Australian Government

BUILDING OUR FUTURE

NSW GOVERNMENT

Coffs Harbour Bypass

Environmental Impact Statement

September 2019

VOLUME 6A

Urban design, landscape character and visual impact assessment

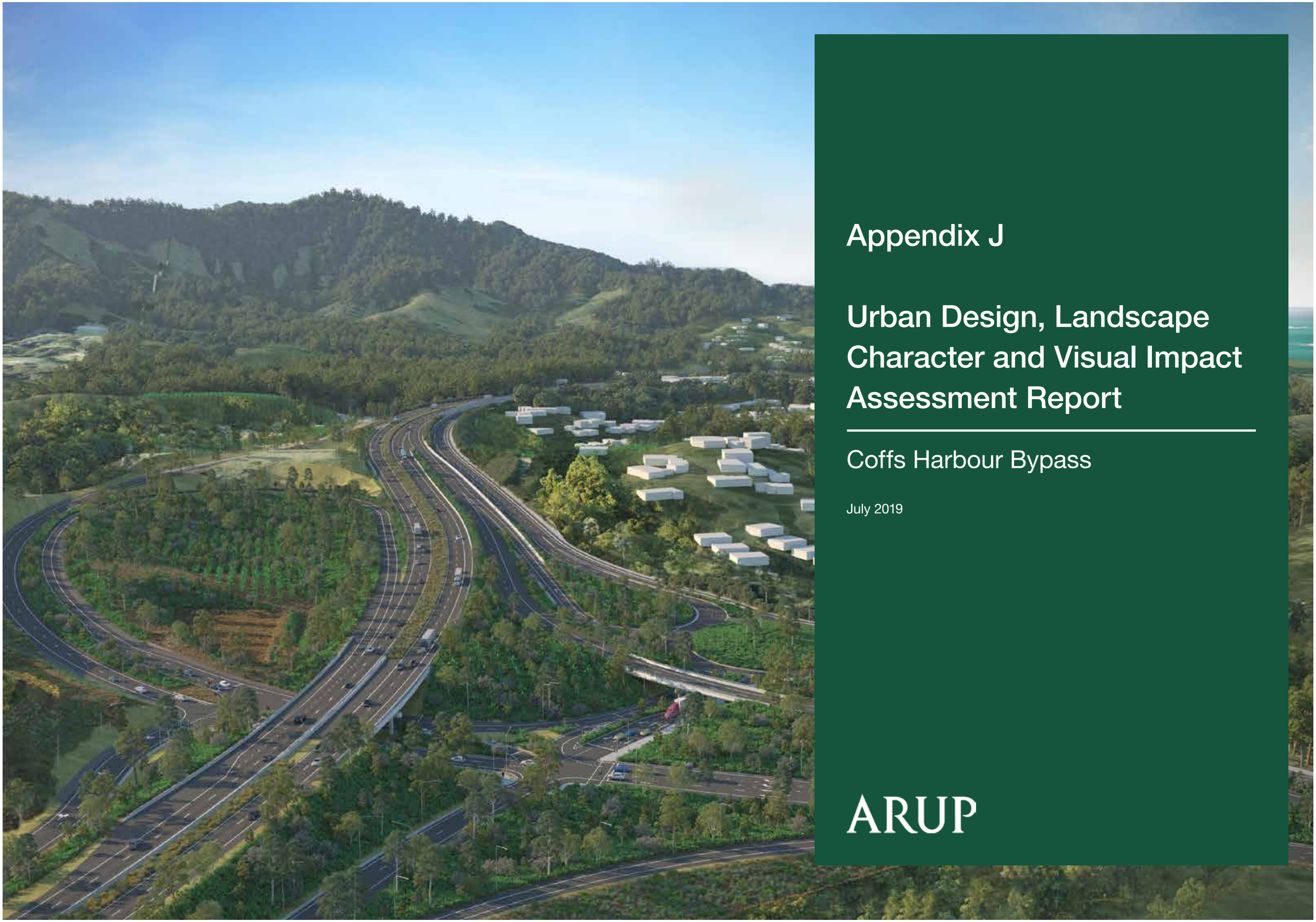
Appendix J

RMS.19.1320
ISBN: 978-1-925891-66-9

(blank page)

Appendix J

(blank page)



Appendix J

Urban Design, Landscape Character and Visual Impact Assessment Report

Coffs Harbour Bypass

July 2019

ARUP

THIS PAGE WAS INTENTIONALLY LEFT BLANK

Contents

Executive summary

“A bypass which expresses the interfaces between the Great Dividing Range and the Pacific Highway, concealed from view from Coffs Harbour.”

Arup has been engaged by Roads and Maritime Services (RMS) to prepare an Urban Design, Landscape Character and Visual Impact Assessment (UD+LCVIA) to form part of the Environmental Impact Statement (EIS).

The design and assessment has been developed concurrently to deliver an integrated design response and embed mitigation in the design development phase of the project.

The overarching strategy for the Coffs Harbour Bypass (the project) is to ensure that the project is physically and visually integrated with its surrounding topography, landscape and urban setting. It seeks to minimise the visual impact and maximise the scenic and dramatic road user journey experience.

The project vision, objectives and principles based on The Pacific Highway Urban Design Framework (Roads and Maritime 2013).

This document covers the urban and landscape design components of the project including; strategy, approach and concept design considerations building on all works completed to date and to inform the future design phases of the project.

The concept design capitalises on the opportunity to experience the coast and ranges simultaneously. Working with the existing and future landforms, the project aims to fit sensitively within its setting, minimising visual impacts and maximising a green vegetated outcome. Built elements would be unobstructive, simple, refined and a recognisable ‘family’ with adjacent Pacific Highway upgrade projects, while providing an enjoyable user experience and responding sensitively to the surrounding communities.

Provide a flowing road alignment that is responsive and integrated with the landscape

Provide a well vegetated, natural road reserve

Provide an enjoyable, interesting highway with varied views and vistas of the landscape

Value the communities and towns along the road

Provide consistency with variety in road elements

Provide a simplified and unobtrusive road design

FIG 1.1 **ENGLANDS ROAD INTERCHANGE**

FIG 1.2 **ROBERTS HILL TUNNEL - SOUTHERN PORTAL**

FIG 1.3 **CORAMBA ROAD INTERCHANGE**

FIG 1.4 **SHEPHARDS LANE TUNNEL - SOUTHERN PORTAL**

FIG 1.5 **GATELYS ROAD TUNNEL - SOUTHERN PORTAL**

FIG 1.6 **KORORA HILL INTERCHANGE**

CHAPTER

1

Chapter 1

Introduction

(blank page)

