened flora are known to have plants immediately adjacent to the project footprint, as identified in this assessment and include: <ul style="list-style-type: none"> Identification and physically surveying and mapping the specific location of individuals and patches along the edges of the project boundary to inform the management actions of the flora and fauna management plan A clearing protocol, translocation trial, seed collection, storage and propagation to use in revegetation of disturbed habitats Details for protection of retained plants, planting and maintenance and monitoring procedure during construction A revegetation monitoring program and performance criteria, reporting and adaptive management. 	Threatened Flora Management Plan

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
B10. A rainforest invertebrates management sub plan focusing on the Pink Underwing Moth and Atlas Rainforest Ground Beetle would be prepared and include: <ul style="list-style-type: none"> Details on targeted surveys of both species within and around the project boundary to identify the extent of the population and map the distribution of suitable habitat adjacent to the project. In particular potential breeding habitat containing the caterpillars' food plant, Carronia multisepealea should be identified. This would inform the detailed design, flora and fauna management plan and translocation and habitat rehabilitation program. The surveys will aim to map the species distribution and correlate presence with the habitat characteristics at identified sites to accurately model the distribution of potential habitat in proximity to the project Consideration to minimise or avoid impacts, where possible. The identified potential habitat would be targeted for translocation of individuals and habitat rehabilitation as compensation for the loss of habitat from the project An outline of capture and relocation actions for Rainforest Ground Beetle and Pink Underwing Moth larvae focusing on identified suitable habitat <ul style="list-style-type: none"> Identify procedures for habitat rehabilitation and revegetation of suitable habitat near the project including the planting of the host plant for the Pink Underwing Moth. Details of a monitoring program for translocated individuals and retained habitat adjacent to the project. The monitoring program would include the collection of baseline data and would continue through construction and operation for a period of three years post-construction. The plan would include clear key milestones, performance indicators, corrective actions and timeframes for the completion of all actions outline. The plan would address the success of habitat rehabilitation as well as the translocation success by monitoring populations of the target species.	Threatened Invertebrate Management Plan
B13. A threatened frog management sub plan (with a focus on the Giant Barred Frog, Green-thighed Frog, and Olongburra Frog) would be prepared and include: <ul style="list-style-type: none"> A program for survey or potential habitat for these species at least 6 months prior to construction to identify potential waterways and swamp habitat locations to inform the flora and fauna management plan A record of riparian / habitat condition baseline data at identified sites near the project to inform construction and post-construction monitoring program Identification of known sites, protection measures to be implemented during construction, monitoring methods and timing for species and habitat condition and monitoring mitigation measures and reporting in line with the flora and fauna management plan An outline of methods for monitoring species and habitat condition during post-construction. 	Threatened Frog Management Plan
B14. A Koala management sub plan would be prepared and include details on targeted surveys to identify the presence and status of koala populations near the project alignment. The surveys will focus near the project alignment and the data used to inform further development of connectivity structures.	Addressed as part of the Ballina Koala Plan

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
<p>B17 A landscape management plan would 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 would include details for the appropriate removal and restoration of temporary creek crossings. The landscape management plan would be developed in line with Roads and Maritime Biodiversity Guidelines (RTA, 2011a), the design principles identified in the Connectivity Strategy and the design principles in Working paper – Urban design, landscape character and visual impact.</p> <ul style="list-style-type: none"> The approach to landscape planting for the purposes of fauna management would be consistent with principles set out in the urban design and landscape strategy for this project (refer to Working paper- Urban design, landscape character and visual impact). 	<p>This report and landscape documentation</p>
<p>B18. Disturbance and clearing of vegetation would be minimised, particularly :</p> <ul style="list-style-type: none"> Avoiding and minimising vegetation removal wherever possible through the detailed design process Sensitive selection of ancillary facilities. The ancillary facilities identified present a selection of available sites; however during detailed design an evaluation should be conducted to select the minimum number of sites required with a priority to avoid native vegetation clearing if possible. A prior site inspection is required to survey and map hollow-bearing trees and check for large nests for species such as raptors, including Osprey and also Black-necked Stork at these sites Construction compounds and stockpile sites are to be sited in cleared or sparsely treed portions of the ancillary facility sites where feasible and reasonable, to avoid unnecessary clearing of vegetation and threatened flora species <p>Water quality basins would be placed in the optimal location for treating surface runoff. During detailed design, the location of water quality treatment measures would consider the competing environmental requirement of minimising vegetation removal, particularly where there is the potential for threatened plant species, threatened fauna habitat or in identified regional wildlife corridors.</p>	<p>Detailed Clearing and stripping documentation, Ancillary Facilities Management Plan prepared by Pacific Complete and Chapter 6, Sub-chapter 6.8</p>
<p>B19. Instream structures such as bridges and culverts are to be designed and managed to minimise any potential impact to flow regimes and fish passage, in accordance with Fairfull and Witheridge (2003).</p> <p>Use of bridges or bebo arch is the preferred structure for Class 1 (major fish habitat) waterways.</p>	<p>Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6</p>

