



**Transport**  
Roads & Maritime  
Services

# URBAN AND LANDSCAPE PRELIMINARY DETAILED DESIGN

## Nambucca Heads to Urunga upgrade

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# Pacific Highway Upgrade: Nambucca Heads to Urunga

Urban and Landscape Preliminary Detailed Design

**SKM**

**Lend Lease**

**NSW** Government  
**Transport**  
Roads & Maritime  
Services

HBO+EMTB

Prepared for:  
Lend Lease

Prepared by:  
HBO+EMTB Urban and Landscape Design

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## A INTRODUCTION

### A.1 BACKGROUND

The Pacific Highway between Newcastle and Brisbane forms part of the Australian Government's AusLink National Network. The AusLink National Network comprises national, regional and urban transport corridors, links to ports and airports, and intermodal connections between road and rail. The Australian and NSW governments have been jointly upgrading the Pacific Highway since 1996. The Nambucca Heads to Urunga (NH2U) Upgrade project, which is the subject of this report, forms part of the New South Wales (NSW) State and Federal Government's ongoing programme for the upgrading of the Pacific Highway between Hexham and the Queensland border. The NH2U Upgrade is the first stage of the 42 kilometre long Warrell Creek to Urunga (WC2U) project.

The Nambucca Heads to Urunga Upgrade totals approximately 21.6 kilometres (Refer Figure A.1.1). It ties into the existing Pacific Highway just south of a crossing over the North Coast Railway, runs along the western side of the existing highway, west of Nambucca Heads and connects with the Nambucca interchange just south of Boggy Creek. North of the Nambucca interchange, the Upgrade runs alongside the western side of the existing highway before deviating north-west at Boundary Road through Little Newry State Forest and then connecting with a new interchange at Ballards Road. The Proposal then traverses Newry State Forest prior to crossing the Kalang River on a new, approximately 190 metre long, bridge near South Arm Road and approximately 2.7 kilometres west of the existing Pacific Highway. It then runs generally to the north, passing to the east of Ridgewood Drive to rejoin the existing highway east of the Raleigh industrial area before connecting with the existing Waterfall Way interchange.

### A.2 PURPOSE

The Urban and Landscape Plan Report has been prepared to present an integrated urban design for the Nambucca Heads to Urunga project. The Report demonstrates the commitment to the Urban Design Performance and Design Criteria outlined in Appendix 15 - Urban Design Performance and Design Requirements, Appendix 17 - Rest Area Performance and Design Requirements, Appendix 5 - Provisions for Fauna and Appendix 4 - Additional Environmental Requirements.

### A.3 PREPARATION

HBO+EMTB Urban and Landscape Design have prepared this report for Lend Lease Engineering as part of the Design and Construct Services Contract with NSW Roads and Maritime Services (Roads and Maritime). The Urban Design and Landscape Plan (UDLP) has been prepared as required by the Minister for Planning and Infrastructure Conditions of Approval discussed further under Section A.5.

### A.4 NAMBUCCA HEADS TO URUNGA OVERALL PROJECT OBJECTIVES

The following objectives have been identified in Chapter 3 of the Environmental Assessment (EA) documents for the WC2U proposal and form the basis of the NH2U Project as the northern half of that proposal:

Table A.4.1 Objectives

Pacific Highway Upgrade Program Objectives	Warrell Creek to Urunga Proposal Objectives
Significantly reduce road accidents and injuries	<ul style="list-style-type: none"> <li>Develop solutions for the ultimate grade separation of the Pacific Highway and local road intersections including consolidation of accesses by the use of service roads.</li> <li>Provide rest areas within the investigation area.</li> <li>Achieve safe driving conditions on the highway for travel speeds of 110km/h in rural areas and 80km/h in urban areas.</li> </ul>
Improve transport efficiency by reducing travel times and freight costs	<ul style="list-style-type: none"> <li>Have acceptable roadway capacity for traffic volumes 30 years after opening.</li> <li>Develop a dual carriageway road that accommodates all vehicles up to and including B-Doubles.</li> </ul>
Develop a route that involves the community and considers their interests	<ul style="list-style-type: none"> <li>Provide acceptable access to properties.</li> <li>Maintain highway access during flood conditions.</li> <li>Integrate input from local communities into the development of the Proposal.</li> </ul>
Provide a route that supports economic development	<ul style="list-style-type: none"> <li>Provide connections from the upgraded highway to the key centres of (Macksville) Nambucca Heads and Urunga.</li> <li>Develop delay management strategies to minimise disruption to local and through traffic and maintain access to affected properties and land during construction.</li> </ul>
Manage the Program in accordance with ecologically sustainable development principles	<ul style="list-style-type: none"> <li>Provide transport infrastructure that is complementary with surrounding land use.</li> </ul>
Provide the best value for money	<ul style="list-style-type: none"> <li>Ensure the Proposal outcomes achieve value for money.</li> <li>Develop solutions that facilitate the staged construction of the Proposal.</li> </ul>

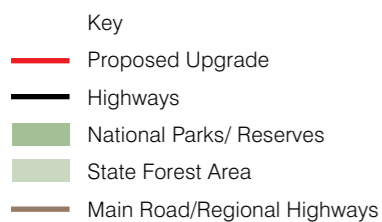


Figure A.1.1 Regional Context

## A.5 MINISTER FOR PLANNING CONDITIONS OF APPROVAL

Following are the Minister's Conditions of Approval (CoA) for the project relating to urban and landscape design. The location where each specific condition is addressed in this Report is noted adjacent to the Minister's Requirement. A new CoA Condition B21 was received on the 19/3/2013 and is included in the table below.

Table A.5.1 Minister for Planning Conditions of Approval

Minister for Planning and Infrastructure Requirement CoA No. B21	Location in Report/Notes
<i>Prior to the commencement of construction (unless otherwise agreed to by the Director General), the Proponent shall prepare and implement an Urban Design and Landscape Plan for the project. The plan shall be prepared in consultation with the relevant Council and shall present an integrated urban design for the project. The plan shall include, but not necessarily be limited to:</i>	This report will form the basis for the information to be distributed for consultation with the relevant Councils.
<i>(a) a principle goal of achieving the urban design objectives outlined in Section 13.4 of Volume 1 of the Environmental Assessment;</i>	Refer Section A.2,C, D, E, F, G, H and I.
<i>(b) sections and perspective sketches</i>	Refer Section D, E and G.
<i>(c) locations along the project corridor directly or indirectly impacted by the construction of the project (e.g. temporary ancillary facilities, access tracks, watercourse crossings, etc.) which are proposed to be actively rehabilitated, regenerated and/ or revegetated to promote biodiversity outcomes and visual integration. Details of species to be replanted/ revegetated shall be provided, including their appropriateness to the area and considering existing vegetation and habitat for threatened species;</i>	Refer Section H generally, H.1.7, H.3.5, H.3.7 Planting and Seeding Schedules. B.7.
<i>(d) location of existing vegetation and proposed landscaping, including use of indigenous and endemic species where possible. The plan shall assess the visual screening effects of existing vegetation and the proposed landscaping at residences and businesses, which have been identified as likely to experience high visual impact as a result of the project. Where high residual impacts are identified to remain, the plan shall in consultation with affected receptors, identify opportunities for providing at-receptor landscaping to further screen views of the project. Where agreed to with the landowner, these measures shall be implemented during the construction of the project;</i>	Refer Section H.1.6.
<i>(e) strategies for progressive landscaping incorporating other environmental controls such as erosion and sedimentation controls, drainage, noise mitigation;</i>	Refer Section H.1.1. Environmental controls are recorded in the erosion and sediment control plans. Noise walls are not required. Refer to Conservation Environment Management Plan (CEMP)

Minister for Planning and Infrastructure Requirement CoA No. B21	Location in Report/Notes
<i>(f) location and design treatments for built elements including retaining walls, cuttings, bridges, and noise barriers;</i>	Refer Section D, E, F and G.
<i>(g) 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, and signs;</i>	Refer Section D.2, E.2, E.2.1, E.2.2 and Section I.
<i>(h) evidence of consultation with the community on the proposed urban design and landscape measures prior to its finalisation; and</i>	Noted - community consultation to be conducted by others in the Project Team. Summary of outcomes will be provided by others to be included in later versions of this Report.
<i>(i) monitoring and maintenance procedures for the built elements and landscaping (including weed control) including responsibilities, timing and duration and contingencies where landscaping measures fail</i>	Refer to Section H.4.
<i>The Plan shall be submitted for the approval of the Director General prior to commencement of construction of the project. The Plan may be submitted in stages to suit the staged construction program of the project. Condition B21: Staged submission granted by the Director General, subject to the following items: – A draft UDLP based on approximately 15% of detailed design for the Nambucca to Urunga stage of the project is to be submitted with the corresponding CEMP. – The final UDLP for the Nambucca Heads to Urunga Stage is to be submitted by close of business 28 February 2014. – Subsequent UDLPs are to be submitted with the CEMP for each respective stage.</i>	This document is the final draft UDLP.

**A.6 METHODOLOGY AND REPORT STRUCTURE**

The methodology is reflected in the report structure. The document is sequentially categorised as follows:

**A Introduction**

- Roads and Maritime Project Objectives
  - » Statement of Roads and Maritime Project Objectives from the EA process.
- Examination of the Minister for Planning Conditions of Approval.
- Reference Sources/ Document Review
  - » A systematic review of Roads and Maritime documents, in particular the EA, and those from other relevant sources to identify the urban and landscape design implications that these documents have upon the overall corridor.

**B Contextual Route Analysis**

- Brief local and regional contextual analysis of the road corridor in terms of built, natural and community constraints and opportunities. Includes site visits, view analysis – from site and detailed desktop review, aerial route alignment overlay to ensure:
  - a. Familiarity with the route and its environmental and landscape context;
  - b. Ability to adequately develop a cohesive and integrated urban and landscape design vision and strategy for the road corridor;
  - c. Establishment of key site parameters impacting on the design development; and
  - d. Consideration of the impact of existing and proposed services on the road corridor.
- Urban and Landscape Design Opportunities and Issues - identification of urban and landscape opportunities and constraints which informed further refinement of the Roads and Maritime Concept Design during the tender design process.

**C Urban and Landscape Design Strategy**

- Statement of an overall vision for the project.
- Statement of urban and landscape design project objectives.
- Development of a cohesive set of urban and landscape design principles for the road corridor that reflect all previous route investigations, other base data gathered and reviewed, the above route appreciation and analysis and consistency with the Roads and Maritime's overall goals and objectives.
- Description of the proposed urban and landscape design treatments by character precinct.
- Presentation of a colour strategy diagram of the project works at 1:20,000 scale.

**D Bridges**

- Presentation of a series of elevations at 1:250 scale to show appropriate level of detail; and
- Cross sectional elevations at 1:150 scale, with supporting text, which fully describes the urban design and landscape aspects of all the following proposed bridges. The bridges are ordered by visibility and type beginning with Transverse Bridges over the Main Carriageway (Overbridges), followed by Main Carriageway Bridges and lastly Underpasses:
  - » Transverse Bridges over Main Carriageway (Overbridges)
    - Bridge over Highway No.10 at Nambucca Interchange;
    - Bridge over Highway No.10 at East West Road;
    - Bridge over Highway No.10 at Ballards Road;
    - Bridge over Highway No.10 at Martells Road;
    - Bridge over Highway No.10 at Local Access Road G; and
    - Bridge over Highway No.10 at Short Cut Road.
  - » Main Carriageway Bridges (Underbridges)
    - Twin bridges over North Coast Railway (Station 61km800);
    - Twin bridges over Boggy Creek (Station 62km750);
    - Twin bridges over Cow Creek (Station 63km650);
    - Twin bridges over Valla Road (Station 64km150);
    - Twin bridges over Deep Creek (Station 64km900);
    - Twin bridges over McGraths Creek Floodplain 1 (Station 71km550);
    - Twin bridges over McGraths Creek Floodplain 2 (Station 71km930);
    - Twin bridges over Dalhousie Creek (Station 73km370 and 73km400);
    - Twin bridges over fauna crossing (Station 74km810);
    - Twin bridges over Kalang River Floodplain 1 (Station 76km950);
    - Twin bridges over Kalang River (Station 77km650);
    - Twin bridges over fauna crossing, northbound at Station 79km860 and southbound at Station 79km910;
    - Twin bridges over Flow Balancing Water Course and fauna crossing (Station 81km880); and
    - Twin bridges over Flow Balancing Water Course and fauna crossing (Station 82km420).
  - » Other Bridges
    - Service Road bridge over Boggy Creek (Station 62km750);
    - Service Road bridge over Cow Creek (Station 63km650); and
    - Service Road bridge over Watercourse and fauna crossing (Station 82km420).
  - » Culverts
    - There are 17 box culvert locations throughout the Upgrade, most of which are fauna underpasses or combined drainage and fauna underpasses. Details are provided in Section D.5.

**E Retaining Wall Structures**

- Presentation of a series of elevations at 1:250 scale to show appropriate level of detail; and
- Cross sections at appropriate scales, with supporting text, which fully describe the urban design and landscape aspects of the project's proposed retaining walls.

**F Rest Area**

- Annotated colour plan of the rest area illustrating the whole rest area and adjacent features and land use;
- Minimum three annotated cross sections through the rest area illustrating the whole road corridor and adjacent land and properties; and
- Minimum two colour photomontages or sketches for the rest area, with at least one taken from an aerial perspective and at least one taken from the main alignment carriageway.

**G Earthworks, Landform and Slope Stabilisation**

- Presentation of dimensioned and annotated cross sections of all significant cuttings and embankments;
- Schedule of finishes and selected illustrations for slope stabilisation;
- Shotcrete Minimisation Methodology covering use and design appearance; and
- Drawings showing the application of shotcrete for rock seam stabilisation.

**H Landscape Design**

- Presentation of a series of colour Landscape detailed design plans overlaid on an aerial photographic base at 1:4,000 scale illustrating the detailed urban and landscape design.
- Plant Palette - Pictures illustrating the proposed species of Trees, Shrubs, Groundcovers, Tussocks, Grasses and Sedges.
- Existing Vegetation Strategy and Principles
  - » Strategy and principles to minimise clearing extents;
  - » Strategy and principles to maximise retention of existing vegetation;
  - » Methodology to protect existing vegetation.
- Planting and seeding schedules
  - » Planting area information in tabulated form; and
  - » Seeding area information in tabulated form
- Seed Collection
  - » Programme and method for seed collection
- Draft Landscape Management Report

**I Road Furniture**

- » Road Lighting - Description and images
- » Rest Area Lighting - Description and images



## A.7 DESIGN REFERENCE SOURCES, DESIGN CRITERIA AND REVIEW DOCUMENTS

The urban and landscape design has been developed on the basis of the NH2U Scope of Works and Technical Criteria (SWTC) Project Approval documents and the guidelines and reference documents as listed below. In particular the following Appendices from the SWTC:

- Appendix 15 - Urban Design Performance and Design Requirements.
- Appendix 17 - Rest Area Performance and Design Requirements
- Appendix 5 - Provisions for Fauna
- Appendix 4 - Additional Environmental Requirements

The design complies with the SWTC and will be developed during the design development process to minimise areas of noncompliance, if any. A Design Criteria Compliance Register has been included in Appendix 1.

The following documents and their principles in particular, have been utilised during the design process:

- Pacific Highway Urban Design Framework – Urban design guidelines for the SH10 from Hexham to Tweed Heads, RTA, April 2005.
- Beyond the Pavement - RTA urban design policy, procedures and design principles, RTA, July 2009.
- Bridge Aesthetics – Design Guidelines to Improve the Appearance of Bridges in NSW, RTA, July 2012.
- Noise wall design guideline – Design guidelines to improve the appearance of noise walls in NSW, RTA, November, 2006.
- Landscape guideline – Landscape design and maintenance guidelines to improve the quality, safety and cost effectiveness of road corridor planting and seeding, RTA, April 2008.
- Shotcrete Design Guidelines - Design guidelines to avoid, minimise and improve the appearance of shotcrete – RTA, June 2005.
- Designing to Minimise Vandalism (Final Draft), RTA, November 2008.
- Procedure for Selecting Treatment Strategies to Control Road Runoff Version 1.1 – RTA, June 2003.
- Guidelines for Treatment of Stormwater runoff from the Road Infrastructure – AUSTRROADS, 2003.
- AUSGRID Network Standard NS179 Vegetation Safety.
- Soil Landscape Series: Sheet 9436, Macksville – Nambucca; Sheet 9537, Coffs Harbour; and Sheet 9437, Dorrigo - NSW Department of Land and Water Conservation, 2000.
- Warrell Creek to Urunga Environmental Assessment, Volume 1 and 2, NSW Roads and Traffic Authority, January 2010.
- Warrell Creek to Urunga Pacific Highway Upgrade Working Paper 2 – Urban And Regional Design.
- Landscape and Visual Assessment, DEM with Sinclair Knight Merz January 2010.
- Project Approval file No. S02/01634, Minister for Planning and Infrastructure, 19 July 2011.

## B URBAN AND LANDSCAPE DESIGN CONTEXT ANALYSIS

The purpose of this section of the report is to:

- Confirm the overall urban and landscape design approach established in the project EA by way of confirmation mapping and identification of design issues.
- Present additional relevant information gained through our investigation of the route.
- Synthesise key elements and issues for the urban and rural landscape that need to be addressed in the development of the overall design principles and concept design for the road corridor.

### B.1 REGIONAL ROUTE CONTEXT

The Pacific Highway is the major eastern coastal route linking Sydney to Brisbane and functions as a major tourist, transport and freight route. The NH2U project is located in the Mid North Coast Region of NSW which extends from Port Macquarie to Coffs Harbour. The southern portion of the project lies within the Nambucca Shire Council local government area and the northern portion within the Bellingen Shire Council local government area. The coastal township of Nambucca Heads lies just to the southeast of the southern extent of the project. The existing highway and the proposed Upgrade pass just to the west of the smaller settlement of Valla Beach. At the northern end of the project the new alignment bypasses Urunga to its west.

To the north of the project and south of Coffs Harbour are the completed Raleigh deviation and the Bonville upgrade. Immediately to the south of the Upgrade is the proposed WC2N upgrade and further south the existing Allgomera deviation, the proposed Frederickton to Eungai Upgrade and the new Macleay River Floodplain Bridge.

The RTA Pacific Highway urban design framework (2005) describes the road user experience of the Pacific Highway and in particular the area of the Nambucca Heads to Urunga Upgrade as:

*“While providing access to the Pacific Coast the highway has very few views of the Pacific Ocean and is probably more accurately characterised by the mountains and foot hills of the Great Dividing Range to the west of the highway as well as the broad rivers that cross the floodplains between the mountains and the ocean ... it is the connection to the hills, mountains and rivers that provides a strong identity to the Pacific highway (p.17)...South of Coffs Harbour, the mountains, although visible, again recede into the distance.” (p.20)*

Travelling from south to north, the Nambucca Heads to Urunga Upgrade emerges from the Nambucca State Forest to the west of Nambucca Heads, where an interchange provides access to the township and planned rural residential and industrial areas in the vicinity of Boggy Creek. The alignment then traverses a mix of undulating semi-open rural areas, agricultural land and dense areas of remnant vegetation interspersed with scattered pockets of rural residential development. This section of the route also includes crossings of the Deep Creek floodplain and other creeks and watercourses. Intermittent views of Picket Hill and other spurs from the Great Dividing Range are seen to the north and west. Approximately at the midpoint of the Proposal and just south of Ballards Road, where another interchange connects to Valla Beach and vicinity, the alignment turns northwest and away from the existing Pacific Highway to traverse Newry State Forest, where the terrain is steeper and heavily forested. It then emerges from the forest to cross the Kalang River and associated floodplain, with westerly views again to hills and escarpments, before traversing the eastern edge of Tarkeeth State Forest, to the west of Urunga. The new highway then skirts the eastern edge of the Raleigh industrial area before joining the existing highway upgrade at the Waterfall Way interchange, which provides access to Urunga and Bellingen.

### Issues/Opportunities

- Recognise and strengthen the legibility of the mid coast region urban and rural structure through particular urban and landscape design treatments of the approaches and exits to Nambucca Heads, Valla Beach and Urunga.
- Provide design consistency with the recently completed upgrade to the Pacific Highway at Bonville.
- Enable views, where practicable, from the foothills of the Great Dividing Range and the open floodplains and swamp areas.
- Ensure that the Landscape Design Strategy responds to the changes in character along the alignment.

### B.2 LAND USE + LANDSCAPE CHARACTER + HERITAGE ITEMS

#### B.2.1 Land Use Character

Land use in the vicinity of the Upgrade is diverse and includes industrial development, rural residential development, agriculture and bushland/forest. Agriculture, primarily cattle grazing, occurs on the pasture lands along the southern portion of the route and on the Kalang River floodplain. Limited plantation areas are located in the vicinity of East West Road. Scattered areas of remnant forest in the south give way to state forests to the south and north of the Kalang River. The existing Raleigh Industrial Area lies just to the west of the alignment at the northern end of the project.

Coastal urban settlements lie to the east of the Upgrade: Nambucca Heads at the southern end, the smaller settlement of Valla Beach at about the midpoint of the route and Urunga at the northern end.

Nambucca Shire Council's 20 year Structure Plan, November 2006–2026, identifies Boggy Creek as a proposed future town centre. This includes a proposed area dedicated to heavy industry, bulky goods and inter-modal transport. The location of the proposed industrial component is on both sides of the Pacific Highway, north of Nambucca Heads. The proposed industrial area starts where the Proposal crosses the existing North Coast Railway line and extends on the western side of the existing Pacific Highway until Deep Creek. The area to the immediate east of this, around Cow Creek is proposed as rural residential land.