01
Introduction

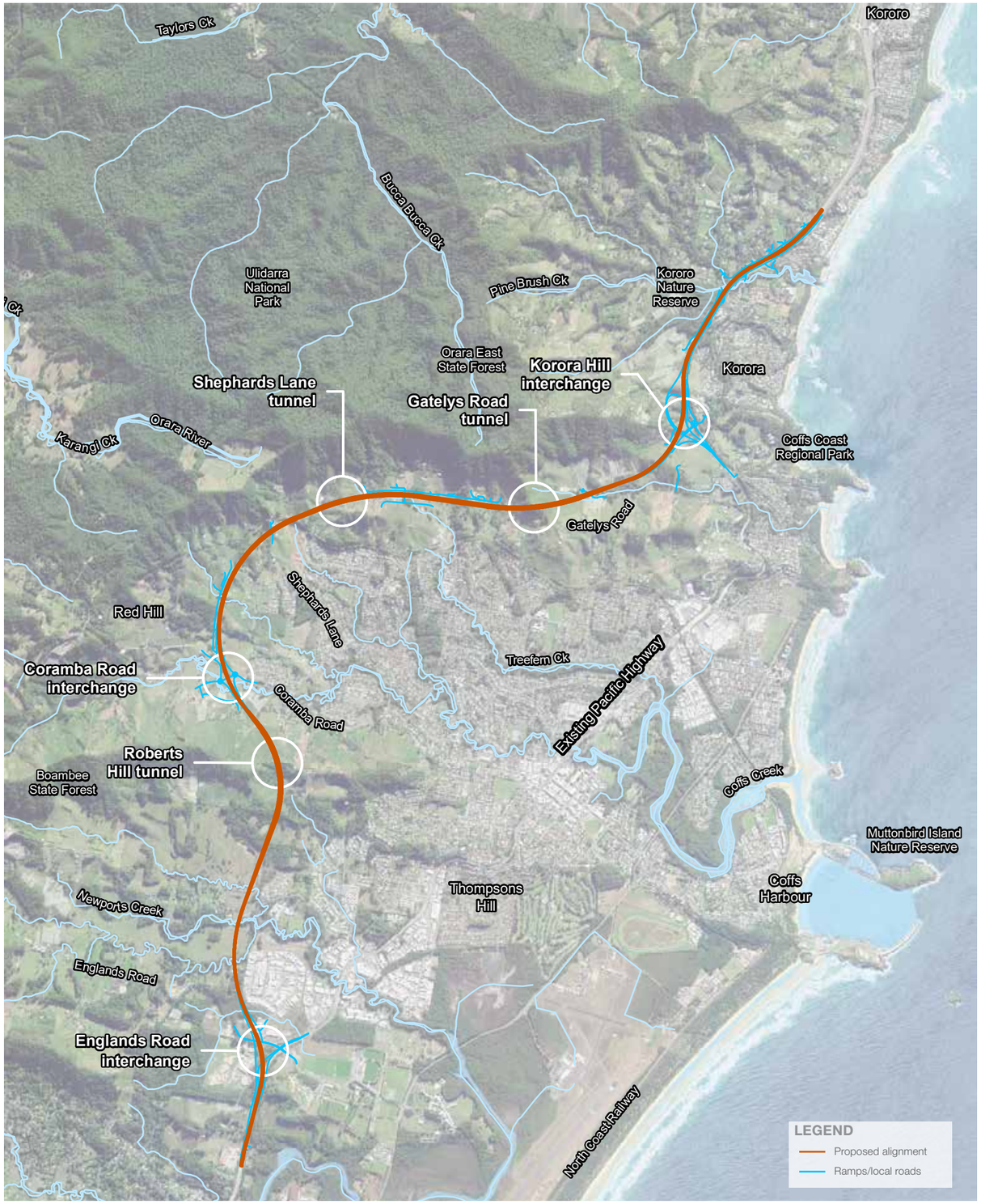


FIG 1.7 **PROJECT ALIGNMENT AND CONTEXT**

1.1 Project overview

Roads and Maritime Services (Roads and Maritime) is seeking approval for the project under Division 5.2 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) as Critical State Significant Infrastructure (CSSI).

The project includes a 12 km bypass of Coffs Harbour from south of Englands Road to Korora Hill in the north and a 2 km upgrade of the existing highway between Korora Hill and Sapphire. The project would provide a four-lane divided highway that bypasses Coffs Harbour, passing through the North Boambee Valley, Roberts Hill and then traversing the foothills of the Coffs Harbour basin to the west and north to Korora Hill.

The key features of the project include:

- Four-lane divided highway from south of Englands Road roundabout to the dual carriageway highway at Sapphire
- Bypass of the Coffs Harbour urban area from south of Englands Road intersection to Korora Hill
- Upgrade of the existing Pacific Highway between Korora Hill and the dual carriageway highway at Sapphire
- Grade-separated interchanges at Englands Road, Coramba Road and Korora Hill
- A one-way local access road along the western side of the project between the southern tie-in and Englands Road, connecting properties to the road network via Englands Road
- A new service road, located east of the project, connecting Solitary Islands Way with James Small Drive and the existing Pacific Highway near Bruxner Park Road
- Three tunnels through ridges at Roberts Hill (around 190 m long), Shephards Lane (around 360 m long), and Gatelys Road (around 450 m long)
- Structures to pass over local roads and creeks as well as a bridge over the North Coast Railway

- A series of cuttings and embankments along the project
- Tie-ins and modifications to the local road network to enable local road connections across and around the project alignment
- Pedestrian and cycling facilities, including a shared path along the service road tying into the existing shared path on Solitary Islands Way, and a new pedestrian bridge to replace the existing Luke Bowen footbridge with the name being retained
- Relocation of the Kororo Public School bus interchange
- Noise attenuation, including low noise pavement, noise barriers and at-property treatments as required
- Fauna crossing structures including glider poles, underpasses and fencing
- Ancillary work to facilitate construction and operation of the project, including:
  - Adjustment, relocation and/or protection of utilities and services
  - New or adjusted property accesses as required
  - Operational water quality measures and retention basins
  - Temporary construction facilities and work including compound and stockpile sites, concrete/asphalt batching plant, sedimentation basins and access roads (if required).

FIG 1.8 **ARTIST IMPRESSION - SHEPHARDS LANE - SOUTHERN PORTAL**

1.2 Report structure

Chapter 1 - Introduction

Provides the project overview, structure, SEARs, policy planning and guidance which describes the state and local policy and legislation relevant to the urban design, landscape character and visual amenity of the project.

Chapter 2 - Methodology

Outlines the methodology used for the urban design, landscape character and visual impact assessment.

Chapter 3 - Context analysis

Provides the relevant information gained through investigation of the project. Outlines associated opportunities and issues for the urban and rural landscape addressed in the development of the overall design principles and concept design for the project.

Chapter 4 - Urban design strategy

This section describes the high level urban design strategy and principles, and landscape design approach for the project.

Chapter 5 - Urban design concept

In response to the SEARs, this section describes the proposed urban design concept in more detail including location specific urban design outcomes, principles and future design requirements.

Chapter 6 - Landscape character impact assessment

In response to the SEARs, this section provides urban design requirements and landscape character for the project.

Chapter 7 - Visual impact assessment

In response to the SEARs, this section provides urban design requirements and a visual impact assessment for the project.

Chapter 8 - Management of Impacts

This section describes relevant construction and operational management measures to be applied to the project to reduce the identified visual and landscape character impacts.

Chapter 9 - Conclusion

Provides the integrated design outcomes to conclude the report.

1.3 Purpose of this report

The purpose of this report is to provide an urban design response that addresses the SEARs as outlined in the table adjacent. This specialist report addresses the SEARs related to Urban Design and Visual Amenity, providing:

- A strategic urban design framework for the project. The framework:
  - Provides a high level vision, objectives and principles to guide the future urban design of the project
  - Identifies project urban design outcomes that have been achieved during the initial concept design stage
  - Provides requirements for future design of infrastructure elements to ensure the project exhibits outcomes of a quality and level of amenity that are consistent and readily associated with the project's transport functions
  - Acknowledges the strategic directions and urban design strategies as directed by Roads and Maritime's Centre for Urban Design and NSW Government Architects
- A landscape character and visual impact assessment (LCVIA) that considers the potential impacts (adverse and beneficial) that are likely to occur as a result of the project
- Mitigation measures and design recommendations to avoid, minimise or improve potential landscape character and visual impacts.

Secretary's requirement	Where addressed in this report
Urban Design - The project design complements the visual amenity, character and quality of its environment. The project contributes to the accessibility and connectivity of the communities. The proponent must:	
(a). Identify the urban design and landscaping aspects of the project and its components, including interchanges, tunnel portals, bridges noise walls, landscaped mounds, ancillary buildings and infrastructure services	Chapter 3-5
(b). Assess the impact of the project on the urban, rural and natural fabric, including residual land treatment, and demonstration of how the proposal hard and soft urban design elements of the project would be consistent with the existing and desired future character of the area traversed or affected by the project	Chapter 3-5
(c). Explore the use of Crime Prevention Through Environmental Design (CPTED) principles during the design development process, including natural surveillance, lighting, walkways, signage and landscaping	Appendix A
(d). Identify urban design strategies to enhance healthy, cohesive, and inclusive communities directly impacted by the project	Chapter 3, 4, 5, 8 and 9
(e). Describe urban design and landscape mitigation measures, having regard to the urban design and landscape objectives for the project and the overall Pacific Highway Upgrade program	Chapter 3-9
Visual Amenity - The project minimises adverse impacts on the visual amenity of the built and natural environment (including public open space) and capitalises on opportunities to improve visual amenity.	
(1). The proponent must assess the visual impact of the project and any ancillary infrastructure (including noise walls) on: (a). Views and vistas (b). Streetscapes, key sites and buildings (c). Heritage items including Aboriginal places and environmental heritage; and (d). The local community (including view loss and overshadowing)	Chapters 6-7 Appendix A-E
(2). The Proponent must provide artist impressions and perspective drawings of the project from a variety of locations along and adjacent to the route to illustrate how the project has responded to the visual impact through urban design and landscaping	

TABLE 1.1 **SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS**

1.5 Guidance and policy

Guidance

The following documents and their principles in particular have been used during the design process, considered in the preparation of this UD+LCVIA report and have assisted with defining the methodology.