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
<p>B22. Each waterway crossing is to be designed to ensure no physical, hydraulic and behavioural barriers to aquatic fauna movements. Impacts would be minimised by ensuring that:</p> <ul style="list-style-type: none"> The natural stream flow and velocity are maintained as closely as possible Surface level of any causeway is the same or lower than the natural stream bed to reduce interference with flow Habitat within a culvert is as natural as possible (eg allow rock and bed materials to infill the culvert base) There is the maximum light penetration Fauna and fish passage standards are maintained, as detailed in the Connectivity Strategy, including minimum design widths, including for natural banks, while also providing for scour protection and cut and fill batters Creek crossing structures would be designed to maximise habitat features within the passage. To achieve this, the design of bridge and culverts would encourage the deposition of sediment creating similar bed substrate to adjacent creek and the planning of specific plant species Pools would be constructed or retained upstream and downstream of the waterway crossings to provide resting and refuge habitat near the crossing structures Design culverts (specifically where Oxleyan Pygmy Perch has been confirmed) so that hydraulic habitat conditions would be suitable for fish passage Bridges would be designed and sized to limit peak flood velocities to less than 1m per second in commonly occurring flood events, similarly to the bridge design over Macdonalds Creek where Oxleyan Pygmy Perch have been confirmed 	<p>Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6</p>
<p>B23. Bridge structures would be designed in light of the following principles:</p> <ul style="list-style-type: none"> Bridges are to be single span bridges with piers located outside the main channel Bridge structures to be designed to prevent an increase of backup of water during times of flood, that would enable Plague Minnow to access waterbodies where they are currently not found (eg Broadwater National Park) Construction would not alter or reduce flow where there are existing or potential Oxleyan Pygmy Perch populations (primarily within Sections 7, 8 and 9) which would negatively impact on this threatened species by draining the waterbodies. 	<p>Detail Drainage design documentation and Chapter 8, Sub-chapter 8.1.2</p>
<p>B24. Where temporary access tracks are required over drainage lines with no flow, fords may be installed.</p>	<p>CEMP, Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6</p>
<p>B25. Where possible, existing crossings would be used. Where this is not feasible or reasonable, the temporary crossings would be designed to minimise impacts on the existing aquatic ecology and water quality.</p>	<p>CEMP, Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6</p>
<p>B26. Temporary crossings would be further investigated during detailed design including, location, type of structure, duration of need and rehabilitation process.</p>	<p>CEMP, Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6</p>

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
<p>B27. General temporary waterway access track mitigation measures have been provided below:</p> <ul style="list-style-type: none"> Installation and subsequent decommissioning of temporary crossings would be undertaken outside of Oxleyan Pygmy Perch spawning seasons (October to March). Temporary crossings would be constructed from clean fill using pipe or box culvert cells to carry flows. All temporary works (eg crossings, flow diversion barriers) would be removed as soon as practicable and in a way that does not promote future channel erosion. The preferred temporary structure for crossing waterways would be consistent with Witheridge (2002) where the use of bridges is the preferred structure for Class 1 (major fish habitat waterways). Scour protection works would be established at temporary crossings as required At the completion of construction, the temporary crossings would be removed and rehabilitated. 	<p>CEMP, Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6</p> <p>Note: <i>Oxleyan Pygmy Perch has not been identified within Richmond River to Ballina (Sections 10 - 11)</i></p>
<p>B30 The location of exclusion zones would be identified, with temporary fencing or flagging tape to indicate the limits of clearing (in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a)). Permanent fauna exclusion fencing for the project (as described in the Connectivity Strategy), where reasonable and feasible, would be installed prior to clearing and can function as exclusion fencing.</p>	<p>Detail Fencing design documentation and Chapter 8, Sub-chapter 8.3.1</p>
<p>B32 Woody debris and bushrock would be re-used on site for habitat improvement where possible and would be detailed in the landscape management plan in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and include:</p> <ul style="list-style-type: none"> Implementing the removal, stockpiling, transportation and relocation of woody debris and/or bushrock in a manner that minimises disturbance to native vegetation or bushrock Engaging an ecologist in the pre-clearing phase of the proposal to provide advice on the re-use of woody debris and bushrock including potential negative impacts and positioning of woody debris and bushrock at the relocation areas When relocating woody debris, placing it evenly across the site while keeping topsoil disturbance to a minimum Avoiding the spread of any weeds or pathogens that may be in the soil when relocating woody debris and bushrock from stockpiles Mulching would include only native vegetation and separate stockpiles need to be established for weedy vegetation and the native vegetation to be mulched. Manage stockpiles in accordance with RTA's Stockpile Site Management Guideline, RTA Environmental Protection (Management System) QA Specification G36 and RTA Vegetation QA Specification R178 Preparing a mulch tannin management plan for the project where tannins are likely to be generated. 	<p>To be detailed in CEMP and co-ordinated with landscape documentation</p>