Bellingen Shire Council has identified the South Arm Road scenic road landscape as an area of high scenic value.

#### B.2.2 Heritage

The Warrell Creek to Urunga study area was originally occupied by groups of Kumbainggiri (Gumbainggirr or Gumbaynggirr) and Jaiku (Ngaku) speaking people. No declared Aboriginal Places exist within the assessment area. As part of the EA research, registered cultural sites and newly identified cultural areas were identified. These areas include Boggy Creek spiritual area and Cow Creek Aboriginal Reserve. Numerous areas of potential archaeological sensitivity (PAS) and potential archaeological deposits (PADs) were also identified as being within the Proposal corridor. In total, 14 sites resulted from archaeological investigations (survey and excavation) across the assessment area and were assessed for heritage significance. Extensive consultation with the local Aboriginal communities has also assisted with the development of mitigation and management measures, and the outstanding impacts are generally perceived by the local Aboriginal community to be acceptable. Known and potential impacts associated with the construction of the Proposal will be managed through a heritage management sub-plan. This sub-plan will be developed in consultation with the Department of Planning and Infrastructure (DoPI), the Office of Environment and Heritage (OEH) and the relevant Aboriginal community stakeholders.

According to the EA Report, there are no listed European heritage items (items or places currently listed on statutory heritage registers) located within the Warrell Creek to Urunga study area. There are, however, eight items located within the Nambucca Heads to Urunga portion of the study area that are considered to be of potential local heritage significance, including the Cow Creek Aboriginal Reserve and South Arm Road Conservation Area. For items where the potential for adverse impacts has been identified, a Statement of Heritage Impact (SOHI) has been prepared to determine their heritage significance and to assist with development of management and mitigation measures. Of the eight items identified above, six are considered susceptible to direct or indirect construction impacts. Impact mitigation and management measures are proposed for some of these, ranging from preparation of archival records prior to demolition to special appropriate landscaping treatments at South Arm Road at the Kalang River.

### Issues/Opportunities

- Incorporate interpretation signage at the Rest Area that explains the cultural heritage significance and/or history of the surrounding area. This may include information on the traditional landowners, indigenous heritage archaeological sites in the vicinity and key aspects of European settlement.



### B.3 TOPOGRAPHY + GEOLOGY + SOIL LANDSCAPES

Refer to Figure B.3.1 and B.3.2– Topography, Geology and Soil Landscapes

The Warrell Creek to Urunga (WC2U) Environmental Assessment identifies two major geological terrain types across the study area: the alluvial floodplains at major waterway crossings, and the foothills of the coastal ranges. The topography of the floodplains comprises flat to gently sloping coastal plains and river terraces, with estuarine mud flats. Floodplain geology consists of Quaternary alluvial and estuarine soils up to about 15 to 35 metres thick. Soils are Alluvial/estuarine: sands, silts, clays, organic clays, possible gravels, expected to be potential acid sulphate soils. The topography of the floodplains comprises gently to moderately undulating hills, with wide river valleys and creeks. Floodplain geology consists of Nambucca Beds (schists and phyllites), with some granite intrusions and local granodiorite dykes.

The following soil landscape types (with a description of their landscape and soils characteristics) directly underlie the new road:

- **Newry** – gently undulating rises to low hills on Bellingin Slates. Local relief less than 30m, slopes between 5-20%, elevation between 5-40m, partially cleared, tall open-forests. Deep soils (greater than 1500mm) comprising moderately well-drained Red Podzolic soils and Brown Podzolic soils on crests and slopes, deep moderately well-drained Brown Podzolic soils and structured Red Earths on lower slopes. Strongly acid soils with low to moderate fertility, high aluminium toxicity potential, high topsoil organic matter, low topsoil/shallow subsoil wet bearing strength and slow subsoil permeability. High water erosion hazard, high run-on (localised).
- **Pine Creek** – undulating to rolling low hills to hills on Permian metasediments in the southern Gleniffer-Bonville Hills and the Bellinger Valley. Local relief up to 50m, slopes 10-33%, elevation 5-60m, Partially to extensively cleared, tall open-forest. Deep soils (greater than 1500mm) comprising moderately well-drained, structured Brown Earths, and Yellow Earths on crests and slopes, with deep, moderately well-drained Brown Podzolic Soils and yellow Podzolic Soils on steeper slopes. Strongly to very strongly acid soils with moderately low to low fertility, high aluminium toxicity potential, high topsoil organic matter, low topsoil/shallow subsoil wet bearing strength, and slow subsoil permeability. High water erosion hazard, high run-on (localised), steep slopes (localised).
- **Nambucca River** – floodplain and adjacent terraces on Quaternary alluvium along Kalang River. Level to undulating, narrow floodplain with narrow to moderately broad, braided channel and narrow to moderately broad terrace surfaces with minor depressions, drainage lines and small intermittent swamps. Local relief less than 10m, slopes 0-5%, often to 33% or greater on terrace edges, elevation less than 100m. Completely cleared tall closed-forest. Deep soils (greater than 1500mm) consisting of well-drained Brown Earths on floodplains, with deep, rapidly drained Brown Earths on point bars and deep, moderately well-drained Brown Earths on terraces. Soils of low wet bearing strength, high subsoil erodibility, high subsoil stoniness and low subsoil plant available water capacity. High stream bank erosion hazard, high run-on, high foundation hazard, flood hazard (localised) and seasonal waterlogging (localised)
- **Raleigh** – long, narrow, curved fluvial levees and scrolls on the meander plain of the tidal Bellinger and Kalang Rivers. Local relief 1-5m: elevation less than 10m; slopes generally less than 2% on upper surfaces, up to 33% on sideslopes. Deep soils (greater than 1500mm) comprising moderately well-drained to poorly drained Earth Sand, alluvial loams, alluvial clays, Yellow Podzolic Soils and Gleyed Podzolic Soils. Strongly acid soils with high aluminium toxicity potential, low to very low wet bearing strength, high erodibility and low subsoil fertility, high water erosion hazard (localised along banks of major rivers), flood hazard (localised), seasonal waterlogging (localised), foundation hazard (localised).

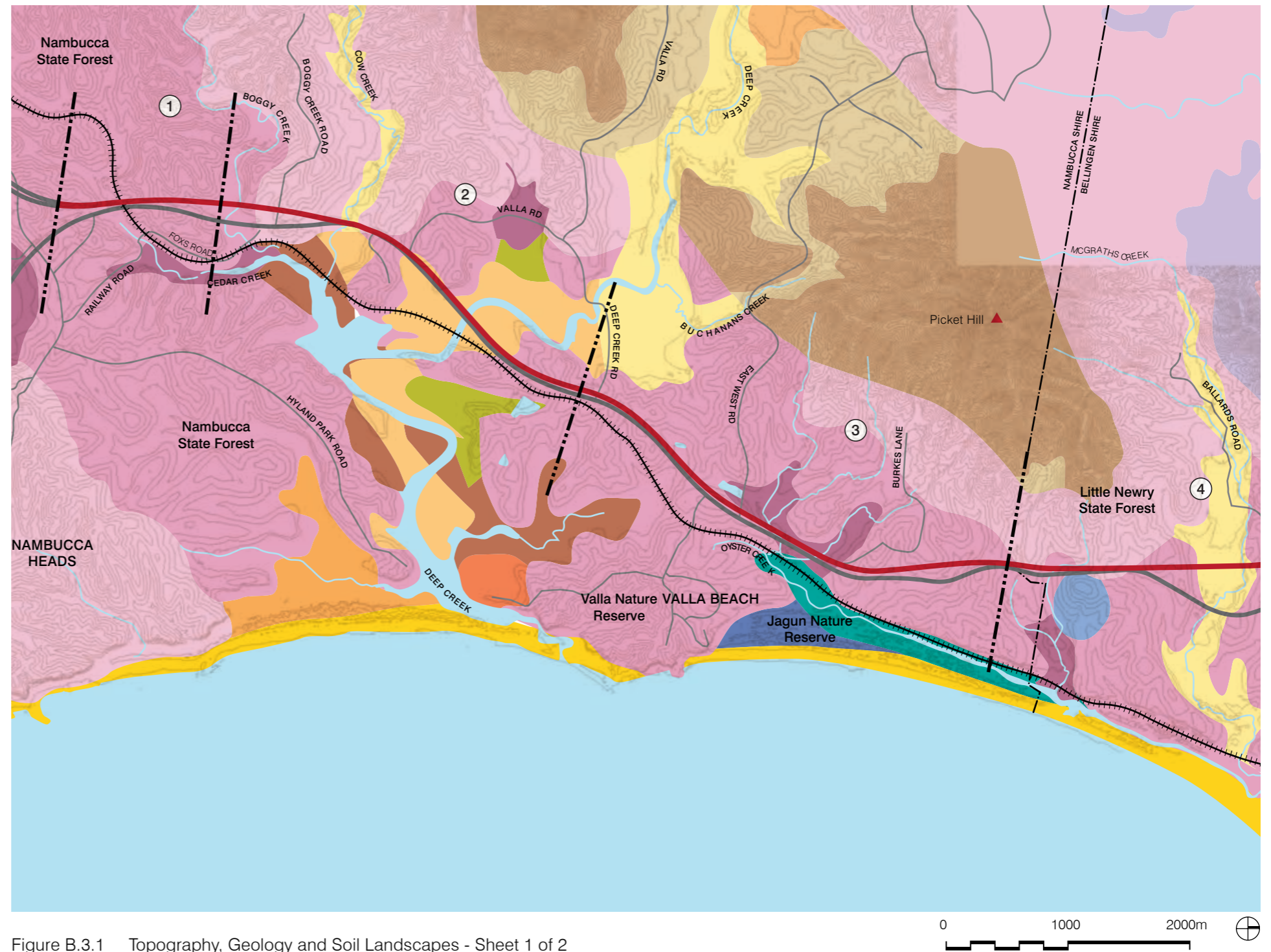


Figure B.3.1 Topography, Geology and Soil Landscapes - Sheet 1 of 2

- **Bowra Creek** – narrow, often slightly convex alluvial fans and footslopes grading to open depressions, below erosional landscape on the Nambucca Beds. Slopes 1-5%, very low relief (less than 5m), low elevation (5-50m), open swamp sclerophyll forests, often cleared for pastures. Soils are imperfectly drained, 1000-2000mm, Haplic Yellow or Brown Kandosols (Yellow or Brown Earths) in fans and in drainage depressions with Mottled Grey or Yellow Kurosols (Gleyed Podzolic Soils) on footslopes. Soils with low wet bearing strength, organic topsoils, sodicity/dispersibility, low permeability, hardsetting surface, strong acidity, aluminium toxicity potential, low fertility. Poor drainage, high run-on, localised flood hazard, potential groundwater discharge, seasonal waterlogging, groundwater pollution hazard, gully erosion hazard, foundation hazard.
- **Charlmont** – broad, flat to gently inclined, occasionally elongated swampy floodplains and backplains along lower intertidal reaches of the Bellinger and Kalang Rivers. Local relief less than 10m, slopes less than 2%, elevation less than 10m, almost completely cleared closed- scrub, open-scrub and herbland. Deep soils (greater than 2000mm) comprising, poorly drained Yellow Podzolic Soils, structured plastic clays and Gleyed Podzolic Soils. Strongly to extremely acid, sodic, saline soils with high aluminium toxicity potential, high organic matter, low to very low wet bearing strength and slow subsoil permeability. Flood hazard, waterlogging, permanently high watertables, high to severe foundation hazard, high to severe acid sulfate soil hazard, high to severe foundation hazard.



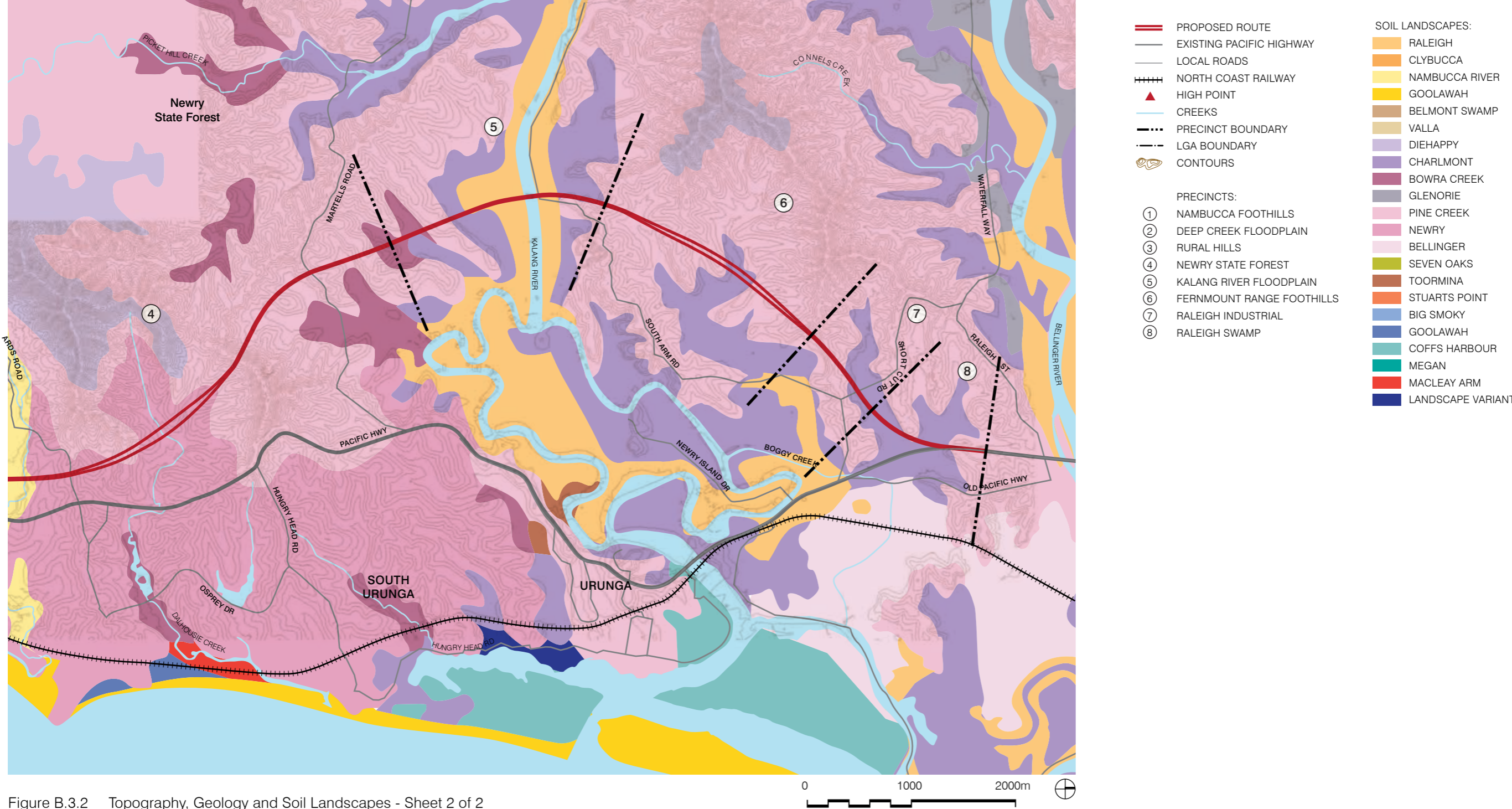


Figure B.3.2 Topography, Geology and Soil Landscapes - Sheet 2 of 2

**Issues/Opportunities**

- Traversing the slopes and foothills means changes in heights which have implications in the design of the vertical road alignment and in minimising cuts.
- Traversing the floodplains and swampland above the specified flood level means the vertical road alignment must be located on fill embankments. Relief structures (bridges and culverts) are required in the embankments to avoid localised flooding.
- Dramatic topography of the Great Dividing Range provides a diverse travelling experience and views and vistas, travelling from the low coastal floodplains and over the higher elevation of the lower slopes of the Great Dividing Range.
- Maintaining and enabling views are an important landscape design consideration.

- The undulating hills require some significant cuttings. The largest of these is at Station 74km350 and is 28 metres in depth. Other significant cuttings include: Station 76km000 - 11 metres in depth, Station 78km500 - 20 metres in depth, Station 76km760 - 10 metres in depth.
- The floodplains require embankments. Considering both length and height, the largest embankment is at Station 61km700 and is 13 metres in height. Other significant embankment include: Station 77km600 - 7 metres in height, Station 64km800 - 4 metres in height, Station 66km200 - 7 metres in height.
- Topography influences the vegetation communities that the alignment passes through.
- The soils of the Deep Creek and Kalang River floodplains are characterised as being soft soils and will influence construction techniques.

- The water in the floodplain soils will impact on the selection of suitable landscape species.
- As soils are tied to particular plant communities, it is important that soil types remain in locations that they are stripped from.
- High soil acidity will require soil amelioration.
- There is likely to be a high percentage of seed stock in the soil, therefore, soil needs to be managed appropriately - i.e. stockpiled, mixed through, covered and so on.
- There is a potential risk of acid sulfate soils in the floodplain areas.
- The disturbance and exposure of soils, in particular within or immediately adjacent to drainage lines and waterways, is recognised as one of the potential main environmental risks to the integrity of local water quality.



## B.4 WATERCOURSES + WETLANDS + VEGETATION COMMUNITIES + FAUNA

Refer to Figure B.4.1 and B.4.2 – Watercourses, Wetlands, Vegetation Communities and Fauna.

The highway upgrade includes seven drainage/ watercourse crossings of which two are significant estuarine systems – Deep Creek and the Kalang River. At the northern end of the project the new alignment is located in the vicinity of two wetlands designated under State Environmental Planning Policy 14. The Upgrade passes approximately 70 metres from Wetland Number 351 and Wetland Number 353. These wetlands are not impacted.

### A.8.5 Vegetation Communities + Fauna

Refer to Figure B.4.1 and B.4.2 – Watercourses, Wetlands, Vegetation Communities and Fauna.

The Upgrade corridor and its context contain a diversity and richness of flora and fauna species and communities, despite the area being heavily modified through land clearing, timber logging, agricultural activities and rural residential development. Generally there are two landscape types:

- the alluvial floodplains of the Kalang River and smaller creeks such as Deep Creek, Boggy Creek and Oyster Creek, where only fragments of endemic vegetation remain; and
- the Ingalba Coastal Hills, rising above the floodplains, with remnant forested areas dominated by dry sclerophyll forests with moist sclerophyll forests in gullies. Logging in the State forests traversed by the Upgrade is most evident within the vicinity of tracks and forestry roads. In steep sloping creek and riparian areas some remnant tree cover has been retained as creek buffers with fewer disturbances.

There are eight main Vegetation Communities along the Upgrade corridor, with four listed as Endangered Ecological Communities (EEC) under the NSW Threatened Species Conservation Act:

- Blackbutt Dry Sclerophyll Forest
- Mixed Floodplain Forest (EEC)
- White Mahogany/Grey Gum/Ironbark Open Forest
- Flooded Gum Open Forest
- Swamp Mahogany/Paperbark – Swamp Forest (EEC)
- Swamp Oak – Swamp Forest (EEC)
- Freshwater Wetland (EEC)
- Lowland Rainforest (EEC)

Little Newry and Newry State Forests comprise three main types of vegetation communities:

- Dry sclerophyll forest, comprising mainly black butt, grey gum, tallowwood, white mahogany, ironbark and pink bloodwood
- Wet sclerophyll forest, comprising mainly Black Butt, Tallowwood, Flooded Gum, Grey Ironbark, Pink Bloodwood, Red Mahogany, Turpentine, Brush Box, Ironbark and Pink Bloodwood
- Rainforest, comprising mainly Flooded Gum, Brush Box and dense sub-canopy of rainforest species

Significant tracts of land within the Project Area, particularly south of Ballards Road and on the Kalang River floodplain have been cleared for agricultural purposes.