- Pacific Highway Urban Design Framework – Urban design vision, objections and design principles for the upgrade of the pacific highway from Hexham to Tweed Heads, Roads and Maritime Services, 2013
- Upgrading the Pacific Highway Guidelines, Roads and Maritime Services, 2015
- Beyond the Pavement - RTA urban design policy, procedures and design principles, Roads and Maritime Services, January 2014
- Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects, Revision 0, Roads and Maritime Services, September 2011
- Bridge Aesthetics - Design Guidelines to Improve the Appearance of Bridges in NSW, Roads and Maritime Services, February 2019
- Designing to Minimise Vandalism - An investigation into planning and design measures to avoid or mitigate vandalism (Final Draft), Roads and Maritime Services, November 2008
- Guideline for Batter Surface Stabilisation using vegetation, Roads and Maritime Services April 2015
- Landscape design guideline - Design guideline to improve the quality, safety and cost effectiveness of green infrastructure in road corridors, Roads and Maritime Services, December 2018
- Noise Wall Design Guideline - Design guidelines to improve the appearance of noise walls in NSW, Roads and Maritime Services, March 2016
- Shotcrete Design Guideline - Design guideline to avoid, minimise and improve the appearance of shotcrete in NSW, Roads and Maritime Services, March 2016
- Soil Landscapes of Sydney, Soil Conservation Service of NSW, 1989.—Designing to Minimise Vandalism (Final Draft), Roads and Maritime Services, November 2008
- Procedure for Selecting Treatment Strategies to Control Road Runoff Version 1.1 – RTA, June 2003
- Guidelines for Treatment of Stormwater runoff from the Road Infrastructure AUSTROADS, 2003
- AUSGRID Network Standard NS179 Vegetation Safety
- Water Sensitive Urban Design Guideline - Applying Water Sensitive Urban Design principles to NSW transport projects, Roads and Maritime Services, May 2017
- Guideline for landscape character and visual impact assessment - Environmental impact assessment practice note EIA-N04, Roads and Maritime Services, December 2018
- Tunnel urban design guideline - design guideline to improve the customer and community experience of road tunnels, Roads and Maritime Services, May 2017
- Crime prevention and the assessment of development applications (DUAP 2001)
- Crime Prevention through Environmental Design (CPTED) (Queensland Government 2007).

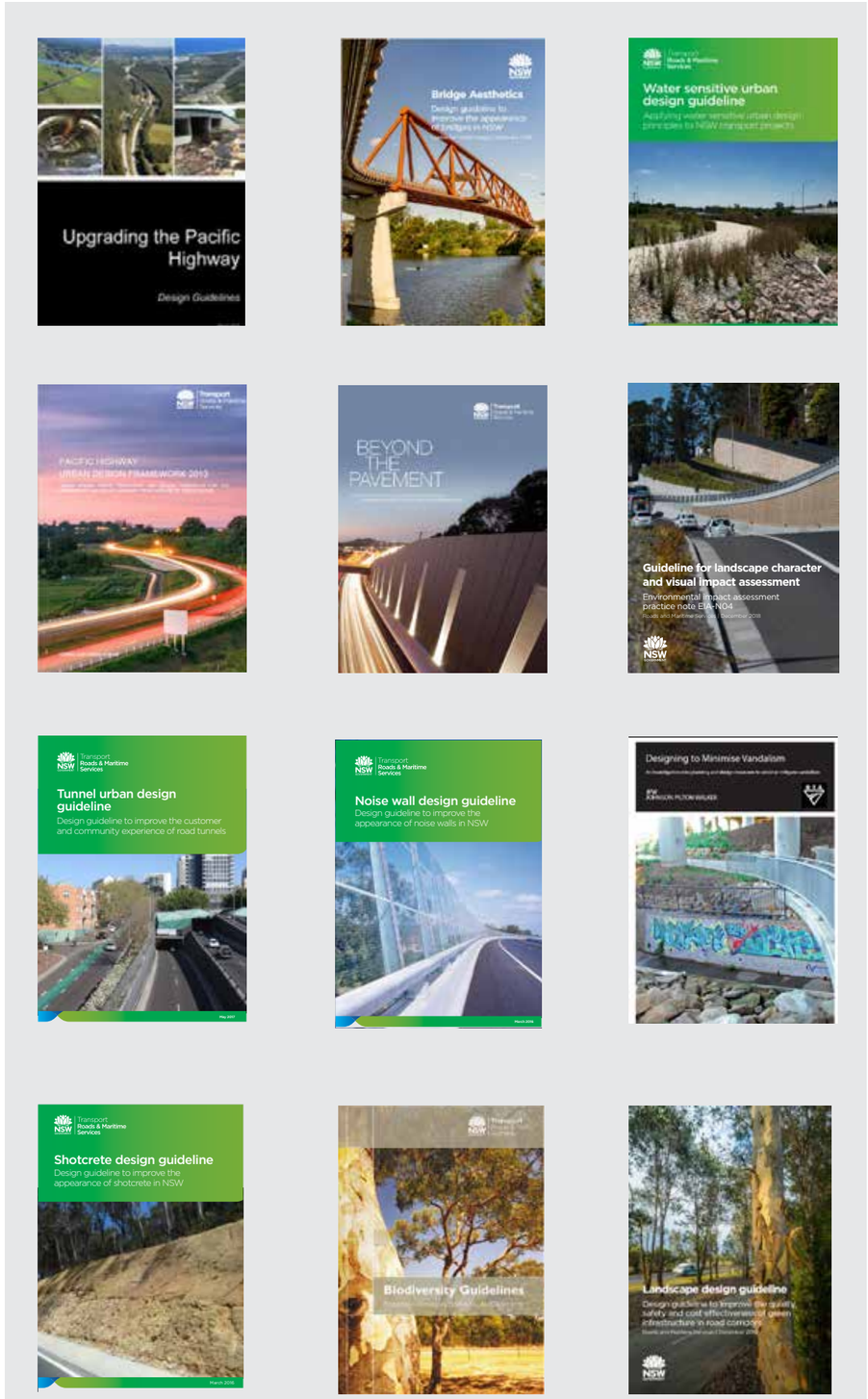


FIG 1.9 **GUIDELINES AND POLICY DOCUMENTS**

Regional plan

North Coast Regional Plan

The North Coast Regional Plan 2036 (Regional Plan) includes an indicative alignment for the proposed Pacific Highway Upgrade and supports the project, noting the many new opportunities that would arise from the project including improved travel safety, reduced travel times, improved transport efficiency and lower freight transport costs.

The Regional Plan includes four key goals to achieve the vision for the region – to create the best region in Australia to live, work and play thanks to its spectacular environment and vibrant communities. Of relevance to the UDLCVIA is Goal 1 which relates to “the most stunning environment in NSW” outlines applicable key directions and actions:

- Direction 2: Enhance biodiversity, coastal and aquatic habitats, and water catchments
    - Actions - Focus development to areas of least biodiversity sensitivity in the region and implement the ‘avoid, minimise, offset’ hierarchy to biodiversity, including areas of high environmental value.

Local planning instruments and policy

The following local planning instruments and policies are applicable to the project:

- The Coffs Harbour Local Environmental Plan 2013 (LEP 2013)
- The Coffs Harbour Development Control Plan 2015 (DCP 2015).

Local Environmental Plan

The LEP 2013 is applicable to the project and was made on 27 September 2013 and prepared in accordance with the Standard Instrument – Principle Local Environmental Plan for NSW.

LEPs guide planning decisions for local government areas through zoning and development controls. LEPs are the main planning tool that shape the future of communities and also ensure local development is done appropriately.

As per the LEP 2013, the project is located mostly on land zoned as SP2 Infrastructure – Classified Road. The purpose of this zone is to provide for infrastructure and related uses, with roads being permitted with consent.

Development Control Plan

DCPs provide guidance to applicants and planning authorities on how development proposals should give effect to aims of environmental planning instruments (such as the LEP), facilitate permissible development, and achieve zoning objectives for the land. A DCP typically provides additional details relating to development standards and character.

The DCP 2015 is the applicable DCP for the project however does not provide any specific planning and design provisions for the project where located within the SP2 – Infrastructure zone.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

CHAPTER

2

Chapter 2

Methodology

(blank page)

02
Methodology

This section *describes how the urban design, landscape character and visual impact assessment was conducted.*

2.1 UD+LCVIA methodology

The UD+LCVIA covers both the concept urban design response for the project as well as the landscape character and visual assessment. The concept design provides a response to the SEARS for the project and identifies design solutions to inform the next phase of the project. It will ensure the road design fits into its setting and provides a high quality piece of highway infrastructure for the adjacent community and for the road users.

The UD+LCVIA approach follows an iterative process where key issues, constraints and mitigation related to the urban design, landscape character and visual assessment are integrated into the engineering and landscape and urban concept response. Refer to Figure 2.1.

