URBAN DESIGN AND LANDSCAPE PLAN - NOWRA BRIDGE
DOCUMENT CONTROL

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Name: Dr. Judy van Gelderen  22 July, 2020

Authorship

Key contributor, responsible for the collation of the UDLP: Dr. Judy van Gelderen - B.L.Arch; D.Envd Des. Judy, is a Director of KI Studio Pty Ltd, with over 35 year's experience in the fields of landscape architecture, urban design and environmental planning. Judy is a Fellow of the AILA and a PIA registered planner.

Miguel Wustemann - B.Arch.(USA, Ger), Master City & Regional Planning (USA, Ger) is a Director of KI Studio responsible for the Urban Design (bridge) Concept Design, and collation of the Fulton Hogan tender concept design report (previous to the UDLP). Miguel is a NSW registered architect (10118) and PIA registered planner. He is also an AKS registered architect and planner in Germany.

Revision History

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<th>Description</th>
<th>Approval</th>
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<td>01</td>
<td>27 April, 2020</td>
<td>Substantial Detailed Design Report for review</td>
<td>JvG</td>
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<tr>
<td>02</td>
<td>26 June, 2020</td>
<td>Final Detailed Design Report</td>
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<td>03</td>
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<td>JvG</td>
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<td>22 July, 2020</td>
<td>Final Detailed Design Report</td>
<td>JvG</td>
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This report has been prepared:

FOR:

Fulton Hogan

BY:

Level 3, Studio 3
“The Cooperage”
56 Bowman Street
PYRMONT NSW 2009
t. +61 29571 7900
www.kistudio.com.au
email: jvg@kistudio.com.au
Contact: Dr. Judy van Gelderen
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Tree Retention & Removal
CONFORMANCE WITH SMMs
(safeguards and management measures)

The urban and landscape design is to comply with the Project SMMs as they relate to urban design and landscape architecture. These are summarised below, with document/design reference information provided.

The compliance tracking register has been updated to reflect the extent of TfNSW’s responsibility for each SMM as specified in Schedule 28 of the Deed (as executed).
### Non-Aboriginal heritage

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<thead>
<tr>
<th>Source Ref</th>
<th>Requirement</th>
<th>Timing</th>
<th>Responsibility</th>
<th>Document reference</th>
</tr>
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<tbody>
<tr>
<td>NAH4</td>
<td>Roads and Maritime will investigate the technical feasibility and suitable location for relocation of the pavilion structure associated with the Captain Cook Bicentennial Memorial, in consultation with Shoalhaven City Council. Subject to the feasibility and suitable location being determined for relocation, Roads and Maritime will meet all reasonable costs associated with its relocation.</td>
<td>Detailed design</td>
<td>Cardno KI Studio</td>
<td>Fulton Hogan TfNSW</td>
</tr>
<tr>
<td>NAH5</td>
<td>Where practicable, investigate opportunities to minimise impacts to the curtilage of ‘Lynburn’ (LEP No.130) and ‘Illowra’ (LEP No. 136). Wherever possible, natural screening adjacent to heritage items along the Princes Highway will be retained. Where impact to vegetation cannot be avoided new plantings will be considered.</td>
<td>Detailed design</td>
<td>Cardno KI Studio</td>
<td>Fulton Hogan TfNSW</td>
</tr>
<tr>
<td>NAH10</td>
<td>Potential impacts of the proposed noise barrier on State heritage listed Graham Lodge (SHR No. 01699) would be assessed during detailed design</td>
<td>Detailed design</td>
<td>Cardno KI Studio</td>
<td>no noise barrier is currently proposed</td>
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### Landscape character and visual impact

<table>
<thead>
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<th>Source Ref</th>
<th>Requirement</th>
<th>Timing</th>
<th>Responsibility</th>
<th>Document reference</th>
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<tbody>
<tr>
<td>LV1</td>
<td>An Urban Design and Landscape Plan (UDLP) will be prepared to inform detailed design and will form part of the CEMP. Development of the UDLP will draw on the Urban Design Report and Landscape and Visual Assessment prepared for the REF. The UDLP will present an integrated urban design for the project, providing practical detail on the application of design principles and objectives identified in the environmental assessment. The UDLP will include design treatments for: • Location and identification of existing vegetation and proposed landscaped areas, including species to be used • Built elements including retaining walls, bridges, and noise walls, and foreshore structures • Pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings • Fixtures such as seating, lighting, fencing and signs • Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage • Procedures for monitoring and maintaining landscaped or rehabilitated areas. The UDLP will be prepared in accordance with relevant guidelines, including: • Beyond the Pavement urban design policy, process and principles (Roads and Maritime, 2014) • Landscape Guideline (RTA, 2008) • Environmentally Friendly Seawalls (OEH, 2009)</td>
<td>Detailed design</td>
<td>KI Studio</td>
<td>refer whole report</td>
</tr>
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Refer to Project Erosion and Sedimentation Plans refer section 5.9 guidelines have been used as reference material
<table>
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<th>Responsibility</th>
<th>Document reference</th>
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<td></td>
<td><strong>Landscape character and visual impact</strong></td>
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<td>LV1 (cont.)</td>
<td>• Bridge Aesthetics (Roads and Maritime 2012)</td>
<td>Detailed design</td>
<td>KI Studio</td>
<td>guidelines have been used as reference material</td>
</tr>
<tr>
<td></td>
<td>• Noise Wall Design Guidelines (RTA, 2006)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• Shotcrete Design Guideline (RTA, 2005). Landscape Guideline (RTA, 2008)</td>
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<td></td>
<td>• Bridge Aesthetics (Roads and Maritime 2012)</td>
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<td>• Noise Wall Design Guidelines (RTA, 2006)</td>
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<tr>
<td></td>
<td>• Shotcrete Design Guideline (RTA, 2005).</td>
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<tr>
<td>LV2</td>
<td>The proposal will be designed to avoid impact to prominent trees and vegetation communities as far as practicable possible.</td>
<td>Detailed design</td>
<td>Cardno</td>
<td>refer sections 4.0, 5.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KI Studio</td>
<td></td>
<td>some areas to be further developed in detail design</td>
</tr>
<tr>
<td>LV3</td>
<td>The proposed bridge design will aim to achieve a slender and less visually intrusive form and be visually harmonious with the existing bridges.</td>
<td>Detailed design</td>
<td>Cardno</td>
<td>refer section 4.3</td>
</tr>
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<td>KI Studio</td>
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</tr>
<tr>
<td>LV4</td>
<td>Investigate introducing retaining walls in the following locations to provide the opportunity to retain existing tree plantings, improve the visual and pedestrian amenity, and reduce the scale of the highway:</td>
<td>Detailed design</td>
<td>Cardno</td>
<td>refer sections 4.0, 5.0</td>
</tr>
<tr>
<td></td>
<td>• Either side of the Princes Highway between Bolong Road and Bomaderry Creek bridge.</td>
<td>KI Studio</td>
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<tr>
<td></td>
<td>• The new northbound bridge approach road</td>
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<td></td>
<td>• Either side of the Princes Highway south of the Bridge Road intersection</td>
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<tr>
<td>LV5</td>
<td>Consider the proposed drainage swale design and location to minimise cutting as well as provide additional space for planting near the corner of the Princes Highway and Illaroo Road</td>
<td>Detailed design</td>
<td>Cardno</td>
<td>refer to section 4.2</td>
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<td>KI Studio</td>
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<tr>
<td>LV6</td>
<td>Consider the proposed footpath alignment and stair design of the path beneath the bridge structures and in Rotary Park to better reflect its parkland setting</td>
<td>Detailed design</td>
<td>Cardno</td>
<td>refer sections 4.2, 5.43</td>
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<td>KI Studio</td>
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<td></td>
<td><strong>Biodiversity</strong></td>
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<tr>
<td>LV7</td>
<td>Consider the alignment of the footpath on the north eastern corner of the existing southbound bridge, in consultation with adjacent land owners, to avoid impact to existing trees.</td>
<td>Detailed design</td>
<td>Cardno</td>
<td>refer section 4.2</td>
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<td>KI Studio</td>
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<tr>
<td>LV8</td>
<td>Investigate the design of the entrance to properties on the north eastern corner of the existing southbound bridge to prioritise pedestrians and cyclists over vehicles and facilitate ease of travel.</td>
<td>Detailed design</td>
<td>Cardno</td>
<td>refer section 4.2</td>
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<td>KI Studio</td>
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<tr>
<td>LV9</td>
<td>Consider the proposed pier designs to strengthen the complementary relationship between the proposed bridge piers and the piers of the existing northbound and southbound bridges. In particular, it will consider tapering the piers at their long elevation</td>
<td>Detailed design</td>
<td>Cardno</td>
<td>refer section 4.3</td>
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<td>KI Studio</td>
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<tr>
<td>LV12</td>
<td>Temporary lighting will be screened, diverted or minimised to avoid unnecessary light spill</td>
<td>Detailed design</td>
<td>Cardno</td>
<td>refer section 4.8.2</td>
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<tr>
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<td></td>
<td><strong>Biodiversity</strong></td>
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<tr>
<td>B17</td>
<td>Shading and artificial light impacts will be minimised through detailed design.</td>
<td>Detailed design</td>
<td>Cardno</td>
<td>refer section 4.8.2</td>
</tr>
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<td>KI Studio</td>
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EXECUTIVE SUMMARY

In accordance with TfNSW’s SMMs, (Safeguards and Management Measures) and the Nowra Bridge 2018 REF, this Urban Design and Landscape Management Plan (UDLP) report includes tables that outline the responses and document references for each SMM requirement.

The UDLP has been developed from a thorough site analysis of the project/landscape context, community aspirations, land use and client's brief. The report outlines the urban and landscape design principles adopted in the design of the new bridge and associated works and demonstrates how the concept designs and strategies proposed provide a design that is highly integrated with the existing site and community context through providing:

- a considered response to the existing natural landscape (especially trees) and community context;
- an understanding of Nowra’s future strategic river/CBD plans and ensuring the design responses help achieve the desired future character;
- a sympathetic response to the existing bridge;
- improved open space connections wherever possible.

The design includes the following key revisions since the tender bid or REF stage:

- maximising tree retention to reduce visual impacts, especially along the Princes Highway- the entrance to Nowra;
- adding a roundabout to Illaroo Road and moving the alignment further to the north
- providing a left turn in lane to Pleasant Way
- new access to the land north of Illaroo Road
- amendment to SUP following receipt of tree survey
Urban Design and Landscape Plan - Nowra Bridge

Urban design strategic concept plan

LEGEND

DESIGN PRECINCTS
1. The Northern Approach, Boolong Rd & Nanno Ridgeline
2. Northbound Bridge over Shoalhaven River
3. Nowra Entrance, Gateway & Southern Abutment
4. The Southern Approach & New Local Rd
   Shared path connecting communities

Key view
- Photomontage viewpoint
- Accent shrubs, trees & groundcovers mark entry to
- Deciduous Brachychiton acerifolium to Boolong Rd
- Spotted Gum woodland dominant
- Swamp Forest dominant
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tr>
<td>CBD</td>
<td>Central Business District</td>
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<tr>
<td>CPTED</td>
<td>Crime prevention through environmental design</td>
</tr>
<tr>
<td>Dia.</td>
<td>Diameter</td>
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<tr>
<td>EEC</td>
<td>Endangered Ecological Community</td>
</tr>
<tr>
<td>LEP</td>
<td>Local Environmental Plan</td>
</tr>
<tr>
<td>LGA</td>
<td>Local Government Area</td>
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<td>NSW</td>
<td>New South Wales</td>
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<td>Not to scale</td>
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<td>REF</td>
<td>Review of Environmental Factors</td>
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<td>SUP</td>
<td>Shared User Path</td>
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<td>Scope of Work and Technical Criteria</td>
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<td>TfNSW</td>
<td>Transport for NSW</td>
</tr>
<tr>
<td>UDLP</td>
<td>Urban Design and Landscape Plan</td>
</tr>
</tbody>
</table>

**REFERENCES**

- Nowra Bridge Project, REF. August 2018
  Roads and Maritime Services
- Nowra Bridge and Interchanges
- Nowra Bridge Concept Design - Existing Structures Report
  Issue 1 | 22 June 2018
  Roads and Maritime Services
- Nowra Riverfront, Strategic Direction: Review & Analysis. October 2017
  Prepared for Shoalhaven City Council by Studio GL
- Proposed Planning Controls, December 2019 - Final Report
  Prepared for Shoalhaven City Council by Studio GL
- TfNSW, Urban and Regional Design Practice Notes,
  Beyond the Pavement, 2009
- TfNSW, Landscape Guideline, December 2018
- TfNSW, Bridge Aesthetics, February 2019
1.0 INTRODUCTION

1.1 BACKGROUND

The project is located in Nowra on the south coast of NSW, about 200km south of Sydney.

Transport for NSW (TfNSW) will construct a new bridge across the Shoalhaven River, Nowra, and undertake ancillary road widening along the main road, adjacent roadworks and intersection upgrades, in addition to providing an improved shared user path (SUP) connectivity.

Key works include:

- Construction of a new northbound bridge to the west (upstream) of the existing bridge crossings over the Shoalhaven River including:
  - four northbound lanes including a dedicated left turn only lane from Bridge Road to Illaroo Road
  - a 3.5 metre wide shared use path on the western side of the bridge connecting the Illaroo Road intersection to the Bridge Road intersection.

- Widening of the existing bridge over Bomaderry Creek to the west

- Minor lane adjustments on the existing northbound bridge to convert it to three lanes of southbound traffic

- Removal of vehicular traffic from the existing southbound bridge. Additional works would be provided under a separate project to convert the existing southbound bridge for adaptive reuse

- Upgrading of the Princes Highway to provide three northbound and three southbound lanes from Bolong Road through to about 10 metres north of Moss Street intersection

- Widening of Illaroo Road over a distance of about 270 metres

- Upgrading of the Princes Highway and Illaroo Road intersection to provide:
  - Two southbound right turn lanes from the Princes Highway into Illaroo Road
  - Three dedicated right turn lanes and one dedicated left turn lane from Illaroo Road to the Princes Highway
  - Acceleration and merge lane for northbound traffic turning into Illaroo Rd from the Princes Highway

- Upgrading of the Princes Highway and Bridge Road intersection to provide:
  - Two southbound right turn lanes from the Princes Highway into Bridge Road
  - One left turn lane from Bridge Road to the Princes Highway

- New Local Road adjustments including:
  - Closing the access between Pleasant Way and the Princes Highway
  - Construction of a new local road connecting Lyrebird Drive to the Princes Highway about 300 metres south of the existing Pleasant Way intersection

- Construction of a new local road connecting Lyrebird Drive to the Princes Highway, about 300 metres south of the existing New Local Road intersection.

- Provision of a roundabout intersection for Fairway Drive and Illaroo Road approximately 200 metres from the Illaroo Road and Princes Highway Intersection.

- Dedicated off road shared use paths and footpaths along the length of the project

- Urban design and social amenity improvements, and landscaping including foreshore pedestrian links to the truss bridge

- Relocation and/or protection of utility services within the affected road corridor

- Drainage and water quality management infrastructure along the road corridor

- Property works including acquisition, demolition, and adjustments to access.

1.2 SCOPE & PURPOSE OF THE REPORT

The purpose of this report is to describe the Urban Design and Landscape Management Plan for the project, its relationship to its context and how the proposed solutions respond to the specific requirements of the context and the community.

The urban and landscape design takes as its starting point the “Nowra Bridge and Interchanges Urban Design Report and Landscape Character and Visual Impact Assessment,” August 2018, by Spackman Mossop Michaels for TfNSW, for the REF (Review of Environmental Factors).

The current design further maximises tree retention to minimise community, visual/environmental impacts and incorporates water sensitive design strategies.

Responses to the Project SMMs (Safeguards and Management Measures) are outlined in the previous section.
1.3 PROJECT SCOPE

This Report responds to SWTC Appendix 31: Urban Design in conjunction with Appendix 15 - Urban Design Performance and Design Requirements of the RFT. The urban and landscape design builds on the Nowra Bridge and Interchanges Urban Design Report and Landscape Character and Visual Impact Assessment, September 2017 and a number of TfNSW urban design guidelines noted in Figure 1.1, including:

- ‘Beyond the Pavement – Urban design policy, procedures and design principles’, Roads and Maritime Services, updated February 2014
- ‘Bridge Aesthetics – Design guideline to improve the appearance of bridges in NSW’, Centre for Urban Design, February 2019
- ‘Landscape design guideline - Design guideline to improve the quality, safety and cost effectiveness of green infrastructure in road corridors,’ Roads and Maritime, December 2018
- “Water sensitive urban design guideline - Applying water sensitive urban design principles to NSW transport projects,” May 2017.