BIODIVERSITY WORKING PAPER COMPLIANCE	DOCUMENT REFERENCE
<p>B33. A weed management plan would be developed as part of the CEMP, in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and the Introductory Weed Management Manual (Richards, 2004) and would include:</p> <ul style="list-style-type: none"> Taxa and potential sources of the weed species (including alligator weed, tropical soda apple and myrtle rust) Weed management priorities and objectives Sensitive environmental areas within or adjacent to the site Location of weed infested areas Mechanical weed control methods such as slashing or mowing, as well as a range of herbicides to avoid the development of herbicide resistance Measures to prevent the spread of weeds A monitoring program to measure the success of weed management Strategic management with adjacent landowners Appropriate disposal of weed infested materials and soils to be identified in the CEMP Communication strategies to improve contractor awareness of weeds and weed management 	<p>To be detailed in CEMP and co-ordinated with landscape documentation</p>
<p>B34. A site assessment by an ecologist or person trained in weed identification would be undertaken to identify the presence and extent of Alligator weeds. If present, management measures in the Weed Management Plan would be in accordance with the DPI Alligator Weed control manual (van Oosterhout, 2007).</p>	<p>To be detailed in CEMP and co-ordinated with landscape documentation</p>
<p>B35 Measures to prevent the introduction and/or spread of pests and disease causing agents such as bacteria and fungi would be incorporated into the CEMP, in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and would include:</p> <ul style="list-style-type: none"> A background search of government-maintained websites for the most up-to-date hygiene protocols for each pathogen Provide vehicle and boot wash down facilities and ensure vehicles and footwear is free of soil before entering or exiting the site The risk of spreading pathogens and the mitigation measures required on site should be regularly communicated to staff and contractors during inductions and toolbox talks Construction works would be programmed to move from uninfected areas to any known infected areas Restrict vehicles to designated tracks, trails and parking areas 	<p>To be detailed in CEMP and co-ordinated with landscape documentation</p>
<p>B40 Streams to be crossed perpendicular to flow and where possible crossing sites selected to avoid unstable banks, bends in the channel, deep pools and confluences with other channels</p>	<p>Detail Drainage design documentation and Chapter 8, Sub-chapter 8.6</p>
<p>B62 Ancillary facilities would be sensitively location to avoid removal of any Threatened Ecological Community.</p>	<p>Ancillary Facilities Management Plan prepared by Pacific Complete and Chapter 6, Sub-chapter 6.8</p>
<p>B63 Stockpiles would be managed in accordance with RTA's Stockpile Site Management Guideline.</p>	<p>CEMP and Chapter 8, Sub-chapter 8.5.2</p>

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APPENDIX C THREATENED SPECIES MANAGEMENT PLAN COMPLIANCE

THREATENED SPECIES MANAGEMENT PLAN COMPLIANCE	DOCUMENT REFERENCE
THREATENED FISH MANAGEMENT PLAN	
Mitigation measures relate to :	
Suitable design of temporary and permanent waterway crossings	Chapter 8, Sub-chapter 8.6
Construction measures including timing, method of construction and erosion control	Chapter 8, Sub-chapter 8.6, CEMP
Aquatic habitat management measures including revegetation of disturbed areas of waterway	Chapter 8, Sub-chapter 8.6 and 8.7.3
Development of a monitoring program to monitor impacts, the effectiveness of mitigation measures and incorporate adaptive management actions where impacts noted.	CEMP
THREATENED FLORA MANAGEMENT PLAN	
Provision of exclusion fencing to protect in situ threatened flora populations	Clearing and topsoil documentation, CEMP, Chapter 8, Sub-chapter 8.4
Management of indirect impacts to these in situ populations during construction	CEMP
Water quality, erosion and sediment control	CEMP
Weed management; and	CEMP, Chapter 8, Sub-chapter 8.4.10 and Landscape Management Plan
Targeted revegetation of disturbed areas adjoining in situ threatened flora including translocation strategy.	CEMP, Landscape documentation
THREATENED FROG MANAGEMENT PLAN	
Provision of exclusion fencing; both temporary, to exclude frogs from construction activities, but also permanent frog fencing, to prevent frogs from accessing the road during the operation of the road and often strategically aligned to fauna underpasses capable of facilitating movement and maintaining habitat connectivity.	CEMP, Fencing documentation and Chapter 8, Sub-chapter 8.7
In particular provide: frog exclusion fencing in W2B Section 10 (ch148300–148750) for the eastern side of the carriageway due to the close proximity of populations in this area	
Using of sediment and erosion control measures.	CEMP
Water quality controls.	CEMP and Drainage design
Provision of crossing structures including bridges and culverts.	Drainage design
Pest and pathogen management.	CEMP
Re-establishment of threatened frog habitat at approaches to crossing structures.	Chapter 8, Sub-chapter 8.7
Compensatory habitat (ponds) where habitat has been removed by construction activities and is considered locally important as recognised by a frog expert.	N/A
Development of a monitoring program to monitor impacts on the populations of threatened frogs and assess the effectiveness of mitigation measures, incorporating adaptive management actions where impacts are recorded.	CEMP
THREATENED INVERTEBRATE MANAGEMENT PLAN	
The objectives of the management strategy include:	
Development of a sound method for undertaking pre-clearing surveys	CEMP, Clearing and Topsoil documentation
A suitable fauna handling procedure	CEMP