Of the 12 threatened native flora species with the potential to be located in the project corridor, two were specifically identified in the Environmental Assessment documents:

- *Marsdenia longiloba* (Slender Marsdenia)
- *Niemeyera whitei* (Rusty Plum)

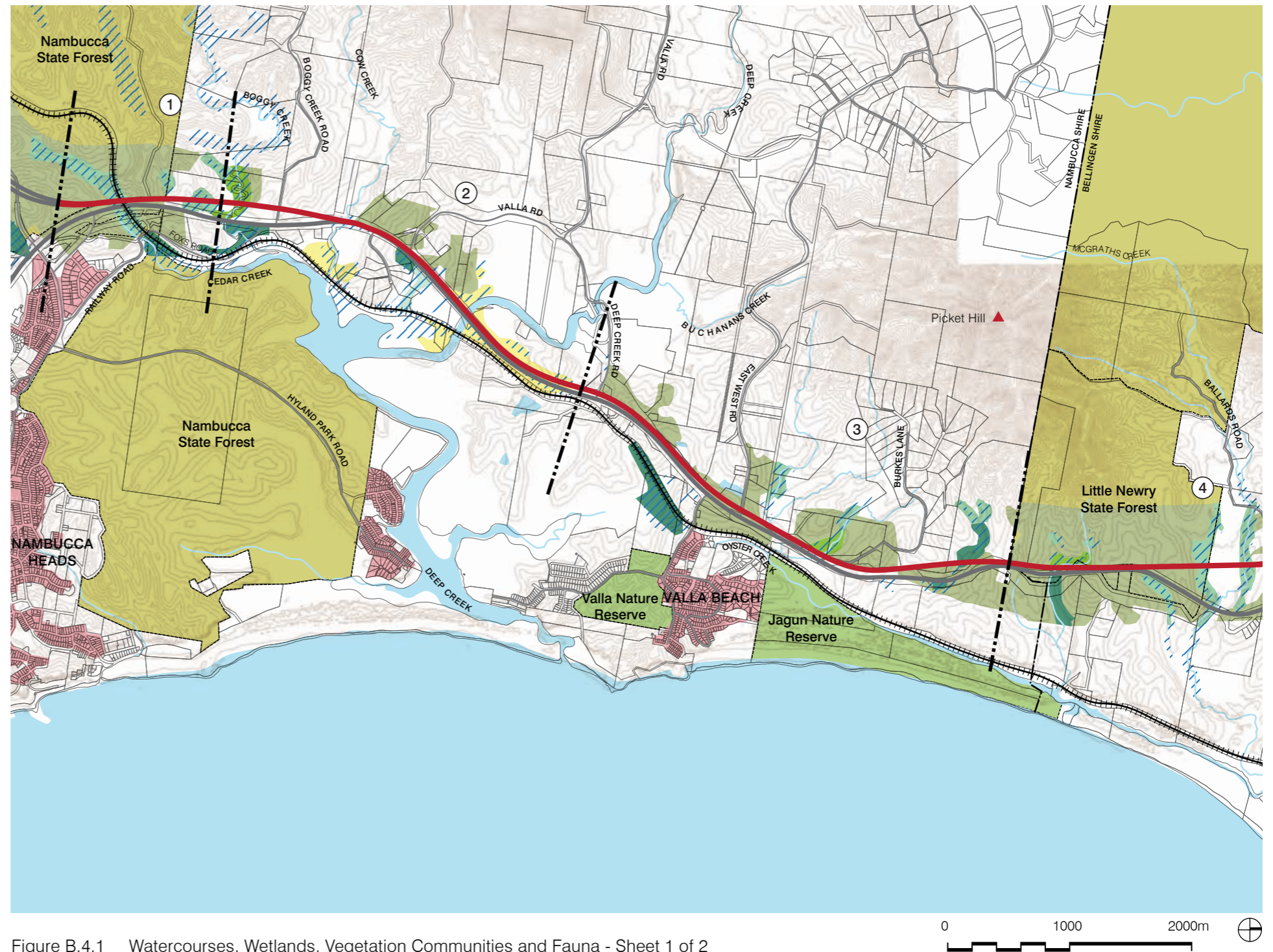


Figure B.4.1 Watercourses, Wetlands, Vegetation Communities and Fauna - Sheet 1 of 2

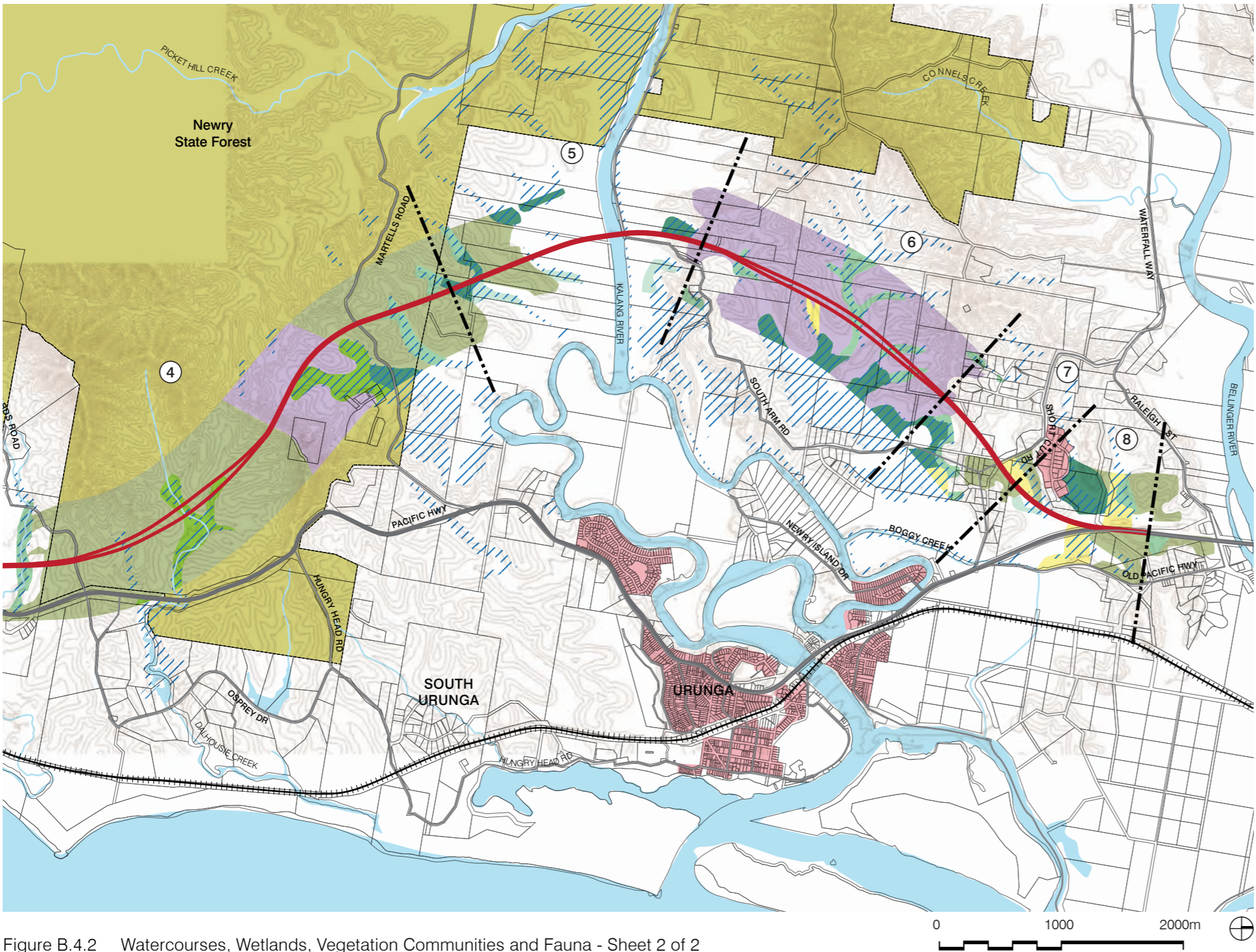
A further flora survey conducted by Roads and Maritime has identified 11 individuals of Spider Orchid (*Dendrobium melaleuca*), 57 individuals of Koala Bells (*Artemisia fimbriatum*), 6 individuals of Fords Goodenia (*Goodenia fordian*) and 1 individual of Wool's Tylophora (*Tylophora woolsii*).

Slender Marsdenia is designated as Vulnerable under Commonwealth legislation and Endangered under the NSW TSC Act. Rusty Plum is listed as Vulnerable under the NSW legislation. The Environmental documents identify in particular the potential for significant impacts on Marsdenia longiloba (Slender Marsdenia). The mitigation measures proposed to be implemented in order to minimise the impacts on Marsdenia longiloba and other threatened flora include the protection and relocation of individual plants within the road corridor during the construction of the Proposal where feasible.

Fourteen threatened fauna species were confirmed as present in the study area in the Environmental Assessment process:

- Green-thighed Frog (*Litoria brevipalmata*)
- Giant Barred Frog (*Mixophyes iteratus*)
- Black-necked Stork (*Ehippiorhynchus asiaticus*)
- Yellow-bellied Glider (*Petaurus australis*)
- Koala (*Phascolarctos cinereus*)
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*)
- Square-tailed Kite (*Lophotinia isura*)
- Osprey (*Pandion haliaeetus*)
- Little Bentwing-bat (*Miniopterus australis*)
- Eastern Bentwing-bat (*Miniopterus schreibersii*)





- PROPOSED ROUTE
- EXISTING PACIFIC HIGHWAY
- LOCAL ROADS
- NORTH COAST RAILWAY
- HIGH POINT
- CREEKS
- PRECINCT BOUNDARY
- LGA BOUNDARY
- NATIONAL PARKS
- STATE FORESTS
- ENDANGERED ECOLOGICAL COMMUNITY (EEC)
- URBAN AREA
- VEGETATION COMMUNITIES:
  - BLACKBUTT DRY SCHLEROPHYLL FOREST
  - MIXED FLOODPLAIN FOREST (EEC)
  - WHITE MAHOGANY/GREY GUM/IRONBARK OPEN FOREST
  - FLOODED GUM OPEN FOREST
  - SWAMP MAHOGANY/PAPERBARK - SWAMP FOREST (EEC)
  - SWAMP OAK - SWAMP FOREST (EEC)
  - FRESHWATER WETLAND (WET MEADOW) (EEC)
  - LOWLAND RAINFOREST (EEC)
- PRECINCTS:
  - ① NAMBUCCA FOOTHILLS
  - ② DEEP CREEK FLOODPLAIN
  - ③ RURAL HILLS
  - ④ NEWRY STATE FOREST
  - ⑤ KALANG RIVER FLOODPLAIN
  - ⑥ FERNMOUNT RANGE FOOTHILLS
  - ⑦ RALEIGH INDUSTRIAL
  - ⑧ RALEIGH SWAMP

**Issues/Opportunities**

- Retain and enhance riparian plantings at creek crossings where possible.
- There is a diversity of plant species available for use in re-vegetating creek edges and detailing water quality basins.
- Managing impacts on wetland systems will be important to ensure no decline in water quality. Water quality issues at creeks will need to be taken into account in the design of water quality basins as well as managed during construction.
- The sections of the alignment in the vicinity of Deep Creek and the Kalang River are on embankment due to flooding issues.
- There are no direct impacts on SEPP14 Wetlands.
- The Landscape plan will need to ensure that areas disturbed by Project Works are replanted with species which reflect endemic communities.
- Plant communities should be designed to reinforce the adjacent landscape character and link bushland remnants where possible.
- The planting palette will reinforce, re-establish and supplement existing vegetation communities where appropriate.
- Utilise dominant species from vegetation communities through which the alignment passes.
- Avoid use of the *Acacia* spp. in planting mixes.
- Utilise sedges in ground covers.
- Species mixes need to reflect the local natural species.
- Planting in the corridor is to avoid weed introduction and spread within existing vegetation areas.
- Impacts on native vegetation communities occur throughout the upgrade.
- Seven threatened species including *Niemeyera whitei* and *Marsdenia longiloba* would require translocation in accordance with Appendix 14 Warrell Creek to Urunga Upgrade Threatened Plant Species Management Plan of the SWTC.
- Artificial habitat for the Green-thighed Frog in the form of frog ponds will be provided in the road reserve.
- The proposed project incorporates a number of fauna mitigation measures to cater for fauna corridor areas - fauna underpasses (bridges and culverts), glider crossings and fauna exclusion fencing. Integration of fauna fencing and landscaping will be an important design detail.

Figure B.4.2 Watercourses, Wetlands, Vegetation Communities and Fauna - Sheet 2 of 2

- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Yellow-bellied Sheath-tail bat (*Saccolaimus flaviventris*)
- Wompoo Fruit-dove (*Ptilinopus magnificus*)
- Powerful Owl (*Ninox strenua*)

The Upgrade design includes elements such as fauna underpasses to manage impacts on fauna.

The Proposal would result in the loss of significant areas of native vegetation including wetlands and mangroves. Habitat compensation and rehabilitation measures would be developed in consultation with the EPA during the detailed design phase of the project in order to mitigate anticipated habitat fragmentation and wildlife corridor impacts. The Environmental Assessment concludes that: "There is unlikely to be significant residual impacts associated with the construction and operation of the Proposal, following the adoption of the proposed mitigation and management measures identified in this environmental assessment".



## B.5 VIEWS + SITE PHOTOS ANALYSIS + URBAN AND LANDSCAPE CHARACTER PRECINCTS

Refer to Figure B.5.1 and B.5.2 – Views, Site Photo Analysis + Urban and Landscape Character Precincts.

Eight character precincts have been identified in total along the highway upgrade.

The summary Views, Site Photos Analysis and Urban and Landscape Character Precincts diagram (Figures B.5.1 and B.5.2) documents the following existing visual character and potential views and vistas, including the photos on the preceding pages, with a description of each precinct as follows:

### Precinct 1: Nambucca Foothills

This short precinct is located at the southern end of the Upgrade and comprises forest areas with some open pastureland to the west of the corridor. The Nambucca Heads Interchange is proposed at the northern end of the precinct. Photo 1 looks south to the point in the distance and to the right of the existing highway where the new alignment crosses the North Coast Railway. Travelling north and looking along the new highway there will be intermittent views to Picket Hill and spurs from the Great Dividing Range. Similar views are expected from the Interchange and nearby Rest Area.

### Precinct 2: Deep Creek Floodplain

Boggy Creek, Cow Creek and Deep Creek all lie within this precinct, which is characterised by gently undulating terrain and open pasturelands interspersed with forested areas. Photo 2 looks south along the existing highway to Boggy Creek. The new twin bridges of the Upgrade are located to the west (right of Photo 2). Photo 3 is a view to the west of the existing highway looking towards the proposed alignment north of the rest area. Photo 4 looks west on Boggy Creek Road from the new alignment and Photo 6 west on Valla Road. Views to the south of Deep Creek are shown in Photos 7 and 8. The new twin bridges over Deep Creek will be located to the centre and right of Photo 7. With the new carriageways elevated on embankments to cross Deep Creek, intermittent views of the floodplain will be generally available, with more extensive views to the pasturelands to the west from the bridge and northern approach.

### Precinct 3: Valla Rural Foothills

Continuing undulating terrain and a greater extent of bushland characterise Precinct 3. Photo 9 looks west on Deep Creek Road, with the alignment running across the view in the foreground. Photo 10 is a view on East West Road looking east to the existing highway in the background. The Upgrade will cross the image just beyond the water body. Photo 12 is a view south with the existing highway in the foreground. The Upgrade and a new service road connecting to Burke's Lane are located beyond the existing road. Photo 13 looks east from the existing and new alignments to open fields and rural residences. Views from the Upgrade in this precinct will occur just to the south of East West Road and encompass the plantations to the west.

### Precinct 4: Newry State Forest

In this precinct the Upgrade departs from the existing highway and travels north west through State Forests. The terrain is steeper and the dense vegetation will create a strong sense of enclosure for travellers on the new highway. Photos 14, 15 and 16 are located at Ballards Road where a full interchange is proposed and 17, 18 and 19 are at Martells Road where the new main carriageways are in cut and Martells Road passes over them. Views from the highway in this precinct are limited to the McGraths Creek floodplain.

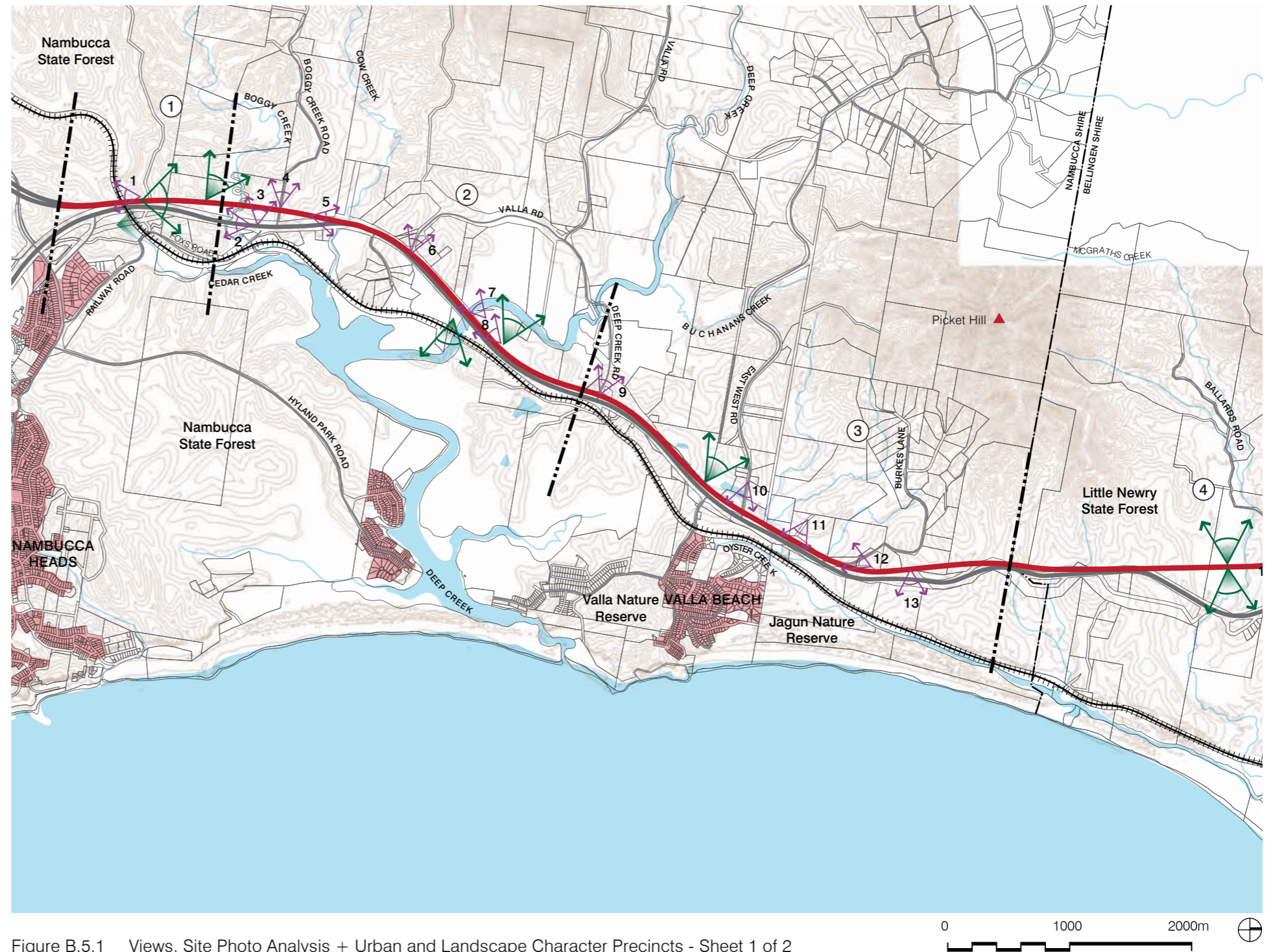


Figure B.5.1 Views, Site Photo Analysis + Urban and Landscape Character Precincts - Sheet 1 of 2

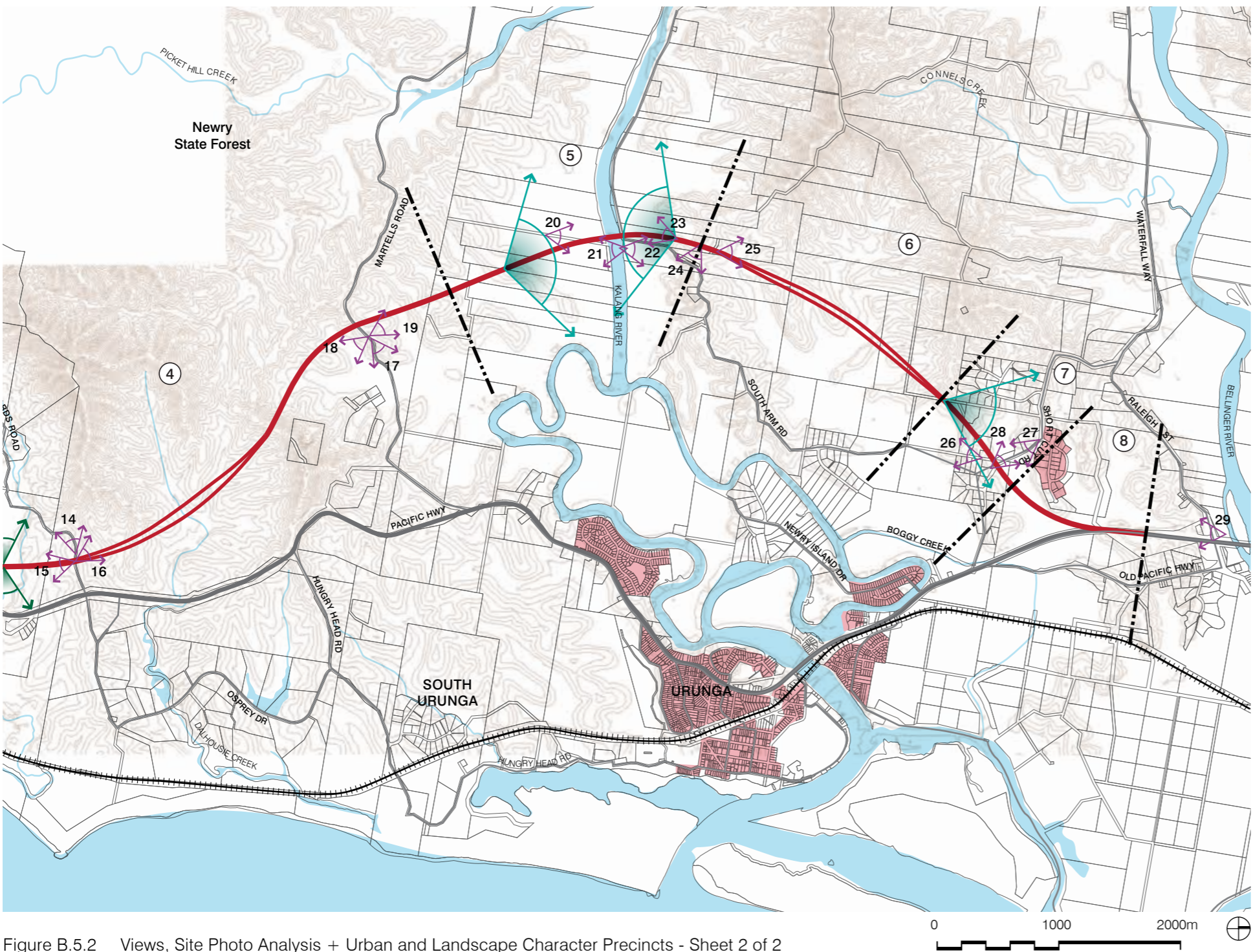
### Precinct 5: Kalang River Floodplain

The flat and open character of the Kalang River floodplain and the location of the new carriageways on fill embankments will offer extensive views from the highway, but also make the Upgrade highly visible from its surroundings. Photo 20 looks north along a local access road as it leaves Newry State Forest. The Upgrade will emerge from the forest on the far right of the photo and cross the river at about the distant endpoint of the local road. The approximate crossing point of the new twin highway bridges is shown in Photo 21. Photo 22 looks northeast across the floodplain and Photo 23 looks south and west across the floodplain to Picket Hill and spurs from the Great Dividing Range. The most impressive views from the Upgrade will occur in this precinct, with the river and pasturelands in the foreground and middle distance and the distant hills providing a scenic backdrop.