Key steps within the process include:

- **Legislative and planning context**
  A review of state, regional and local planning policy to gather information on the planning objectives and aims that are relevant to the UD+LCVIA
- **Context analysis**
  An analysis of the local context is undertaken with a focus on landscape and urban features, visual amenity through a selection of representative views, and landscape character. Determination of the sensitivity of the landscape and visual amenity
- **Urban design strategy**
  Development an overarching urban design strategy with supporting objectives and principles
- **Urban design concept**
  Development an overarching urban design concept to support the urban design strategy and UD+LCVIA
- **Assessment**
  An analysis of the potential change that may arise as a result of the project and the potential impact on landscape character and representative views
- **Integrated design outcomes**
  Potential impacts that may arise are fed back in to the design development process to embed mitigation measures within the project through the delivery of landscape and urban design response
- **Mitigation measures**
  Where potential impact cannot be resolved through the embedded design process, additional measures have been explored, for example, off site screen planting.

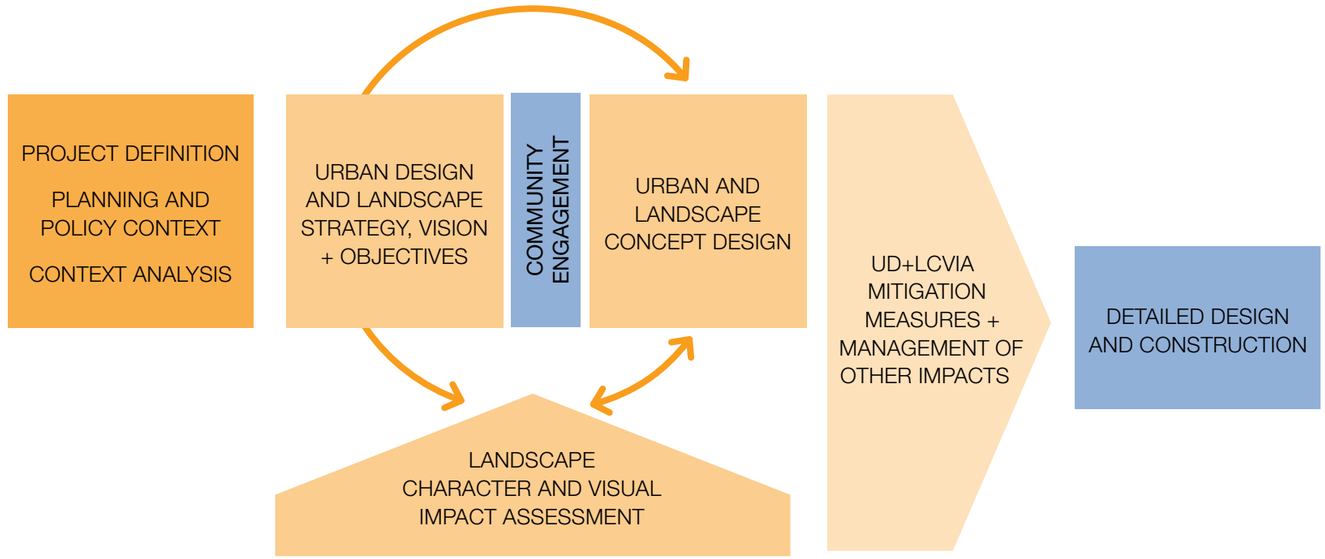


FIG 2.1 **UD+LCVIA ITERATIVE PROCESS DIAGRAM**

Landscape character approach

Landscape character can be defined as the aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. It includes all aspects of a piece of land – built, planted and natural topographical and ecological features.

To enable the assessment of impacts on landscape character, Landscape Character Zones (LCZs) have been defined for the study area. The LCZs are defined as areas having a distinct, recognisable and consistent pattern of elements making one landscape character zone different from another.

The LCZs identified as part of this assessment have been derived based on a review of planning policy, GIS baseline analysis and site investigations. The extent of character area analysis is informed by an understanding of potential perceived area of change that may arise from the project. This process included a review of the physical extent of the project corridor and visual analysis.

Visual assessment approach

In undertaking the visual impact assessment, a Visual Envelope Map (VEM) study has been prepared. This identifies the theoretical area of the landscape from which the project could be visible. The VEM was generated based on the visibility of a high sided vehicle (4.5m above carriageway level) traveling on the road.

The VEM is a helpful tool for providing an overview as to the extent to which these elements may, or may not be visible from the surrounding study area, assisting the site work. However, it is important to note that the VEM is by its nature approximate only and generated to represent a worst case scenario and has been used to assist and inform subsequent site investigations.

Study area

The landscape and visual study area has been defined through a preliminary review of the project and analysis of the VEM. Refer to chapter 6 and 7 for the full Landscape Character and Visual Impact Assessment.

Viewpoint selection

Following a thorough desktop study, review of the VEM plans and site visits, representative viewpoints with the potential to be visually affected by some element of the project were identified and selected for further analysis. Viewpoints were selected to illustrate:

- A range of receptor types including public and private domain views (residents, motorists and users of public open space)
- A range of view types including elevated, panoramic and filtered views
- A range of viewing distance from the project
- Key or protected views identified within the planning literature.

Note, for residential visual receivers, access was not always possible to the property itself and so accordingly a site assessment was made from the closest accessible public location with views towards the project. In these instances, the description of visual impact was estimated from the main dwelling area of the property.

Landscape and visual impact assessment rating

The overall impact rating of the project is based on themes of magnitude and sensitivity. The severity of these impacts are calculated using the matrix illustrated in Table 2.1, taken from the Roads and Maritime Services Guideline for landscape character and visual impact assessment. Refer to Appendix E for Assessment Criteria.

Potential landscape and visual impacts have been documented for the construction stage and operational stage, including the potential day time and night time impacts that may arise. The same methodology for the operational and construction stage impacts is applied for night lighting time impacts.

Assumptions

The following assumptions are made with regards to the assessment process:

- The assessment is based on the assumptions documented within chapter 5, Project Description and chapter 6, Construction of the EIS, including the types and extent of lighting likely to be installed for both the construction and operation stages
- There is no assessment of existing or proposed luminance levels
- Operational lighting during construction is assumed to be in operation seven days a week and at levels sufficient to meet work occupational health and safety levels, and security levels.

Limitations

It should be noted that selected viewpoints are by no means an exhaustive list of all receivers that might be impacted by the project. They have been selected to be representative of the spread and type of receivers throughout the study area.

Site visits were undertaken throughout 2018 and early 2019 to gather site information and take photographs from representative viewpoints. It is acknowledged that development has occurred since the time of these visits, which is not reflected in photos contained within this document.

Sensitivity \ Magnitude	High	Moderate	Low	Negligible
High	High Impact	High-Moderate Impact	Moderate Impact	Negligible Impact
Moderate	High-Moderate impact	Moderate Impact	Moderate - Low Impact	Negligible Impact
Low	Moderate Impact	Moderate - Low Impact	Low Impact	Negligible Impact
Negligible	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact

Table 2.1: Landscape and visual impact assessment matrix

Chapter 3

Context analysis

(blank page)

03

Context analysis

The purpose of this section is to identify relevant information gained through our investigation of the project and the associated opportunities and issues for the urban and rural landscape, that need to be addressed in the development of the overall design principles and concept design for the project.

FIG 3.1 **REGIONAL CONTEXT**

3.1 Regional context

Coffs Harbour is located approximately 540km north of Sydney and 390km south of Brisbane on the Mid North Coast of New South Wales (NSW). The region begins at Seal Rocks, 275km north of Sydney, and extends as far as Woolgoolga, approximately 380km south of Brisbane. From south to north, the region's main towns include the twin towns of Forster and Tuncurry, Taree, Port Macquarie, Kempsey, South West Rocks, Nambucca Heads, Bellingen and Coffs Harbour. Of these Taree, Port Macquarie and Coffs Harbour are the major commercial centres. The NSW Government's Regional Plan nominated Coffs Harbour as a Regional City in 2016.

The region has a subtropical climate and is known for its beaches. The major industries in the region are dominated by agriculture with the banana and blueberry industries being nationally significant. Logging and tourism are also key economic drivers for the region.

The substantial mountains of the Great Dividing Range are broadly positioned in a north-south direction, and are recognised as the third longest land based range in the world. The range stretches for more than 3,500km, running from the top of Queensland, the entire length of the eastern coastline through NSW and into Victoria. The width of the range varies from 160km to over 300km.

FIG 3.2 **LOCAL CONTEXT**

3.2 Local context

Coffs Habour City Council (CHCC) divides the city in to 16 suburbs or profile areas. Five of these suburbs are considered relevant to the project.

Bonville - Bundagen - Boambee

This area is bound by the locality of North Boambee Valley, Boambee Creek, Sawtell Road and the Pacific Highway in the north, Lyons Road, the locality of Sawtell, Bonville Creek and the Coral Sea in the east, and Bellingen Shire and Pine Creek in the south and west. Key features include Bongil Bongil National Park, Bonville Golf Resort Coffs Harbour Butterfly House, Boambee and, Bonville Memorial Halls, Bonville Creek, Pine Creek and several schools.