THREATENED SPECIES MANAGEMENT PLAN COMPLIANCE	DOCUMENT REFERENCE
Provision of exclusion fencing to protect areas of invertebrate habitat to be retained during construction	CEMP, Clearing and Topsoil documentation
A staged habitat removal process	CEMP, Clearing and Topsoil documentation
A method for the re-use of woody debris and bedrock (habitat for Atlas Rainforest Ground Beetle)	CEMP and Landscape documentation
Identification of procedures for habitat rehabilitation and revegetation of suitable habitat near the project to minimise the potential for indirect impacts and inform the design of appropriate buffers between the habitat and the project; and	Chapter 8, Sub-chapter 8.4 and landscape documentation
Develop a monitoring program to monitor impacts on the populations of threatened invertebrates and the effectiveness of mitigation measures and incorporate adaptive management actions where impacts are noted.	CEMP
Management of artificial light spill on surrounding known and potential breeding habitat for Southern Pink Underwing Moth and Atlas Rainforest Ground Beetle.	Lighting documentation, Chapter 8, Sub-chapter 8.3.4
THREATENED GLIDER MANAGEMENT PLAN	
The aim of the mitigation measures is to ensure the continued viability of Squirrel Glider and Yellowbellied Glider populations in the project area by achieving the following goals:	
Targeted rehabilitation to direct glider movements across connectivity structures or locations where a natural crossing may be possible (with the goal to reduce road mortality) without compromising road safety provisions. Targeted rehabilitation plans are detailed within the Draft Urban Design and Landscape Plan (Draft UDLP)	Landscape Concept Plans Chapter 7 and Chapter 8, Sub-chapter 8.7; Landscape documentation
Minimise clearing through appropriate location of ancillary facilities (supported by ancillary impact assessment report as an addition to the SPIR, 2014)	Clearing and Topsoil documentation,
Implementation of a staged habitat removal process consistent with the Roads and Maritime Biodiversity Guidelines (RTA 2011)	CEMP
Revegetation of areas disturbed during construction and installation of nest boxes in accordance with the NBMP	Landscape Concept Plans Chapter 7 and Chapter 8, Sub-chapter 8.7; Landscape documentation; and CEMP
An updated Connectivity Strategy(s) detailing arboreal crossing structures and widened medians with retained vegetation that has been informed by targeted surveys undertaken for Squirrel Glider and Yellow-bellied Gliders in 2014/15 by glider experts from Sandpiper Ecology (Appendix C and Appendix D	CEMP
The minimum design and locations of crossing structures for threatened gliders will be based on the principles outlined in the EIS, expert feedback and the process for managing connectivity requirements described in the Fauna Connectivity Strategy; and	Landscape Concept Plans Chapter 7
Management of light, dust and noise will be in accordance with the CEMP.	CEMP
THREATENED MAMMAL MANAGEMENT PLAN	
In general these mitigation measures related to:	
Exclusion zones to protect adjoining habitats during construction	Clearing and topsoiling documentation; CEMP

THREATENED SPECIES MANAGEMENT PLAN COMPLIANCE	DOCUMENT REFERENCE
Fauna Connectivity Strategy and mitigation measures (arboreal crossing structures, widened medians, dedicated overpasses and underpasses and combined drainage / fauna crossing structures). The strategy is to be informed by targeted surveys for threatened mammals to refine crossing structures and their final location. The minimum design and locations of crossing structures for threatened mammals will be based on the principles outlined in the EIS and the process for managing connectivity requirements described in the Fauna Connectivity Strategy	Appendix G; Chapter 8, Sub-chapter 8.7
Permanent fauna exclusion fencing to minimise road mortalities and direct to crossing structures	Fencing documentation; Chapter 8, Sub-chapter 8.3
Sensitive pre-clearing and clearing procedures to consider animal welfare and translocation from clearing areas	Clearing and topsoiling documentation; CEMP
Minimise clearing through appropriate location of ancillary facilities, implementation of a staged habitat removal process consistent with the Roads and Maritime Biodiversity Guidelines (RTA 2011), revegetation of areas disturbed during construction and installation of nest boxes	Ancillary Facilities Management Plan prepared by Pacific Complete, Chapter 8, Sub-chapter 8.4
Management of light, dust and noise will be in accordance with the Construction Environment Management Plan (CEMP)	CEMP
Establish a comprehensive monitoring program to assess the effectiveness of mitigation measures and allow for ongoing updates to these measures based on the results of monitoring	CEMP
Engagement of appropriate stakeholders to identify appropriate predator and pest control actions; and	Chapter 3
Revegetation of suitable habitat along areas disturbed by construction and land bridge crossings including reuse of woody debris and bush rock.	Chapter 8, Sub-chapter 8.7, CEMP and Landscape documentation
Focus for Section 10 Long-nosed Potoroo: Exclusion fence all potential wet and dry heath habitats bordering the highway footprint in the Wardell heath area	Landscape Plans Chapter 7
THREATENED RAINFOREST AND RAINFOREST PLANTS MANAGEMENT PLAN	
Mitigation measures related to EPBC listed lowland Rainforest in Sub tropical Australia is limited to Sections 10 and 11 of the highway upgrade. EPBC listed Littoral Rainforest is limited to Section 10 of the highway upgrade. In ADDITION, Cryptocarya foetida (v), Macadamia tetraphylla (v), Syzygium hodgkinsonia (v) and Sreblus pendulinus (E) are found in Section 10.:	
Provision of exclusion fencing to protect in situ threatened flora populations	Fencing documentation, Clearing and Topsoil documentation
Management of indirect impacts to these in situ populations during construction	CEMP
Weed management; and	CEMP, Chapter 8, Sub-chapter 8.4.10 and Landscape Management Plan
Targeted revegetation of disturbed areas adjoining in situ threatened flora. Including: 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. Further details of areas for revegetation and native species to be used, will be provided in the Draft Urban Design and Landscape Plan (Draft UDLP) for each section of the project	Chapter 7, Chapter 8, Sub-chapter 8.4, Appendix B and Landscape documentation
BALLINA KOALA PLAN	
Fully closed highway fencing system	Fencing documentation, Chapter 8, Sub-chapter 8.3
Connectivity structures	Chapter 8, Section 8.7, Appendix G
130 ha New Habitat	Koala Revegetation Strategy and Landscape Plans Chapter 7

APPENDIX D SCHEDULE OF FINISHES AND MATERIALS

Bulk materials are adopted in accordance with the *Pacific Highway Guidelines* (Roads and Maritime, 2013)

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APPENDIX E PLANTING AND SEEDING SCHEDULES

PLANTING MIXES

All plant and seed tables are subject to further development, including confirmation that seeds/ material are commercial available.