### Precinct 6: Fernmount Range Foothills

In this precinct the terrain is again steep and the route is heavily forested. Photo 25 looks east along a service road which will pass over the main carriageways. Deep cuttings and dense vegetation will give this precinct a strong sense of enclosure and prevent distant views from the Upgrade.





- PROPOSED ROUTE
  - EXISTING PACIFIC HIGHWAY
  - LOCAL ROADS
  - NORTH COAST RAILWAY
  - HIGH POINT
  - CREEKS
  - PRECINCT BOUNDARY
  - LGA BOUNDARY
  - URBAN AREA
  - PHOTOGRAPH LOCATION
  - VIEWS
  - SIGNIFICANT VIEWS
- PRECINCTS:
- ① NAMBUCCA FOOTHILLS
  - ② DEEP CREEK FLOODPLAIN
  - ③ VALLA RURAL FOOTHILLS
  - ④ NEWRY STATE FOREST
  - ⑤ KALANG RIVER FLOODPLAIN
  - ⑥ FERNMOUNT RANGE FOOTHILLS
  - ⑦ RALEIGH INDUSTRIAL ZONE
  - ⑧ RALEIGH SWAMP

Figure B.5.2 Views, Site Photo Analysis + Urban and Landscape Character Precincts - Sheet 2 of 2

**Precinct 7: Raleigh Industrial Zone**

This short precinct encompasses the open land in the vicinity of the intersection of South Arm Road and Short Cut Road. Photo 26 looks south along South Arm Road. The Upgrade will be located to the right of this image. Photo 27 is taken from Short Cut Road looking east and southeast. The new highway will cross this image at the far end of the cleared land. Photo 28 is a panorama looking west with South Arm Road in the foreground and Short Cut Road heading into the distance in the centre of the image. The Upgrade will run across this image from the middle ground on the left to the foreground on the right. Views from the main carriageway to the north across the cleared land will be available from the south end of the precinct.

**Precinct 8: Raleigh Swamp**

This precinct is located at the northern end of the Upgrade where the new carriageways tie into the existing dual carriageways just south of the Waterfall Way interchange. It comprises wetlands and some modified landscapes. Views from the Upgrade in this precinct are limited by existing vegetation.

**Issues/Opportunities**

- Retain and enhance open views where appropriate, especially distant views to natural and cultural landmarks such as Picket Hill and the Kalang River.
- Utilise landscape to enhance the forest experience, particularly where the route traverses State Forests.
- Utilise landscape to ameliorate adverse visual impacts where necessary.
- Utilise landscape where appropriate to screen views to the highway from adjacent residences.
- Maintain views along creek corridors and the Kalang River.
- Design the Nambucca Heads and Ballards Road Interchanges and the adjustments to the Waterfall Way Interchange to each have a distinct identity to aid in legibility for both the Pacific Highway traveller and local road users.
- Design urban and landscape design treatments to integrate, respond and be sensitive to the existing adjacent precinct context in terms of topography, landscape, settlements and views.
- Provide variety and legibility in the journey experience.





Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8



Photo 9



Photo 10



Photo 11



Photo 12



Photo 13



Photo 14



Photo 15



Photo 16



Photo 17





Photo 18



Photo 19



Photo 20



Photo 21



Photo 22



Photo 23



Photo 24



Photo 25



Photo 26



Photo 27



Photo 28



Photo 29



## B.6 PROPOSED HIGHWAY ELEMENTS, EXISTING ROAD NETWORKS + FLORA + FAUNA REQUIREMENTS

Refer to Figure B.6.1 and B.6.2 – Proposed Highway Elements, Existing Road Networks + Flora and Fauna Requirements.

The Project comprises:

- Two full Interchanges located at:
  - » Nambucca Heads; and
  - » Ballards Road.
- One modified full interchange at Waterfall Way.
- One Rest Area located at Station 62km300 at the Nambucca Heads Interchange
- Transverse Bridges over the Main Carriageways (Overbridges):
  - » Bridge over Highway No.10 at Nambucca Interchange;
  - » Bridge over Highway No.10 at East West Road;
  - » Bridge over Highway No.10 at Ballards Road;
  - » Bridge over Highway No.10 at Martells Road;
  - » Bridge over Highway No.10 at Local Access Road G; and
  - » Bridge over Highway No.10 at Short Cut Road.
- Main Carriageway Bridges over the North Coast Railway, creeks, local roads, fauna, farm and drainage access:
  - » Twin bridges over North Coast Railway (Station 61km800);
  - » Twin bridges over Boggy Creek (Station 62km750);
  - » Twin bridges over Cow Creek (Station 63km650);
  - » Twin bridges over Valla Road (Station 64km150);
  - » Twin bridges over Deep Creek (Station 64km900);
  - » Twin bridges over McGraths Creek Floodplain 1 (Station 71km550);
  - » Twin bridges over McGraths Creek Floodplain 2 (Station 71km930);
  - » Twin bridges over Dalhousie Creek (Station 73km370 and 73km400);
  - » Twin bridges over fauna crossing (Station 74km810);
  - » Twin bridges over Kalang River Floodplain 1 (Station 76km950);
  - » Twin bridges over Kalang River (Station 77km650);
  - » Twin bridges over fauna crossing, northbound at Station 79km860 and southbound at Station 79km910;
  - » Twin bridges over Water Course and fauna crossing (Station 81km880); and
  - » Twin bridges over Water Course and fauna crossing (Station 82km410).
- Other Bridges
  - » Service Road bridge over Boggy Creek (Station 62km750);
  - » Service Road bridge over Cow Creek (Station 63km650); and
  - » Service Road bridge over Watercourse and fauna crossing (Station 82km420).
- Culverts
  - » There are 17 box culvert locations throughout the Upgrade, most of which serve as fauna underpasses or combined drainage and fauna underpasses. Details are provided in Section E.

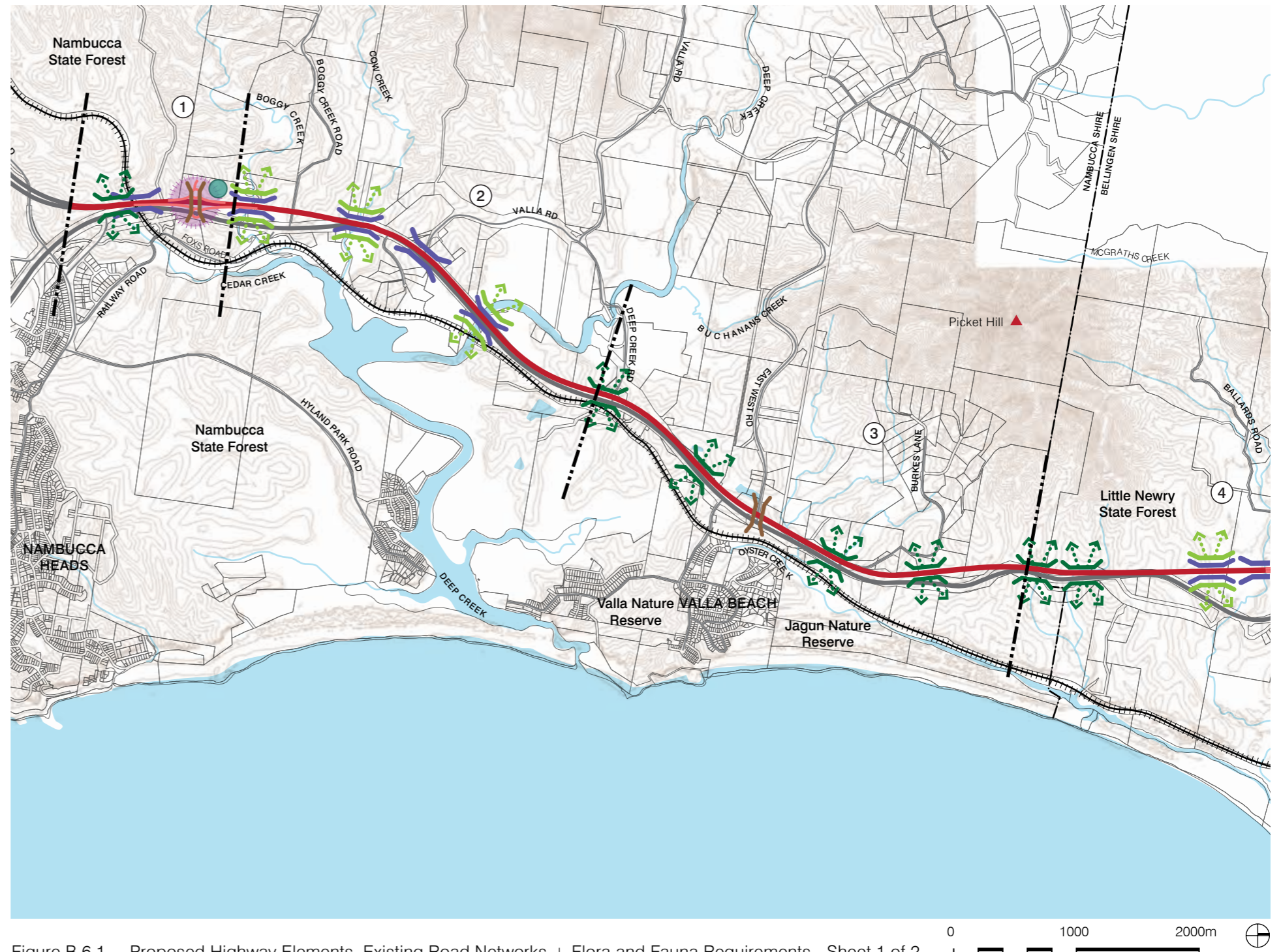


Figure B.6.1 Proposed Highway Elements, Existing Road Networks + Flora and Fauna Requirements - Sheet 1 of 2

- Retaining walls are approximately located at:
  - » Station 62km250;
  - » Station 62km315;
  - » Station 63km600;
  - » Station 69km950;
  - » Station 78km750; and
  - » Station 78km850.

- Reinforced soil wall abutments are provided for the twin bridges over the North Coast Railway (Station 61km800)
- There are two Threatened Glider Crossing Zones located in the widened medians at approximately:
  - » Station 72km300 - Station 74km000; and
  - » Station 78km850 - Station 80km750.



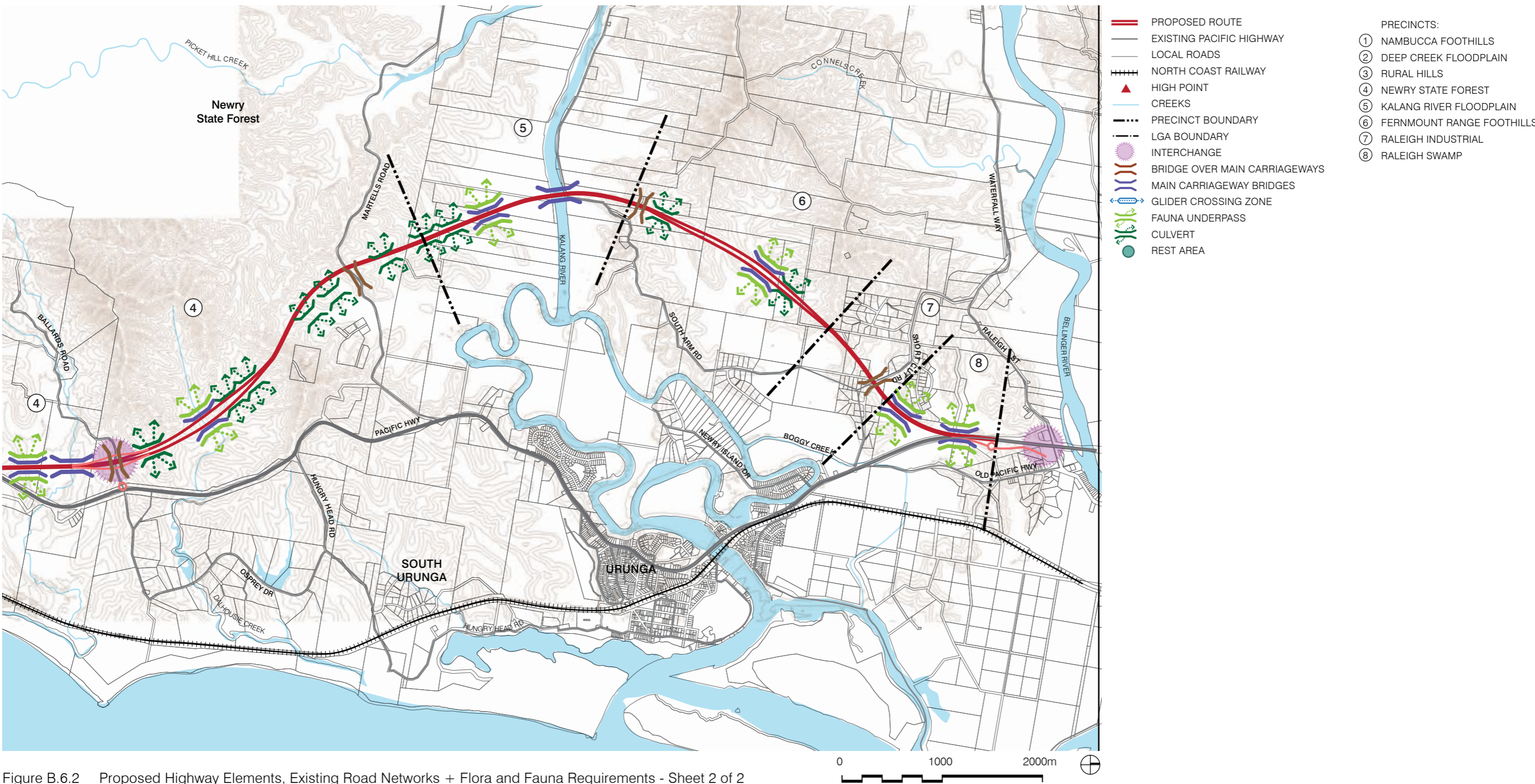


Figure B.6.2 Proposed Highway Elements, Existing Road Networks + Flora and Fauna Requirements - Sheet 2 of 2

- There are a total of 20 Green-thighed Frog Breeding Ponds located at:
  - » Approximate Station 74km665 (both sides of main carriageways);
  - » Approximate Station 79km845 (eastern side of main carriageways); and
  - » Approximate Station 80km015 (western side of main carriageways).
- Nest Boxes are provided at locations as identified in SWTC Appendix 14, Section 14.1 but are not shown on Figures B.6.1 and B.6.2.

**Issues/Opportunities**

- Specific urban and landscape design treatments to the Nambucca Heads and Ballards Road Interchanges to provide legibility in the highway journey.
- Rest Area to provide interpretive signage and specific design treatments to enhance legibility in the highway journey.
- Bridge design treatments, principally for overbridges, to provide linear identity.



## **B.7 IMPACT OF EXISTING AND PROPOSED SERVICES ON THE ROAD CORRIDOR**

The Nambucca Heads to Ballards Road section of the upgrade, impacts on existing utilities comprise:

- Power (Transmission): The proposal passes beneath existing overhead transmission cables near Mines Road, which need to be raised to suit the new road alignment; and at Ballards Road, which can remain in its existing configuration.
- Power (Local Distribution): Impacts on the local distribution network within the area, impacted utilities have generally been relocated underground beneath the new alignment or diverted overhead along the boundary.
- Water: No impacts.
- Sewer: No impacts.
- Telecommunications: Impacts on local distribution network within the area, impacted utilities have generally been relocated underground beneath the new road alignment along the boundary. The existing Optic Fibre and underground rail services within the rail corridor need to be diverted clear of bridge SB1 southern alignment.

In the Ballards Road to Waterfall Way section of the upgrade, impacts on existing utilities comprise:

- Power (Transmission): The proposal passes beneath existing overhead transmission cables near Short Cut Road and Waterfall Way, which need to be raised to suit the alignment.
- Power (Local Distribution): Impacts on the local distribution network within the area, impacted utilities have generally been relocated underground beneath the new road alignment or diverted overhead along the boundary.
- Sewer: No impacts.
- Telecommunications: Impacts on local distribution network within the area, impacted utilities have generally been relocated underground beneath the new road alignment and along the boundary.

The majority of required utility relocations have been completed, with the remaining relocations to be finalised in consultation with relevant authorities, organisations and property owners through the construction phase.

In general, it is possible to relocate trees locally to avoid planting them over services or under overhead wires. Ausgrid Network Standard NS179 Vegetation Safety Clearances December 2010 which covers the clearance requirements for vegetation in the vicinity of high voltage and low voltage lines, optical fibre, poles, attachments to poles, streetlights, standards and towers will be used as the standard.

Where new underground services are proposed, planting above will be limited to shrubs and groundcovers under 3 metres in height to facilitate future maintenance and tree planting will be located a minimum of 3 metres from utility trenches.

Where the Proposal passes beneath overhead transmission cables, approximately 1km south of Ballards Road and between Short Cut Road and Waterfall Way Interchange and at Ballards Road, the alignment is partially in cut and partially on embankment and there is existing vegetation either side of the power line easement corridor. These conditions and new appropriately sized planting will ensure that the easement will not have any adverse visual impact on the corridor.

## C URBAN DESIGN STRATEGY

### C.1 VISION AND OBJECTIVES

The Pacific Highway Urban Design Framework (Roads and Maritime 2005) sets a vision for the Pacific Highway as follows:

*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.*

The Framework document also identifies the following key objectives to support the Vision:

- 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.
- The EA developed the following objectives specifically for the Proposal:
  - » Design the upgraded highway to integrate with immediate context.
  - » Design for safe, yet convenient, connections to local roads and access to adjacent properties.
  - » Ensure and enhance visual connections to significant landscape features.
  - » Integrate the new highway landforms and landscape with adjoining lands where appropriate.
  - » Provide a positive contribution to the landscape.
  - » Ensure a safe driving environment.
  - » Create a quality driving experience that reflects the significance of this motoring route.
  - » Provide cost effective solutions.
- Additional to the above and in summary, the urban and landscape design of the Project Works will:
  - » Deliver a positive, functional and aesthetic experience to road users and to adjoining rural residents and visitors.
  - » Integrate with, and be sensitive and responsive to, the landform and landscape character of the surrounding rural and natural areas.
  - » Provide a well vegetated corridor which is related to and supportive of the landscape and ecological assets of its context including Newry State Forest and the sedge land and riparian edges at the creek systems.
  - » Retain and enhance quality views from the highway west to the Great Dividing Range and over rolling hills and pastures.

### C.2 KEY URBAN AND LANDSCAPE DESIGN STRATEGIES/PRINCIPLES

The existing character of this section of the Pacific Highway is part floodplain, where agricultural pursuits and rural residential development have resulted in widespread clearing, and hills and spurs which are mostly forested. The design context is typical of Pacific Highway upgrades where the route traverses mainly rural lands and there are relatively few visible structures in the landscape framework of the project. The Project itself also includes relatively small numbers and extents of structures visible from the new highway: six overbridges, no noise walls or headlight screens and minimal retaining walls. The urban and landscape design strategy therefore is predominantly a landscape approach as it is the context which creates the specific identity of this section of the highway. Linear identity is provided by structures such as overbridges which in design continue similar treatments for the piers, parapets and screens from nearby upgrade projects. Lateral integration is provided by the design of the corridor landscaping so that it responds to the existing vegetation and agricultural patterns through which the highway passes - eight character precincts are identified in this report along the Upgrade. Planting has been selected from and is designed to conform to the seven identified vegetation communities and various land uses encountered throughout the alignment.

The key urban and landscape design strategies for the Project Works include:

1. Establishing a linear theme and identity through unified urban design treatments of highway structures visible from the carriageways. Linear urban design identity elements which establish a theme for this section of the highway include:
  - » Overbridges - the bridge design for the overbridges is an evolution of the Bonville bridge design aesthetic with refinements to the pier shapes and throw screens designs, whilst maintaining the “family” of bridges concept. The local access road overbridge just north of the Kalang River is treated as an exceptional case because of its unique situation at a deep cutting. All overbridges have abutment slopes which are finished with concrete pavers and cement edging strips;
  - » Highway bridge barriers – identical low concrete and twin metal rail barriers are used on all highway bridges;
  - » Retaining walls – all walls which are visible from the main carriageways have the same surface treatment.
2. Providing lateral integration with the Project context through strategies such as:
  - » Strengthening the forested edge experience with additional tall open forest planting to link isolated stands of trees.
  - » Responding to the existing cultural and rural residential landscape by incorporating scattered feature tree planting within the road edge planting.
  - » Enhancing the visual experience from the road by enabling views of the broader skyline and horizon line over foreground screen planting.
  - » Utilising tall forest planting (a combination of tall open forest species and low shrub species) to maintain visual “depth” into the forest. This strategy avoids mid storey vegetation blocking views into the woods.