1.4 STRUCTURE OF THE REPORT

This report is structured as follows:

Chapter 1: Introduction and project scope

Chapter 2: Contextual Analysis, provides an overview of the natural and built environment, land use and landscape character sensitivity to inform the design resolution.

Chapter 3: The Design Approach, introduces the design objectives and principles that guide the design. This chapter also includes the Design Philosophy and a Strategic Concept Plan that presents key features of the design in an overview.

Chapter 4: Urban and Landscape Concept Plan, illustrates the overall urban design resolution as a cohesive composition presenting all built form and landscape elements.

Chapter 5: Landscape Design Elements, introduces further details of the landscape design such as earthworks treatments, planting design, species, typical details and schedules.

Chapter 6: Conclusion
2.0 CONTEXTUAL ANALYSIS

Figure 2.1 Existing bridge over Shoalhaven River
2.1 NOWRA PLANNING

Land Use

North of the Shoalhaven River, the suburbs of North Nowra and Bomaderry are divided by Bomaderry Creek. These residential suburbs are surrounded by a highly scenic landscape with extensive greenery.

Bomaderry includes pockets of land used for industrial and agricultural purposes and the Bomaderry Railway Station is situated here.

South of Bomaderry is agricultural land, wedged between the suburb and the Shoalhaven River.

The Shoalhaven River is the most dominant landscape feature of the general area and marks the arrival sequence from the north.

To the south of the river, mixed use dominates the land use, north of the central business district of Nowra. This area comprises a variety of uses, including residential, commercial and recreational.

Just to the south east of the bridge crossing is a caravan park fronting the river while further afield, residential land use dominates the setting.

East of Harry Sawkins Park is a large floodplain area designated as open space.

The varied land use, gives the traveller a rich tapestry of landscapes. It is this varied tapestry that will also influence the design resolution by being site specific and responsive.

Figure 2.2 Land Use pattern. NTS

Source: Nowra Bridge and Interchanges Urban Design Report and Landscape Character and Visual Impact Assessment, Final 06 August 2018; prepared by Spackman Mossop Michaels
Riverfront Strategic Plan

The Nowra Bridge Project is a significant link in the overall strategic planning for Nowra. The adjacent image from the “Understanding the Riverfront Precinct”, 2017 project clearly illustrates three key elements:

- green continuous open space along the Shoalhaven River
- the significance of the high knoll located to the north of the Shoalhaven City Council; and
- the widened footprint for the new road/bridge link into Nowra.

This plan influenced the Fulton Hogan Urban Design & Landscape Plan for this project by acknowledging the significance of the important ridgeline and knoll, north of the Council premises. This influenced the location of the shared path, its relationship to the gateway and the landscape design response. The design responds to the opportunities the topography presents.

The key planning & design principles outlined in the Strategic Design report, as illustrated in Figure 2.3 have influenced the planning and design of the Nowra Bridge project site. Effective pedestrian/cycle connectivity, creation of a strong gateway, having well defined open spaces that connect the river to the CBD and allowing for future catalysts for urban renewal, such as in the Scenic Drive area- are all important planning principles that this plan supports. In relation to the latter, options are presented within this report for further consideration.

Figure 2.3 Riverfront Strategic Plan, Understanding the Riverfront. NTS
Source: Nowra Riverfront Precinct, Strategic Direction: Review & Analysis, Understanding the Riverfront October 2017; prepared by Studio GL for Shoalhaven City Council
1. A permeable and connected network
Redevelopment of the area should create a more permeable access and movement network with improved links from the CBD and Civic Precinct to the river & should prioritise connectivity (pedestrian, bike and vehicle) and links across the river and improve wayfinding by creating new routes to the river.

2. Local Activity Nodes
Create development that can leverage off the value and activity created by existing key nodes including the pool, the hospital, Shoalhaven Entertainment Centre (which now includes the Visitor Information Centre), Council Administration Centre and the nearby CBD and large shopping centre.

3. A strong gateway into Nowra
Create a strong gateway into Nowra that showcases the attractions of the location through high quality landscape, built form, signage and public art and that makes it easy to access the town and the key attractions of the waterfront.

4. An effective pedestrian/cycle network
Ensure direct, safe and convenient pedestrian routes from key destinations such as the Entertainment Centre, the hospital and the Council Building to the river front. Link pedestrian and cycle routes across the river to safe, convenient routes to the high school and town centre and to the shared pathway along the river front.

5. A safe and well defined public domain
Maximise the size and quality of the public domain open space along the waterfront. Increase the amount of level and easily accessed open space that has views of the river. Reduce the number of areas which have links back out onto the open space and increase the attractiveness and value of the existing open space. Retain tall trees and indigenous landscape where possible.

6. Catalyst for urban renewal
Leverage off a high quality public domain as a catalyst for urban renewal and use developer contributions to improve the quality and attractiveness of the open space.

Figure 2.4 Main planning & design principles- Riverfront Strategic Plan, 2017; prepared by Studio GL for Shoalhaven City Council
Nowra Riverfront Entertainment and Leisure Precinct Plan 2019

This report, prepared for Council by Studio GL in December 2019 Nowra Bridge Project outlines planning controls proposed for the riverfront precinct. The intent was to relate to the TfNSW Nowra Bridge Project Submission Report of May 2019. The intent was that planning controls within this document were to be read in conjunction with the Strategic Design Report (on previous page). The scope of this report is the area as shown below and includes areas each side of the Princes Highway, within this current project boundary.

Figure 2.7 illustrates an artist impression of possible future uses along Scenic Drive. The report notes its suitability for entertainment and tourist related facilities, serviced apartments and a wide variety of residential uses, including seniors living.

During the development of the UDLP, alternative options were considered for either removing the cul-de-sac or reducing its length. The current scope is to retain the cul-de-sac option as contemplated by the REF.

From an urban design viewpoint, creating generous open space buffers within the river precinct and complementing future city visions should be encouraged.
The Princes Highway is the dominant route, a major north-south spine for the region. As a result, a lot of regional traffic use this route, including heavy vehicles. The Princes Highway also acts as a key local arterial road, linking North Nowra and Bomaderry with the town centre. Hence, it is important to achieve clear and legible entry points into Nowra CBD.

Illaroo Road is the main connecting road to North Nowra, whilst Bolong Road links to Bomaderry and the railway station.

Bridge Road and Moss Street are two key access points from the Princes Highway to Nowra’s CBD. The New Local Road will provide additional connectivity for cars, pedestrians and cyclists, with the new SUP provided.

For pedestrians and cyclists, the project offers improved facilities. Key shared path links include North Nowra, Bomaderry, the railway station and the southern river foreshore.

The project will also provide a new SUP route south of Bridge Road and extending to Moss Street, linking with the existing underpass across the Princes Highway at Harry Sawkins Park.

With the introduction of the new bridge and cross connectivity for pedestrians and cyclists, it is important to ensure a friendly and open spatial character is achieved that responds to CPTED principles, especially for the areas beneath the new bridge.

**Figure 2.8** A new SUP will link to North Nowra and sections of existing footpaths are retained within the park.

**Figure 2.9** The areas under the abutments require careful design resolution to ensure a friendly environment.

**Figure 2.10** Connectivity. NTS: Source: Nowra Bridge and Interchanges Urban Design Report and Landscape Character and Visual Impact Assessment, Final 06 August 2018; Nowra Riverfront Precinct, Strategic Direction: Review & Analysis, Access network diagram, October 2017; FH Tender design.
2.3 LANDFORM AND HYDROLOGY

The new Nowra Bridge will connect the landforms between North Nowra, Bomaderry and Nowra. The Shoalhaven River divides these land masses.

Key elements as illustrated in the adjacent plan that have informed the design include:

- significant skyline ridges - the main one pertinent to this project being Illaroo Road ridgeline running east - west. Along this ridge, there will be a need for significant cut into rocky areas to fit the widened road and the new access road to the private residence below, as well as earthworks for the bioretention basin. This ridgeline is currently clad in dense vegetation.
- the high knoll east of Bridge Road, which frames the Nowra gateway
- extensive floodplain and creek systems including Bomaderry Creek.

Figure 2.11 From the road corridor, vistas to Cambewarra Mountain are attainable

Figure 2.12 The floodplain is the dominant feature east of the corridor and south of the river

Figure 2.13 Landform and Hydrology. NTS
2.4 SOIL LANDSCAPES

Existing environment:

There are two main soil landscapes throughout the project area - Shoalhaven and Nowra.

"Shoalhaven and Nowra Soil Landscapes by the Soil Landscapes of the Kiama 1:100 000 Sheet (Hazelton, 1992). The Shoalhaven Soil Landscape occurs mainly throughout the northern parts of the study area, with the Nowra Soil Landscape occurring through both the northern and southern parts of the study area.

The Shoalhaven landscape is level to gently undulating with present river bed and banks, active floodplain with levees and backwater swamps on alluvium. It includes the flat to undulating terrace surfaces of the Shoalhaven River.

The soils are moderately deep to Prairie Soils that occur on levees. Red Earths and Yellow and Red Podzolic Soils occur on terraces. Alluvial Soils and Gleyed Podzolic Soils occur on the floodplain.

Limitations include flood hazard, seasonal waterlogging, permanently high water table, hardsetting, acid sulphate potential, strongly acid and sodicity.

The Nowra landscape contains moderately to gently undulating rises to low hills on Nowra Sandstone. Benched sandstone outcrops occur adjacent to drainage lines. Vegetation in the landscape is extensively moderately cleared tall open - forest."

Soil Landscapes

**Shoalhaven soil landscape**

Shoalhaven soil occurs in level to gently sloping river bed, banks and active flood plains where relief is less than 5m and gradients less than 3%. The soil type is alluvium sandstone and shale deposits over an estuarine base. The plant community on this soil type is Swamp Paperbark - Swamp Oak tall shrubland. The area has been completely cleared of vegetation except for a few stands of decorative paperbark (Melaleuca decora), swamp oak (Casuarina glauca), Illawarra flame tree (Brachychiton acerifolium) on terraces and various reeds in swamps. Erosion is an issue with the floodplain subject to scour or sheet and rill erosion during flood events. Generally, the soil has moderate to low fertility, is strongly acidic with low water holding capacity. Flooding is the main landscape limitation.

**Nowra soil landscape**

Nowra soil occurs on moderately to gently undulating rises to low hills where relief is less than 40m and gradients less than 5%. This soil type supports Spotted Gum - Blackbutt shrubby open forest. The area has been extensively to moderately cleared with stands of tall open - forest. Common species include turpentine (Syncarpia glomulifera), grey gum (Eucalyptus punctata), scribbly gum (Eucalyptus sclerophyla), sydney peppermint (Eucalyptus piperita), thin leaved stringybark (Eucalyptus eugenioides), red bloodwood (Eucalyptus gummifera), forest oak (Allocasuarina torulosa) and blackbutt (Eucalyptus pilularis) with an understorey of flaky - barked tea - tree (Leptospermum attenuatum), Mountain devil (Lambertia formosa), hairpin banksia (Banksia spinulosa), pine - leaf geebung (Persoonia pinifolia) and burrawang (Macrozamia communis) grow on sandier soils. Fertility is low to moderate though high organic matter occurs in the top soil. Shallow soils and stoniness are a limitation though these occur in localised sites only. Low water holding capacity.

Figure 2.14 Soil Landscapes. NTS
Source: https://www.environment.nsw.gov.au
Roads and Maritime Services, Nowra Bridge Biodiversity Assessment, August 2018
2.5 VEGETATION

Relating to the two soil landscapes are two main indigenous vegetation communities as summarised below.

**Swamp Paperbark - Swamp Oak tall shrubland on estuarine flats, Sydney Basin Bioregion and South East Corner Bioregion (PCT 1236)**

“Description: This community occurs on the shorelines of estuarine lagoons and brackish lakes, wetlands and creek flats below 10 metres above sea level. The community is predominantly a canopy of Swamp Oak (Casuarina glauca) with occasional remnant mature Eucalypts such as Bangalay (Eucalyptus botryoides) present. The ground cover is highly disturbed and supported mainly exotic grasses and herbaceous perennials.

Large flowering Eucalyptus species such as Bangalay provide high quality seasonal foraging opportunities for nectar feeding fauna. Swamp Oak provides a season foraging resource for seed dependent birds and arboreal mammals. The Swamp Oak also is host for a small number of mistletoe Amyema cambagei which is an important fruit and nectar source for small forest and woodland birds. The vegetation lacked hollows adjacent to the boat ramp for hollow dependent fauna.”

**Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South - East Corner Bioregion (PCT 1206)**

“Description: This community occurs on sheltered slopes with loamy soils below 250 metres mostly between Nowra and Batemans Bay, and mainly east of the Clyde River. The canopy was found to only consist of Corymbia maculata and had a varied, shrubby midstorey dominated by Bursaria spinosa subsp. spinosa, Backhousia myrtifolia, Pittosporum undulatum and Prostanthera incana. Groundcovers species include mix of grasses and forbs such as Themeda triandra, Entolasia stricta, Epidendrum sp., Bryophyllum delagoense and Chlorophytum comosum. Also identified was a diversity of climbers including Smilax australis, Pandorea pandorana and Glycine clandestina. The majority of this community was mapped within the study area as in a moderate condition with a partially disturbed understorey.”

Figure 2.15 Vegetation overlaid on soil landscapes map. NT3

Source: https://www.environment.nsw.gov.au
26 HERITAGE

Non Aboriginal

There are 13 listed heritage items in the Shoalhaven Local Environment Plan, located within the project study area. Two of these items, Graham Lodge and grounds and the Lynburn Timber Federation residence are also listed on the State Heritage Register.

The existing truss bridge over the Shoalhaven River is listed on the Roads and Maritime Heritage and Conservation Register and on the non-statutory Register of National Estate. As this bridge is to be converted to pedestrian use only, there is the opportunity to remove non-original elements including the pedestrian walkway, road signs and guardrails to partially reinstate its original appearance. This scope however, is outside these project works.

The Captain Cook Bicentennial Memorial, situated south west of the southern abutment would need to be relocated. As recommended in the REF, TfNSW could consult with Shoalhaven City Council in relation to its relocation.

The Project will result in a moderate impact to two heritage items, the locally listed “Lynburn” and “Illoera”, both situated in Bomaderry. In both cases, fencing will be relocated and the roadworks would encroach into these properties. In the case of “Illoera”, the impacts are considered higher due to the transition in the topography, limited buffer zones and removal of exotic trees that create a dense buffer to the homestead. For Lynburn, the access is being relocated.

Urban design measures for “Illoera” include replacement fencing; for “Lynburn”, retention of the significant heritage trees noted in the statement of significance:

“The house is a very good example of a single storey, late Victorian, Federation style residence set in landscaped grounds that contain many magnificent mature trees including a Cedar of Lebanon at the gate and a Virginian Swamp Cypress on the south side of the drive that date back to the 1890s.”

This item is assessed as historically rare locally. This item is assessed as aesthetically rare at a State level.

The Project will result in a major impact to the potential heritage item ‘M&M Guesthouse’ (former “Culburra House”). This item will be relocated in consultation with Shoalhaven Council.

Figure 2.16  Figure 3.6: Workers at the approach to the Nowra Bridge, 1881. Source: Wollongong City Library

Figure 2.17  The 1906 built Illoera residence will be impacted by the project. Trees that buffer the property will be removed and the rear fence will be removed and relocated

Figure 2.18  The Captain Cook Bicentennial Memorial needs to be relocated in consultation with Shoalhaven Council

Figure 2.19  Heritage map of the area. NTS Source: Nowra Bridge and Interchanges Urban Design Report and Landscape Character and Visual Impact Assessment, Final 06 August 2018
Aboriginal

Nowra is within the country of the Wodi Wodi speakers of the Dharrwul language (Wesson 2005). Dharrwul speakers reach from Botany Bay and Campbelltown in the north, through to Moss Vale and south to Jervis Bay.

“Nowra is situated at the border between coastal saltwater and plateau freshwater country and it is possible that Nowra constituted a natural meeting place for coastal and inland Aboriginal people”.

Key items that have cultural heritage values include:

- Bomaderry Aboriginal Children’s Home (1908 - 1988) - place of social significance
- Dharrwul - Cabbage Tree Palm (Livistona australis) - food resource; social/religious totem
- Shoalhaven River - waterways providing resources for past and present Aboriginal populations
- Bomaderry Creek - waterways providing resources for past and present Aboriginal populations
- Nowra - place where Aboriginal people presently live and work
- Nowra - place where Aboriginal people previously live and work
- Graham Lodge - evidence of Aboriginal contact with early settlers
- Archaeological sites.