MIX TYPE	COMMUNITY / ASSOCIATION	DOMINANT CANOPY SPECIES	OTHER CANOPY SPECIES	DOMINANT SHRUB SPECIES	GROUNDCOVER SPEICES	IMAGES
01	Swamp Forest					
1A	Swamp Mahogany Swamp Forest of the Coastal Lowlands	<i>Banksia aemula</i>	<i>Banksia aemula</i>	<i>Acmena smithii</i>	<i>Blechnum indicum</i>	
		<i>Banksia ericifolia</i>	<i>Elaeocarpus reticulatus</i>	<i>Alphitonia excelsa</i>	<i>Cyperus polystachyos</i>	
		<i>Callistemon salignus</i>	<i>Eucalyptus pilularis</i>	<i>Callistemon pachyphyllus</i>	<i>Gahnia sieberiana</i>	
1B	Paperbark Swamp Forest	<i>Casuarina glauca</i>	<i>Lophostemon suaveolens</i>	<i>Leptospermum trinervium</i>	<i>Imperata cylindrica</i>	
		<i>Eleocarpus reticulatus</i>		<i>Ottochloa gracillima</i>	<i>Juncus usitatus</i>	
		<i>Eucalyptus robusta</i>		<i>Solanum mauritianum</i>	<i>Lomandra longifolia</i>	
		<i>Eucalyptus tereticornis</i>		<i>Solanum nigrum</i>	<i>Pteridium esculentum</i>	
		<i>Melaleuca linariifolia</i>			<i>Viola hederacea</i>	
		<i>Melaleuca quinquenervia</i>				
		<i>Melaleuca sieberi</i>				
<i>Melaleuca styphelioides</i>						

MIX TYPE	COMMUNITY / ASSOCIATION	DOMINANT CANOPY SPECIES	OTHER CANOPY SPECIES	DOMINANT SHRUB SPECIES	GROUND COVER SPECIES	IMAGES
02	Dry Forest					
2A	Banksia-Callitris Dry Heathy Woodlands and Heaths	<i>Acacia spp.</i>	<i>Allocasuarina littoralis</i>	<i>Acacia concurrens</i>	<i>Acacia ulicifolia</i>	
		<i>Banksia aemula</i>	<i>Angophora floribunda</i>	<i>Acacia maidenii</i>	<i>Aristida vagans</i>	
		<i>Banksia ericifolia</i>	<i>Angophora woodsiana</i>	<i>Acacia melanoxylon</i>	<i>Baloskion tetraphyllum</i>	
2B	Scribbly Gum - Needlebark Stringbark Heathy Open Forest	<i>Corymbia gummifera</i>	<i>Callitris columellaris</i>	<i>Acacia suaveolens</i>	<i>Cheilanthes sieberi subsp. sieberi</i>	
		<i>Corymbia henryi</i>	<i>Corymbia gummifera</i>	<i>Acacia ulicifolia</i>	<i>Cymbopogon refractus</i>	
		<i>Corymbia variegata</i>	<i>Corymbia intermedia</i>	<i>Allocasuarina littoralis</i>	<i>Desmodium rhytidophyllum</i>	
2C	Blackbutt - Pink Bloodwood Shrubby Open Forest	<i>Eucalyptus moluccana</i>	<i>Eucalyptus baileyana</i>	<i>Allocasuarina torulosa</i>	<i>Dianella caerulea</i>	
		<i>Eucalyptus pilularis</i>	<i>Eucalyptus eugenioides</i>	<i>Alphitonia excelsa</i>	<i>Dichondra repens</i>	
		<i>Eucalyptus propinqua</i>	<i>Eucalyptus fibrosa</i>	<i>Banksia oblongifolia</i>	<i>Entolasia stricta</i>	
		<i>Eucalyptus siderophloia</i>	<i>Eucalyptus pilularis</i>	<i>Banksia spp.</i>	<i>Eragrostis brownii</i>	
		<i>Eucalyptus signata</i>	<i>Eucalyptus resinifera</i>	<i>Banksia spinulosa var. collina</i>	<i>Eustrephus latifolius</i>	
			<i>Eucalyptus signata</i>	<i>Breynia oblongifolia</i>	<i>Glycine clandestina</i>	
			<i>Eucalyptus tereticornis</i>	<i>Callistemon salignus</i>	<i>Goodenia hederacea</i>	
			<i>Eucalyptus umbra</i>	<i>Gompholobium pinnatum</i>	<i>Hardenbergia violacea</i>	
			<i>Lophostemon confertus</i>	<i>Jacksonia scoparia</i>	<i>Hibbertia scandens</i>	
			<i>Lophostemon suaveolens</i>	<i>Lambertia formosa</i>	<i>Hibbertia vestita</i>	
			<i>Syncarpia glomulifera</i>	<i>Leptospermum juniperinum</i>	<i>Homoranthus virgatus</i>	
				<i>Leptospermum polygalifolium</i>	<i>Homoranthus virgatus</i>	
				<i>Leptospermum spp.</i>	<i>Imperata cylindrica var. major</i>	
				<i>Leptospermum trinervium</i>	<i>Jasminum suavisimum</i>	
				<i>Leucopogon lanceolatus</i>	<i>Lepidospermum laterale</i>	
				<i>Lomatia silaifolia</i>	<i>Lomandra longifolia</i>	
		<i>Melaleuca nodosa</i>	<i>Lomandra multiflora</i>			
		<i>Melaleuca sieberi</i>	<i>Melaleuca nodosa</i>			
		<i>Persoonia stradbrokeensis</i>	<i>Oplismenus aemulus</i>			
		<i>Persoonia tenuifolia</i>	<i>Panicum simile</i>			
		<i>Phyllanthus hirtellus</i>	<i>Pratia purpurascens</i>			
		<i>Pimelea linifolia</i>	<i>Pteridium esculentum</i>			
		<i>Pultenaea spp.</i>	<i>Themeda australis</i>			
		<i>Trochocarpa laurina</i>	<i>Vernonia cinerea</i>			
		<i>Xanthorrhoea latifolia</i>				