- » Utilising only indigenous species (or in some cases, selections of indigenous species). A great deal of effort has been made to extract the best species from each plant community with which to revegetate the alignment.
- » Specifying wire rope barrier at appropriate locations in the sections of the Upgrade with widened medians to increase the effectiveness of the median as a glider crossing, by enabling tree planting closer to the inner carriageway edges.
- » Due to the diversity of macrophytes available, large detention basins in view of highway users can be designed to have a distinctive character.
- » Feature trees have been selected from the plant communities occurring within precincts in which they occur.
- » Frangible shrub planting at bridge pylons to reduce their visual impact.
- » Batter re-vegetation strategies that improve erosion resistance.
- » Post construction an assessment will be made of where open concrete drainage channels are visible from the highway or other vantage points and a dark coloured dye will be added to the surface of the concrete. This approach was implemented on the Hunter Expressway project.
- » A topsoil management strategy that optimised natural regeneration from soil, stored seed and seeding from adjacent forested areas.
- » A landscape maintenance strategy that will address the specific maintenance issues that will assist natural regeneration.



### C.3 PROPOSED URBAN AND LANDSCAPE DESIGN TREATMENTS

The following diagrams C.3.1 to C.3.5, text and images describe the lateral integration design elements proposed for each precinct. The proposed plant palette is provided in Section C.4.1.

#### Precinct 1: Nambucca Foothills

Refer Figure C.3.1.

The Nambucca Foothills Precinct at the southern extent of the project is a forested precinct in the rolling foothills at the western extent of the Nambucca State Forest. The main vegetation community is Flooded Gum Open Forest with their tall straight trunks and a dense understorey. In the foothills, the proposed landscape treatment is generally seeding with frangible shrubs adjacent to carriageways with tall shrub seeding on fill and cut batters. Where the new highway begins to run parallel with the existing highway, it will be important to ensure good vegetation establishment on the fill batters to minimise headlight glare from the existing highway.

Views to the distant Picket Hill (Elevation 383m) will be available to the north and the landscape design will ensure that this view is appropriately framed. In this zone the existing fringing vegetation will contribute significantly to the character of the highway. There will be minimal planting in this precinct except at Stations 61km700 and 61km730 where there are fauna underpasses. The North Coast Railway crossing is the principal highway element in this precinct.



Hoop Pines - Nambucca Heads is the southern limit of the Hoop Pines natural distribution.

#### Precinct 2: Deep Creek Floodplain

Refer Figure C.3.1.

In contrast to the previous character zone, the Deep Creek Floodplain breaks out into an open paddock landscape with intermittent patches of bushland associated with creek and floodplain crossings. The character zone is highly varied with undulating topography, residences set within treed enclosures and frequently changing views. The character zone includes the Rest Area and the Nambucca Interchange in close proximity. The interchange will signify the arrival at Nambucca Heads through the planting of particular advanced tree species. The Visual Assessment accompanying the Environmental Assessment suggested that Norfolk Island Pines are synonymous with Nambucca Heads, however investigation showed that very few Norfolk Island Pines occur when compared with other seaside towns. Hoop Pines are far more in evidence and Hoop Pine is near the southern limit of its distribution at Nambucca Heads. Hoop Pine signifies to the motorist from the south a milestone in reaching the north coast of NSW. Therefore Hoop Pine has been selected as the signature tree to both announce the gateway to Nambucca Heads and to give the Rest Area a different character to the rest of the alignment. Species from the Mixed Floodplain Forest landscape will also be used to provide shade and interest in the rest area.

Other vegetation communities include extensive Swamp Oak – Swamp Forest on the Deep Creek Floodplain and Blackbutt Dry Sclerophyll on the rises. The vegetation will reflect these communities with dense planting at fauna crossings and where rural holdings occur in order to screen the highway from adjacent residences. Where views to pasture landscapes are desirable, pasture grass seeding will be used.

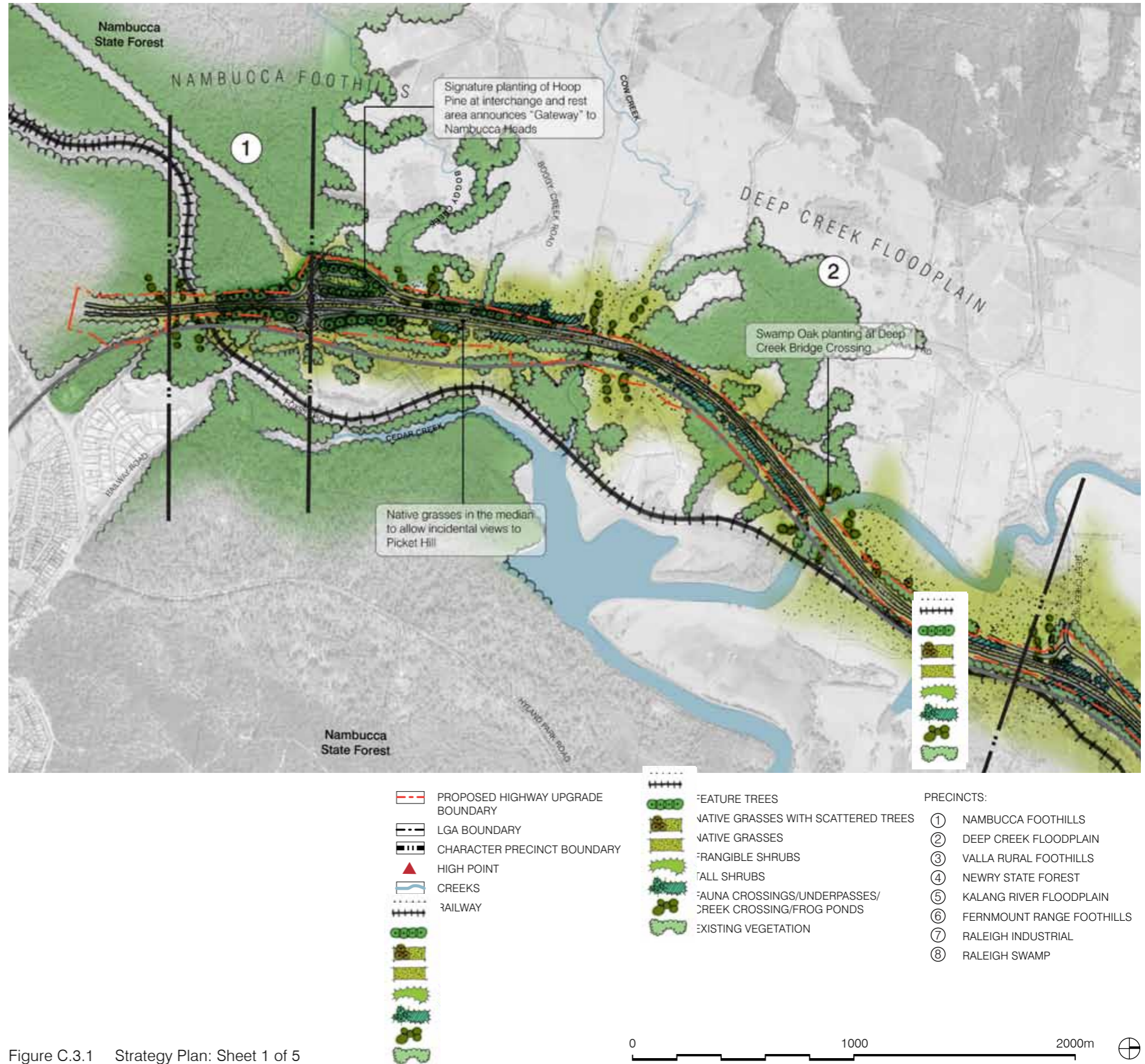


Figure C.3.1 Strategy Plan: Sheet 1 of 5



**Precinct 3: Valla Rural Foothills**

Refer Figure C.3.2.

Where the alignment leaves the floodplain just before Deep Creek Road, it passes through an undulating landscape of rural smallholdings with a preponderance of Avocado and Macadamia orchards. The dominant vegetation community is Blackbutt Dry Sclerophyll forest with Flooded Gum or Mixed Floodplain Forest at the creek crossings. The landscape treatment will mimic this character by providing breaks in the vegetation to give views to the rural landscape with additional tree planting at creek crossings to indicate the watercourses.

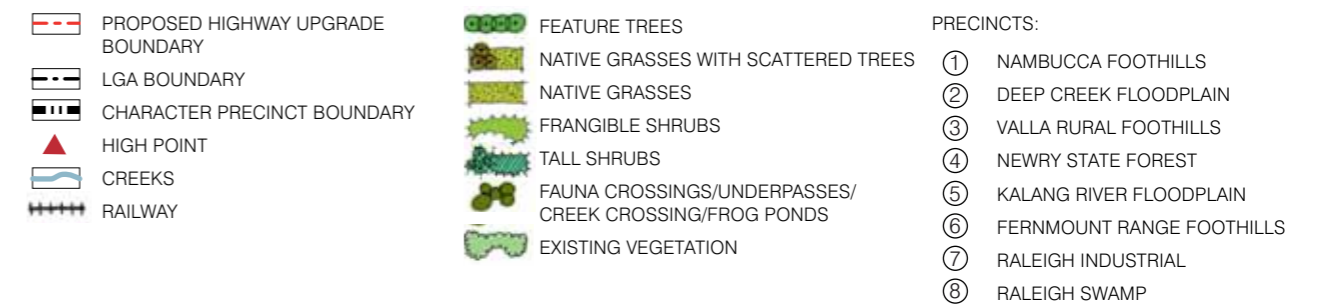
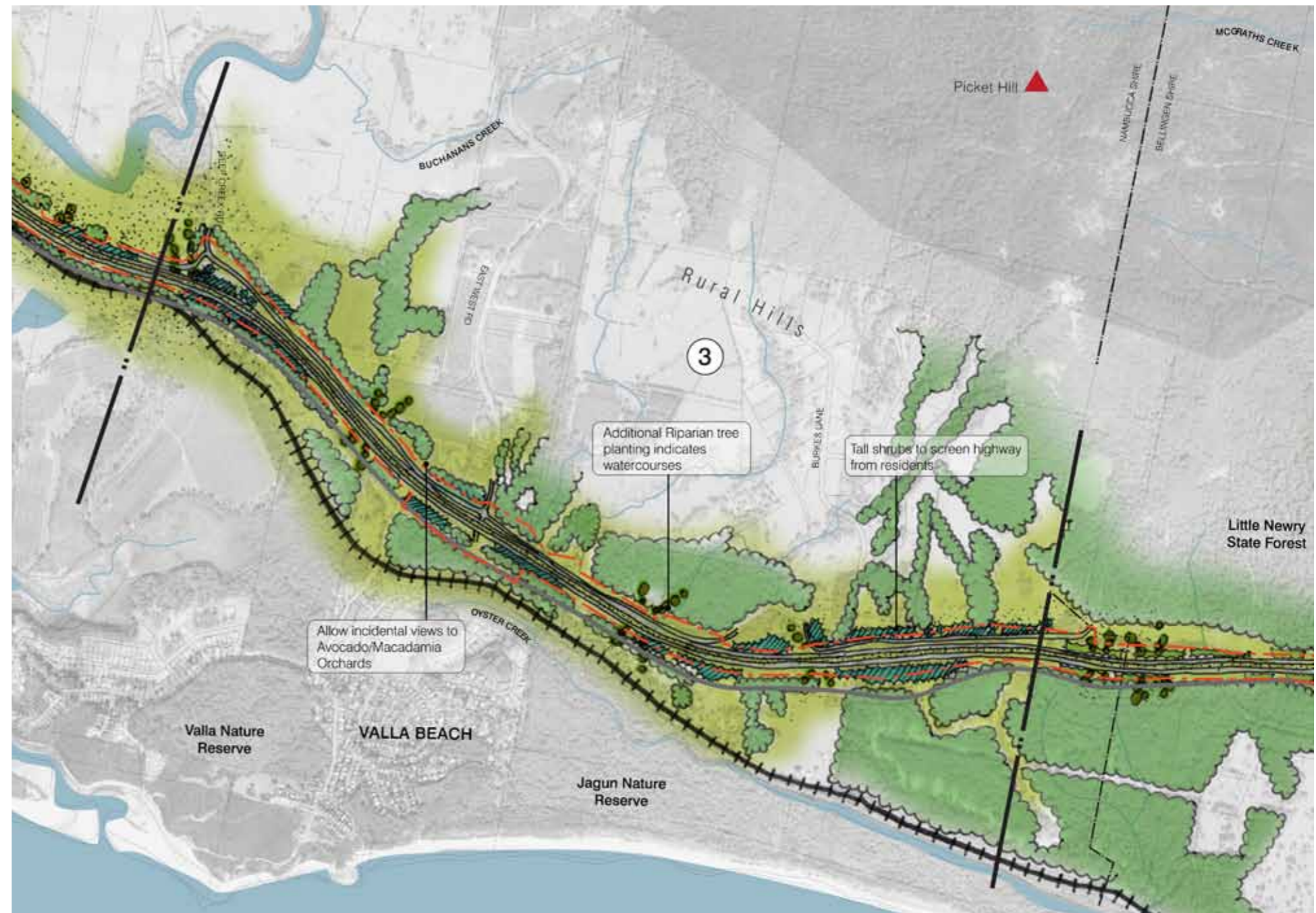
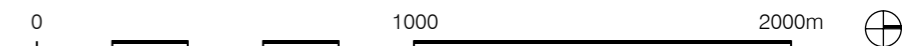


Figure C.3.2 Strategy Plan: Sheet 2 of 5





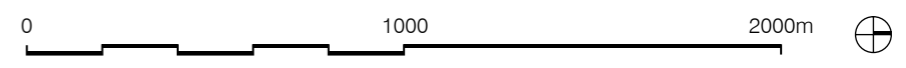
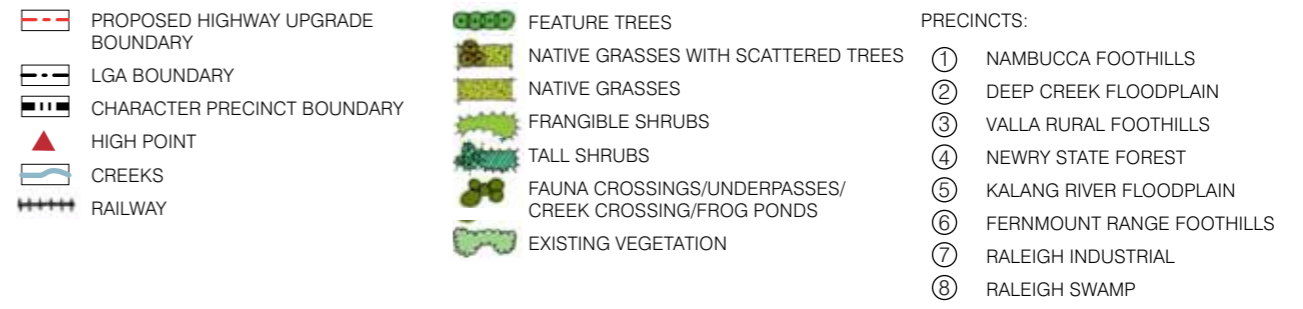
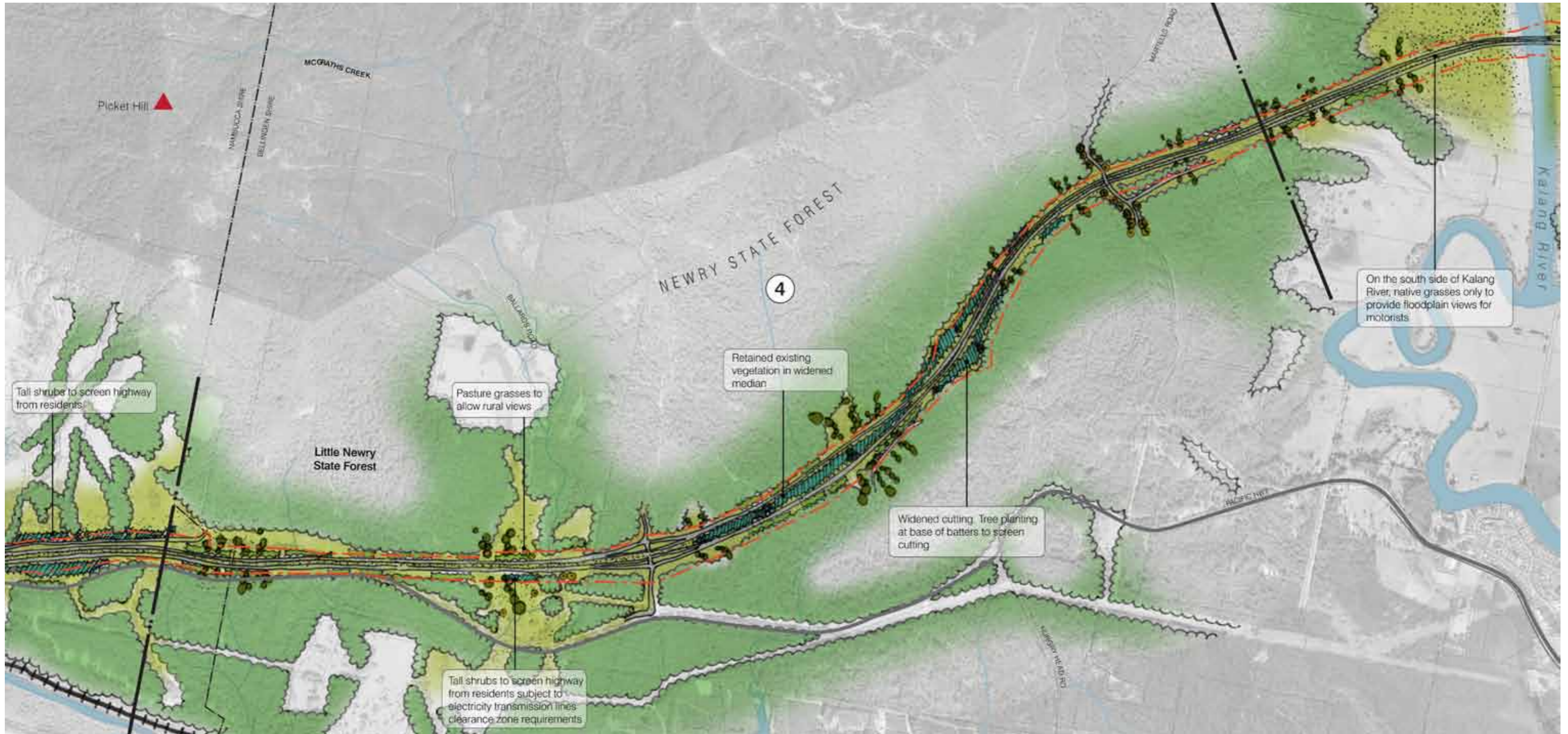


Figure C.3.3 Strategy Plan: Sheet 3 of 5



**Precinct 4: Newry State Forest**

Refer Figure C.3.3.

Largely forested, the Newry State Forest character zone commencing at the Bellingen/Nambucca Shire boundaries is the largest, stretching for 6.2kms, with varied topography including steeply undulating hills with steep forested creeklines. The cuttings increase in height through this section with a wide cutting between Stations 74km000 to 74km400 where additional select material is to be won. Wire rope barriers and/or landscaped mounds are installed at this location to prevent motorists from stopping and the area is to be seeded with frangible shrubs with intermittent tree planting to reduce the visual impact of the cuttings behind.

This precinct calls for the full complement of trees, shrubs and groundcovers to match the existing communities. Additional tree planting will be used at creeks and fauna crossings and at the base of the wide cutting. A 1.7km long widened median between approximately Stations 72km300 to 74km000 facilitates glider crossing. Here targeted planting will be used where there are gaps in the existing vegetation.

**Precinct 5: Kalang River Floodplain**

Refer Figure C.3.4.

As the alignment exits the Newry State Forest there will be dramatic views to the Dorrigo escarpment in the distance and to the Kalang Floodplain and River in the foreground. Native grasses containing sedges will be used to revegetate fill batters in order to facilitate these views, and the species makeup will match that of the adjacent Freshwater Wetlands. At both the northern and southern banks of the Kalang River there is an existing strip of Mixed Floodplain Forest with Mangrove elements. Where this community is disturbed it is to be re-instated to its former extent.

On the northern embankment the situation is different due to the presence of South Arm Road which is listed as a Bellingen Shire Scenic Conservation Area. The new highway embankments will be screened from South Arm Road but only grasses will be used in the median in order to frame views of Picket Hill for motorists heading south.

**Precinct 6: Fernmount Range Foothills**

Refer Figure C.3.4.

Leaving the Kalang Floodplain the alignment again enters a heavily forested precinct. The character of this area will differ from Newry State Forest because the precinct consists entirely of the White Mahogany/Grey Gum/Ironbark Forest vegetation community. A 2km long widened median occurs from approximately Station 78km850 to 80km750 facilitating glider crossing and lending significantly to the bushland character of the highway through this section by preserving existing forest in the median.

As this precinct is composed of a single vegetation community which is largely intact and with few weeds it will benefit significantly from topsoil management procedures which preserve the soil seedbank. Therefore revegetation is via topsoil management and native seeding with only limited additional planting at the three box culvert fauna underpasses (Stations 78km800, 80km220 and 80km230) and two bridges (Stations 79km860 and 79km910).