The archaeological sites have been assessed as demonstrating unknown scientific significance. The nature, extent and significance of these places cannot be determined without further investigation.
2.7 LANDSCAPE PATTERNS

The study area interfaces with two distinct geomorphological and botanical zones, the Shoalhaven Plateaus to the west of the bridge and the Shoalhaven Floodplains to the east. The adjacent image illustrates the essence of the landscape patterns. The Shoalhaven River winds through the middle of the project area, which is basically defined as the Princes Highway and Nowra Bridge creating the entrance to Nowra.

To the south west of the Princes Highway, on the southern land mass lies the Nowra CBD, with the Council area ("Communal Hub") adjacent the highway and beside "The Hill" - the prominent knoll.

The river edge is defined along the southern edge by open space that extends into small scaled development areas.

The river’s northern banks are more varied with both steep and gentle transitions to land, including a broader flatter area (e.g. golf course) to the west, contained by a steep cliff face in North Nowra, or the transition from Bomaderry Creek to a wider green link forming the river’s edge.

"The Hill" and the Illaroo Ridge line offer unique view potential from these high areas to adjacent mountains to the north, or floodplain to the south east.
3.0 THE DESIGN APPROACH

3.1 OVERALL APPROACH

The landscape and urban design draws from the REF documents and in particular, Appendix G: Nowra Bridge and Interchanges, Urban Design Report and Landscape Character and Visual Impact Assessment. The urban design has focused in identifying mitigation measures to improve the design and reduce visual impact to the community.

Urban design has been developed as an integral part of the engineering design to ensure a high quality infrastructure is delivered for the community.

The urban design recognises that this project is not only environmentally sensitive, but also highly scenic both for road users and viewers outside the road corridor, particularly along the Shoalhaven River foreshores. The new northbound Bridge over the Shoalhaven River will also reinforce the entry experience into Nowra and improve access into the centre of town, including improved pedestrian and cycle amenity.

The urban design has been developed in close collaboration with the engineering resolution to deliver a high quality design that sensitively integrates the wider footprint into the adjacent landscape. Retention of existing trees has been given high priority.

Urban and landscape design strategies have been integrated in the design to reinforce the identity and to enhance the driver’s experience, creating legible features that will be recognised by the community by and large. Key elements include the new Nowra Bridge and the town’s gateway area.

Built form elements have been designed as site specific and responding to each situation, rather than as part of a suite with a common language. Hence, the adjacent structure, park, trees, heritage items, etc. take precedence and the design directly responds to these elements, creating a form dialogue between old and new, rather then creating a linear landscape. The urban design solutions are simple, durable, low maintenance and engaging.

This approach reinforces the urbaniy and sense of place of the corridor and attempts to achieve a sensitive site response.

Visual and landscape character impacts have been considered in the design resolution and mitigation strategies have been adopted to limit impacts to the community. Key initiatives include the retention of mature trees along the eastern verge, south of New Local Road and maximising tree retention along the western verge. Consolidation of built form elements will reduce visual clutter and provide improved visual screening to heritage items.

The landscape design focuses on the re-establishment of the two key indigenous vegetation communities (Spotted Gum and Swamp Forest) along with integration of cultural landscape themes to mark the gateway.

Batters have been sensitively integrated with civil requirements. Paths and SUP alignments have been further rationalised to reduce footprints and improve user experience.

Landscape design reinforces sustainable principles with planting and water sensitive design strategies wherever feasible to promote longevity, durability, low maintenance and biodiversity.

The urban design vision has considered a sensitive construction methodology that minimises impacts to the community during construction by maximising the use of precast elements for a speedy construction process.

3.2 URBAN DESIGN OBJECTIVES AND PRINCIPLES

The urban design vision focuses on minimising disturbances to the existing riverfront and urban settings, allowing the landscape and its scenery to dominate. To achieve this, it is important to mitigate any impacts along the river foreshore as well as limit the removal of established vegetation, particularly those skyline trees along the ridgelines and tops of cuttings.

The riverscape with its open scenic views to the ranges beyond is a most memorable part of the journey and acts as a gateway into Nowra, when coming from the north.

The urban design of built form components has been developed to take a minimalistic role, except for the new river crossing, which celebrates the river landscape and respects the existing adjacent structures.

At a local level, the urban design attempts to minimise impacts to the community. It is important that the project delivers a sensitive design that is functional for the local community. This approach is fundamental to the urban design resolution of the project.

The design objectives and principles stated in the REF have been considered in the design and have been further refined. The principles have been distilled from the REF and refined to support a practical and sensitive vision.
Achieve a project that fits sensitively with the existing qualities and characteristics of Nowra, North Nowra, Bomaderry and its Shoalhaven River setting.

Urban Design Principles
- Align the abutments on the new bridge to provide visual and spatial continuity and fluidity along the foreshore
- Retain a similar open character of the bridge as the existing northbound bridge
- Re-establish strong greenery at the southern abutment to help settle the structure and frame the entry into Nowra
- Mitigate removal of mature trees along the eastern verge, south of the river
- Make built form elements recede in the setting to allow the landscape to dominate
- Apply gentle batters within floodplain areas where possible
- Minimise the height of the road formation above the floodplain
- Use endemic species for the landscape design strategy to reflect and reinforce the original landscape character
- Apply finishes such as the use of oxides, textures etc for retaining and noise walls that help recede built form structures
- Minimise impacts to and protect the visual curtilage of the heritage properties - Amaroo and Graham Lodge
- Minimise impacts to Aboriginal heritage sites
- Incorporate themes and look for inspiration from Aboriginal history.

Contribute to the accessibility and connectivity into and through Nowra and the surrounding areas

Urban Design Principles
- Where possible, create a more open character for pedestrian access to enhance urban permeability (southern abutment east side, north west abutment park)
- Where practical, locate pedestrian and cycle facilities away from the road carriageway to provide improved amenity for this user group (e.g. shared user path in front of Council building, and through the North Nowra Rotary Park)
- Integrate the pedestrian and cycle path of the new northbound bridge into the Shoalhaven City Council’s existing and future planned network
- Provide easy, logical connections for cyclists/pedestrians and for future land use requirements.

Enhance the quality and value of the public domain within and surrounding the project study area.

Urban Design Principles
- Situate site compounds in areas marked for new uses and foreshore developments
- Align the treatment and locations of abutments to seamlessly integrate with the public domain as far as practical
- Consider the integration of accent planting south of the Shoalhaven River bridge as part of the entry sequence into Nowra
- Allow for clear open views at the abutments as part of CPTED initiatives
- Create a town entry marker that is sympathetic to the community values
- Integrate the design with future land use planning potential as identified in earlier studies, e.g., open space on high knoll south of the existing gateway landscape.
To minimise impacts on the public realm and surrounding land uses

Urban Design Principles

• Develop a construction methodology that minimises disruption during construction for the community. For example, the use of precast elements limits noise and site disturbances during construction.
• Minimise the removal of mature vegetation, as far as possible.
• Ensure pedestrian and cycle paths respond to the topography and existing vegetation to minimise impacts.

Ensure the design responds appropriately to the existing heritage bridge

Urban Design Principles

• Situate shared user path along the western side of the new bridge to maximise panoramic views and vistas to the landscape beyond. This will also ensure good connectivity with existing networks.
• Ensure that the bridge deck is aligned as much as possible in height with the existing bridge.
• Develop a form language of the piers that is sympathetic and consistent with the existing northbound bridge.
• Respect the truss bridge by avoiding any superstructure/design that visually competes with the historic structure.
• Create an ensemble between the new south and northbound bridges so that the historic truss bridge stands out.
• Retain a parallel alignment in plan view with the existing northbound bridge as far as practical.
• Design built form elements that are simple and easy to maintain.
• Create a high quality design with durable materials.
• Consider heritage interpretation on the historic truss bridge or its approaches.
• Introduce street lighting that is consistent in form with the existing northbound bridge.
• Align joints, balustrade post, lighting poles etc., so that these elements create an overall composition with other elements of the bridge such as piers.

Demonstrate sustainability

Urban Design Principles

• Use indigenous plant species suited to the area that require minimal maintenance and that reflect the soil landscape pattern.
• Limit planting of exotic trees in rocky foundations.
• Minimise earthworks and excess materials.
• Reuse and treat existing soils on site to minimise importation of topsoils.
• Utilise existing rock cut material in landscape/drainage works and creatively reuse spoil on site where acceptable.
• Integrate water sensitive design to improve water quality, improve flooding and minimise impacts to the water table.
• Maximise the use of precast construction methodologies to minimise carbon footprints.
• Minimise carbon footprints by sourcing materials locally, minimising fill haulage.
• Use robust, durable materials that minimise maintenance.
3.3 URBAN DESIGN PHILOSOPHY & STRATEGIC CONCEPT PLAN

The Urban Design Strategy is to minimise impacts to the skyline trees that currently frame the entrance to Nowra, rationalise the connectivity footprint for pathways, unify the various areas with a strong landscape planting strategy and resolve each area in a sensitive way that responds to each area’s sense of place.

Within the various zones, the urban design responses reflect unified resolution for each individual component.

For example, the area around Bomaderry Creek requires a completely different response to the area south of New Local Road. Likewise the Northbound Nowra Bridge requires a different response then the widening of Bomaderry Creek Bridge.

A simple story of the corridor is illustrated in the adjacent plan and is divided into four main zones:

1. The Northern Approach, Bolong Rd & Illaroo Ridgeline
2. Northbound Bridge over Shoalhaven River
3. Southern Abutment & Nowra Gateway
4. The Southern Approach & New Local Road

Key strategies include:
- Minimising impacts to existing mature Eucalypts, especially those on the skyline that currently create a strong vegetated framework for the entrance into Nowra
- Enhancing the new gateway to Nowra CBD
- Revegetating using a combination of the original indigenous plants of the area and urban species for the gateway areas
- Exploiting the panoramic contextual views to Cambewarra Mountain and across the floodplain
- Integrating WSUD and infiltration areas within the rural landscape settings
- Screening adjacent residences
- Creating a gateway bridge that heralds the arrival sequence to Nowra
- Varying the fills to relate to the changing landform
- Applying sustainable landscape strategies, with the earth, geology, water and plants.

Bridge Design Approach:

The Northbound Bridge over the Shoalhaven River and the Bridge over Bomaderry Creek each have a distinct role, one crossing a creek whilst the other is crossing a major river. Hence each bridge has a different character and responds to its interface with the landscape / waterscape differently.

The design approach is to respond to each bridge within its own context and relate the new construction to its setting.

The Bridge over Bomaderry Creek is an extension of an existing bridge and the urban design focus has been to integrate the new works with the existing structure in a practical manner. This bridge is visually less exposed than the main bridge over the Shoalhaven River and plays a secondary role in the journey experience.

However, the crossing of the Shoalhaven River needs to be celebrated, whilst respecting the adjacent heritage bridge structures. The urban design focuses on achieving a sympathetic design that is consistent in form language to the adjacent bridge, allowing the historic truss bridge to be the visual focal point of the crossing, together with panoramic vistas into the landscape.
Figure 3.1 Urban design strategic concept plan. NTS

Sources: Spotted Gum Woodland image source: Atlas of Life in the Coastal Wilderness
Key design changes that have effected the urban design since the REF or tender design include:

• Inclusion of the Illaroo Road / Fairway Drive roundabout
• Change from 14 perpendicular car parking along Illaroo Road to 5 parallel parking
• Inclusion of a new access road through the Illaroo Road escarpment
• Inclusion of a bioretention basin and access track to the south bank of Bomaderry Creek
• Additional tree clearing for compound sites
• Adjustment of the proposed spoil site on the south east corner of Bolong Road / Princes Highway intersection and inclusion of a maintenance access track and bioretention basin
• Removal of Scenic Drive / Bridge Road intersection and replacement by Scenic Drive cul-de-sac
• Adjustment of shared and pedestrian paths at several locations, in particular Illaroo Road east verge, and Princes Highway west verge
• Adjustments in relation to “Illowra” homestead
• Reductions in extent of “green”, planted medians along Prince Highway (due to safety concerns)
• Provision of a left turn land into Pleasant Way from Princes Highway Southbound
• Additional tree/vegetation removals due to impacts from the above changes, including extended areas of 4:1 batters along Princes Highway
4.0 URBAN & LANDSCAPE CONCEPT PLAN

4.1 DESIGN PRECINCTS

Three concept plans cover the project works and the approaches for urban and landscape design across the four key design precincts are illustrated on the following pages. The four precincts are:

- The Northern Approach, Bolong Road & Illaroo Ridgeline
- Northbound Bridge over Shoalhaven River
- Nowra Entrance, Gateway & Southern Abutment
- The Southern Approach

Key infrastructure elements of the project include new dual lane carriageways in both directions, and the introduction of new bridges to protect local road connections along the alignment.

As a response to the analysis and brief requirements, the engineering road requirements have been synthesised to reduce the carbon footprint and overall impacts.

The design reinforces the landscape quality of the setting, the unique views from high ridgelines and knolls to the mountain ranges beyond and across the floodplain and enriches the biodiversity of the area through reinforcing the two main vegetation communities of the area.

Within the urban areas, memorable tree species (Grevillea robusta and Brachychiton (Illawarra Flame Tree) are used to mark the new entry into Nowra, and the intersection with Bolong Road. In addition, strong plantings are included for the new gateway to Nowra, which is now reflected on both sides of the Princes Highway.

The landscape will be a stronger, more robust and sustainable landscape in the long term. The increased and improved, bio-diverse greening strategy that also integrates cultural landscape themes will assist the traveller’s perception of time and place.

The urban design introduces simple, articulated elements with new bridge structures with simple, easy to construct pier arrangements.

This is further complemented with the introduction of selected areas of green medians that will help articulate the motorway corridor.

The landscape and urban design strategies will assist in mitigating the impact of the new additions in the Nowra landscape and urban environments and ensure a successfully scaled, integrated outcome between built form and the existing landscape.

4.2 THE NORTHERN APPROACH, BOLONG RD & ILLAROO RIDGELINE

4.2.1 Princes Highway North

Key design elements within this zone include:

- planting of the striking red flowering Brachychiton acerifolium (Illawarra Flame Tree) which is also part of the Swamp Forest vegetation community to mark the intersection of Bolong Road
- design of subtle filling adjacent the Bolong Road intersection to create a low mounded area that also integrates water sensitive design bio-retention areas and swales. There is potential to also integrate a viewing area across the floodplain in this location.
- plantings that reinforce the Swamp Forest vegetation community on the western verge, adjacent Bomaderry Creek Bridge
- weed eradication and revegetation over the area of existing houses to be removed alongside the northern verge of Illaroo Road. This area affords views to Cambewarra Mountain
- weed eradication and bushland revegetation to the rocky, escarpment area (see Figure 4.38)
- plantings of hardy native grasses, cascading groundcovers and low shrubs atop the new rock cuttings to visually mitigate them into the landscape setting
- open space improvements to North Nowra Rotary Park to sensitively integrate the new infrastructure elements, including retention of rock outcrop areas, indigenous tree and shrub interplanting, plantings of native grasses and low shrubs for visual surveillance and integration of the new stairs and access paths under the bridges
- retention of significant Eucalypts where ever possible along the roadside and within the parkscape
- accent low native grasses, groundcovers and shrubs within the median at the approach to the bridge
- improvements (realignment of SUP pathways) to verge design in front of the Perfect Catch Seafoods & Takeaway (now closed) and on the east bridge abutment area to maximise tree retention and to achieve new street trees within the clear zone
- dense screening and combination of retaining wall/filling approach adjacent the “Illowra” heritage property, impacted by the road widening works

Figure 4.1  It is important to minimise any impacts to the eastern verge and retain as much of the existing mature vegetation as possible

Figure 4.2  The interface with the Illowra property is critical as some of its vegetation buffer will be removed
LEGEND

EXISTING ELEMENTS
- Existing trees retained
- Batter as shown
- Existing contours
- Rock revetment
- Rock shelf
- Photomontage view points
- Project boundary
- Local or temporary boundary

TREES
- Eucalyptus spp.
- Riverine spp.
- Deciduous spp.