MIX TYPE	COMMUNITY / ASSOCIATION	DOMINANT CANOPY SPECIES	OTHER CANOPY SPECIES	DOMINANT SHRUB SPECIES	GROUNDCOVER SPEICES	IMAGES
03	Wet Schelrophyll Forest					
3A	Blackbutt Grassy Open Forest	<i>Eucalyptus grandis</i>	<i>Angophora woodsiana</i>	<i>Acacia spp.</i>	<i>Adiantum hispidulum</i>	
		<i>Eucalyptus microcorys</i>	<i>Corymbia intermedia</i>	<i>Acmena smithii</i>	<i>Blechnum cartilagineum</i>	
3B	Narrow-leaved Red Gum Woodlands	<i>Eucalyptus pilularis</i>	<i>Eucalyptus acmenoides</i>	<i>Allocasuarina littoralis</i>	<i>Cissus antartica</i>	
		<i>Eucalyptus resinifera subsp. hemilampra</i>	<i>Eucalyptus pianchoniana</i>	<i>Allocasuarina torulosa</i>	<i>Cissus hypoglauca</i>	
		<i>Eucalyptus resinifera subsp. resinifera</i>	<i>Eucalyptus propinqua</i>	<i>Archontophoenix cunninghamiana</i>	<i>Dianella caerulea</i>	
		<i>Livistonia australis</i>	<i>Eucalyptus siderophloia</i>	<i>Banksia oblongifolia</i>	<i>Dichondra repens</i>	
		<i>Lophostemon confertus</i>	<i>Syncarpia glomulifera</i>	<i>Breynia oblongifolia</i>	<i>Entolasia stricta</i>	
		<i>Lophostemon suavolens</i>		<i>Cordyline stricta</i>	<i>Geitonoplesium cymosum</i>	
		<i>Melaleuca quinquinervia</i>		<i>Cryptocarya microneura</i>	<i>Hardenbergia violacea</i>	
				<i>Cryptocarya rigida</i>	<i>Hibbertia scandens</i>	
				<i>Dioscorea transversa</i>	<i>Imperata cylindrica var. major</i>	
				<i>Elaeocarpus reticulatus</i>	<i>Ischaemum australe</i>	
		<i>Endiandra sieberi</i>	<i>Lepyrodia scariosa</i>			
		<i>Glochidion sumatranum</i>	<i>Lomandra longifolia</i>			
		<i>Guioa semiglauc</i>	<i>Morinda jasminoides</i>			
		<i>Jagera pseudorhus</i>	<i>Pratia purpurascens</i>			
		<i>Leptospermum polygalifolium</i>	<i>Ptilothrix deusta</i>			
		<i>Melaleuca sieberi</i>	<i>Smilax australis</i>			
		<i>Melicope elleryana</i>	<i>Smilax glycyphylla</i>			
		<i>Persoonia stradbokensis</i>	<i>Themeda australis</i>			
		<i>Pultenaea spp.</i>				
		<i>Synoum glandulosum</i>				
		<i>Syzigium oleosum</i>				
		<i>Trochocarpa laurina</i>				
		<i>Wilkiea huegeliana</i>				

MIX TYPE	COMMUNITY / ASSOCIATION	DOMINANT CANOPY SPECIES	OTHER CANOPY SPECIES	DOMINANT SHRUB SPECIES	GROUNDCOVER SPECIES	IMAGES
04	Lowland Rainforest					
04A	White Booyang - Fig Subtropical Rainforest	<i>Backhousia myrtifolia</i> <i>Dendrocnide excelsa</i>	<i>Archontophoenix cunninghamina</i> <i>Castanospermum australe</i>	<i>Acacia maidenii</i> <i>Acacia melanoxylon</i>	<i>Adiantum formosum</i> <i>Calochlaena dubia</i>	
04B	Tuckeroo - Riberry - Yellow Tulipwood Littoral Rainforest	<i>Euphomatia laurina</i> <i>Ficus spp.</i> <i>Flindersia bennettiana</i> <i>Flindersia schottiana</i> <i>Glochidion sumatranum</i> <i>Guioa semiglauc</i> <i>Heritiera trifoliolatum</i> <i>Lophostemon confertus</i> <i>Syzygium smithii</i> <i>Tristaniopsis laurina</i>	<i>Cryptocarya obovata</i> <i>Daphnandra micrantha</i> <i>Dendrocnide excelsa</i> <i>Dysoxylum fraserianum</i> <i>Dysoxylum muelleri</i> <i>Endiandra pubens</i> <i>Flindersia schottiana</i> <i>Sloanea australis</i> <i>Toona australis</i>	<i>Acacia suaveolens</i> <i>Alphitonia excelsa</i> <i>Cordyline petiolaris</i> <i>Cyathea leichhardtiana</i> <i>Harpullia alata</i> <i>Linospadix monostachya</i> <i>Neolitsea dealbata</i> <i>Wilkiea austro-queenslandica</i>	<i>Cordyline stricta</i> <i>Elatostema reticulatum</i> <i>Geitonoplesium cymosum</i> <i>Helmholtzia glaberrima</i> <i>Hibbertia aspera</i> <i>Hibbertia scandens</i> <i>Lastreopsis spp.</i> <i>Oplismenus aemulus</i> <i>Pteris umbrosa</i>	
05	Grassland				<i>Austrodanthonia richardsonii</i> var. <i>Hume</i> <i>Imperata cylindrica</i>	