Rural West

This area is bound by the Clarence Valley Council area in the north and west, the Coral Sea, the Corindi River, the localities of Corindi Beach, Woolgoolga, Emerald Beach, Moonee Beach, Sapphire Beach, Korora, Coffs Harbour and North Boambee Valley in the east, and the localities of Boambee and Bonville and Bellingen Shire in the south. Key features include Bindarri National Park, Dorrigo National Park, Ulidarra National Park, Yuraygir National Park, various state forests, Bindarri State Conservation Area and Sherwood Nature Reserve.

North Boambee Valley

This area is bound by the locality of Coffs Harbour and Kratz Drive in the north, the Pacific Highway in the east, the locality of Boambee in the south, and the locality of Upper Orara in the west. A key feature includes Bishop Druitt College.

Coffs Harbour (West)

This area is bound by the locality of Korora and Bruxner Park Road in the north, the Pacific Highway, the North Coast Railway, Mackays Road, Dunn Place, Wills Street, Coffs Creek, Robin Street, Gailor Drive, Combine Street, Remembrance Close and Endeavour Drive in the east, the locality of North Boambee Valley in the south, and the locality of Upper Orara, the North Coast Railway, Shephards Lane and the locality of Karangi in the west. Key features include The Big Banana, Opal Shop, Baringa Private Hospital and Polwarth Drive Reserve.

Korora - Sapphire Beach

This area is bound by the locality of Moonee Beach in the north, the Coral Sea in the east and Bruxner Park Road and the locality of Coffs Harbour in the south, and the locality of Karangi, Bucca Bucca Creek in the west. Key features include Ulidarra National Park, Coffs Coast Regional Park, Bruxner Park Flora Reserve, Campbells, Hills, Korora and Sapphire Beaches, Opal Cove Resort, Korora Nature Reserve, Solitary Islands Marine Park and Kororo Public School.

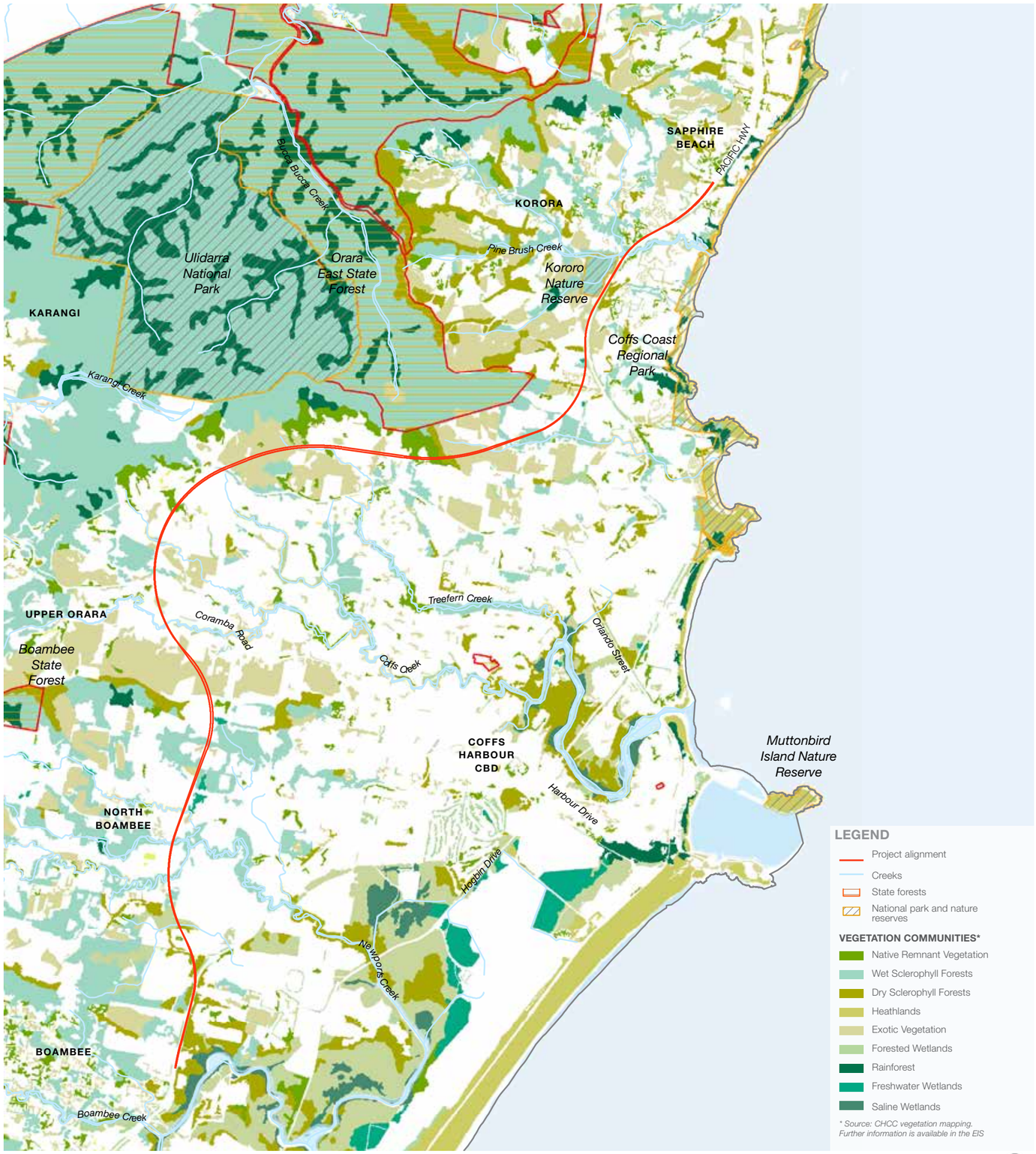


FIG 3.3 **VEGETATION COMMUNITIES**

3.3 Vegetation

The vegetation cover across Coffs Harbour responds in part to the topographical features, underlying soils and historical farming practices. The vegetation communities are illustrated in Figure 3.3. Within these vegetation communities, 9 plant community types were recorded within the project. These are:

- Wet Sclerophyll Forest
- Black Booyong Subtropical Rainforest
- Blackbutt Open Forest
- Sydney Blue Gum Open Forest
- Paperbark Swamp Open Forest
- Tallowwood Dry Open Forest
- Tallowwood Moist Open Forest
- Turpentine Open Forest
- White Booyong Fig Subtropical Rainforest.

Common features of the distribution of vegetation includes:

- Natural vegetation communities are responsive to the topography and changing influence of water in the landscape
- The floodplains of North Boambee Valley and some of the creek lines of Coffs Harbour are characterised by paperbark swamp open forest community species including *Casuarina sp* and *Melaleuca sp*
- The more undulating lands have a drier community dominated by Eucalyptus species, with wetter vegetation communities of *Eucalyptus pilularis,* tree ferns, and shrub species including *Syzygium sp.*, Elaeocarpus on the steeper terrain, reflecting the influence of the escarpment
- The overall vegetation pattern of Coffs Harbour is distinct as the small creek lines which drain the valley have been protected and retained as open space. This produces a green web which stretches through Coffs Harbour and reaches towards the escarpment to the west
- On the escarpment the vegetation is protected in either Ulidarra National Park or Boambee State Forest. The potential to reconnect these communities exists by extending the green web across the corridor.

Opportunities

- Enhance the vegetation diversity as the project is located in generally disturbed landscapes
- Enhance the variation in landscapes to provide scenic and varied views and vistas and views to rural landscape, forest and residential areas
- Provide east-west flora and fauna connectivity at key remnant vegetation corridors and waterways
- Retain and enhance riparian plantings at creek crossings where possible
- Use dominant species from vegetation communities through which the project passes
- Develop species mixes to reflect and enhance the local natural species
- Provide landscape screening of low/ medium density and large lot residential close to the project
- Incorporate a number of fauna mitigation measures to cater for fauna corridor areas - fauna underpasses (bridges and culverts)
- Potential to reconnect the existing vegetation communities by extending the green web across the corridor with the batter treatments.