PLANTING & SEEDING
- Direct seeding - shrubs & groundcovers
- Interplanting
- Mulch only
- Mixed planting beds
- Turf
- Dryland grass
- Native grasses & groundcovers
- Low shrubs & native grasses
- Shrub
- Mixed canopy (Spotted Gum)
- Mixed canopy (Swamp Gum)
- Accent native grasses & groundcovers
- Accent shrubs

WATER SENSITIVE DESIGN
- Vegetated swale
- Bio-retention
- Rock mulch swale
- Infiltration area

WALLS & BARRIERS
- Stone faced retaining wall
- Dry stone boulder retaining edge
- Individual stone placement
- Road barriers: type F wire rope, guard rail

Note: refer to detail plans for location of retaining walls & fencing

OTHER
- Shared user path
- Footpath
- Stabilised granite gravel
Figure 4.4 Urban Design Concept Plan sheet 1. Scale 1:2000
Figure 4.5  View point 1: existing view looking south along the Princes Highway from the intersection with Bolong Road

Figure 4.6  View point 1: indicative photomontage just after construction, illustrating the road widening and landscape design measures
Figure 4.7  View point 1: indicative photomontage ten years after construction, illustrating the road widening and landscape design measures
The section below illustrates the retention of existing trees on the north east approach to the bridge, by retaining existing ground levels and new plantings that reinforce the indigenous species of the Swamp Forest to the western bank.

Figure 4.8 Section at chainage 76875, Princes Highway before Bomaderry Creek. Scale 1:200
The photomontage below indicates the existing trees that are retained on the bridge approach and within the North Rotary Park. It also shows cascading ground covers to top of rock cuttings at this intersection. Accent low planting of low shrubs, native grasses, tussocks and ground covers will be provided to verges either side of the SUP.
Figure 4.11  View point 2: indicative photomontage of the project ten years after construction
4.2.2 Illowra Homestead Interface

The new road works will encroach into the historic Illowra property, requiring modifications to the driveway and removal of the tennis building and some mature trees.

As a result of the road widening, the following mitigation works have been considered:

- combination of retaining walls and filling areas along the western side of the property to mitigate the level transitions and provide privacy
- new fencing atop the new retaining wall to replace existing
- a new gravel driveway cutting through the existing tennis building
- new brick edging to the driveway to match existing
- additional plantings of exotic trees and hardy shrubs and groundcovers

Figure 4.12 Illowra homestead with entrance driveway and central planting/pool focal point

Figure 4.13 Detail plan of Illowra Homestead Interface. Scale 1:500
Figure 4.14 Driveway and turnaround area of the Illowa property. The new fence line will come close to the turnaround area.

Figure 4.15 The Illowa homestead to the left with a steep embankment running up to the Princes Highway. To the right is the existing solid fence fronting the Princes Highway.

Figure 4.16 The driveway will be relocated to the left and the existing tennis building will be removed. A lot of vegetation to the right will require removal due to the roadworks. Sensitive earthworks in the form of batters will be introduced and extensive planting re-instated to limit the impacts of the new works.
Retaining wall & fencing

The new fence is conceived as a privacy screen, replacing the existing solid fence and finished as a metal clad wall with vertical standing seams to give it a neat and minimalistic appearance. The fence will run along the property boundary and design levels have been incorporated to allow for the potential future expansion of the roadway in order to minimise any impacts to the historic property in the future.

A strong piece of flashing will be used as an anti-climbing device on top of the barrier and all accessible surfaces will be treated with an anti-graffiti coating.

Due to level differences between the property’s garden and the shared use path, a retaining wall will be required. This retaining wall is finished as a brick clad wall in a burnt umber colour, sympathetic to other elements within the historic property.
4.2.3 Bolong Road Floodplain

This floodplain area just east of the intersection with Bolong Road was previously used as dairy land, prior to the project going ahead. It offers potential to provide some subtle mounding to be able to utilise some excess spoil from site.

Integrated with the mounding is the required 115m² bio-retention area, which will overflow into the existing swale. The mounding will hug the intersection area and not protrude into high risk flood channel areas to the east. A maintenance bay and track is provided to the bio-retention area.

The majority of all existing mature Eucalypt trees on the steep batter along the Princes Highway will be retained, however some will be removed to accommodate the temporary road works.

Plantings will reinforce the Swamp forest vegetation of the area. Swathes of native grasses and low shrubs will assist in integrating the earthworks in the broader landscape setting.
4.2.4 Bridge over Bomaderry Creek

The Bridge over Bomaderry Creek is an extension of an existing bridge and a practical, yet integrated approach has been undertaken in its design resolution.

Superstructure

The bridge widening is based on a 700 mm deep precast plank superstructure. Even though this treatment is inconsistent with the existing concrete girder's of the existing structure, the width of the new bridge would make this barely perceptible when standing in front of the structure, refer figure 4.25.

Piers and Headstock

The widening includes two piers with a headstock, in line with the existing piers. The headstock will have the same depth as the existing one to ensure visual consistency and a taper is introduced at its ends.

Parapet

The existing pedestrian railing will be removed from the existing bridge and a double rail traffic barrier will be incorporated.

Abutments

The abutments will consist of a batter to match the existing one using scour protection. Additional planting works will be carried out to repair disturbed ground in the vicinity of the scour protection works and drainage works. Hardy indigenous shrubs and grasses will be used.

All accessible surfaces will be treated with an anti-graffiti coating.
Figure 4.26 Cross section of the Bomaderry Creek Bridge. Scale 1:100
4.2.5 North Nowra Rotary Park

Since the REF, the road along Illaroo Road has moved north, which limits impacts on the park, and also includes a roundabout design at the crest.

Unfortunately with the new roundabout design, some of the mature Eucalypts closer to Fairway Drive will now be removed. However previous tree removals shown beside the road kerb are now retained.

Key design elements include:

- indigenous tree plantings within North Nowra Rotary Park where beyond clear zones and away from the top of the rock cut
- a new footpath following the existing alignment and location of the SUP now adjacent the kerbline to limit tree removals
- exposure of rock cut beside the road, planted with native grasses in front, and native grasses and low shrubs atop the rock cut within the park
- accent low native grasses, groundcovers and shrubs to the wider section of median at the bridge approach.
- interplantings of indigenous shrubs, grasses and trees in areas adjacent the new fenceline facing the river
- consolidation of existing grassed areas
- integration of a riprap areas with rock mulch swale to the erodable area adjacent the roundabout

Figure 4.27 The design retains the skyline trees on the northeast bridge approach where no widening is proposed and the two main Eucalypts within the park on the right of the photo

Figure 4.28 Two of these skyline trees will be removed, and two retained. New planting will be re-instated to visually mitigate the project

Figure 4.29 The project will replace the existing footpath through the park and the shared user path is now located kerbside. The majority of the above trees are retained

Figure 4.30 The Rotary obelisk will be retained in its current location

Figure 4.31 These natural rock platforms are retained

Figure 4.32 The project design safeguards two of these skyline trees on the right of the photograph. The toilet blocks will be removed, but a rock cut in this location will reduce views of the river
Figure 4.33. Partial plan of North Nowra Rotary Park. NTS.

Figure 4.34. A provisional amount of landscape remediation works—rockwork and interplanting will be allowed for restorative works under the bridges. New fencing is also required and will be integrated in detail design stage.

Figure 4.35. The amenities blocks will be removed, opening up views to the river and bridge from the park.

Figure 4.36. Both trees in this view are retained, along with the rock boulders and outcropping and majority of the existing footpath.

Figure 4.37. This are closest to Fairway Drive is eroded from road drainage shooting across it. The works include riprap, with wetland filter plantings along with filling scours, finishing with stabilised granite gravel surfacing in between existing trees, and interplanting of indigenous shrubs and trees adjacent the fenceline.
Figure 4.38 Section at chainage MC10, Ilaroo Road - 1:200 - showing concept for exposing rock cuts beside the roadway with native grasses in front, and use of cascading native groundcovers on higher cuts (to right). Right verge is currently housing which will be removed to make way for the widened road corridor and new parkway. Beyond this parkland to the right is a steep escarpment that will have weed eradication, interplanting of indigenous trees, shrubs and native grasses and bushland regeneration approaches. (Will require discussion with Council and community.)
4.2.6 Illaroo Road Escarpment

With the change to the roundabout design since the tender stage, the western verge of Illaroo Road has now become longer. The existing houses along this verge will be removed for the project, thereby opening up a new open space buffer atop the escarpment that steeply falls away to the north to Bomaderry Creek environs.

Within the steep escarpment are massive sandstone formations, boulders and indigenous trees, amongst weed infested vegetation. The vegetation currently provides a dense screen to the escarpment.

There is a new access road now required due to safety concerns with using the location of existing track off the Princes Highway, in relation to the new bridge road design. A high voltage above ground power line will cut through the space and limiting tree planting potential.

It is realised that the new access road, along with the proposed bio-retention basin and required separate access track will have a high visual impact on the escarpment in what is a significantly constrained area. This may be alleviated subject to inspection on site by a Landscape Design Representative.

Key design elements include:

- tree plantings in mulched riplines. This is suggested due to rocky conditions and to achieve a minimal maintenance regime for Council to slash the park grass in the long term
- majority of plantings are restricted to being low in height due to ausconnex clearance requirements
- native grasses in front of rock cutting to define the Illaroo Road edge & direct seeding atop new rock cuttings beside new access road
- planting of cascading native climber, Hardenbergia violacea above the rock cutting on the north verge and along Princes Highway section to assist in visual mitigation
- interplanting of hardy indigenous species from the Spotted Gum Woodland dominant vegetation community within the steep escarpment area, (see figure 4.38) including weed eradication, and areas of bushland revegetation

Figure 4.39 Massive rock boulders within the indigenous vegetation on the escarpment area. Clearing of trees and boulders should be minimised.

Figure 4.40 These houses will be demolished and replaced with widened roadworks, shared path and landscaping along this verge to create a widened open space buffer for the community.

Figure 4.41 Vegetation beyond the houses will require weed management and bushland regeneration practices.

Figure 4.42 Existing vegetation is of mixed character beyond the housing. A tree survey will be necessary to determine which ones are to remain and which are weeds etc.

Figure 4.43 View looking from the access track to the ridgeline of Illaroo Road. These existing trees are significant as they frame the skyline looking both directions - to and from Nowra. The design needs to ensure minimal interference with this environment.
4.3 NORTHBOUND BRIDGE OVER SHOALHAVEN RIVER

The crossing of the Shoalhaven River is the main journey event that signals the arrival into Nowra’s CBD and expresses the town’s river interface. The crossing is celebrated with open views to the high quality riverscape setting, whilst equally considering views from the shoreline onto the structure.

The aim of the new bridge design is to visually relate it to the adjacent bridge and to create a cohesive ensemble of two structures that allows the historic truss bridge to define its unique character. The alignment of the new bridge runs parallel to the existing adjacent structure, ensuring an integrated siting of the new bridge.

Figure 4.44 View point 5: existing situation (left) and photomontage (above) ten years after construction of the new bridge. Note the relationship of piers and deck echo the existing northbound bridge.
4.3.1 Relationship to existing Structures

The northbound bridge is designed to be similar in character and as parallel as possible to the existing northbound bridge. The soffit of the superstructure of the northbound bridge has been designed to match the existing northbound bridge as close as possible, to ensure maritime traffic clearances are retained.

The deck height of the new northbound bridge will be somewhat higher, governed by the depth of the superstructure in relation to the span lengths and driven by the location of the piers on the existing bridges. To align with the existing adjacent structure, the vertical alignment has been kept as ‘flat’ as possible.

Figure 4.45 Cross section of the existing and New Bridge over the Shoalhaven River, illustrating the relationship between the various structures. Scale 1:200.
4.3.2 Superstructure

The superstructure is based on twin T beam girders typically spanning 38.5 metres. The girders are about 1.8 m deep similar to the adjacent structure.

4.3.3 Piers

The piers have been aligned with the adjacent existing bridge, typically spaced at 38.5 m. An exception to this is the end span at the northern abutment and the two end spans by the southern abutment. The northern end span will be about 31 m while the southern end span will be about 22 m, with the second last end span at the southern abutment spanning 34 m.

The northern end span is consistent with the adjacent existing bridge, while the southern end span is shorter, allowing the adjacent span to be more consistent with the typical spans.

The shape of the pier is inspired by the adjacent bridge, based on a ‘V’ shape tapered configuration with a wider base. No headstock is required providing a consistent form language with the adjacent bridge.

Horizontal reveals have been introduced to visually relate to the adjacent bridge piers and also to visually disguise pouring sequences.
4.3.4 Parapets

The parapet facing the existing bridge is based on a double rail barrier with an overall height of 1.78 m, while the parapet facing west has been kept uncluttered and will be 0.35 m high, creating a striking edge.

A kerb has been integrated to minimise staining of the parapet and balustrade posts, mounted on the kerb, are spaced to align with the span rhythm. The balustrades are treated in a similar way as the existing structure and painted white to visually relate to the adjacent existing bridges.

Figure 4.47 View point 7: existing view from Riverbank Reserve looking at the bridge crossing

Figure 4.48 View point 7: indicative photomontage of the new bridge in its setting ten years after construction. Note the limited visual effect of the new structure compared to the existing situation
4.3.5 Abutments

4.3.5.1 Northern Abutment

The northern abutment will approximately align with the abutment of the adjacent existing bridge and interfacing with the sandstone outcrop. It will be treated in a similar way by providing a conventional sill beam founded on rock.

The existing pedestrian walkway underneath the bridge will be modified to suit and widened to 2.5m in width.
4.3.5.2 Southern Abutment

To visually integrate with the existing situation, the southern abutment is conceived as a spill-through abutment with stone pitching. The abutment aligns with the existing ones to unify the two bridges and creates a neat interface of the new structure.

The existing pedestrian path will be widened to 2.5m and realigned.

Figure 4.52: The spill batter will reflect a similar treatment to the existing situation to create a seamless integration of the new structure.

Figure 4.53: The abutment will be supported by driven steel tubular piles.

Figure 4.54: The existing walkway will be slightly re-aligned and widened. Areas on the lower side will be planted with native grasses.
4.3.6 Lighting

Light poles have been integrated and aligned either with the piers or at mid-span. To avoid any clutter along the parapets, the lighting poles have been situated along the barrier. This will reduce the visual prominence of these elements and provide a more integrated design resolution.

4.3.7 Anti-Graffiti

All accessible concrete surfaces will be treated with an anti-graffiti coating.
Figure 4.56 Viewpoint 6: Indicative photomontage of the new Bridge over the Shoalhaven River ten years after construction
4.4 NOWRA ENTRANCE, GATEWAY & SOUTHERN ABUTMENT

This area will experience the highest visual impact of the project. Currently the entrance into Nowra for this section of Princes Highway is flanked on both sides of the road by Eucalypts. Whilst this design retains many more trees than in the REF design, there will still be high visual impact due to the roadworks.

This area includes an array of open spaces and foreshore areas, all interconnected to create a green spine that connects from the foreshore to Council’s chambers and future development sites in the future.

It also includes the Nowra Gateway, marking the entrance into Nowra’s CBD and treatments in vicinity of the bridge abutments.

The key design principles for this section are to:

- create a strong treed entrance into the Nowra CBD.
- introduce green medians at bridge approaches to articulate the roadway
- carefully integrate the SUP from the gateway to the south by articulating it at a higher level to ensure improved user experience and also to retain maximum number of trees
- ensure the design for the south west abutment enhances long term Council plans for the River revitalisation
- use a mixture of Eucalypts (to reinforce the river) and deciduous accents (to reflect the CBD) to mark the gateway intersection
- reinforce the indigenous Spotted Gum Woodland character to the higher ridgeline areas
- integrate bridge abutments into their adjacent settings

Figure 4.57 Existing gateway marking the entrance into Nowra’s CBD
Figure 4.58 Urban Design Concept Plan sheet 2. Scale 1:2000
4.4.1 Existing Southern Abutment

4.4.1.1 Existing Northbound Bridge

A gate will be introduced to deter access to the pedestrian path of the existing northbound bridge. The gate will be similar in character to the existing balustrade and will be painted white to match the existing structure.

4.4.1.2 Return Wall of Historic Truss Bridge

There is an existing crib-wall with interlocking concrete pre-cast modules in disrepair. This wall interfaces with the existing southern abutment of the truss bridge, facing east.

The existing crib wall will be removed and replaced with a shotcrete wall with soil nails, clad with natural sandstone.

The sandstone cladding will have a strong horizontal emphasis with an Ashlar pattern to complement the finish of the existing northern abutment. This wall will have a 1:40 tilt towards the retained side.

The top of wall will include a concrete capping with a strong shadowline and a smooth top edge.

The walls will be finished in a neutral grey oxide colour to visually settle these elements and all accessible areas will be treated with an anti-graffiti coating.
4.4.2 Southern abutment open space - Scenic Drive

The REF, tender design, and current design development all show a long cul-de-sac in this area, that restricts (from an urban design viewpoint) the future open space connectivity of the area.

The Council Riverfront reports dated 2017 and 2019 illustrate future aspirations for this area, that this project could also embrace.