SEED MIXES

S1-D WET SCHLEROPHYLL FOREST

SHRUBS

Breynia oblongifolia
Hakea dactyloides
Hakea sericea
Leptospermum juniperinum

GROUNDCOVERS

Desmodium brachypodum
Dianella caerulea
Dichondra repens
Hardenbergia violacea
Imperata cylindrica var. major
Lomandra longifolia
Pratia purpurascens
Themeda australis

S2-D DRY FOREST

SHRUBS

Acacia fimbriata
Acacia ulcifolia
Banksia oblongifolia
Banksia spinulosa var collina
Gompholobium virgatum
Jacksonia scoparia
Lambertia formosa
Leptospermum juniperinum
Leptospermum trinervium
Pultenaea villosa

GROUNDCOVERS

Aristida vagans
Dianella caerulea
Entolasia stricta
Gyline clandestina
Hardenbergia violacea
Hibbertia scandens
Imperata cylindrica
Imperata cylindrica var. major
Lepidosperma laterale
Lomandra longifolia
Panicum effusum
Themeda australis

S3-D LOWLAND RAINFOREST

SHRUBS

Acacia maidenii
Acacia melanoxydon
Acacia suaveolens
Alphitonia excelsa
Cordyline petiolaris
Cyathea leichhardtiana
Harpullia alata
Linospadix monostachya
Neolitsea dealbata
Wilkiea austro-queenslandica

GROUNDCOVERS

Adiantum formosum
Calochlaena dubia
Cordyline stricta
Elatostema reticulatum
Geitonoplesium cymosum
Helmholtzia glaberrima
Hibbertia aspera
Hibbertia scandens
Lastreopsis spp.
Oplismenus aemulus
Pteris umbrosa

S4-D SWAMP FOREST

SHRUBS

Acacia brownei
Acacia elongata
Acacia fimbriata
Acacia maidenii
Baeckea virgata
Banksia spinulosa var collina
Bossiaea rhombifolia
Callistemon rigidus
Hakea dactyloides
Hakea sericea
Leptospermum juniperinum
Melaleuca nodosa
Melastoma affine
Melaleuca thymifolia

GROUNDCOVERS

Dianella caerulea
Dianella revoluta
Gahnia sieberiana
Hardenbergia violacea
Imperata cylindrica
Juncus usitatus
Lomandra longifolia
Lomandra multiflora
Myoporum montanum

SEED MIXES

S5-D EXOTIC GRASSLAND

Coolabah oats

Cymbopogon refractus

Cynodon dactylon

Eclipse rye

Secate cereate "sterile"

Trifolium pratense

S6-D NATIVE GRASSLAND

Aristida vagans

Cymbopogon refractus

Imperata cylindrica

Microlaena stipoides var Griffin

Themeda australis

Themeda triandra var Tangara

S7-D GRASSLAND / SEDGELAND

Carex appressa

Cymbopogon refractus

Ficinia nodosa

Gahnia aspera

Gahnia sieberiana

Imperata cylindrica

Juncus usitatus

APPENDIX F WEED SPECIES LIST

WEED SPECIES

SCIENTIFIC NAME	COMMON NAME	NATIONAL SIGNIFICANCE	NOXIOUS WEEDS BALLINA
<i>Asparagus aethiopicus</i>	Asparagus Fern	x	4
<i>Asparagus plumosus</i>	Climbing Asparagus Fern	x	4
<i>Ageratina adenophora</i>	Crofton Weed		4
<i>Ageratina riparia</i>	Mistflower		4
<i>Ambrosia artemisiifolia</i>	Annual Ragweed		5
<i>Baccharis halimifolia</i>	Groundsel Bush		3
<i>Chrysanthemoides monilifera subsp. rotundata</i>	Bitou Bush	x	4
<i>Senecio sp.</i>	Fireweed		4
<i>Senecio madagascariensis</i>	Fireweed	x	4
<i>Bryophyllum pinnatum</i>	Live Plant		4
<i>Cinnamomum camphora</i>	Camphor Laurel		4
<i>Ligustrum lucidum</i>	Large-leaf Privet		4
<i>Ligustrum sinense</i>	Small-leaf Privet		4
<i>Salvinia molesta</i>	Salvinia	x	3
<i>Lantana camara</i>	Lantana	x	4

Noxious Weed Class Requirements

3. Reduce the area and the impact of those plants in parts of NSW
4. Minimise the negative of those plants on the economy, community or environment of NSW
5. Prevent the introduction of those plants within NSW or from NSW to another jurisdiction