Wet Sclerophyll Forest

Black Booyong
Subtropical Rainforest

Blackbutt
Open Forest

Sydney Blue Gum
Open Forest

Tallowwood Moist
Open Forest

Paperbark Swamp
Open Forest

Tallowwood Dry
Open Forest

Turpentine
Open Forest

White Booyong Fig
Subtropical Rainforest

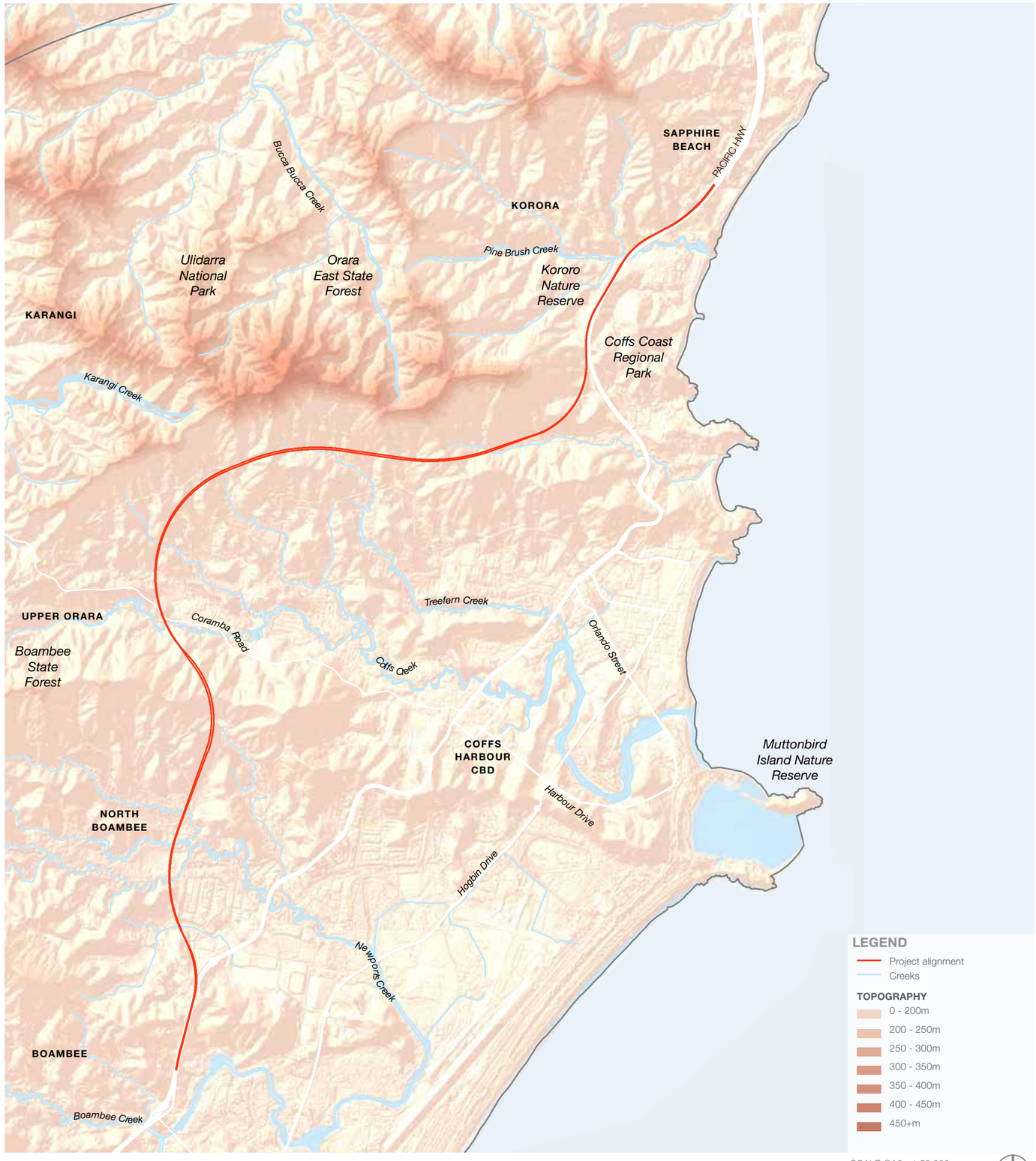


FIG 3.4 **TOPOGRAPHY**

3.4 Topography

The topography associated with the Great Dividing Range is of scenic value to Coffs Harbour with the higher crests of the range broadly orientated in a north-south direction. The foothills mark the transition of topography with ridgelines, including Roberts Hill, extending in an east-west direction declining in height to the coastline. Ulidarra National Park is situated approximately 700m to the west of the coastline and is noted as the closest point that the Great Dividing Range gets to the ocean.

Opportunities

- Use the dramatic topography of the Great Dividing Range to create a diverse traveling experience and views and vistas, traveling from low coastal floodplains and over the higher elevation of the lower slopes of the Great Dividing Range
- Retain and frame views within the soft landscape design
- Use topography to influence plant selection and vegetation communities
- Develop earthworks design to provide a sympathetic fit to topography
- Develop design so cuts and embankments have 2H in 1V or flatter slopes to promote vegetation cover
- Use the landform to assist in the mitigation of visual impacts to conceal the highway from adjacent residential developments
- Retain and enhance ridgelines through the inclusion of tunnels.

FIG 3.5 **WATERWAYS AND FLOOD EXTENTS**

3.5 Waterways

The proposed project is located within the Bellingen catchment, which is a 1000 km^2 coastal catchment that extends from Scotts Head (about 50 km south of Coffs Harbour) to the southern side of Yamba (about 95 km north of Coffs Harbour). The western side of the catchment is bounded by the Great Dividing Range, which is located 0.6 km to 4.8 km west of The project. The Bellingen catchment comprises a relatively narrow floodplain bounded by steep mountainous areas of the Great Dividing Range. The steep, headwater areas of the catchment are typically well vegetated, while some of the floodplain and foothill areas have been cleared for agriculture and other uses. Several unregulated rivers and creeks within the catchment flow in an easterly direction, discharging into the Pacific Ocean. The project passes through six sub-catchments:

- Boambee Creek
- Newports Creek
- Coffs Creek
- Jordans Creek
- Pine Brush Creek
- Treefern Creek.

Opportunities

- Retain and frame views within the soft landscape design
- Retain and enhance riparian plantings at creek crossings where possible
- Incorporate and enhance wetland systems along the project- to ensure no decline in water quality
- Align bridge pier locations to minimise overshadowing impacts
- Riparian corridors are enhanced and operational spill basins are integrated with the topography.