Prior discussions between TfNSW & Shoalhaven Council discussed potential amendments to the cul-de-sac, including removal of the cul-de-sac and shortening of the cul-de-sac.

The advantages of these options included maximisation of open space opportunities and relationships between future land uses and the river.

However, the cul-de-sac arrangement has been maintained as contemplated by the REF. This ensures consistency with the current project approvals and prior consultation with adjacent land owners. Alternatives as mentioned above may be explored at a later date, subject to further consultation with relevant stakeholders, although do not currently form a part of the Detailed Design.
4.4.3 Nowra Gateway

Key design elements within this zone include:

- planting of upper canopy of Spotted Gums, (to reinforce indigenous context) with mid storey of Pyrus spp (Ornamental Pear) and Lagerstroemia “Natchez”(White, Indian Summer Crepe Myrtle) to reinforce the CBD context
- redesigning new signage and retaining walls in keeping with the existing rock retaining walls, and the South Nowra sign, yet with a more contemporary form
- relocating the Nowra Bridge memorial and commemoration plaque to better integrate it with the new works (especially the new feature garden beds) at the approach to the old truss bridge
- retaining a large grassed meeting place in front of the signage area, (approximately 15 metres) and providing seating height stone walls in front of the signage
- maximising the views to Cambewarra Mountain by integrating a bench seat on the upside of the SUP with good views
- integrating a SUP that gently meanders along the ridgeline/ knoll that will integrate well with future open space corridor plans as envisaged in Nowra’s strategic planning
- providing one wide section of low, hardy median planting of native grasses and low shrubs to articulate the scale of the road and to mark the approach to the Nowra Gateway
- accent plantings in vicinity of the signage and walls to provide colour, texture and form contrast, fitting to the gateway area
- providing low hardy native grass plantings on topsoil in front of the exposed solid rock cuttings
- retaining the existing heritage trees (deciduous) within the road verge adjacent Graham Lodge
- providing a backdrop of Spotted Gum Woodland trees on the knoll behind the new gateway.
Figure 4.68: Gateway plan, NTS

Figure 4.69: Existing situation

Figure 4.70: Indicative cross section of the gateway, NTS. The signage & seating walls will be complemented with a strong landscape design and will visually relate to the southern gateway by using a similar font and contemporary feel. The signage will be treated with an anti-graffiti coating.
Figure 4.71 Viewpoint 3: Indicative close up view of the new Nowra gateway area just after construction
Figure 4.72 Viewpoint 3: Indicative close up view of the new Nowra gateway area ten years after construction
4.4.4 Integrating the SUP with the gateway

The REF design would have removed the majority of the existing trees along this batter that currently provide important visual skyline greening to not only the entrance to Nowra, but also to views from the floodplain.

This Urban Design scheme maintains some of the groups of mature Eucalypts along this verge, that are feasible to retain - either within the verge slope or atop the cutting that provides screening to Council buildings as well as skyline greening. Key design elements include:

- locating the SUP partly atop the ridgeline running parallel to the road corridor, adjacent Council property boundary to enable tree preservation with a sinuous alignment weaving between the main groups of trees and connecting to the high knoll behind the gateway area
- weaving the SUP back to the kerbline before weaving back to the lower level of the open space beside the existing pond to meet the pedestrian path at the existing underpass, from where it grades back up to kerbline at chainage 77700.

Advantages of this design are:

- maintaining some groups of trees with the aim to protect some of the green framework on this entrance to Nowra
- improving safety for pedestrians and cyclists by being away from a busy road
- providing an improved user experience for cyclists/pedestrians-as they experience the landscape knoll/ridgelines
- the scheme complements the future planning for the area through providing for future connectivity with planned new development
- provides opportunity for a viewing area to capitalise on views across to Cambewarra range
- using rock cut to express geology of the area

Figure 4.73 Views to Cambewarra Mountain are obtained from this ridgeline and knoll - the shared use path users will appreciate this view

Figure 4.74 The SUP alignment will wind up behind this group of trees to higher ground

Figure 4.75 The majority of this group of trees is retained with the design-they provide dense screening of the road corridor from the Council building

Figure 4.76 The SUP will be winding up to the higher ground south of the gateway. NTS
Figure 4.77  Section at chainage 77650. Scale 1:200 - showing rock cuts to west verge with concept for integrating the SUP with rock cutting earthworks and creation of gentle batters to council side.
4.5 THE SOUTHERN APPROACH & NEW LOCAL ROAD

This area includes the Prince Highway widening areas south of the Gateway to the Moss Street intersection at Nowra CBD and the floodplain area of New Local Road.

4.5.1 Shared User Path Alignment on west verge

The design carefully integrates the shared user path along the western verge in the adjacent landscape. It retains some of the significant trees along the sections where it was feasible with levels to retain them; and retains significant screening of dense Casuarina dominant vegetation adjacent the Council buildings.

Where trees are in close proximity to the shared path, and there is a level difference less than one metre or so, introducing retaining boulders edges to minimise level changes within tree root zones may be undertaken subject to inspection on site by a Landscape Design Representative.

The shared path crosses an existing drainage channel prior to leaving the kerb meet the culvert and underpass in the southern section (near the drainage outfall of Harry Hawkins Pond).

Figure 4.78 Views looking south in front of Council building - the majority of these trees will be retained

Figure 4.79 The SUP here is against the kerb, within a new, widened verge for the future intersection. Unfortunately these trees will be removed.

Figure 4.80 The SUP is aligned against the kerbline, and with the current 4:1 batter, the majority of trees will be removed. Drystone boulder retaining edges will be applied to minimise impacts to tree roots where shown. NTS
LEGEND

EXISTING ELEMENTS

- Existing trees retained
- Batter as shown
- Existing contours
- Rock revetment
- Rock shelf
- Photomontage view points
- Project boundary
- Local or temporary boundary

TREES

- Eucalyptus spp.
- Riverine spp.
- Deciduous spp.

PLANTING & SEEDING

- Direct seeding - shrubs & groundcovers
- Interplanting
- Mulch only
- Mixed planting beds
- Turf
- Dryland grass
- Native grasses & groundcovers
- Low shrubs & native grasses
- Shrub
- Mixed canopy (Spotted Gum)
- Mixed canopy (Swamp Gum)
- Accent native grasses & groundcovers
- Accent shrubs

WATER SENSITIVE DESIGN

- Vegetated swale
- Bio-retention
- Rock mulch swale
- Infiltration area

WALLS & BARRIERS

- Stone faced retaining wall
- Dry stone boulder retaining edge
- Individual stone placement
- Road barriers: type F wire rope, guard rail

Note: refer to detail plans for location of retaining walls & fencing

OTHER

- Shared user path
- Footpath
- Stabilised granite gravel
Figure 4.81 Urban Design Concept Plan sheet 3. Scale 1:2000

- Existing slope retained where possible to maximise tree retention
- Rock mulch/soil interplanted
- Existing trees retained against culvert
- Dense tree plantings to replace removed trees
- RW sections adjusted for SUP
- Underpasses
- Biofiltration/riprap
- New swale connection to wetland filters
- Dry stone retaining edges where possible to minimise impacts to trees
- Weed removal & interplanting of Swamp Paperbark spp.
4.5.2 Eastern verge - between Bridge Road and New Local Road

Along this eastern verge section of the Princes Highway there are key design responses:

- retention of the existing heritage trees in vicinity of Graham Lodge
- exclusion of a noise wall (as proposed in the REF) as it would have caused removal of all trees along this verge
- maximising tree retention as they create a strong green skyline to the corridor and also to the floodplain
- measures such as varying the batter and steepening the rock cut in the vicinity of the tree canopies as illustrated will minimise impacts to ground levels in vicinity of tree roots
- incorporation of native grass and low shrub plantings along the edges of cuts and SUP

Figure 4.82 Looking across to the eastern verge of Princes Highway, where the existing Eucalypts frame the road and the floodplain

Figure 4.83 Looking north along the eastern verge of Princes Highway, where the existing Eucalypts frame the road and sit beyond the existing cut. The widening of the road will cut into the existing rock bank, and remove the trees in the foreground.

Figure 4.84 Looking from the verge to Graham Lodge through the surrounding heritage trees that are significant in the way they define the property and provide a visual buffer. These trees are being retained

Figure 4.85 Plan showing works along east verge with SUP meandering between groups of trees. NTS
4.5.3 Princes Highway widening—
from New Local Road to Moss Road

Key design responses to the road widening in this area are:

• tree retention where possible (Casuarinas on north verge and for a section of the south verge)
• replacement of large Eucalypts removed with tree canopy dominated by *Eucalyptus saligna* x *botryoides* (Bangalay) and *Syncarpia glomulifera* (Turpentine)
• rock mulched swale from New Local Road to the large culvert to the south
• reinforcement of Swamp Forest species along the low lying areas
• integrating WSUD with existing drainage lines, especially in vicinity of the culvert on the west verge

Figure 4.86 Looking north along the eastern verge of Princes Highway, where the existing Eucalypts will be removed. This area will be densely planted to reinforce the Swamp Forest species.

Figure 4.87 These Casuarinas that currently screen the skate park and frame the view and the road corridor at this southern end will require removal with the road widening.

Figure 4.88 Looking to the Casuarinas that will be removed as part of the road widening. Eucalypt dominant plantings will replace them with improved CPTED outcome.

Figure 4.89 Looking north to mountain ranges in the background. Some of the Casuarina trees in the foreground will be retained, on both sides of the road, yet the majority of existing mature Eucalypts will need to be removed with the road widening. This will impact skyline views in both directions.
Figure 4.90  Section at chainage 78075, Princes Highway. Scale 1:200, showing goal of maximising retention of existing Casuarina dominant trees on both sides of the widened road at this section near the culvert.
Figure 4.91  View point 4: existing view looking north along the Princes Highway, near the intersection of New Local Road

Figure 4.92  View point 4: indicative photomontage of the project just after construction
Figure 4.93 View point 4: indicative photomontage of the project ten years after construction
4.5.4 Harry Sawkins Park Interface

This area is where the SUP meanders down from the kerb to the culvert area, where the existing park pond outflows through the culvert to the area on the east verge. Currently there is an extensive wet area, with stepping stones.

The design responds to the site constraints through:

- extension of the stormwater culvert to also allow for the meandering SUP alignment
- installation of wet native grassland plantings, and riprap with infiltration are adjacent the pond where to integrate with the realigned swale
- reinforcement of Swamp Forest tree species
- retention of the existing Casuarinas wherever feasible
- realignment of the low stone retaining wall to allow the SUP to link to the north
- designing the planting for visual surveillance

Figure 4.94 Existing pond interface/outflow adjacent the culvert (right)

Figure 4.95 Concept plan for landscape improvements showing new plantings of trees, shrubs, native grasses, wetland filters and restoration of existing grassed areas. NTS

Figure 4.96 Looking towards the existing culvert which will be extended for the road widening
4.5.5 Floodplain - the southern approach

This section describes the New Local Road design which will provide a new access to the residential area east of the bridge. Key design elements include:

- dryland grassing to batters and turfed vegetated swale
- informal groups of Swamp Forest tree species (*Eucalyptus botryoides*, *Casuarina glauca* and *Melaleuca decora*) to allow open views across floodplain and provide shade to the shared user path
- reinforcement of Swamp Forest species along the low lying areas
- screen planting along the fenceline for the existing housing
- retention of view corridors along the road to the heritage cemetery

Figure 4.97 View looking west across floodplain to line of Eucalypts on both sides of the Princes Highway

Figure 4.98 View looking towards the new housing that will back onto the road corridor. Indigenous tree and shrub screening will mitigate this view

Figure 4.99 The cemetery associated with Graham Lodge, within the flood plain. The project allows for connectivity to this from the new pathways
Figure 4.100 Section at chainage MC30 - 100, New Local Road Scale 1:200 - showing introduction of SUP with shade trees in clusters to retain openness of floodplain landscape.
4.6 SIGNAGE AND LIGHTING

4.6.1 Signage

The signage of the project follows stringent regulations, based on a number of parameters. Locations for the signs have been reviewed and consolidated as far as practical and relocated in situations to make these elements less obtrusive.

For further information on signage locations, refer to Appendix A.

4.6.2 Lighting

The road lighting has been developed with the intent of retaining consistency with the existing light poles along this stretch of highway.

The poles will have a curved outreach and use impact absorbing type poles. The poles will vary in height from 10.5m to 12.5m depending on the road’s geometry and column spacing.

Where the shared user path is isolated from the roadway, a 6m high pole is introduced with a short 0.5m outreach to minimise glare and provide a more pedestrianised character.

Temporary Lighting

To satisfy the SMM (LV12), the team will ensure that temporary lighting will be screened, diverted or minimised to avoid unnecessary light spill. In addition to minimise impacts on biodiversity (SMM B17), the detail design will ensure that shading and artificial light impacts will be minimised.

Figure 4.101 Example of the type of light pole used for the project
Figure 4.102 Erection and installation details for light columns (typical). NTS
Figure 4.103 Erection and installation details for light columns (adjacent to a fill batter). NTS
Figure 4.104 Detail of lighting column for SUP. NTS
5.0 LANDSCAPE DESIGN ELEMENTS

5.1 EARTHWORKS, LANDFORM AND SLOPE STABILISATION

5.1.1 Design Principles
The design of cuts and fills has been integrated with the landscape in order to maximise retention of existing vegetation and to reduce visual impacts. Key principles incorporated include:

• rounding tops and side edges of cuts
• exposing natural rock faces wherever possible
• designing earthworks that fit the adjacent terrain
• locally steepening slopes around existing trees at the base of batters to maximise tree retention
• integrating existing drainage wherever possible
• avoiding steep slopes and use of shotcrete.

5.1.2 Varying Batter slopes
Batters vary throughout the corridor, changing to integrate with the adjacent topography. Many of the batters will be in rock cut, and left exposed as stable rock.

Other than the rock cuts, the maximum batter slopes of 2:1 will reduce the need for batter stabilisation. Wherever possible, batters are gentler and integrated with the topography. Through the floodplain and lowland areas, 4:1 batters are common.

The following pages outline the main revegetation scenarios for the varying conditions that will be applied according to location, accessibility, element of risk, and practicality in constructability. Note: the landscape design and methodology may vary during implementation, due to additional site constraints identified during construction.

5.1.3 Typical Earthworks Sections
Refer to section 4 for additional sections. The sections below illustrate typical cut and fill sections.

The following methods will be further assessed in detail design.

5.1.4 Shotcrete Treatments
It is not anticipated to apply any shotcrete in the project. However, should this be necessary the shotcrete colour and finish will match the natural rock colour, geological pattern and texture of the adjacent cutting.

This will be achieved through the application of oxide colours on the surface to create a mottled “faux” rock finish and the sculpting of shotcrete to achieve a varied texture. TfNSW’s shotcrete principles and guidelines will be applied during detail design should any shotcrete be used.

Figure 5.1 Maintaining existing levels around the root zones of mature trees will be given high priority where feasible in fill embankments as illustrated, with local steepening of batters to achieve this.

Figure 5.2 Typical cut situation where existing rock will be visually exposed, showing planting in front and low shrubs and native grasses above.
5.2 PLANTING DESIGN

5.2.1 Plant selection influences

Soil Landscapes Influence

The adjacent plan of Soil Landscapes and remaining sections of original vegetation illustrates the result of urbanisation across the area.

Whilst there is little space within the project for reflecting the indigenous vegetation communities that were aligned with the original soil landscapes, there is scope for using dominant tree and shrub species from the main communities where space and services allow.

It is mainly in the broader open space areas, adjacent Bomaderry Creek where this scope arises. The indigenous plant species also support local fauna/bird species, hence promoting biodiversity.

The two key plant community associations that have been applied in broader park and river areas include:

- Spotted Gum (on higher ground)
- Swamp Paperbark (on lower areas and floodplain)

Council Species Lists

The lists of plant species suitable for each Nowra precinct, and additional species lists provided in 2020 by Council, have also been used as a reference for species selection for plant mixes.

5.2.2 Planting Design Strategy

As illustrated in the Strategic Urban Design Concept, the revegetation strategy reinforces both:

- the natural ecologies, including the two existing remnant vegetation communities through the corridor for enhancement in open space areas where space and services permit. The Swamp Paperbark community is mainly in vicinity of Bomaderry Creek and the Spotted Gum Woodland is in the gateway area and higher ridge beyond
- the cultural landscape for the areas such as around historic homesteads and for the intersections and Nowra gateway area.

The landscape concept design drawings outline more detailed revegetation information, based on the above two themes and appropriate species for urban landscape park areas, arrival into Nowra and the gateway accent area.