SECTION	CHAINAGE REFERENCE	DESIGN CHAINAGE	NAME	STRUCTURE NUMBER	LENGTH (M)	WIDTH (M)	HEIGHT (M)	FUNCTIONALITY	FAUNA STRUCTURE TYPE	COMMENTS
10	146000		Back channel road / Richmond River Bridge northern abutment				4.0	COMBINED	Minimum clearance	Removed
10	146280	146252	Unknown		29.28	3.0	3.0	DEDICATED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 29.28m.
10	146390	146361	Unknown		32.94	3.0	3.0	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 32.94m
10	146630	146604	Unknown	D50	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath	Koala Structure, Chainage adjustment
10	146980	146840	Unknown	D51	15 (along mainline)		2.4	DEDICATED	Bridge with fauna furniture beneath	Koala Structure, Location moved to align better with existing koala habitat (refer RFI response from PC 3-Feb-16)
10	147100	147072	Unknown		35.38	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Decreased length from 40 m to 35.38 m, Chainage adjustment
10	147600	147600	Unknown					GLIDER CROSSING	Rope Bridge	The Glider MP Version 2.1, required a rope bridge where the landbridge was located at SPIR chainage 147600. Final position to be as close to the previous overbridge as possible. The bridge is in a large cutting which may make it difficult to span
10	148620	148592	Unknown		37.82	3.0	3.0	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 37.82m, 5 cell culvert., Chainage adjustment
10	149250	149218	Bingal Creek	D04	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath Minimum clearance 2.4 m	Koala Structure, Decreased in length from 50m to 37.82m., 5 cell culvert., Chainage adjustment
10	150080	150035	Unknown	D52	20 (along mainline)		2.4	COMBINED	Bridge with fauna furniture beneath Minimum clearance 2.4 m	Koala Structure, Chainage adjustment
10	150580	150549	Unknown		39.04	2.4	2.4	COMBINED	Culvert with fauna furniture	Koala Structure Decreased in length from 50m to 39.04m Chainage adjustment
10	150630	150603	Unknown	D53	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath	Koala Structure, Previously a dedicated structure, Chainage adjustment
10	151220	151196	Unknown		37.82	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Chainage adjustment, Length decreased from 40 m to 37.82 m
10	151825	151795	Wardell Viaduct 6	D05	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath Minimum clearance 2.4 m	Koala Structure, Previously a dedicated structure , Chainage adjustment
10	152050	152050	Unknown		36.6	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Now a dedicated crossing
10	152750 Wardell Rd (CH466)	152750/CH450 (On Wardell Road west not on Mainline)	Unknown		19.52	2.4	2.4	DEDICATED	Culvert with fauna furniture	Now off Mainline on Wardell Road west to achieve sufficient cover (refer RFI response 3-Feb16). Length has decreased from 40 m to 19.52m., Koala Structure
10	152970 Wardell Rd (CH150)	152940/CH140 (On Wardell Road west not on Mainline)	Unknown		19.52	2.4	2.4	DEDICATED	Culvert with fauna furniture	On Wardell Road, Koala Structure, Decreased in length from 40m to 19.52m, Chainage adjustment
10	153090	153058	Unknown		36.6	3.0	3.0	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 36.6m, Two structures
10	153620	153591	Unknown		48.8	3.0	3.0	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 48.8m, Chainage adjustment, Four structures

APPENDIX G FAUNA CONNECTIVITY SCHEDULE

SECTION	CHAINAGE REFERENCE	DESIGN CHAINAGE	NAME	STRUCTURE NUMBER	LENGTH (M)	WIDTH (M)	HEIGHT (M)	FUNCTIONALITY	FAUNA STRUCTURE TYPE	COMMENTS
10	153900	153882	Unknown	D55	15 (along mainline)			COMBINED	Bridge with fauna furniture beneath	Koala Structure, Previously a dedicated structure
10	154030	154041	Unknown	D56	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath	Koala Structure, Chainage adjustment
10	154770	154738	Unknown		36.6	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Decreased in length from 40m to 36.6m, Chainage adjustment, Lumleys Lane culvert now removed
10	155500	155280	Unknown		36.6	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Decreased in length from 50m to 36.6m, Re-located to avoid opening in private property., Chainage adjustment
10	155950	155920	Unknown		32.94	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure, Decreased in length from 40m to 32.94m, Chainage adjustment
10	156000	155978	Unknown		45			DEDICATED	Single Rope	Glider Structure; length of structure noted is typical road width, Chainage adjustment
10	156300	156263	Unknown	D57	32	2.4	2.4	COMBINED	Bridge with fauna furniture beneath	Koala Structure, Formerly 20m in length along mainline, Chainage adjustment
10	156970	156937	Unknown		36.6	2.4	2.4	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 40m to 36.6m, Chainage adjustment, Two structures
10	157250	157191	Unknown		39.04	2.4	2.4	COMBINED	Culvert with fauna furniture	Koala Structure, Decreased in length from 40m to 39.04m.
10	157630/ CH190 (Not on Mainline on Coolgardie Rd)	157580	Unknown		24.6	3.6	2.4	COMBINED	Culvert with fauna furniture	Koala Structure, Change to dimensions and location. Six structures, On Coolgardie ramp east of mainline approx. Ch190.
10	157780	157745	Unknown		39.4	2.4	2.4	COMBINED	Culvert with fauna furniture	Koala Structure. Insitu raised headwalls required to keep culvert length to 40m, Decreased in length from 40m to 39.4m Chainage adjustment, Three structures
10	157900	157857	North Wardell Viaduct 7: Randles Creek	D10	20 (along mainline)			COMBINED	Bridge with fauna furniture beneath	Koala Structure, Chainage adjustment
11	158900	158868	Unknown		56.12	2.4	2.4	DEDICATED	Culvert with fauna furniture	Koala Structure Chainage adjustment.