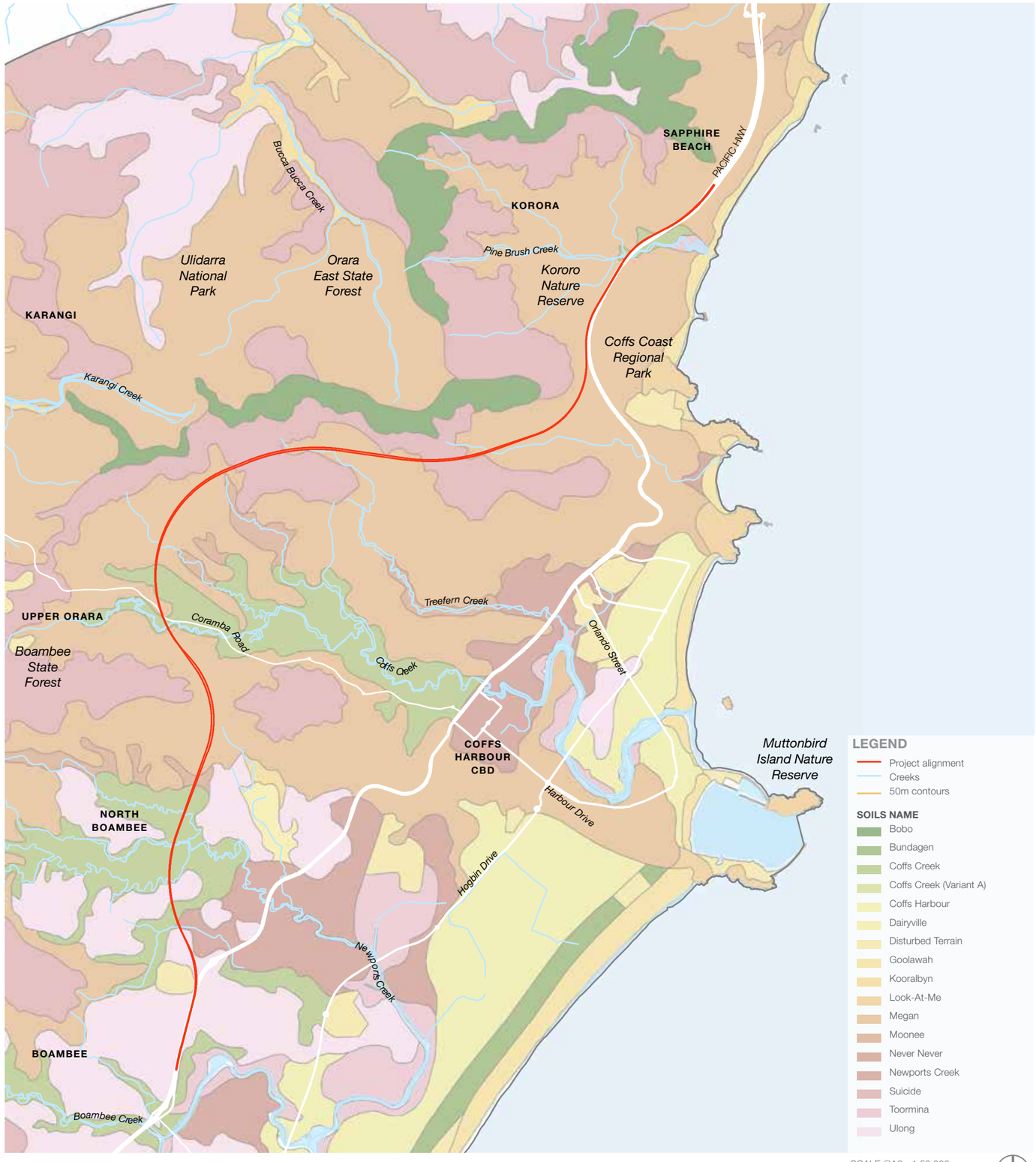


FIG 3.6 **SOILS**

3.6 Soils

The project traverses the Boambee and Newports floodplain and scenic footslopes of the Great Dividing Range, with views to the eastern coastline of NSW. The topography of the floodplains comprises flat to gently sloping coastal plains and river terraces, with estuarine mud flats. The landform rises rapidly from the adjoining plains with a series of spurs and ridgelines that cut across the project creating steep and undulating topography.

The project area occurs across six landscape soil types and are described in more detail overleaf:

1. Coffs Creek (Alluvial landscape)
2. Ulong (Erosional landscape)
3. Newports Creek (Swamp landscape)
4. Moonee (Transferral landscape)
5. Megan (Erosional landscape)
6. Suicide (Colluvial landscape).

Opportunities

- As soils are tied to particular plant communities, it is important that soil types remain in locations that they are stripped from
- Retain and manage topsoil on site to ensure revegetated communities thrive
- Align planting species with sensitive floodplain soils to enhance and strengthen riparian corridors.

Coffs Creek (alluvial landscape)

- Level to gently undulating floodplains, inset floodplains and terraces on Quaternary alluvium
- Deep, moderately to poorly drained alluvial soils, yellow podzolic soils and yellow earth on floodplains, deep moderately to poorly drained red podzolic soils on drainage plains, moderately deep to deep, moderately well drained yellow podzolic soils and yellow earths on terraces; and deep, poorly drained gleyed podzolic soils on drainage plains and floodplains in the middle Pine Brush Creek Catchment
- Low wet bearing strength, strong to very strong acidity. Localised flood hazard, foundation hazard, seasonal water logging, permanently high-water tables.

Ulong (erosional landscape)

- Undulating to rolling low hills on Late Carboniferous metasediments
- Moderately deep to deep, well drained red and brown earths, red and yellow podzolic soils and deep, well drained kasnozems in moist area. Moderately deep imperfectly drained structure Yellow Earths and Yellow Podzolic soils in drier areas
- Strongly to very strongly acidic soils with low wet bearing strength. Localised water erosion hazard, steep slopes and high run on.

Newports Creek (swamp landscape)

- Low, level to gently undulating coastal back-barrier floodplains on Pleistocene estuarine sediments
- Deep, poorly drained yellow podzolic soils and humic gleys
- Strongly to very strongly acidic, strongly sodic, strongly saline soils, low to very low wet bearing strength, slow deep topsoil/subsoil permeability, high topsoil organic matter and low fertility. Flood hazard, seasonal waterlogging, foundation hazard, localised water erosion hazard.

Moonee (transferral landscape)

- Undulating rises, footslopes and drainage plains adjacent to steeper low hills on Carboniferous metasediments
- Moderately deep to deep, poorly drained humic gley
- Strongly to very strongly acidic soils, low to very low wet bearing strength, slow permeability, high subsoil erodibility, and high subsoil sodicity. Seasonal waterlogging, water erosion hazard, permanently high watertables.

Megan (erosional landscape)

- Rolling low hills to hills on Late Carboniferous metasediments
- Moderately deep to deep, well drained structured red earths, brown earths, brown podzolic soils and red podzolic soils, with moderately deep to deep structured yellow earths and yellow podzolic soils in drier situations, and moderately deep to deep well drained krasnozems in the moistest sites
- Strongly acidic, stony soil of high erodibility. Localised steep slopes, mass movement hazard, high water erosion hazard, foundation hazard.

Suicide (colluvial landscape)

- Steep hills and dissected valleys on Late Carboniferous metasediments
- Moderately deep to deep, well drained stony structure yellow earths on crests and upper slopes, with stony lithosols and structured red earths on mid-slopes and footslopes
- Strongly acidic stony soils with low wet bearing strength, strong subsoil acidity and low fertility. Steep slopes, mass movement hazard, high run-on, high water erosion hazard, foundation hazard, localised rockfall hazard.

FIG 3.7 **FAUNA CORRIDORS**

3.7 Fauna connectivity

Biodiversity links are present along the length of the project. These include:

- A 'regionally significant biodiversity link' in the North Coast of NSW at Newports Creek
- Buffer zones (Pine Brush Creek and Newports Creek)
- A 'large biodiversity link' connecting Roberts Hill in the west to remnant native vegetation within the vicinity of Eyre Road, North Boambee Valley
- Several 'local area biodiversity links' exist along the project, including:
  - Riparian vegetation associated with Jordans Creek and tributaries which connect vegetation of the coastal plain with that of the escarpment in the north of the study area
  - Vegetation running south east from Shephards Lane and following the North Coast Railway
  - Vegetation connecting the escarpment foothills along Roberts Hill to vegetation of the coastal plain in the vicinity of Coramba Road
  - Riparian vegetation of Newports Creek in the North Boambee Valley
- Kororo Nature Reserve forms part of a regionally significant koala habitat corridor that also includes Boambee State Forest, Bruxner Park Flora Reserve and Orara East State Forest.

This will be managed by an integrated fauna connectivity design strategy connecting habitat wildlife corridors across the project.

Opportunities

- Provide east-west fauna connectivity at remnant vegetation corridors and waterways
- Integrate fauna mitigation measures along the corridor
- Enhance disturbed landscapes due to the large extent of urban development in Coffs Harbour along the corridor through species selection
- Align bridge pier locations to maximise fauna movement and connectivity
- Retain vegetation along ridge lines with the inclusion of tunnels at Roberts Hill and Gatelys Road
- Enhance connections across the corridor at Shephards Lane
- Retain existing sound vegetation wherever possible across the project to facilitate ease of connectivity
- Reduce vegetation loss and impedance during construction.