Planting design has been discussed with Council and changes made to reflect more “urbanity” into the approaches to Nowra. Massing of native shrubs (including more hybrids) in lieu of a mixture of native grasses, and refinements to native grass mixes and upper tree canopy selection have been made since the Tender Design.

Figure 5.3 Existing indigenous vegetation remaining on site, within the soil landscapes. NTS
5.2.2 Planting Design Strategy

Tree sizes vary from tubestock, 5L to 45L, and a few at 150mm pots, depending upon location and species type. Tree sizes vary from tubestock, 5L to 45L, and a few at 150mm pots, depending upon location and species type.

Trees in mixed canopy areas are at 0.25/m² (i.e., the average density for SWT minimum 3-5m spacings).

High shrubs and small shrubs in mass planted beds will be planted at 1/m² for all areas as they are narrow spaces.

Low shrubs will be planted at 1/m² in corridor areas / for screening, and 2/m² in medians (few areas now proposed) compared to 4/m² as requested for shrubs in these areas for SWT.

Native grasses are planted as 6/m² as 50mm tubes in areas beyond medians and roundabouts. (compared to previous 100mm tubes planted at 4/m²)

Spot Planting & Interplanting: tree spot planting is with 45 litre sizes (with a few at 75L) used to accentuate key intersections and areas of high visually impact as per SWT. Elsewhere spot planting & inter planting will be at 5 litre sizes.

Median plantings will have 150mm pots for accent shrub planting @2/m², rather than smaller size tubestock at lighter densities (4/m² as stipulated in SWT). Native grasses will be 150mm pot size @ 4/m².

Mulched ripline plantings are proposed within the new open space area along Illaroo Road- north verge. Tree planting within these will be 5L and planted at varying spacing between 1.5 and 3m with average of 2 metres.

Refer to the detail design drawings for construction planting plans that illustrate the location of each mix through the project.

**Plant Mixes**

The following plant mixes and graphic strips represent the key planting design characters for the project. The mixes are varied and either relate to the natural vegetation communities, cultural landscape themes already present or other local landscape character influences. The closer to the gateway, and at intersections, the more “formal” or “semi urban” the plant selection is. Adjacent creeks and on ridgelines in more natural areas, the planting design reflects the indigenous vegetation communities.

### Plant Densities

Plant densities are illustrated in the tables.

**Plant Sizes**

Sizes are according to SWT. All plantings of native grasses (50mm tubes) will be at 6/m² unless otherwise noted. Where accent planting is used in medians or in accent planting areas, such as at the gateway, larger 150mm pot sizes are used and the density is reduced to 4/m².

Shrubs will be in tubestock or 150mm pots, depending on location and groundcovers will vary from tubestock to 150mm pots, depending upon location and species type.

Tree sizes vary from tubestock, 5L to 45L, and a few at 75L as shown on the planting plans.

<table>
<thead>
<tr>
<th>Species Common Name</th>
<th>Size</th>
<th>Plant%</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocasuarina floriformis</td>
<td>‘Forest Oak’</td>
<td>tubestock</td>
<td>5%</td>
</tr>
<tr>
<td>Corymbia maculata</td>
<td>‘Spotted Gum’</td>
<td>tubestock</td>
<td>10%</td>
</tr>
<tr>
<td>Eucalyptus globulus</td>
<td>White Stringybark</td>
<td>tubestock</td>
<td>30%</td>
</tr>
<tr>
<td>Eucalyptus radiata</td>
<td>Grey Ironbark</td>
<td>tubestock</td>
<td>15%</td>
</tr>
<tr>
<td>Eucalyptus sclateriana</td>
<td>Scribbly Gum</td>
<td>tubestock</td>
<td>10%</td>
</tr>
<tr>
<td>Backhousia myrtifolia</td>
<td>Grey Myrtle</td>
<td>tubestock</td>
<td>5%</td>
</tr>
<tr>
<td>Gossamer Wattle</td>
<td>tubestock</td>
<td>5%</td>
<td>0.25 m²</td>
</tr>
<tr>
<td>Allocasuarina cunninghamiana</td>
<td>‘Deciduous Paperbark’</td>
<td>tubestock</td>
<td>10%</td>
</tr>
<tr>
<td>Syncarpia glomulifera</td>
<td>Turpentine</td>
<td>tubestock</td>
<td>8%</td>
</tr>
<tr>
<td>Acacia longifolia</td>
<td>Sydney Golden Wattle</td>
<td>tubestock</td>
<td>5%</td>
</tr>
<tr>
<td>Backhousia myrtifolia</td>
<td>Grey Myrtle</td>
<td>tubestock</td>
<td>5%</td>
</tr>
<tr>
<td>Kunzea ambigua</td>
<td>Tick Bush</td>
<td>tubestock</td>
<td>3%</td>
</tr>
<tr>
<td>Melaleuca ericifolia</td>
<td>Swamp Paperbark</td>
<td>tubestock</td>
<td>10%</td>
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### HS_A High Shrubs Mix A

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant%</th>
<th>Density</th>
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</thead>
<tbody>
<tr>
<td>Acacia triumvata</td>
<td>Two-veined Hickory</td>
<td>Tubestock</td>
<td>5%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Acacia forbesii</td>
<td>Gossamer Wattle</td>
<td>Tubestock</td>
<td>5%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Acmena smithii</td>
<td>Dwarf Lilly Pilly</td>
<td>Tubestock</td>
<td>2%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Banksia ericifolia</td>
<td>Heath-leaved Banksia</td>
<td>Tubestock</td>
<td>10%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Banksia serrata</td>
<td>Old Man Banksia</td>
<td>Tubestock</td>
<td>24%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Banksia marginata</td>
<td>Silver Banksia</td>
<td>Tubestock</td>
<td>7%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Bursaria spinosa</td>
<td>Blackthorn</td>
<td>Tubestock</td>
<td>10%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Callistemon salignus</td>
<td>Willow Bottlebrush</td>
<td>Tubestock</td>
<td>12%</td>
<td>1 /m²</td>
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<tr>
<td>Hakea salicifolia</td>
<td>Willow-leaved Hakea</td>
<td>Tubestock</td>
<td>20%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Kunzea ambigua</td>
<td>Tick Bush</td>
<td>Tubestock</td>
<td>14%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Persoonia linearis</td>
<td>Narrow-leaved Geesung</td>
<td>Tubestock</td>
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<td>1 /m²</td>
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</table>

### HS_B High Shrubs Mix B

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<tbody>
<tr>
<td>Acacia triumvata</td>
<td>Two-veined Hickory</td>
<td>Tubestock</td>
<td>5%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Acacia forbesii</td>
<td>Gossamer Wattle</td>
<td>Tubestock</td>
<td>5%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Acmena smithii</td>
<td>Dwarf Lilly Pilly</td>
<td>Tubestock</td>
<td>2%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Banksia ericifolia</td>
<td>Heath-leaved Banksia</td>
<td>Tubestock</td>
<td>7%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Banksia serrata</td>
<td>Old Man Banksia</td>
<td>Tubestock</td>
<td>10%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Bursaria spinosa</td>
<td>Blackthorn</td>
<td>Tubestock</td>
<td>20%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Hakea salicifolia</td>
<td>Willow-leaved Hakea</td>
<td>Tubestock</td>
<td>20%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Kunzea ambigua</td>
<td>Tick Bush</td>
<td>Tubestock</td>
<td>20%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Persoonia linearis</td>
<td>Narrow-leaved Geesung</td>
<td>Tubestock</td>
<td>5%</td>
<td>1 /m²</td>
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</table>

### LS_A Low Shrubs Mix A

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant%</th>
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<tbody>
<tr>
<td>Acacia binervata</td>
<td>Two-veined Hickory</td>
<td>Tubestock</td>
<td>5%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Banksia spinulosa</td>
<td>Hairpin Banksia</td>
<td>Tubestock</td>
<td>20%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Dodonaea triquetra</td>
<td>Large-leaf Hop-bush</td>
<td>Tubestock</td>
<td>15%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Grevillea buxifolia</td>
<td>Grey Spider Flower</td>
<td>Tubestock</td>
<td>30%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Indigofera australis subsp. australis</td>
<td>Austral Indigo</td>
<td>Tubestock</td>
<td>15%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Leptospermum attenuatum</td>
<td>Coastal Rosemary</td>
<td>Tubestock</td>
<td>10%</td>
<td>1 /m²</td>
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### LS_B Low Shrubs Mix B

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Banksia spinulosa</td>
<td>Hairpin Banksia</td>
<td>Tubestock</td>
<td>20%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Bauera rubidola</td>
<td>River Rose</td>
<td>Tubestock</td>
<td>5%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Callistemon veronicus “White Arons”</td>
<td>Willow Bottlebrush</td>
<td>Tubestock</td>
<td>30%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Grevillea lanigera</td>
<td>Woolly Grevillea</td>
<td>Tubestock</td>
<td>15%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Westringia fruticosa “Smokey”</td>
<td>Coastal Rosemary hybrid</td>
<td>Tubestock</td>
<td>25%</td>
<td>1 /m²</td>
</tr>
</tbody>
</table>

### LS_C Low Shrubs Mix C

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant%</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia binervata</td>
<td>Two-veined Hickory</td>
<td>Tubestock</td>
<td>5%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Banksia spinulosa</td>
<td>Hairpin Banksia</td>
<td>Tubestock</td>
<td>25%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Grevillea buxifolia</td>
<td>Grey Spider Flower</td>
<td>Tubestock</td>
<td>30%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Indigofera australis subsp. australis</td>
<td>Austral Indigo</td>
<td>Tubestock</td>
<td>16%</td>
<td>1 /m²</td>
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<tr>
<td>Macrozamia communis</td>
<td>Burrawang 200mm</td>
<td>Tubestock</td>
<td>25%</td>
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</table>

### LS_D Low Shrubs Mix D

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<tr>
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<th>Plant%</th>
<th>Density</th>
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</thead>
<tbody>
<tr>
<td>Callistemon veronicus “Captain Cook”</td>
<td>Burrawang</td>
<td>Tubestock</td>
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<td>1 /m²</td>
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<tr>
<td>Crepea australis</td>
<td>Pink Leaf Crepea</td>
<td>Tubestock</td>
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<tr>
<td>Grevillea lanigera</td>
<td>Woolly Grevillea</td>
<td>Tubestock</td>
<td>25%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Westringia “Kynyndible Gem”</td>
<td>Coastal Rosemary hybrid</td>
<td>Tubestock</td>
<td>25%</td>
<td>1 /m²</td>
</tr>
</tbody>
</table>
### LS & NG_A - Low Shrubs & Native Grasses Mix A

<table>
<thead>
<tr>
<th>Species Common Name</th>
<th>Size</th>
<th>Plant%</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia bougainvillea</td>
<td>50mm</td>
<td>3%</td>
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</tr>
<tr>
<td>Banksia ericifolia</td>
<td>50mm</td>
<td>20%</td>
<td>6 m²</td>
</tr>
<tr>
<td>Dipladenia speciosa var. speciosa</td>
<td>50mm</td>
<td>10%</td>
<td>6 m²</td>
</tr>
<tr>
<td>Leptospermum scoparium</td>
<td>50mm</td>
<td>10%</td>
<td>6 m²</td>
</tr>
<tr>
<td>Leptospermum scoparium</td>
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<td>Leptospermum scoparium</td>
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<td>10%</td>
<td>6 m²</td>
</tr>
</tbody>
</table>
| Leptospermum scoparium | 50m
### Accent Low Shrubs - South of Bridge

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant %</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acmena smithii &quot;Minor&quot;</td>
<td>Dwarf Lilly Pilly</td>
<td>140mm</td>
<td>20%</td>
<td>1 m²</td>
</tr>
<tr>
<td>Callistemon viminalis &quot;White Anzac&quot;</td>
<td>White Bottlebrush</td>
<td>140mm</td>
<td>25%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Grevillea buxifolia</td>
<td>Grey Spider Flower</td>
<td>140mm</td>
<td>10%</td>
<td>2 m²</td>
</tr>
<tr>
<td>Westringia fruiticosa &quot;Smoky&quot;</td>
<td>Coastal Rosemary hybrid</td>
<td>140mm</td>
<td>35%</td>
<td>1 /m²</td>
</tr>
</tbody>
</table>

### AC_S_C Accent Shrubs Mix C

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant %</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acmena smithii &quot;Minor&quot;</td>
<td>Dwarf Lilly Pilly</td>
<td>140mm</td>
<td>20%</td>
<td>1 m²</td>
</tr>
<tr>
<td>Callistemon viminalis &quot;Captain Cook&quot;</td>
<td>Bottlebrush</td>
<td>140mm</td>
<td>30%</td>
<td>1 /m²</td>
</tr>
<tr>
<td>Hakea australis</td>
<td>Willow-leaved Hakea</td>
<td>140mm</td>
<td>10%</td>
<td>1 m²</td>
</tr>
<tr>
<td>Leptospernum laevigatum</td>
<td>Coastal Tea Tree</td>
<td>140mm</td>
<td>20%</td>
<td>1 m²</td>
</tr>
<tr>
<td>Syzygium australe &quot;Bush Christmas&quot;</td>
<td>Christmas Lily Pilly</td>
<td>140mm</td>
<td>25%</td>
<td>1 m²</td>
</tr>
</tbody>
</table>

### AC_S_D Accent Shrubs Mix D

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant %</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acmena smithii &quot;Minor&quot;</td>
<td>Dwarf Lilly Pilly</td>
<td>140mm</td>
<td>10%</td>
<td>1 m²</td>
</tr>
<tr>
<td>Callistemon viminalis &quot;White Anzac&quot;</td>
<td>White Bottlebrush</td>
<td>140mm</td>
<td>10%</td>
<td>1 m²</td>
</tr>
<tr>
<td>Syzygium australe &quot;Bush Christmas&quot;</td>
<td>Christmas Lily Pilly</td>
<td>140mm</td>
<td>85%</td>
<td>1 m²</td>
</tr>
</tbody>
</table>

### ACC_G A Accent Groundcovers Mix A

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant %</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anigozanthos &quot;Big Red&quot;/&quot;Bush Revolution&quot;</td>
<td>Kangaroo Paw Hybrids Mix</td>
<td>140mm</td>
<td>30%</td>
<td>4 /m²</td>
</tr>
<tr>
<td>Liriope muscari</td>
<td>Liriope Evergreen Giant</td>
<td>140mm</td>
<td>20%</td>
<td>4 /m²</td>
</tr>
<tr>
<td>Lomandra longifolia &quot;Shara&quot;</td>
<td>Spry-head Mat-rush &quot;Shara Hybrid&quot;</td>
<td>140mm</td>
<td>50%</td>
<td>4 /m²</td>
</tr>
</tbody>
</table>

### ACC_GC_B Accent Groundcovers Mix B

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant %</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liriope muscari</td>
<td>Liriope Evergreen Giant</td>
<td>140mm</td>
<td>45%</td>
<td>4 /m²</td>
</tr>
<tr>
<td>Lomandra longifolia &quot;Verday&quot;</td>
<td>Spry-head Mat-rush &quot;Verday Hybrid&quot;</td>
<td>140mm</td>
<td>30%</td>
<td>4 /m²</td>
</tr>
<tr>
<td>Westringia fruiticosa &quot;Mundi&quot;</td>
<td>Coastal Rosemary-prostrate hybrid</td>
<td>140mm</td>
<td>20%</td>
<td>4 /m²</td>
</tr>
</tbody>
</table>

### ACC_GC_C Accent Groundcovers Mix C

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant %</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myoporum parvifolium</td>
<td>Creeping Boobialla</td>
<td>140mm</td>
<td>40%</td>
<td>4 /m²</td>
</tr>
<tr>
<td>Westringia floribunda &quot;Mundi&quot;</td>
<td>Coastal Rosemary-prostrate hybrid</td>
<td>140mm</td>
<td>50%</td>
<td>4 /m²</td>
</tr>
</tbody>
</table>

### ACC_NG_A Accent Native Grasses Mix A

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant %</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dianella revoluta</td>
<td>Blueberry Lily</td>
<td>140mm</td>
<td>10%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Juncus effusus</td>
<td>Common Rush</td>
<td>140mm</td>
<td>50%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Lomandra longifolia</td>
<td>Spry-head Mat-rush &quot;Verday&quot;</td>
<td>140mm</td>
<td>30%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Lomandra longifolia &quot;Shara&quot;</td>
<td>Spry-head Mat-rush &quot;Shara Hybrid&quot;</td>
<td>140mm</td>
<td>20%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Themeda triandra</td>
<td>Kangaroo Grass</td>
<td>140mm</td>
<td>20%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Viola hederacea</td>
<td>Native Violet</td>
<td>140mm</td>
<td>10%</td>
<td>6 /m²</td>
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</tbody>
</table>