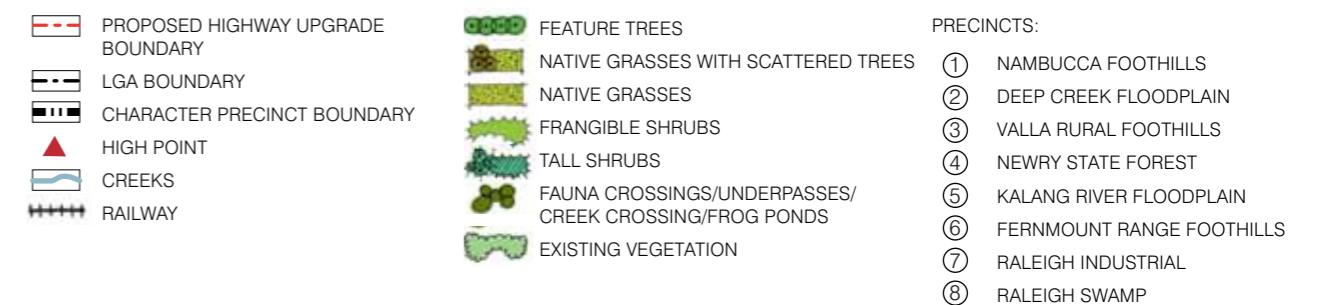
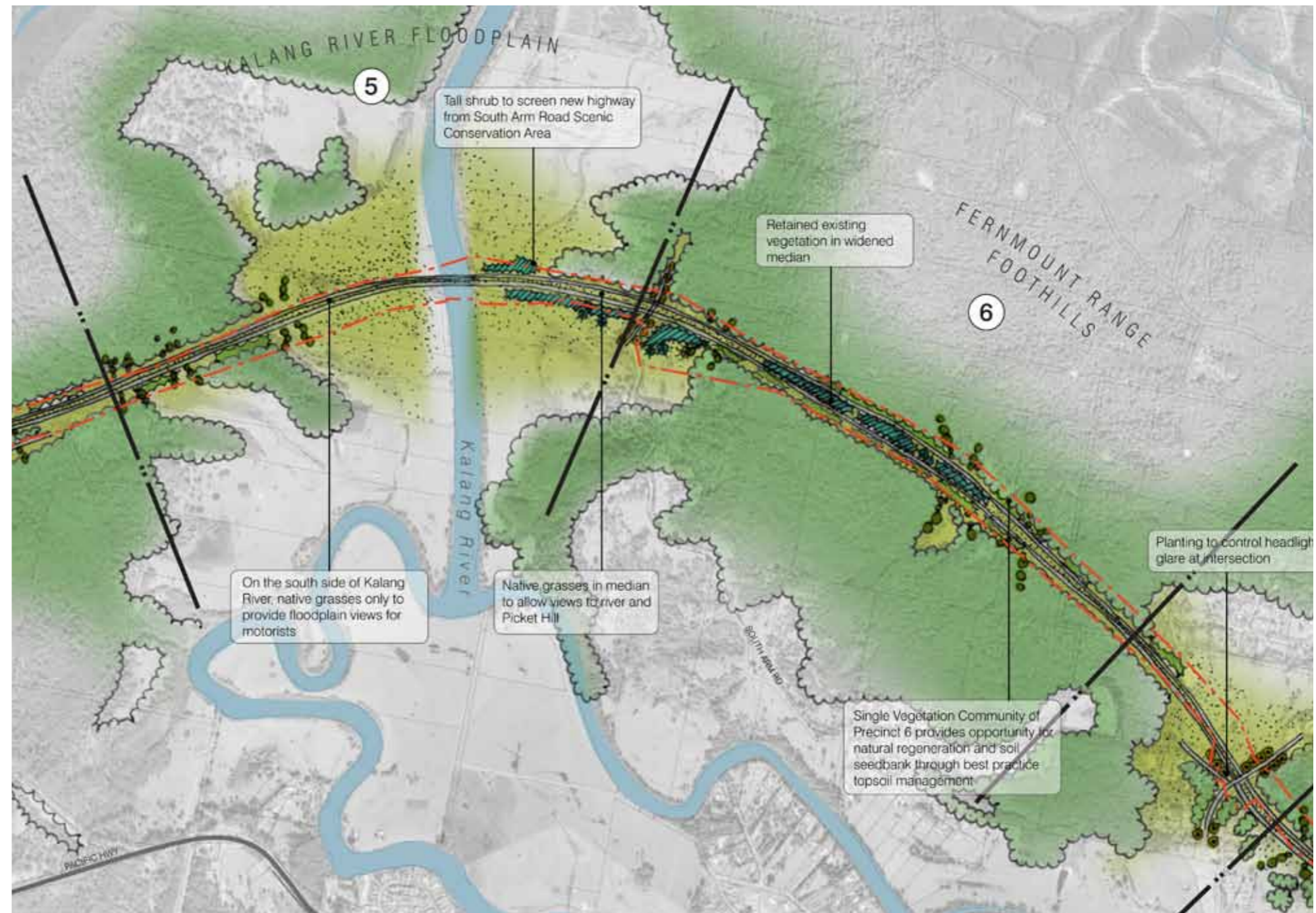
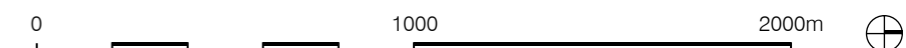
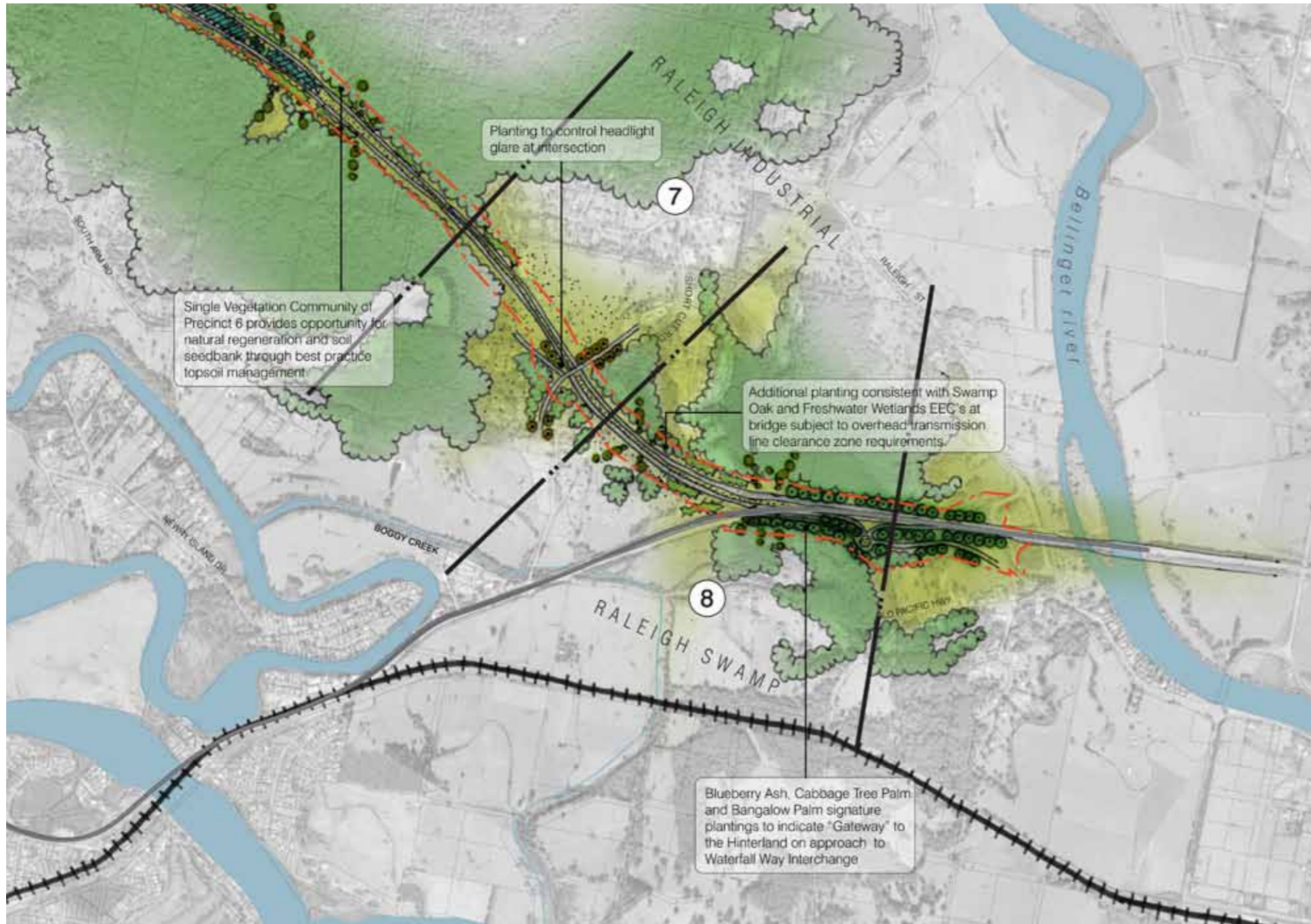


Figure C.3.4 Strategy Plan: Sheet 4 of 5



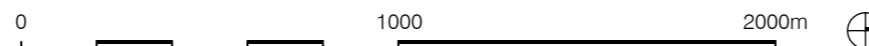




- PROPOSED HIGHWAY UPGRADE BOUNDARY
- LGA BOUNDARY
- CHARACTER PRECINCT BOUNDARY
- HIGH POINT
- CREEKS
- RAILWAY

- FEATURE TREES
- NATIVE GRASSES WITH SCATTERED TREES
- NATIVE GRASSES
- FRANGIBLE SHRUBS
- TALL SHRUBS
- FAUNA CROSSINGS/UNDERPASSES/ CREEK CROSSING/FROG PONDS
- EXISTING VEGETATION

- PRECINCTS:
- ① NAMBUCCA FOOTHILLS
  - ② DEEP CREEK FLOODPLAIN
  - ③ VALLA RURAL FOOTHILLS
  - ④ NEWRY STATE FOREST
  - ⑤ KALANG RIVER FLOODPLAIN
  - ⑥ FERNMOUNT RANGE FOOTHILLS
  - ⑦ RALEIGH INDUSTRIAL
  - ⑧ RALEIGH SWAMP



### Precinct 7: Raleigh Industrial

Refer Figure C.3.5.

The Raleigh Industrial Estate will be screened from the new highway with vegetation with care taken to avoid clashes with overhead transmission lines. Additional screen planting will be required between the new highway and the intersection of South Arm Road and Short Cut Road where they converge, to minimise headlight glare. With the presence of Endangered Ecological Communities (Freshwater Wetland and Swamp Oak) just north of the Shortcut Road overpass and with a Fauna crossing bridge at Station 81km880, additional tree shrub and groundcover planting will be used to ensure the interface between the Highway and EEC's is consistent.

### Precinct 8: Raleigh Swamp


























Refer Figure C.3.5.

Just beyond the interface with Raleigh Industrial Estate and to the end of the upgrade, the alignment is generally set within the flat topography associated with Swamp Oak - Swamp Forest (EEC). The new alignment also converges with the existing highway at a fauna crossing bridge at Station 82km410. Planting will be required at the bridge and will continue to the end of the upgrade with care taken to avoid clashes with overhead powerlines. In addition to seeding, extensive planting will also be used in this precinct for the purposes of minimising headlight glare from the existing highway (which will become a local road), indicating the local road on and off ramps, and for providing an acknowledgement of the Waterfall Way off-ramp and its "Gateway" status to the hinterland, Bellingier Valley and the towns of Bellingen, Dorrigo and Armidale. In reference to the rainforest character of the hinterland, rainforest trees which occur as occasional emergents in the Swamp Oak - Swamp Forest community and also in the subtropical forest of the valley such as *Elaeocarpus obovatus* (Blueberry Ash), *Livistona australis* (Cabbage Tree Palm) and *Archontophoenix cunninghamiana* (Bangalow Palm) will be used as feature marker trees in this zone.

Figure C.3.5 Strategy Plan: Sheet 5 of 5



C.4.1 Plant Palette  
Trees

Lily pilly 	Forest Oak 	Red Ash 	Hoop Pine 	Black Wattle 	White Mahogany 	Grey Gum 
<i>Acmena smithii</i>	<i>Allocasuarina torulosa</i>	<i>Alphitonia excelsa</i>	<i>Araucaria cunninghamii</i>	<i>Callicoma serratifolia</i>	<i>Eucalyptus acmenoides</i>	<i>Eucalyptus propinqua</i>
Hard Quondong 	Blueberry Ash 	Narrow-leaved Paperbark 	Prickly Leaved Paperbark 	Turpentine 	Scentless Rosewood 	
<i>Elaeocarpus obovatus</i>	<i>Elaeocarpus reticulatus</i>	<i>Melaleuca linariifolia</i>	<i>Melaleuca styphelioides</i>	<i>Syncarpia glomulifera</i>	<i>Synoum glandulosum</i>	
						
<i>Casuarina glauca</i>	<i>Eucalyptus microcorys</i>	<i>Archontophoenix cunninghamiana</i>	<i>Corymbia intermedia</i>	<i>Eucalyptus pilularis</i>	<i>Eucalyptus grandis</i>	
Cheese Tree 	Red Mahogany 	Northern Grey Ironbark 	Cabbage-tree Palm 	Broad-leaved Paperbark 	Brush Box 	
<i>Glochidion ferdinandi</i>	<i>Eucalyptus resinifera</i>	<i>Eucalyptus siderophloia</i>	<i>Livistona australis</i>	<i>Melaleuca quinquinervia</i>	<i>Lophostemon confertus</i>	





















C.4.1 Plant Palette (continued)

Shrubs

Willow Bottlebrush		Mountain Tea Tree		Ironwood		Rose Myrtle		Slender Palm Lily		Banana Bush		Narrow-leaved Paperbark	
	<i>Callistemon salignus</i>		<i>Leptospermum polygalifolium</i>		<i>Backhousia myrtifolia</i>		<i>Archirhodomyrtus beckleri</i>		<i>Cordyline stricta</i>		<i>Tabernaemontana pandacaqui</i>		<i>Melaleuca linariifolia</i>
Common Wilkea		Mock Olive		Native Lasiandra		Plum Myrtle							
	<i>Wilkea huegeliana</i>		<i>Notolea venosa</i>		<i>Melastoma affine</i>		<i>Pilidiostigma glabrum</i>						

Groundcovers, tussocks, grasses and sedges

Jointed Twig-rush		Soft Twig-rush		Bare Twig-rush		Tall Sedge		Swamp Lily		Blue Flax Lily		Common Fingerrush	
	<i>Baumea articulata</i>		<i>Baumea rubiginosa</i>		<i>Baumea juncea</i>		<i>Carex appressa</i>		<i>Crinum pedunculatum</i>		<i>Dianella caerulea</i>		<i>Fimbristylis dichotoma</i>
Swamp Club-rush		Tall Sawsedge		Common Rush		Broad-leaf Rush		Green Mat Rush		Spiny Headed Mat Rush		Variable Saw Sedge	
	<i>Isolepis inundata</i>		<i>Gahnia clarkei</i>		<i>Juncus usitatus</i>		<i>Juncus planifolius</i>		<i>Lomandra hystrix</i>		<i>Lomandra longifolia</i>		<i>Lepidosperma laterale</i>
Woolly Frogs Mouth		Common Bog Sedge		Bog Bulrush		Black Bog-rush							
	<i>Philydrum lanuginosum</i>		<i>Schoenus apogon</i>		<i>Schoenoplectus mucronatus</i>		<i>Schoenus melanostachys</i>						



D BRIDGES

Introduction

The project includes a total of thirty seven vehicular bridges at twenty five locations, comprising twin bridges over the Kalang River, six local road overbridges, twin local road underbridges at one location, twin railway underbridges, twin bridges over four creeks, twin bridges over floodplains at three locations, twin bridges over water courses and fauna crossings at four locations, and three local road bridges over creeks or water courses and fauna crossings. Many of the bridges also function as fauna underpasses. Box culvert underpasses occur at 17 locations, providing either fauna crossings, drainage or both. The proposed designs comply with the requirements of the Project Scope of Works and Technical Criteria. In addition, the designs also reflect careful consideration of: the applicable sections of the project EA; SWTC Appendix 15 Urban Design Performance and Design Requirements, Section 15.2 Bridges; and the Roads and Maritime publication Bridge Aesthetics (January 2004). They are also consistent with the overall urban and landscape design strategy established for the project.

The following design characteristics apply generally to the project's bridges:

- The bridge designs are related to the bridges already constructed in upgrades to the north and south of the Nambucca Heads to Urunga project. Immediately to the north, apart from one signature arch bridge at Waterfall Way, there are no overbridges in the short Raleigh Deviation. Beyond this is the recently completed Bonville upgrade and the overbridges proposed in this tender adopt the same general configuration as the Bonville bridges. Immediately to the south are upgrades which are planned but yet to be built, and final overbridge designs for these projects are not yet available. Further south is the Kempsey Bypass, which is under construction and for which some overbridges are completed. The pier shapes, and throw screen post profile for this Nambucca Heads to Urunga project refer directly to the Kempsey Bypass bridges. The design strategy is to use the Raleigh Arch Bridge as the point at which modified design details from the Kempsey Bypass end (assuming they are carried forward in the future upgrades between Kempsey and Nambucca Heads) and those for Bonville begin .

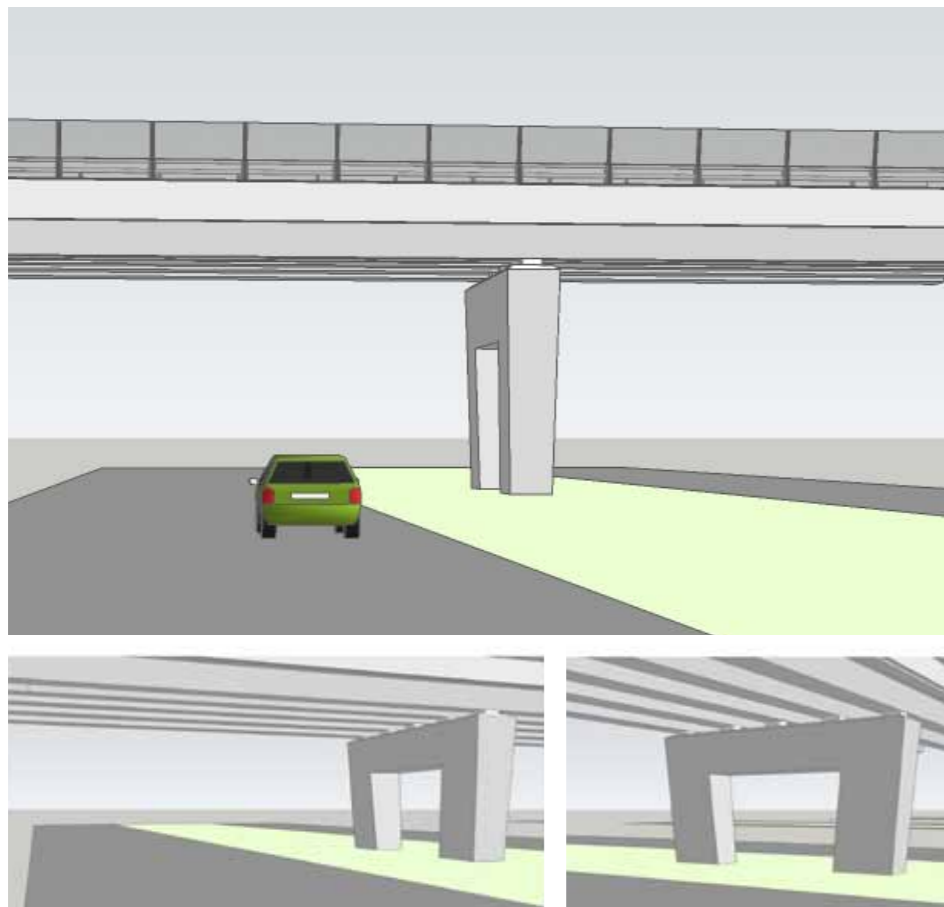
- Bridges carrying local roads over the highway are generally consistent and recognisable as part of a 'family' of bridges, with individual variations to particular bridges which reflect the character and requirements of their specific settings. The bridge carrying a local access road over the highway at Station 78km510, is distinctive in that it is very tall and situated in a deep cutting. A unique design is proposed for this bridge. The typical piers for Main Carriageway Overbridges are tapered in elevation, as far as practicable, given structural and construction limitations and are a reverse trapezoid "pants pier" style in cross sectional elevation. All overbridges are fitted with safety screens to avoid objects being thrown onto the highway below. The safety screen design references the Kempsey Bypass and Bonville Upgrade with a slight modification in the former case to meet the SWTC requirement for parapets to not be obscured by posts. (Refer Figure D.1.1)
- Pairs of bridges carrying the highway over the North Coast Railway, creeks, Valla Road and fauna routes are simple, economical structures, but careful attention is paid to their detailing, particularly the parapets and twin rail barriers which are highly visible from the main highway carriageways. A unique design is proposed for the twin bridges over the Kalang River.
- Spill-through abutments are generally used for the sense of openness they provide. They are also less subject to graffiti attack than retaining wall abutments and are utilised on all main carriageway overbridges. Overbridge spill through abutments are treated with concrete pavers. The spill through abutments for most highway bridges are treated with stone boulders sourced from within the project in the large cutting at Station 74km200, to provide scour protection and a long term low maintenance finish.
- Parapets on bridges consist of a metal two rail and post system mounted on top of a 650mm high concrete barrier, in order to maximise views from the bridges towards the landscape.