### ACC_NG_B Accent Native Grasses Mix B

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant %</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpobrotus glaucescens</td>
<td>Pig Face</td>
<td>140mm</td>
<td>40%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Lomandra confertifolia &quot;Sea Scape&quot;</td>
<td>Mat Rush hybrid</td>
<td>140mm</td>
<td>60%</td>
<td>6 /m²</td>
</tr>
</tbody>
</table>

### ACC_NG_C Accent Native Grasses Mix C

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant %</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lomandra longifolia</td>
<td>Spry-head Mat-rush &quot;Shara&quot;</td>
<td>140mm</td>
<td>30%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Lomandra longifolia &quot;Shara&quot;</td>
<td>Spry-head Mat-rush &quot;Shara Hybrid&quot;</td>
<td>140mm</td>
<td>70%</td>
<td>6 /m²</td>
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### INF_A Native Sedges & Grasses

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant%</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carex appressa</td>
<td>Wild Sedge</td>
<td>hikos</td>
<td>30%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Gahnia clarkei</td>
<td>Tall Saw Sedge</td>
<td>hikos</td>
<td>10%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Isolepis nodosa</td>
<td>Knobby Club-rush</td>
<td>hikos</td>
<td>5%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Isolepis inundata</td>
<td>Swamp Club Sedge</td>
<td>hikos</td>
<td>10%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Juncus usitatus</td>
<td>Common Rush</td>
<td>hikos</td>
<td>40%</td>
<td>6 /m²</td>
</tr>
<tr>
<td>Lomandra longifolia</td>
<td>Spiny-head Mat-rush</td>
<td>hikos</td>
<td>5%</td>
<td>6 /m²</td>
</tr>
</tbody>
</table>

### INF_B Native Sedges & Grasses

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant%</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carex appressa</td>
<td>Wild Sedge</td>
<td>hikos</td>
<td>35%</td>
<td>3 /m²</td>
</tr>
<tr>
<td>Gahnia clarkei</td>
<td>Tall Saw Sedge</td>
<td>hikos</td>
<td>10%</td>
<td>3 /m²</td>
</tr>
<tr>
<td>Juncus usitatus</td>
<td>Common Rush</td>
<td>hikos</td>
<td>40%</td>
<td>3 /m²</td>
</tr>
<tr>
<td>Isolepis inundata</td>
<td>Swamp Club Sedge</td>
<td>hikos</td>
<td>10%</td>
<td>3 /m²</td>
</tr>
<tr>
<td>Lomandra longifolia</td>
<td>Spiny-head Mat-rush</td>
<td>hikos</td>
<td>5%</td>
<td>3 /m²</td>
</tr>
</tbody>
</table>

### Interplanting into river bank

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Size</th>
<th>Plant%</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carex appressa</td>
<td>Wild Sedge</td>
<td>hikos</td>
<td>10%</td>
<td>3 /m²</td>
</tr>
<tr>
<td>Juncus kraussii</td>
<td>Sea Rush</td>
<td>hikos</td>
<td>30%</td>
<td>3 /m²</td>
</tr>
<tr>
<td>Phragmites australis</td>
<td>Common Reed</td>
<td>hikos</td>
<td>60%</td>
<td>3 /m²</td>
</tr>
</tbody>
</table>

Figure 5.4 Tree canopy for Nowra Gateway area, illustrating blend of evergreen/natives (to reflect the natural river context) and highlights of colour with deciduous accent trees (to reflect the Nowra CBD)
5.2.4 Planting Details

Mass Planting Beds

Figure 5.5 Mass planting bed detail- 150mm topsoil depth - for shrubs and mixed canopy areas

Figure 5.6 Typical random mix planting matrix for all planting types

Figure 5.7 Mass Planting Bed Types 5 and 6 - Accent native grasses, groundcovers & shrubs

Figure 5.8 Mass Planting Bed Type 1 - Native grasses & groundcovers

NOTES:
1. THESE DRAWINGS ARE FOR PRESENTATIONAL PURPOSES ONLY AND ARE GENERALLY INDICATIVE OF THE PROPOSED DESIGN.
Tree Planting

Figure 5.9 Typical 45L tree planting detail

Figure 5.10 Typical 5L tree planting detail
Ripline tree planting

Figure 5.11 Mulched Ripline planting plan

Figure 5.12 Ripline planting section
5.2.5 Staking & Tree Guards

Tree guards are to be used for all 5L, and 45L trees spot planted into mass planted beds or dryland grass areas, except where the slopes are steeper than 2.5:1.

<table>
<thead>
<tr>
<th>PLANT SIZE</th>
<th>TIMBER STAKE SIZE</th>
<th>NUMBER OF STAKES</th>
</tr>
</thead>
<tbody>
<tr>
<td>'Tubestock' – Semi Advanced</td>
<td>25 mm x 25 mm x 750 mm long Or 15mm Dia x 750 mm long</td>
<td>1</td>
</tr>
<tr>
<td>'Super Advanced' - 45L</td>
<td>38 mm x 38 mm x 1 800 mm long</td>
<td>2 stakes required with use of tree guard</td>
</tr>
</tbody>
</table>

For Tubestock - Bamboo stakes may be used in place of hardwood, and must be 15 mm in diameter and 750 mm long. Ties must be 50 mm wide hessian webbing.

Tree Guards

Standard tree guards within road reserve areas would be green plastic type tree guards 350 mm dia. x 450 mm long, purpose manufactured, recycled plastic film with holes punched in it to avoid fungal growth (such as Tree Max or approved equivalent) and each tree guard must be secured with three bamboo stakes.

Tree guards along the streets and within parkland areas shall comply with Shoalhaven Council’s requirements and guidelines.
5.2.6 Mulching

Mulching is used on all mass planting beds, and for individual spot planting. Mulch layer will be 75mm thick.

Woodchip mulch used in landscape planting must, to the extent possible, be derived from trees and shrubs removed during the clearing and grubbing works on the site on this project, the mulch produced in this way will be insufficient, and the shortfall shall be made up by using imported hardwood chip.

Hardwood chip mulch or remediated site mulch must comply with AS 4419 and AS4454 and the following requirements:

Mulch types will vary according to the following:

Individual planting of trees - a 75mm thick layer of woodchip mulch around the base of the plant. Mulch to form 1000mm diameter mulched saucers to each tree. Mass planted beds-native grass/tussock - mulch will be 75mm depth.

Riparian Mass planted beds - mixed canopy and shrubs and grasses- either forest blend mulch or remediated, approved site mulch to be used in all mass planting bed areas as shown.

Mulching - mass planting beds

The majority of the landscape revegetation is shown as mass planted beds, and where beds are at intersections and in areas of high visual impact, wood chip mulch or remediamed, approved site mulch would be used.

Elsewhere, forest fines mulch will be used - as this rougher mulch holds to the slope better than the finer wood chip mulch.

Mulching is used on all mass planting beds, and for individual spot planting of advanced trees, 1000mm wide basins will be provided.

Mass planted beds-native grass/tussock - (where 100mm tubes nominated) shall initially have 50mm depth wood chip mulch, as the 100mm tubes are smaller size than tubestock. At completion, plants will be higher and mulch to be topped up to 75mm depth.

Woodchip mulch used in landscape planting must, to the extent possible, be derived from trees and shrubs removed during the clearing and grubbing works on the site. If the mulch produced in this way is insufficient, the shortfall shall be made up by using imported hardwood chip. Hardwood chip mulch or remediamed site mulch must comply with AS 4419 and AS4454 and the following requirements:

Planting into Organic Fibre Matting

If required, where batters steepen locally on site, the mulch surface treatment will be changed to planting into organic fibre matting. These areas are likely to be in vicinity of existing trees.

Organic fibre matting - a 100% organic biodegradable jute fibres, fibre type. Nominal thickness of the mat will be 8mm thick with a density of 600 110-120kg/m2 (nominal) and a mass of 770-800gsm (nominal) and 650 grams per square metre. Material must be needle-punched, high density matting, and a brown/beige colour.
5.3 SOIL CONDITIONING, FERTILISATION

5.3.1 Site Improved Topsoil

The top layer of depth 50mm of high organic trash layer must be stockpiled separately from other topsoils on site.

All other site soil will be stripped and stockpiled according to specification. Soil excavated from the site which contains organic matter, supports plant life, conforms generally to the fine to medium texture classification to AS 4419 and is free from stones > 25 mm diameter, clay lumps > 75 mm diameter, weeds and tree roots, sticks and rubbish, and material toxic to plants will be tested and ameliorated prior for reuse on revegetated areas.

Site topsoil will not be incorporated into the works until soil testing certification has been approved. Site improved topsoil will need to meet standard TfNSW/AS 4419 properties for reuse. Addition of compost, fertiliser, water crystals and additives will be as required by the results of soil testing. Site improved topsoil will be tested to confirm that it meets the above requirements.

Imported Topsoil

Imported organic topsoil must be a weed-free “organic type” soil mix that conforms with AS 4419 and suitable for the culture of plant material in landscape areas. It must:

- be of a friable porous nature
- contain no refuse or materials toxic to plant growth
- contain no stumps, roots, clay lump or stones larger than 25 mm in size
- have an organic content of at least 15% to 20% by mass as determined by the method specified in AS 1289 D1.1 Part D
- have a pH in the range of 5 to 6.5
- have a soluble salt content not exceeding 0.06% by mass
- be suitable for phosphorus sensitive plants
- be free of weed and weed refuse material.

5.3.2 Fertiliser

The amount and type will vary according to location and type of re mediated soil undertaken. For example if compost and additives are added to the site soil for amelioration, then there will be no need for additional fertiliser around the individual plants.

Fertiliser to be used, as per the table below.

<table>
<thead>
<tr>
<th>PLANT SIZE QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>100mm tubes</td>
</tr>
<tr>
<td>Tubestock &amp; 5L</td>
</tr>
<tr>
<td>Advanced (45L)</td>
</tr>
</tbody>
</table>

5.3.3 Soil Additive for Plant Establishment

Soil additive must be a dry granular mixture, comprising water absorbent polymers, organic and mineral fertilisers, trace elements, carrier material and growth stimulators and must be incorporated into the excavated planting hole during planting operations in accordance with the manufacturer’s recommendations. The table below is a guide only as the rates will vary per product. A sample of the product to be used must be approved prior to purchase.

<table>
<thead>
<tr>
<th>PLANT SIZE QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>100mm tubes</td>
</tr>
<tr>
<td>Tubestock &amp; 5L</td>
</tr>
<tr>
<td>Advanced (45L)</td>
</tr>
</tbody>
</table>

5.3.4 Topsoiling depths

Topsoil depths as shown on the planting plans include the following:

- mass planting beds - native grasses with 50mm tubes as per planting plans and schedules-100mm topsoil
- mass planting beds - shrubs and mixed canopy with various sized plants as per schedules: 150mm topsoil
- mass planting accent beds with large stock size plants: 200mm topsoil.

* eg Amgrow Native Plant Food NPK 9.2.3.5.7
* If using the high organic trash layer soil on these areas use only 10g/m2 of urea and omit the compost and fertiliser.
5.4 SEED MIX SCHEDULES

5.4.1 Hydromulched, Vegetated swale areas

Refer to plans, details, specification for locations, soils, and procedures.

Seed Mix for Vegetated Swales, unless otherwise specified in each package or shown on drawings.

<table>
<thead>
<tr>
<th>Cover crop Seed (see Notes below)</th>
<th>Species Application Rate (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rye Corn @25kg/ha (cooler months April to August); or Japanese Millet (warmer months, September to March); or Millet @20kg/ha</td>
<td>20-25kg</td>
</tr>
<tr>
<td>Red Clover 5kg</td>
<td>5kg</td>
</tr>
<tr>
<td>Sub-Total 25kg-30kg</td>
<td>14kg/ha</td>
</tr>
</tbody>
</table>

Native Grass Seed (see Notes below)

<table>
<thead>
<tr>
<th>Species</th>
<th>Application Rate (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austrostipa ramosissima</td>
<td>1</td>
</tr>
<tr>
<td>Bothriochloa macra</td>
<td>2</td>
</tr>
<tr>
<td>Capillipedium spicigerum</td>
<td>4</td>
</tr>
<tr>
<td>Dicanthium sericeum</td>
<td>2</td>
</tr>
<tr>
<td>Microleana stipoides</td>
<td>3</td>
</tr>
<tr>
<td>Themeda australis</td>
<td>2</td>
</tr>
<tr>
<td>Sub-Total</td>
<td>14kg/ha</td>
</tr>
</tbody>
</table>

Application Rates for Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Rate per Hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Hydromulching</td>
<td></td>
</tr>
<tr>
<td>(i) Water</td>
<td>35,000 litres</td>
</tr>
<tr>
<td>(ii) Organic fertiliser: pelletised poultry manure</td>
<td>250 kg</td>
</tr>
<tr>
<td>(iii) Seed</td>
<td>See Annexure R178/A</td>
</tr>
<tr>
<td>(iv) Cellulose fibre mulch:</td>
<td></td>
</tr>
<tr>
<td>- Sugar cane mulch, mixed with 20% (by wgt) of shredded paper; or</td>
<td></td>
</tr>
<tr>
<td>- Wood fibre mulch</td>
<td></td>
</tr>
<tr>
<td>(v) Binder: granulated 'Guar gum'</td>
<td>60 kg</td>
</tr>
<tr>
<td>(vi) Biodegradable green dye</td>
<td>As recommended</td>
</tr>
<tr>
<td>(b) Hydroseeding</td>
<td>As per plant/seed schedules</td>
</tr>
<tr>
<td>(i) Water</td>
<td>20,000 litres</td>
</tr>
<tr>
<td>(ii) Organic fertilizer: pelletised poultry manure</td>
<td>250 kg</td>
</tr>
<tr>
<td>(iii) Seed</td>
<td>See Annexure R178/A</td>
</tr>
<tr>
<td>(iv) Biodegradable green dye</td>
<td>As recommended</td>
</tr>
<tr>
<td>(c) Straw mulching (only for ad hoc temporary stabilization)</td>
<td></td>
</tr>
<tr>
<td>(i) Straw</td>
<td>5,000 kg</td>
</tr>
<tr>
<td>(ii) Binder:</td>
<td></td>
</tr>
<tr>
<td>- Undiluted residual bitumen emulsion; or</td>
<td></td>
</tr>
<tr>
<td>- Granulated 'Guar gum'</td>
<td>2,500 litres</td>
</tr>
</tbody>
</table>

5.4.2 Dryland Grassing

Species-Hydroseeding & Straw mulching seed mix

<table>
<thead>
<tr>
<th>Species</th>
<th>Application Rate (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover crop Seed (see Notes below)</td>
<td>20-25kg</td>
</tr>
<tr>
<td>Rye Corn @25kg/ha (cooler months April to August); or Japanese Millet (warmer months, September to March); or Millet @20kg/ha</td>
<td>5kg</td>
</tr>
<tr>
<td>Red Clover</td>
<td>5kg</td>
</tr>
<tr>
<td>Sub-Total</td>
<td>25-30kg/ha</td>
</tr>
<tr>
<td>Grass Seed (see notes* below)-permanent grass seed to be drilled in %</td>
<td>Percentages</td>
</tr>
<tr>
<td>Chloris truncata, Windmill Grass</td>
<td>12</td>
</tr>
<tr>
<td>Dactylis glomerata, Cockspit</td>
<td>25</td>
</tr>
<tr>
<td>Dovey Summer,Tall Fescue</td>
<td>35</td>
</tr>
<tr>
<td>Lolium rigidum, Annual Rye Grass</td>
<td>20</td>
</tr>
<tr>
<td>Microleana stipoides, Weeping Grass</td>
<td>2</td>
</tr>
<tr>
<td>Sahara,Bermuda Grass</td>
<td>5</td>
</tr>
<tr>
<td>Themeda australis, Kangaroo Grass</td>
<td>1</td>
</tr>
<tr>
<td>Sub-Total-permanent grass</td>
<td>25-30kg/ha</td>
</tr>
</tbody>
</table>

* species to be confirmed with local grass supplier for availability/substitutes if required

Interplanting of sedges

Unless otherwise shown, the swales will be interplanted with native sedges as specified on the detail, at a density of 3 hikos/m², with:

- 1 Carex appressa
- 2 Juncus usitatus
- 1 Isolepis nodosa
5.5 WATER SENSITIVE DESIGN

5.5.1 Soft Engineered Approach to WSUD details

Integrated design approaches to drainage, hydrology and landscape will be further coordinated through the detail design process and applied wherever feasible. The demonstration of practical, sustainable water sensitive design measures will maximise on-site infiltration, reduce piping and kerbs and minimise water table/natural drainage impacts to existing vegetation.

The following approaches and key elements will be integrated through the detail design plans, should space be sufficient.

- vegetated swales - hydroseeded with interplanting and turfed swales
- rock mulched swales
- culvert infiltration areas
- bio-retention areas

Figure 5.13 Vegetated swale/hydroseeded with interplanting- to be used through the project

Figure 5.14 Turfed swale detail- this will be applied along New Local Road, across the floodplain

Figure 5.15 Rock mulch swale detail- for areas suited for steeper longitudinal grades and higher velocities of flow.

Figure 5.16 Typical infiltration area in vicinity of culverts

Figure 5.17 Typical bio-retention area detail Cardno

NOTES:
1. THESE DRAWINGS ARE FOR PRESENTATIONAL PURPOSES ONLY AND ARE GENERALLY INDICATIVE OF THE PROPOSED DESIGN.
5.6 TREE PROTECTION/RETENTION OF EXISTING VEGETATION

MITIGATION STRATEGIES

Protection of local bio-diversity

There are remnant areas of native vegetation along the corridor, mainly remnant large Eucalypts. These would be fenced-off during construction to prevent unauthorised access or accidental damage.

The road corridor will be revegetated using species consistent with the vegetation communities that exist along the upgrade, increasing the level of bio-diversity along the corridor. The following general measures will be taken to protect and assist the recovery of local biodiversity:

- ‘Best practice’ management of erosion and sediment discharges during the construction phase would be implemented to ensure there is no significant discharge of sediment into watercourses or vegetation communities downslope and downstream of the roadworks. A range of measures is to be implemented during construction, including the use of silt fences, sediment ponds and hay bales, and the covering and protection of exposed soil surfaces as rapidly as possible.

- The construction and use of water quality control ponds would incorporate macrophyte vegetation, to ensure that the water quality of adjacent watercourses and waterbodies does not deteriorate as a consequence of discharges from the construction and operational phases of the upgrade.

- Protection of existing mature Eucalypts and any threatened species conservation and Endangered Ecological Community (EEC) vegetation.

Maximising retention of mature trees

For mature trees that may be impacted by earthworks or road corridor constraints, there would be typical guidelines for minimum setbacks to be assessed and agreed upon for this project in the detail design stage. They would include for example:

- Minimum 1.5 metres from edge of trunk to kerb (flat ground, minimal ground disturbance)
- Minimum 1.5 metres retention of natural ground around tree trunks in cut batter situations
- Minimum 2 metres retention of natural ground
- The integrated landscape and urban design plans indicate a few trees close to the kerb lines where tree protection measures would be further investigated in detail design stage to minimise impacts upon root protection zones.
- Retention of trees close to the bottom of fill batters.

Figure 5.18 Individual tree protection

Figure 5.19 Multiple trees protection fencing - typical plan
Tree Protection methods

The following methods would be further evaluated in the detail design stage as options for use in particular circumstances and will be undertaken in consultation with an arborist:

- informal drystone retaining edges
- low concrete RW landscape retainers
- protective fencing around nominated threatened species and EEC’s
- localised grading around trees
- permeable fill areas.

The key principle is to minimise impacts to tree roots to retain significant corridor and streetscape trees that greatly contribute to the overall setting.

The following detail has been included to provide typical approaches that will be developed further in detail design. The details will reflect the principles and guidelines set out in AS 4870-2009, Protection of trees on development sites.

The following details are indicative of tree protection measures that will be developed in further detail alongside construction methodologies to ensure that significant trees adjacent pavement works are retained where feasible. Evaluation of tree root zones, likely service impacts, along with earthworks impacts will be considered simultaneously.

Key points in relation to the various methods for tree protection are provided below:

- Retaining walls are preferred to batters around trees, to maximise soil volumes near retained trees. The use of boulder walls as shown in the adjacent detail or similar is preferred because of the reduced footing excavation required and associated impact.

- Severing tree roots is not recommended on both sides of any tree. Any services adjacent to tree trunks should be investigated for boring under the trees - to arborist’s specification. Planning of common service trenches and proposed service alignments need to be carefully evaluated in the design stage to ensure minimal impacts on trees.

- The use of structural soil in tree planting pits or vaults could be considered to maximise rooting volume. However before such treatment is proposed, an arborist report on the tree’s longevity would be prepared. Refer to typical detail in figure 5.19 for tree wells/dry stone retaining walls that could be used if applicable in the detail design stage.

Figure 5.20 Typical drystone walling around a mature tree to minimise impacts to root zones.

Figure 5.21 Localised grade steepening will be undertaken around significant trees on fill batters to minimise impacts to tree root zones, and drystone rock retainers as shown could also be used where required.
5.7 AN ECOLOGICAL APPROACH TO SOIL & MULCH STRATEGIES

Alternative approaches to mulching, using recycled materials and weed eradication in the early stage of the detail design phase of the project will be discussed with the team.

Mulch Strategy

It is planned to use the recycled clippings of trees and bushes removed for road works for the mulching of revegetation areas. Mulching using organic material from site will improve soil structure and return the necessary organics back into the soil, thereby improving soil structure. The goal is to use a mulch that improves organic content and also provides a longer term mulch cover without replacement.

An approved weed free “Forest Fines” mulch will be used to supplement the recycled mulch on the steep batters and wood chip mulch to areas of high visibility and in all medians.

The compost, soil conditioners and mulches will comply with the Australian Standard AS 4454-1999. Tests will need to be taken to ensure none of the site material contains phytophthora, which is detrimental to plant growth.

Mulching depths and types

Refer to section 6.4.3. Recycled site mulch will be used in all zones for mass planting areas, revegetation areas; 75mm thick, with the outer edges of median plantings being 100mm thick to prevent weed growth. The mulch will be sorted into types from each vegetation communities type as per Topsoil Management Plan.

Topsoil Management

Topsoils will be first tested to ascertain the quality and soil interference before proceeding with the strategy as outlined. Some areas may be badly contaminated or altered.

Topsoil Salvaging: This project will apply the purpose of best practice topsoil stripping, handling and re-use by:

- identifying the extent of different soil/vegetation types present within the project area
- salvaging topsoil (for reuse) according to its natural occurrence within the project area (i.e. maintaining integrity of natural soil landscapes and associated plant communities) For this project there are few “natural” soil landscapes remaining.
- maximising the potential of revegetation works through use of appropriate local topsoil materials
- identifying and quarantining the extent of weed contaminated topsoils to ensure that:
  - Legislative compliance is maintained (in relation to preventing the movement of noxious weeds on the site)
  - Long term maintenance liabilities (weed control) are not increased as a result of weed contaminated topsoils being used
- maximising the potential for salvage of native plant soil seed banks (where present) for reuse on the site where natural regeneration is to be promoted (e.g. adjacent to remnant ecological communities).

Topsoil from any “contaminated” areas will be quarantined from other topsoil to ensure this topsoil is not used on the site.

Salvaging of uncontaminated topsoil and stockpiling / storage will be undertaken in accordance to the topsoil class.

Stockpile heights will be maintained at less than 1.5m depth. Stockpiling of natural soils will be undertaken in weed free areas and the stockpiles will be maintained in a weed free state. Topsoil re-application adjacent to natural ecological community remnants will be reused as soon as possible after stripping seed to minimise storage / stockpile time.

No topsoil stripping will be permitted within areas of existing trees.

Topsoil Application

Refer to section 5.2.4 and 5.3 for information on topsoil depths for various landscape treatments.
5.8 RESTORATION OF COMPOUND & ANCILLARY FACILITY SITES

Figure 5.21 illustrates the areas required for the construction of the bridge and road works for this project. Within these areas are trees—some of which will be marked for protection during construction processes. The detail design stage will identify the trees for protection.

Landscape revegetation and restoration of areas shown that are beyond the Urban and Landscape Concept Plan works indicated on the plans will include:

- topsoiling and seeding of dryland grass species to reflect the existing situation;
- turf in tight urban areas;
- revegetation including mass planting beds with mixed canopy, shrubs or native grasses to replace vegetation removed for site works;
- additional indigenous tree planting to replace removed trees.

It is noted that the areas not within permanent landscape sites for the project will be further developed with planting species and treatments in the detailed design stage.

Figure 5.22 Ancillary Facilities areas, Fulton Hogan, NTS
LANDSCAPE MANAGEMENT

5.9.1 Maintenance

Maintenance is a critical consideration in terms of design treatment and the need for ongoing management of landscapes. Decisions made at the design and construction phases will have ongoing impacts in relation to maintenance and will affect the viability of the landscape scheme. The following strategies are outlined that will be used to address the ongoing management concerns.

Integrated Pest Management - the construction phase will document approved methods for preventing or controlling:
- Unacceptable levels of weed, pest, or disease damage.
- Weed Control for Trees, Shrubs, Vines, and Groundcovers
- Weed, Insect and Disease Control for Turf

The planting design aims to minimise pests through good, varied plant selection, and improving habitats. Should an outbreak be identified which could impact upon the establishment of landscape outcomes, an appropriate action plan will be determined. This is covered in the Flora and Fauna Management Plan.

Weed Control

Good mulch thickness will prevent weeds growing and regular spraying of herbicides, using non-pesticide treatments. A weed management plan will be prepared which covers issues such as management of weed outbreaks both during construction and maintenance phases of the project.

Weed control will be carried out in all areas of the corridor including revegetated and planted areas for a period of 36 months, commencing from the date of final construction completion.

The TfNSW QA Specification M321 will be used as a guide to outline weed management further in the construction phase. The focus of weed control will be on removing noxious weeds and controlling environmental weeds. The ongoing management plan will be further implemented post construction to minimise regeneration or infestation of weeds.

Proposer construction implementation and maintenance procedures will control the level of weed invasion including:
- Restriction on areas of disturbed vegetation.
- Restriction on stockpiling to areas already cleared of vegetation or in weedy areas.
- Use of weed-free topsoil in landscape works, and revegetating disturbed sites with locally sourced indigenous species (local provenance).
- Revegetation using treated, stockpiled topsoil (weed free), along with the use of local provenance plant species to stabilise the soil as well as managing weed control regularly.
- Implementation and enforcement of the landscape design during the construction phase at the correct timing and seasons to ensure better slopes are constructed as designed and revegetated at times of NO extreme weather.
- Ensuring adequate maintenance to landscaped areas and ensuring regular watering in dry period to encourage successful plant revegetation cover.
- Appropriate and compliant topsoil testing and subsoil/topsoil assessments and implementation to encourage plant establishment. To achieve this numerous waterings over topsoil placement are required to encourage weed seed to germinate, prior to planting and mulching so the weed cover can be first removed.
- Complying with the nominate densities for grasses, shrubs and trees, as well as minimum mulch depths specified to ensure maximum plant coverage and weed suppression.
- Maintenance plans will be consistent with the requirements of TNSW Specification R179 and R178. Works will not only include weed removal but also the replacements of failed stock and re-hydomulching, and topping up of mass planting bed mulch layers, following regular on site checks.
- Monitoring of weed invasions, and presence by personnel well experienced in weed management.
- Incorporation of the Weed Management Plan into the Flora and Fauna Management Plan, detailing necessary weed control works.

Fencing

To ensure establishment of planting, pests such as rabbits and hares will also be addressed, as necessary. This may involve temporary rabbit proof fencing or the use of guards. At this stage no fencing is proposed as the intensity of rabbit or other pests appears to be low.

Watering

Planting will be watered and maintained until plants have become established. The period is for 36 months. Normally the watering will be 20 litres of water per plant per week for the first 12 weeks, followed by 10 litres of water per plant per week until the 26th week. This obviously depends on the rainfall. Plant health will be determined, and watering needs assessed following this period. If extended periods without rain are experienced during the establishment period, then watering over and above the normal construction practice will be undertaken to supplement natural rainfall.

Fertilising

Fertilising post planting may be required where specific nutrient deficiencies are identified. The need for additional fertiliser will be minimised by the use of slow release fertiliser. Any additional fertiliser requirements will be reviewed as part of the maintenance plan for the project.

Pruning and Thinning

Pruning is expected to be a minor component of the maintenance. It may be required to ensure sightlines and signs are not obscured.

Plant Replacements

Dead, diseased or dying plants will be replaced to ensure 90% of planting is established after 12 months. The checks on planting will be undertaken every 6 - 8 weeks during the maintenance period, and plants replaced within two months of inspection.

Implementation

A detailed Landscape Maintenance Plan will be developed by the Contractor during the Construction Phase of the project, prior to the commencement of the Landscape Maintenance Period. This plan will consider the maintenance requirements documented in this report, along with the TfNSW Landscape Design and Maintenance Guidelines, and will be subject to TfNSW review prior to implementation.

5.9.2 Monitoring & Evaluation

Ongoing surveillance of the road corridor and streetscapes for weed management and landscape establishment will be undertaken throughout the establishment period of three years. A detailed management plan will be prepared when the final design development is complete for the project.

5.9.3 Work, Health & Safety

The design of the new roadways and streetscapes considers the safety of works during construction and the ongoing maintenance of the project areas. Risk Assessment and safety in design workshops will be held during the detail design stage of the project. Management of registers will ensure the development of the design, with safety as a key input.

All dryland grassed areas that will require slashing have slopes 4:1 and gentler.

Good plant establishment in mass planted beds as designed will reduce the need for maintenance access by foot.

Bridge abutment and culverts also pose safety risks and will be addressed during the detailed design phase.

Maintenance risks also include workers being close to trafficable areas. The implementation needs to consider issues such a sightlines, the need for road closures and other activities adjacent the road when workers are maintaining garden beds, grassland areas, mowing verges, and undertaking pest/Weed management. Maintenance risks can be minimised by reducing the frequency of the occurrence, which can be addressed through appropriate plant density and selection.
6.0 CONCLUSION

The UDLP purpose is to inform the public and stakeholders of the project's design resolution. It describes the project's urban and landscape design and has been developed through an integrated interdisciplinary process to refine the design presented in the REF.

The overall urban design has been carefully developed to respond to each situation and project zone, resulting in a design that sensitively integrates with each individual setting. Hence, the overall aim is not to create a linear corridor, but rather to achieve a sensitive interface between the local setting and the road corridor.

The resulting design reinforces the local identity of the corridor and enhances the travel experience through a varied urban landscape setting.

Key strategies of the urban design resolution include:

- Minimising impacts to mature trees flanking the corridor, particularly south of the Shoalhaven River
- Respecting the heritage fabric of the existing bridges
- Visually integrating a form language of the new Shoalhaven River Bridge that is consistent with the existing northbound bridge
- Reinforcing the identity of Nowra
- Improving amenity for pedestrians and cyclists by separating the SUP from the road alignment where possible
- Celebrating the Shoalhaven River crossing and providing opportunities for the re-use and revitalisation of the historic truss bridge
- Reinforcing the two main plant associations - Spotted Gum and Swamp Forest, to strengthen the landscape patterns and enrich biodiversity.

The described project in this UDLP will provide an important contribution to the wider development and functioning of Nowra, whilst respecting its urban fabric and natural environment.

It is an important project for the future of Nowra.
APPENDIX A  Signage Plans

FROM WOLLONGONG

NOTE: 1. FOR SIGN SCHEDULE REFER TO DWG# RF-1110 TO RF-1118
       2. SIGN LOCATIONS SHOWN ON PLAN ARE INDICATIVE ONLY.
       REFER TO RF-901 FOR LATERAL PLACEMENT OF SIGNS ON SITE.
NOTES:
1. FOR SIGN SCHEDULE REFER TO DWG RF-1110 TO RF-1118
2. SIGN LOCATIONS SHOWN ON PLAN ARE INDICATIVE ONLY. REFER TO RF-0041 FOR LATERAL PLACEMENT OF SIGNS ON SITE.
NOTES:
1. FOR SIGN SCHEDULE REFER TO DWG'S RF-1110 TO RF-1118
2. SIGN LOCATIONS SHOWN ON PLAN ARE INDICATIVE ONLY. REFER TO RF-0041 FOR LATERAL PLACEMENT OF SIGNS ON SITE.
NOTES:
1. FOR SIGN SCHEDULE REFER TO DWG'S RF-1110 TO RF-1118
2. SIGN LOCATIONS SHOWN ON PLAN ARE INDICATIVE ONLY. REFERENCE RF-941 FOR LATERAL PLACEMENT OF SIGNS ON SITE.
APPENDIX B

Tree Retention & Removal

LEGEND
- Existing trees to be removed
- Existing trees to be retained