Bonville Overbridge Safety Screen and Pier Design



Kempsey Bypass Overbridge Safety Screen and Pier Design



Nambucca Heads to Urunga proposed Safety Screen and Pier Design

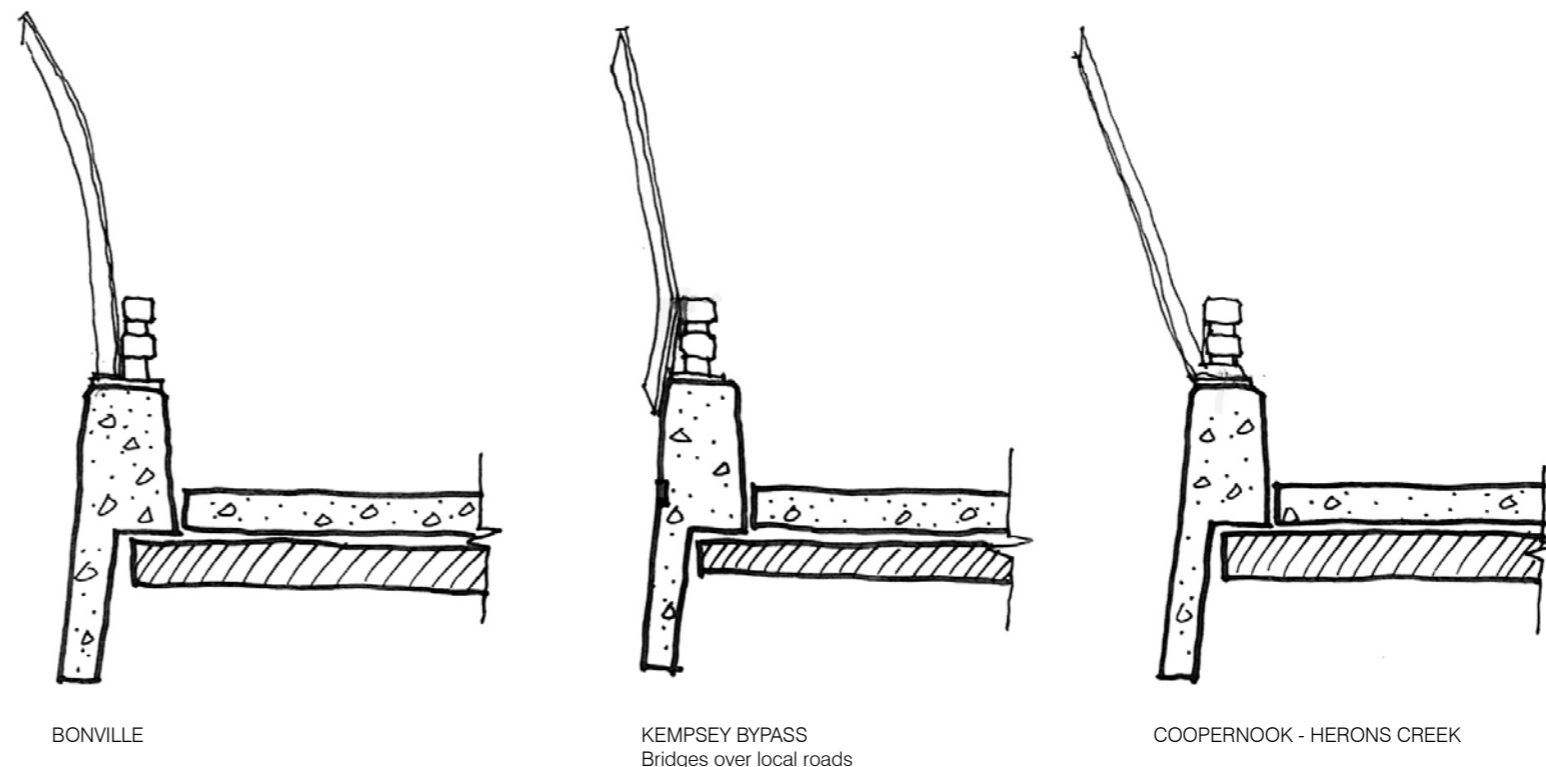


Figure D.1.1 Safety Screen profiles in nearby projects



**D.1 TWIN BRIDGES OVER KALANG RIVER – ELEVATIONS AND CROSS SECTIONAL ELEVATIONS**

**D.1.1 Twin Bridges over Kalang River – Station 77km650**

These highway bridges carry the main carriageways over the Kalang River. They are located within a Bellingen Shire Council Conservation Area, which is an area of high scenic value. Care has been taken to ensure that the bridges are both structurally efficient and aesthetically attractive.

The structure comprises Super-T girders supported on tapered blade piers. This arrangement results in a relatively shallow superstructure depth, which is an advantage, given that the clearance above the river is limited. The relationship between span length and superstructure depth is also visually satisfying.

**Bridge Approaches and Abutments**

The bridge approaches across the river floodplains comprise embankments which are up to 7.5m high. Spill through abutments are adopted to provide more open views from the river and adjoining floodplains. They are less prone to graffiti attack than retaining wall abutments. A 1.5H:1V batter slope is adopted at the bridge abutments and batter protection is provided with stone boulders in accordance with scour protection requirements.

**Piers**

The reinforced concrete blade piers for the Kalang River bridges are tapered in elevation to the maximum extent consistent with structural requirements. Viewed in cross-sectional elevation, the broad faces of the piers are also tapered. The narrow pier face has a tapering vertical groove and the broad face has four of the same grooves. The bottoms of the grooves are finished in a textured surface, in contrast to the smooth off-form concrete of the remainder of the piers. This treatment enhances the appearance of the piers by reinforcing the blade taper, making the piers appear more slender and reducing the perceived scale of the piers.

The piers extend downwards below the river surface level and are supported directly on piles. There are no exposed pilecaps, which allows the bridge to touch the water lightly.

**Superstructure**

The bridge comprises five equal spans of 37.7m each and each span consists of five 1800mm deep Super-T girders. This arrangement results in a slender superstructure and a minimum structural depth that is consistent with the bridge spans and method of construction. The deck width between the inner faces of the bridge barriers is 10.7m for the northbound carriageway and 10.5m for the southbound.

**Parapets**

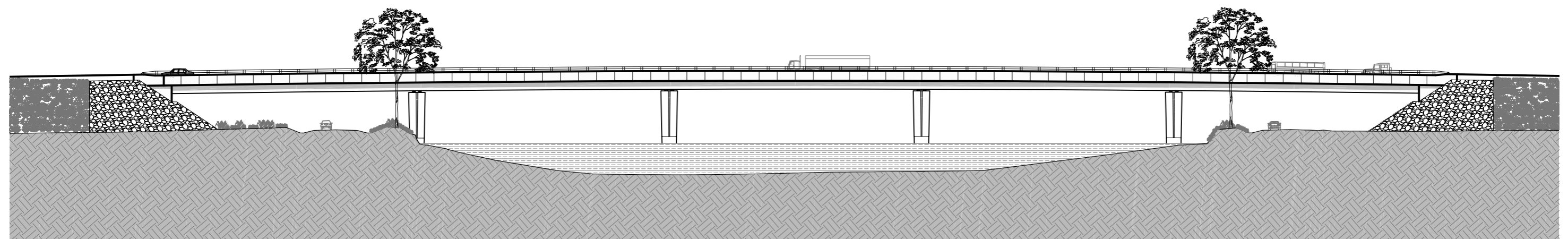
Parapets comprise a 650mm concrete barrier with twin metal rails on top, providing an overall height of 1300mm above road surface level. The twin metal rails maximise views from the highway to the river and surrounding countryside and minimise the parapet depth as seen from the river and floodplains. The outer parapet faces extend downwards below the soffit of the bridge deck, enhancing the perceived slenderness of the superstructure and concealing a drainage pipe under the bridge deck. The parapets slope outwards towards the bottom at an angle of 5 degrees and the top of the parapet has an inward cross fall for drainage to minimise staining on the outer face of the parapet. The twin rail termination detail adopts a Roads and Maritime standard detail. A single conduit is located in each barrier.

**Changes Since 15% DCD**

- Relief pattern in piers changed from single textured panel on broad pier face to textured grooves on both pier faces.

**Urban Design Comments on 85% PDD to be incorporated in 100% SDD**

- None.



GOSSIPS ROAD

SOUTH ARM ROAD

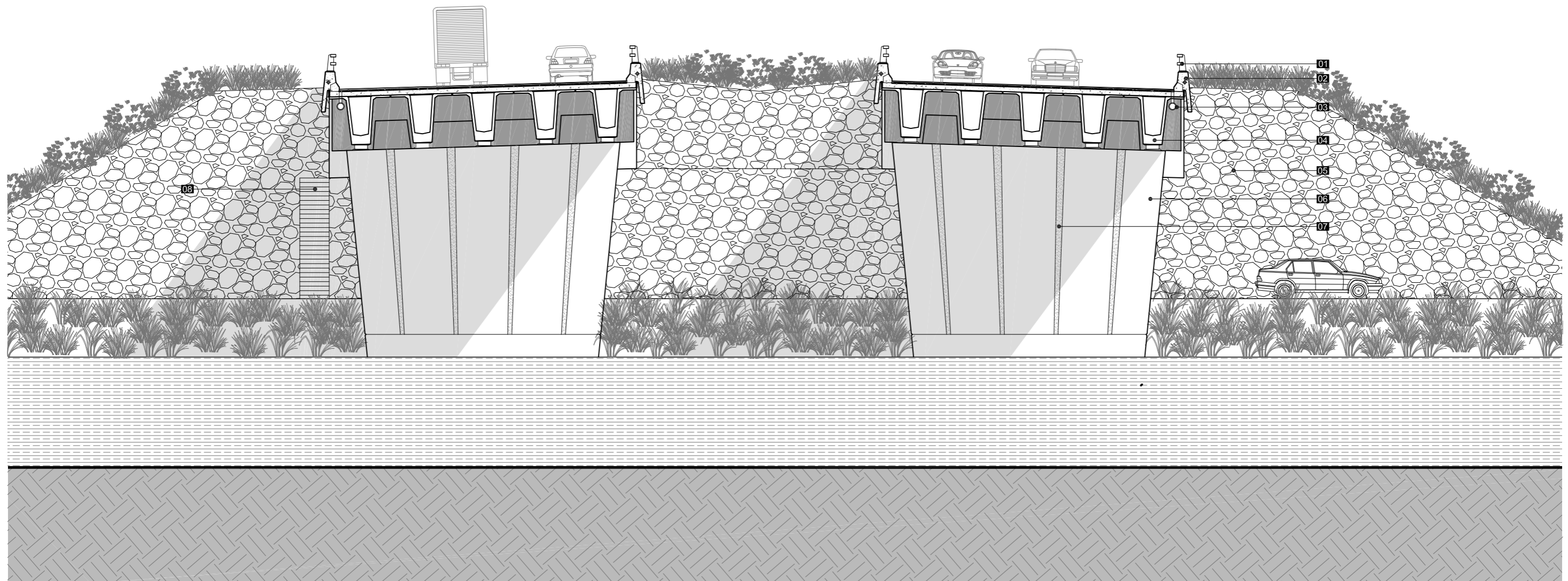
E 1.1.2

Drawings are for illustrative purposes only.  
For dimensions and extent of works refer to Engineers Drawings.  
For Landscape types and extents refer to Landscape Drawings.

0 20 40m

Figure D.1.1.1 Twin Bridges over Kalang River: Elevation

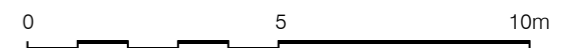




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- 01 TWIN METAL RAIL BARRIER
- 02 CONCRETE PARAPET
- 03 DRAINAGE PIPE
- 04 SUPER-T GIRDERS
- 05 STONE BOULDER SCOUR PROTECTION
- 06 CONCRETE PIERS
- 07 RECESSED GROOVE WITH TEXTURED SURFACE
- 08 MAINTENANCE ACCESS STAIRS

Figure D.1.1.2 Twin Bridges over Kalang River: Cross Sectional Elevation





**D.2 MAIN CARRIAGEWAY OVERBRIDGES (TRANSVERSE BRIDGES) – ELEVATIONS AND CROSS SECTIONAL ELEVATIONS**

Except for the piers of the feature local access overbridge at Station 78km510, key design elements are consistent for all the overbridges on the Nambucca Heads to Urunga Upgrade as follows (Refer to Figures D.2.1 to D.2.3):

**Abutments**

Spill through abutments have been adopted on all overbridges to allow open views along the highway. They are less prone to graffiti attack than retaining wall abutments. A 1.5H:1V batter has been adopted locally at the bridge abutments, except for the Local Access Road G overbridge which has a 2.0H:1V slope. Abutment batters are finished with concrete pavers edged with concrete strips to retain the pavers in place and assist in weed control. The paved surface extends 1m beyond the edge of the parapet to prevent scouring from the drip line.

**Parapets**

Parapets comprise a 650mm concrete barrier with twin metal rails on top to maximise views from the local road to the surrounding countryside and minimise the parapet depth as seen from the highway. The outer parapet faces extend

downwards below the soffit of the bridge deck. The parapets slope outwards towards the bottom at an angle of 5 degrees and the top of the parapet has an inward cross fall for drainage to minimise staining on the outer face of the parapet. The twin rail termination detail adopts a Roads and Maritime standard detail.

**Piers**

The piers for the overbridges are tapered in elevation as far as practicable, given structural and construction limitations, and are a reverse trapezoid “pants pier” style in cross sectional elevation, in line with the look of the Kempsey Bypass bridge piers which are anticipated to be used on future bridges up to Nambucca Heads.

**Footpaths**

Two of the project’s overbridges include a footpath on one side of the bridge deck. In accordance with SWTC requirements, these footpaths will continue beyond the bridge barrier a sufficient distance for pedestrians to be able to access the road surface beyond the bridge, or adjacent paths without crossing turf, bare earth or planting.

**Safety (throw) Screens**

The safety screen design derives from the designs used on the bridges in the Bonville and Kempsey Bypass sections of the highway, with subtle refinements. Each safety screen upright is mounted on top of the baseplate for the twin rail barrier post, which is in turn mounted on the top of the concrete parapet/barrier. The safety screen post is thus located between the two uprights of each barrier post, ensuring a neat and symmetrical integration of the two posts. The proposed safety screen post has tapered T-section steel uprights with tapered edges to support the steel mesh, reducing the visibility of the screens. The supports in cross section follow the line of the parapet with a 5 degree angle to the top of the twin rail barrier and then tilt outwards to a 10 degree angle. This creates a more open feel on the bridge, compared to vertical or inwardly sloping screens. The throw screens taper at each end in elevation to terminate in three evenly spaced sloping panels which end at the last twin metal rail post before the termination point of the parapet twin rail.

The Appendix 15 SWTC Section 15.2 Bridges requirements applicable to Main Carriageway Overbridges and a summary of the SWTC conformance is included in Appendix A.

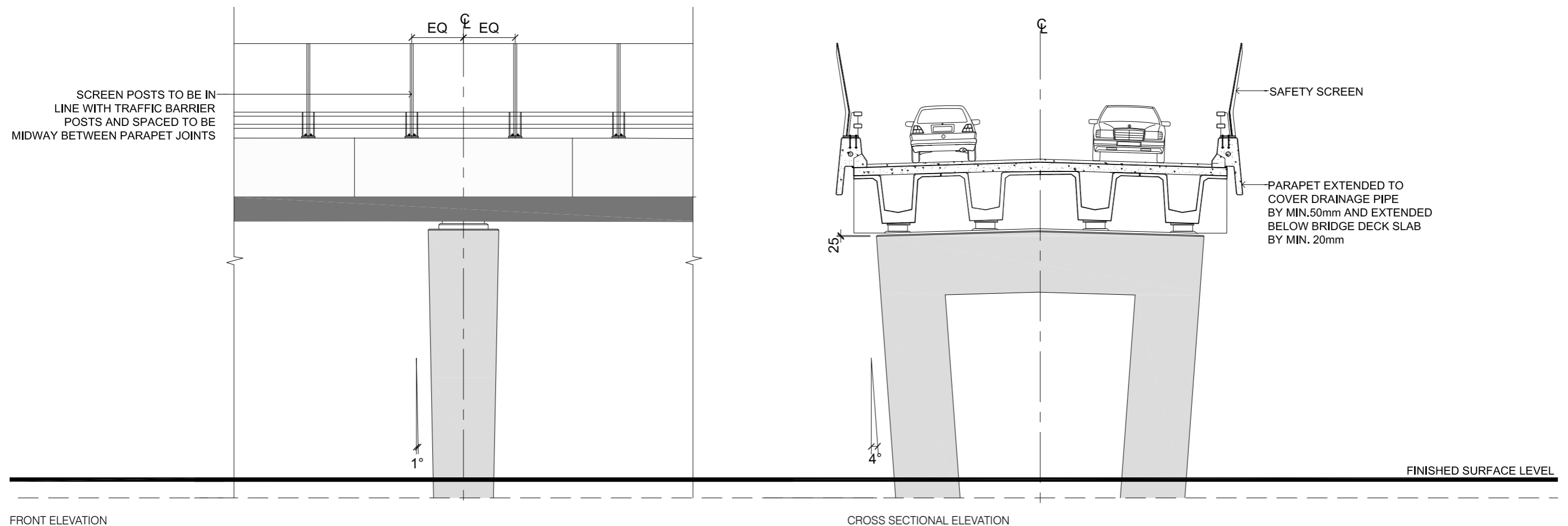
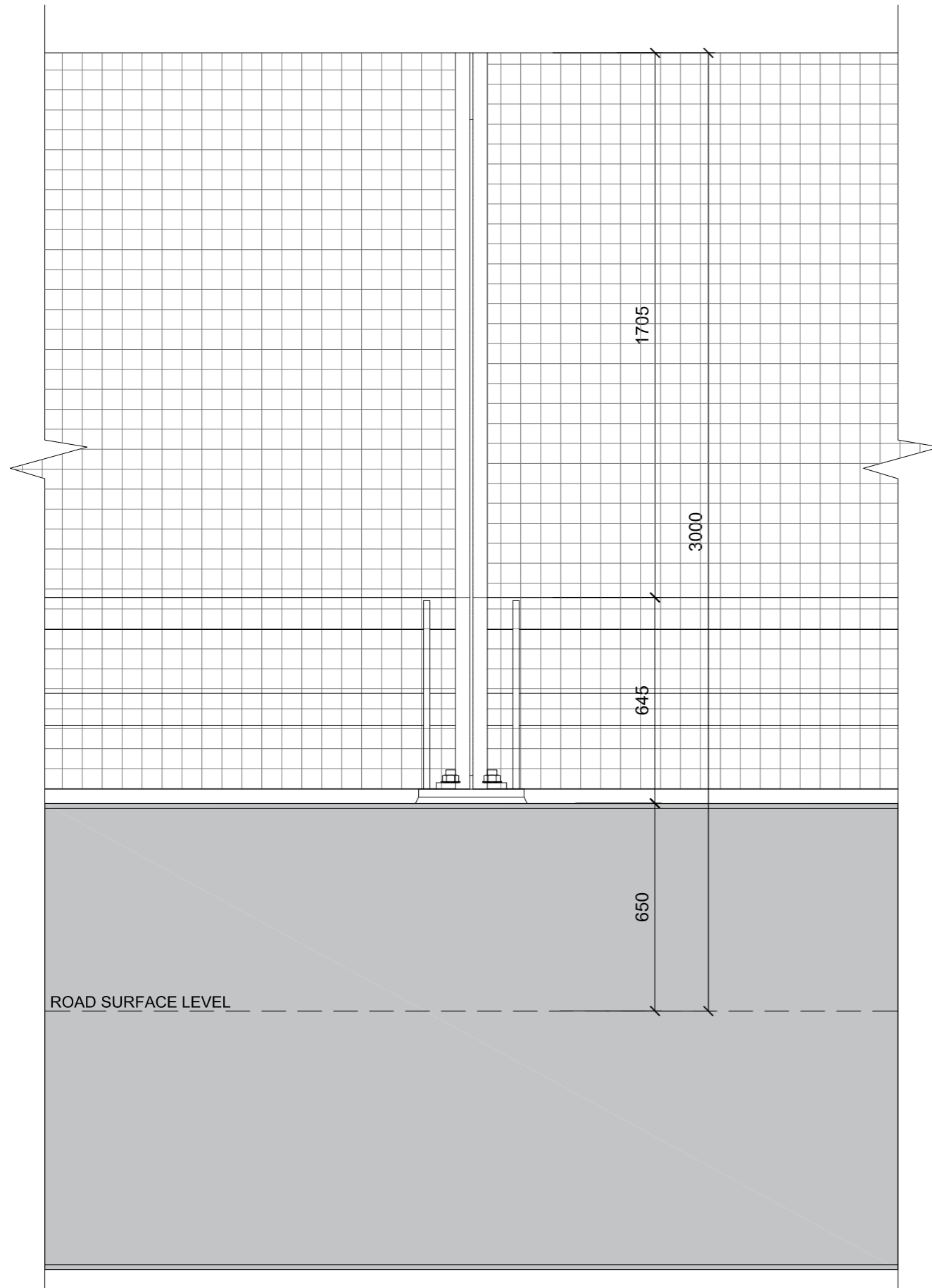
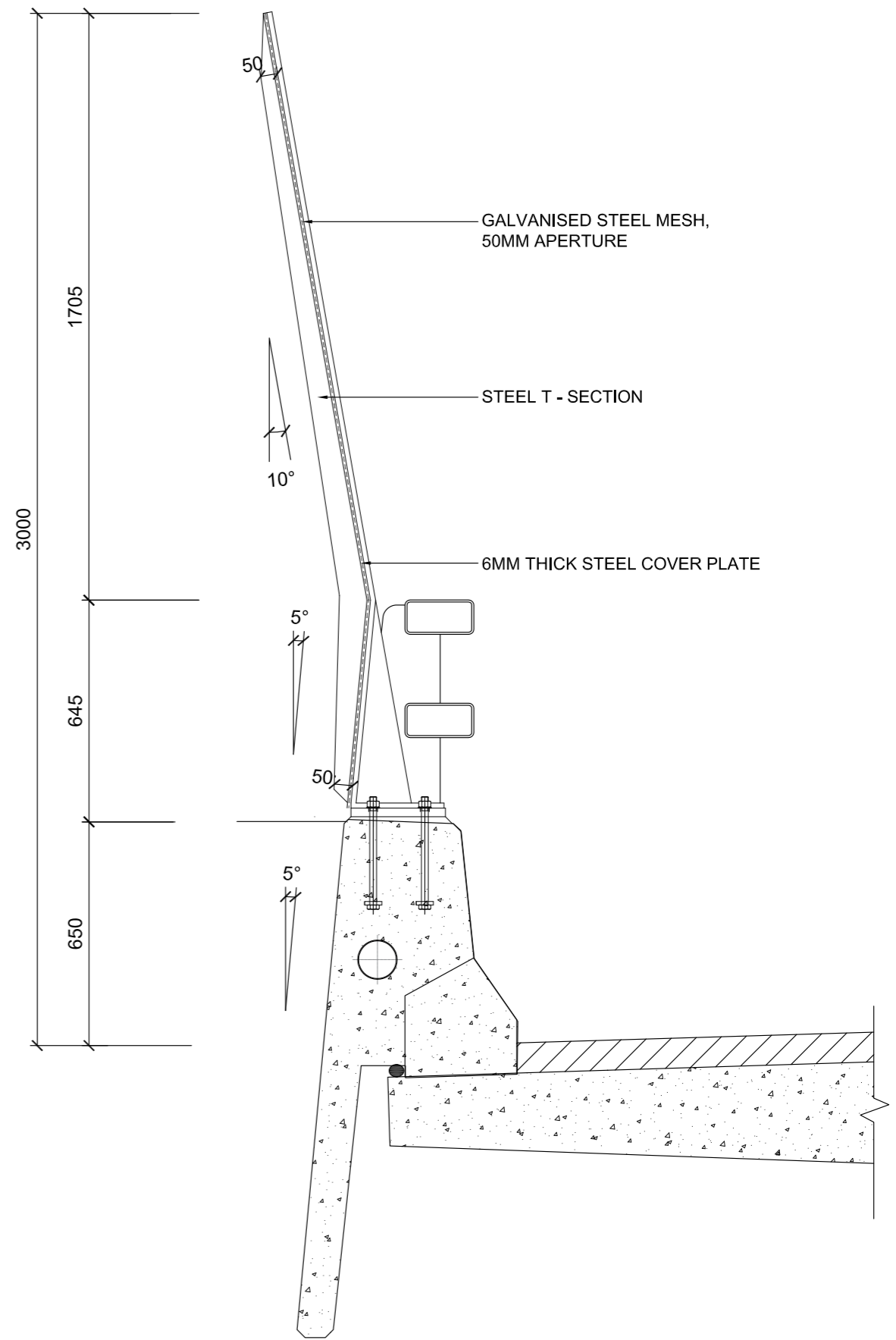


Figure D.2.1 Front elevation taper and reverse trapezoid shaped opening





FRONT ELEVATION



CROSS SECTIONAL ELEVATION

Figure D.2.2 Front elevation and cross sectional elevation of Safety Screen



The following elevations and cross sections demonstrate the Design for the Main Carriageway Overbridges.

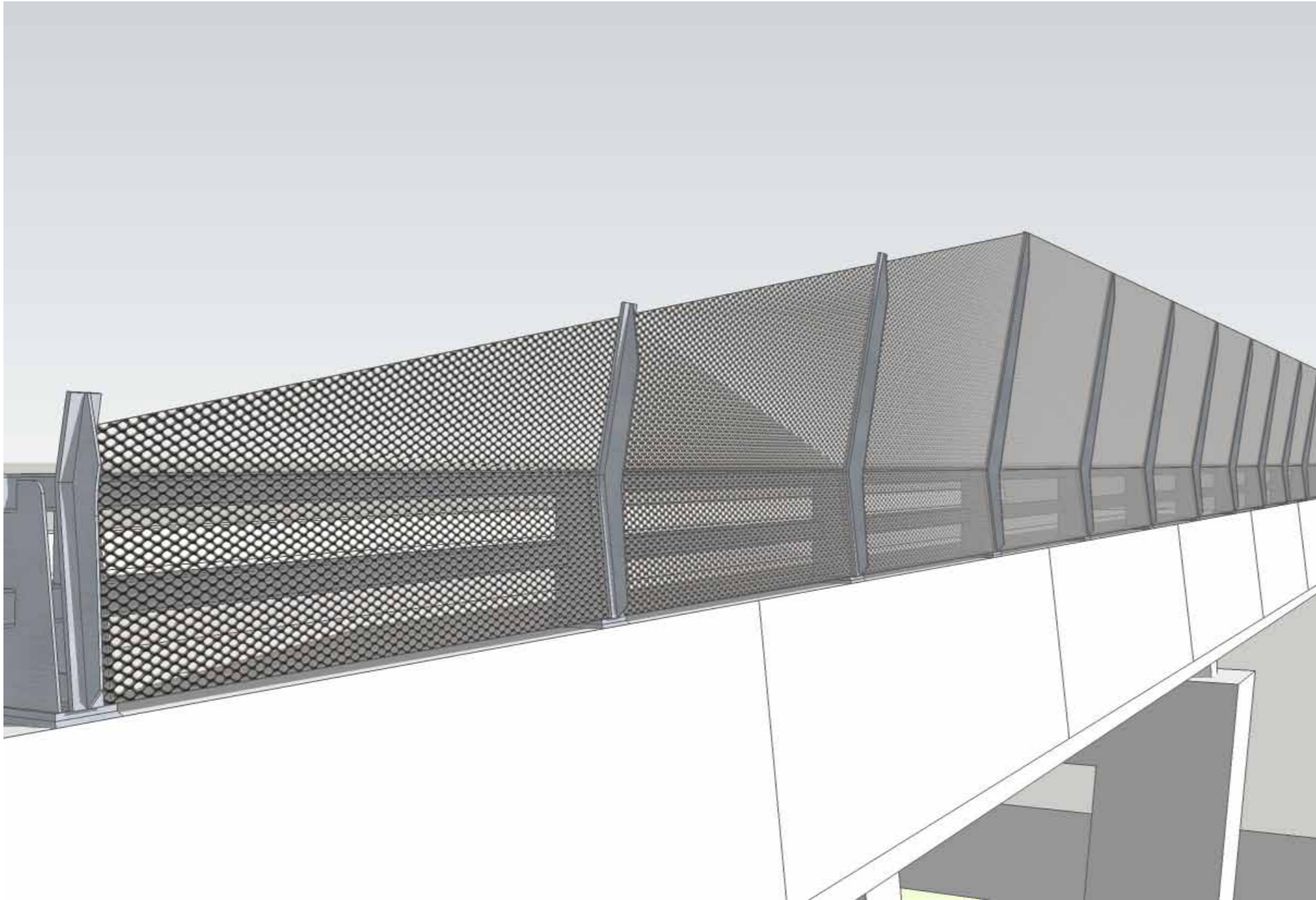


Figure D.2.3 3D sketch image of safety screen



Typical Bonville Safety Screen termination



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**D.2.1 Bridge over Highway No.10 at Nambucca Heads Interchange – Station 62km310**

This bridge comprises two equal spans over the main carriageways of 28.25m each. Each span comprises seven 1200mm deep Super-T girders. The bridge is on a skew of 10 degrees. In addition to the vehicular carriageway, which is 11.05m wide, a footpath 2.5m wide is provided for local pedestrian access. The pier design comprises a single 'trouser leg' pier arrangement in the median with spill through abutments at 1.5H:1V slope.

The parapets are medium performance level barriers comprising a 650mm high precast concrete barrier / parapet surmounted by twin steel rails, providing an overall height of 1300mm above road surface level. A single conduit is located in each barrier. Safety screens are also provided in accordance with the SWTC.

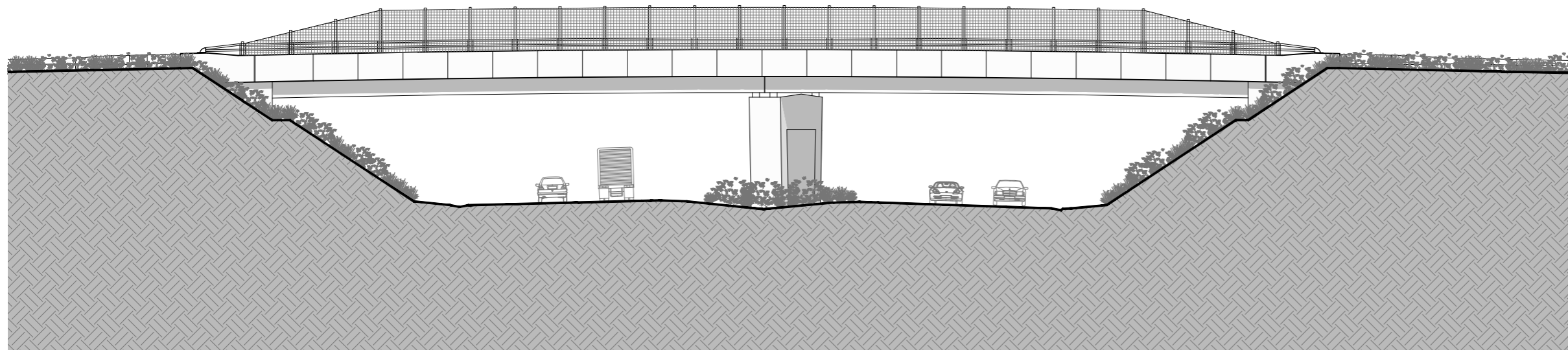
The approaches to the Nambucca Heads Interchange overbridge are located on fill embankments which are approximately 7.0m tall at abutment A and 11.0m at abutment B.

**Changes Since 15% DCD**

- Longitudinal drainage pipe deleted..

**Urban Design Comments on 85% PDD to be incorporated in 100% SDD**

- None.



NORTHBOUND SOUTHBOUND

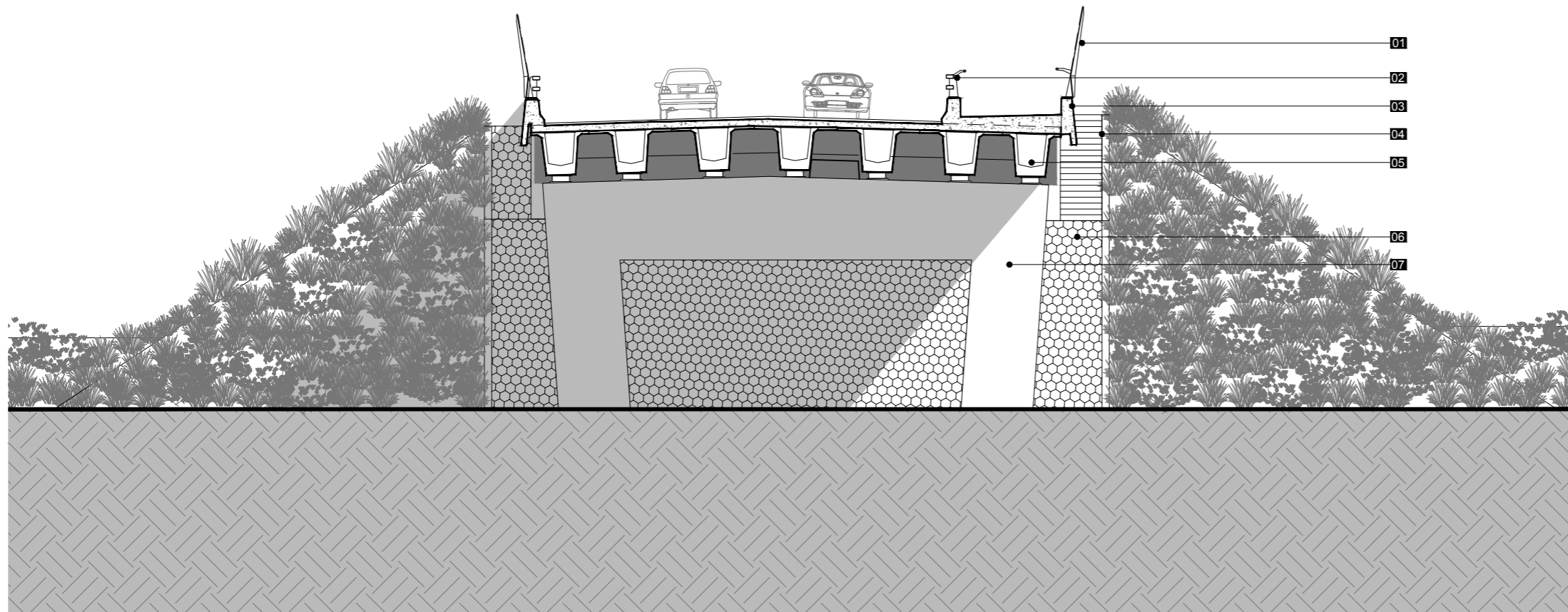
Drawings are for illustrative purposes only.  
For dimensions and extent of works refer to Engineers Drawings.  
For Landscape types and extents refer to Landscape Drawings.

E 2.1.2

0 10 20m

Figure D.2.1.1 Bridge over Highway No.10 at Nambucca Heads Interchange: Elevation

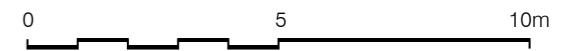




- 01 GALVANISED STEEL SAFETY SCREEN
- 02 TWIN METAL RAIL BARRIER
- 03 CONCRETE PARAPET
- 04 MAINTENANCE ACCESS STAIRS, DARK TINTED CONCRETE
- 05 SUPER-T GIRDERS
- 06 CONCRETE PAVER ABUTMENT TREATMENT
- 07 CONCRETE PIER

Drawings are for illustrative purposes only.  
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Figure D.2.1.2 Bridge over Highway No.10 at Nambucca Heads Interchange: Cross Sectional Elevation





### D.2.2 Bridge over Highway No.10 at East West Road – Station 67km700

This bridge comprises two spans over the main carriageways of 27.0m and 30.0m. The longer span comprises six 1500mm deep Super-T girders and the shorter span eight 1500mm deep Super-T girders. The bridge is on a skew of 10 degrees. In addition to the vehicular carriageway, which is 10.5m wide, a footpath 2.0m wide is provided for local pedestrian access. The pier design comprises a single 'trouser leg' pier arrangement in the median with spill through abutments at 1.5H:1V slope.

The parapets are medium performance level barriers comprising a 650mm high precast concrete barrier / parapet surmounted by twin steel rails, providing an overall height of 1300mm above road surface level. A single conduit is located in each barrier. A longitudinal drainage pipe is located below the footpath section of the deck, between the outermost and second Super-Ts. Safety screens are also provided in accordance with the SWTC.

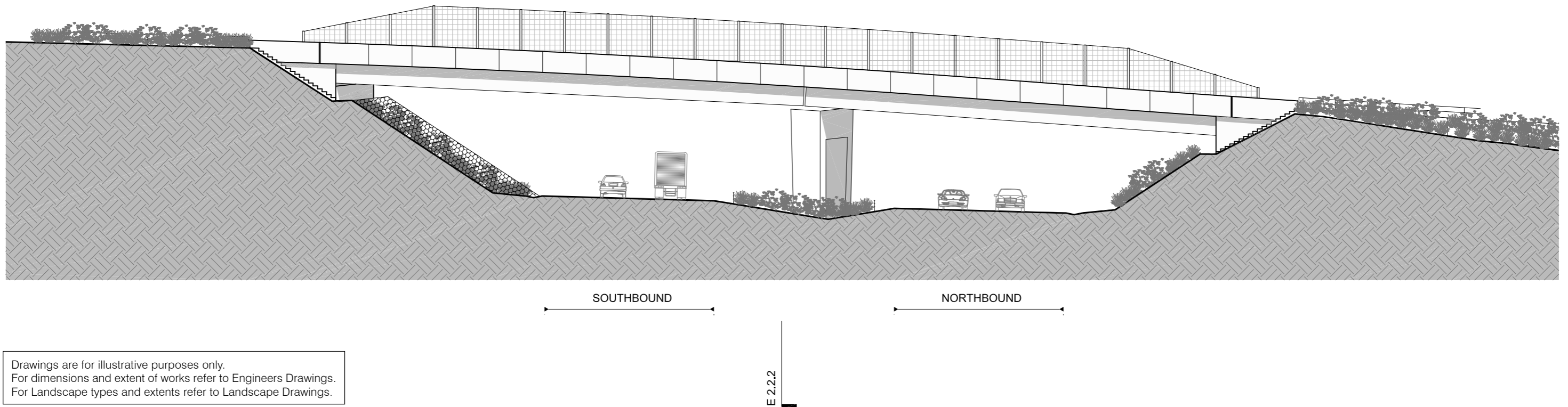
The East West Road Overbridge is located within a cutting approximately 8.0m deep.

#### Changes since 15% DCD

- Minor change in bridge spans.
- Abutment slope increased from 2H:1V to 1.5H:1V.
- One longitudinal drainage pipe deleted.
- Length of safety screen reduced by two bays (still compliant).
- Maintenance access stair moved to opposite side of bridge.

#### Urban Design Comments on 85% PDD to be incorporated in 100% SDD

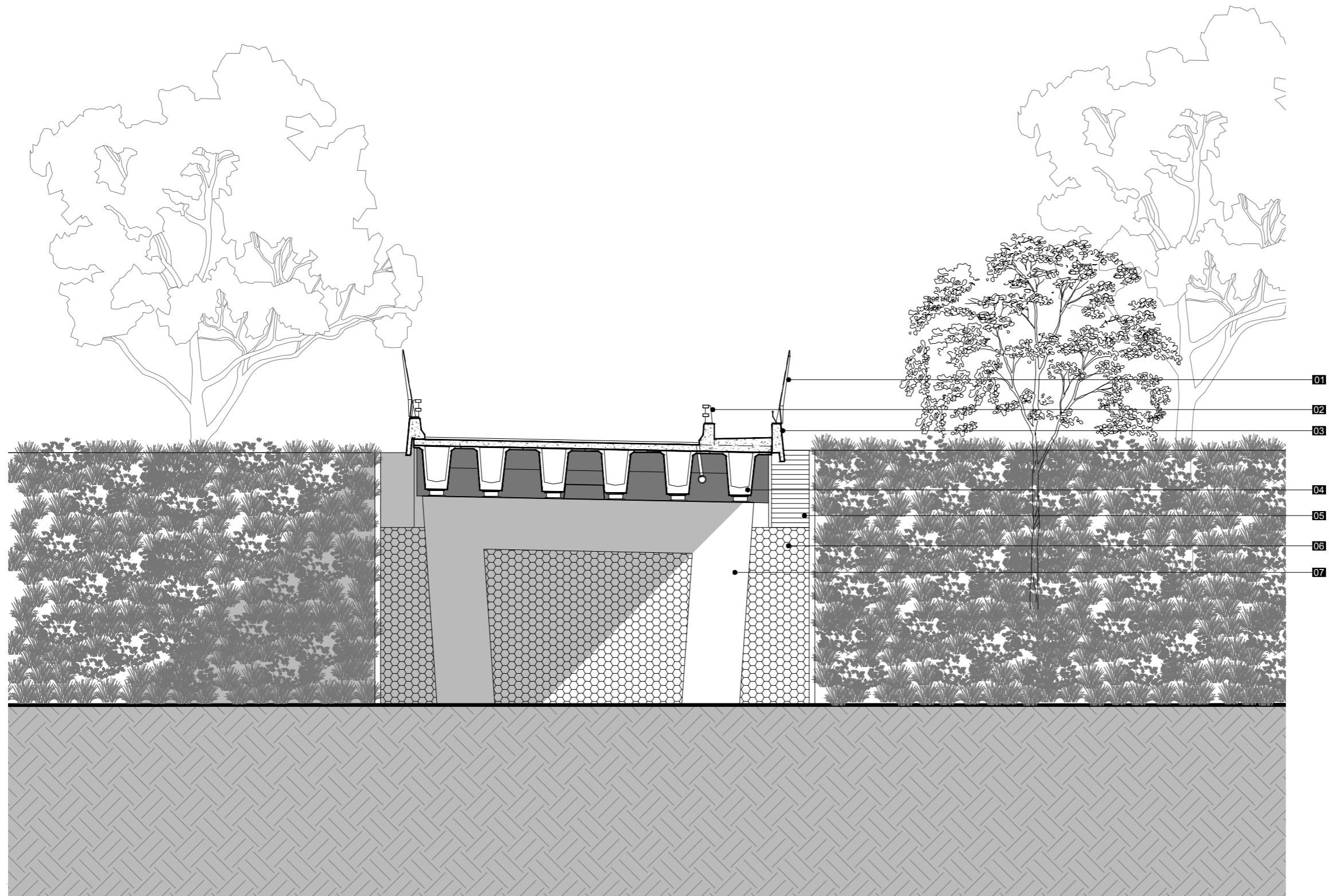
- None.



Drawings are for illustrative purposes only.  
For dimensions and extent of works refer to Engineers Drawings.  
For Landscape types and extents refer to Landscape Drawings.

Figure D.2.2.1 Bridge over Highway No.10 at East West Road: Elevation





- 01** GALVANISED STEEL SAFETY SCREEN
- 02** TWIN METAL RAIL BARRIER
- 03** CONCRETE PARAPET
- 04** SUPER-T GIRDERS
- 05** MAINTENANCE ACCESS STAIRS, DARK TINTED CONCRETE
- 06** CONCRETE PAVER ABUTMENT TREATMENT
- 07** CONCRETE PIER

Drawings are for illustrative purposes only.  
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 For Landscape types and extents refer to Landscape Drawings.

Figure D.2.2.2 Bridge over Highway No.10 at East West Road: Cross Sectional Elevation