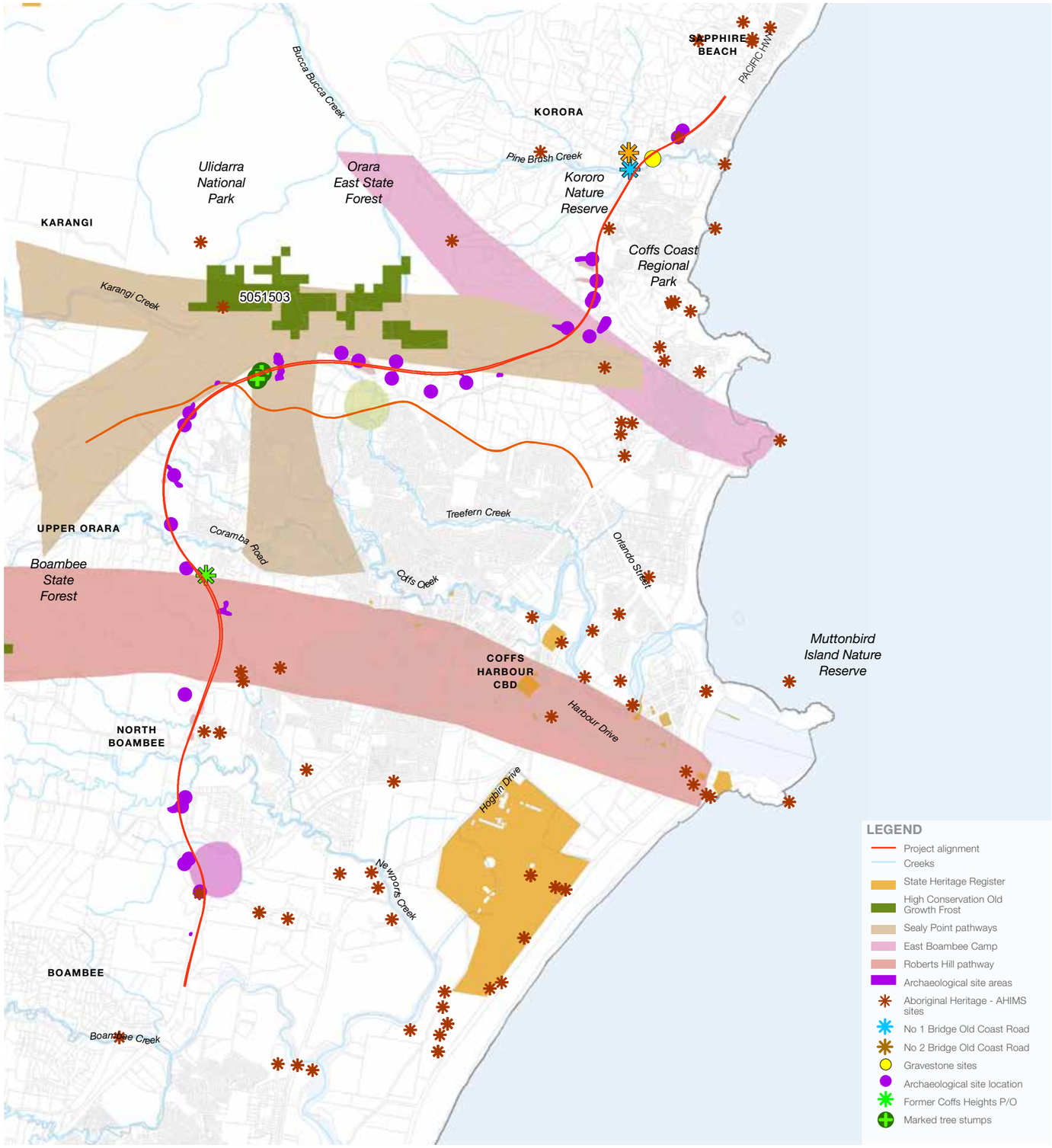


FIG 3.8 **HERITAGE**

3.8 Heritage

The traditional owners of the Coffs Harbour region are the Gumbaynggirr people, who have occupied this land for thousands of years, forming one of the largest coastal Aboriginal Nations in NSW. Their Nation stretches from the Nambucca River in the south to around the Clarence River in the north and to the Great Dividing Range in the west.

Legend has it that the first Europeans to the area were escaped convicts taking refuge on Muttonbird Island. Timber getters, or lumberjacks, were the first to settle in the area in 1841, where cedar trees grew in abundance in the sub-tropical rainforests on the Dorrigo plateau. The workers hauled the timber and tied them together as rafts, with the logs floating to the coastal ports down river. Ship building became important, although the reefs and islands made the water difficult to navigate. The ship wreck of Carywell in 1865 led to the boycott of the harbour until a lighthouse was constructed in 1878.

The local banana growing industry was established in the early 1900s. The crops grew well and by the 1920s, banana plantations were amongst the most highly profitable businesses on the Coffs Harbour coast. In acknowledgment of this historic agricultural business, the Big Banana was officially opened in December 1964 and is a notable tourist attraction within Coffs Harbour. Today, the region produces approximately 40% of NSW bananas.

Opportunities

- Incorporate the cultural stories, significance and history of the surrounding area in the urban design or art strategy. This may include history on the traditional landowners, cultural sites, indigenous heritage archaeological sites in the vicinity and key aspects of European settlement
- Respect and retain the natural landscape history through the inclusion of tunnels.

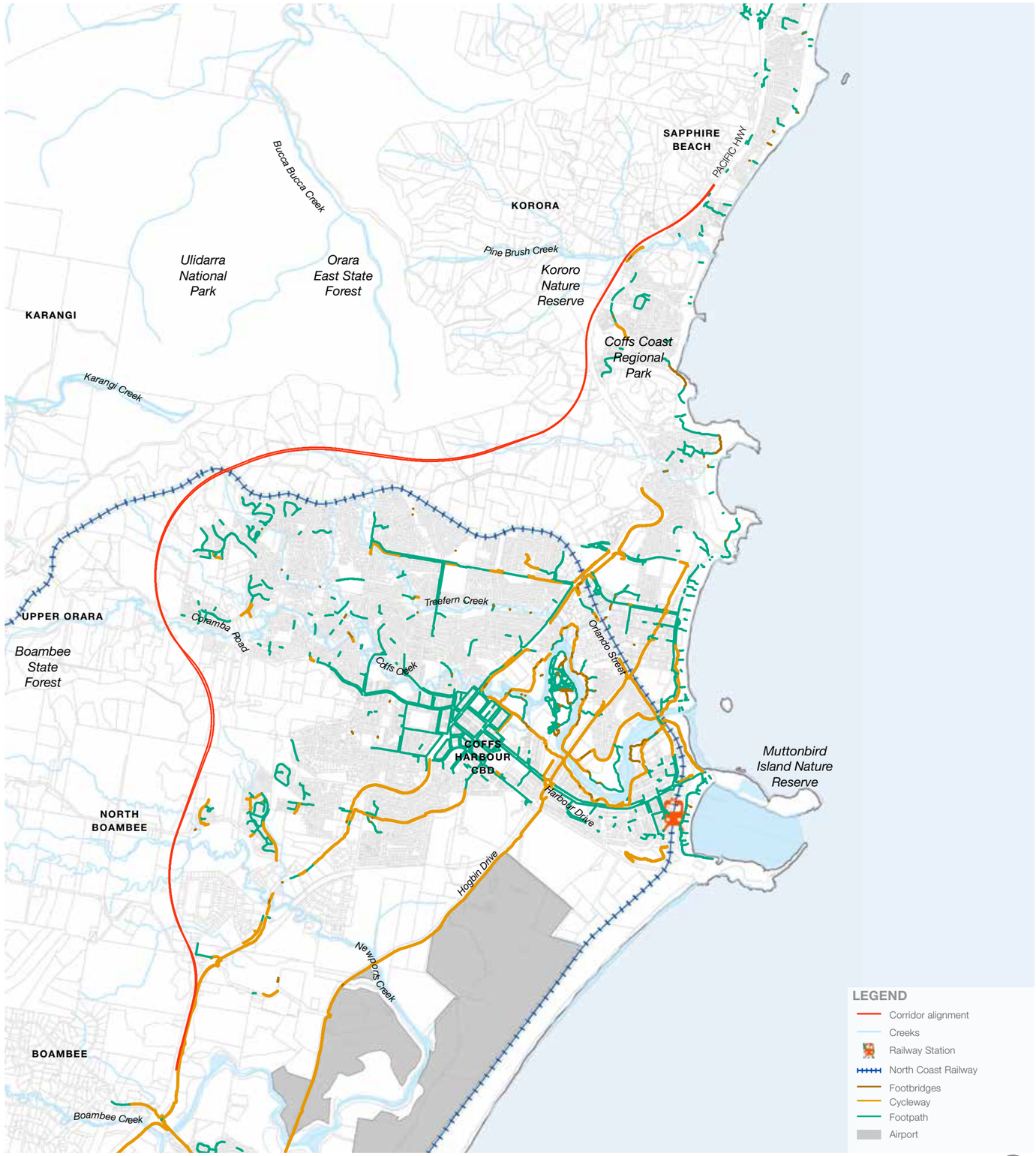


FIG 3.9 **TRANSPORT**

3.9 Transport

The existing Pacific Highway currently bisects Coffs Harbour CBD. This section of the highway is largely a four lane road with raised median and limited parking due to turning lanes with a speed limit of 60 km/h. The speed limit rises to 80km/h as you leave the CBD and move into the resort precinct with limited direct driveway and property access and less active frontage.

The North Coast Railway has played an important role in shaping the development of Coffs Harbour. Its alignment has limited development along the coast as it forms a physical barrier to the east edge. This restriction of growth is also evident to the north of town where it forms a clear delineation between residential development and agricultural lands on the steeper slopes.

An eastern bypass of the CBD, Hogbin Drive is an important link connecting the town to the airport and reducing congestion.

Connections to the west are limited due to the topography of the escarpment and the limited land development along the coast. The main connection to the west is Coramba Road which links Coffs Harbour to the small town of Karangi, Coramba, the Orara Valley and Ulong. It is a rural two lane road with no kerbs which transitions to an urban collector road as it passes through the residential suburbs of Coffs Harbour.

The general layout of the streets in the CBD is a grid in part responding to the topography. Clear linkages to the surrounding landscape are evident along the long straight east-west collector roads which lead into the hills

Footpaths are continuous in the CBD however less so in the residential areas. Cycleways are provided on main access roads.

Opportunities

- Potential for CHCC to create a more pedestrian friendly environment with lower speeds and a reduction of heavy vehicles in the city centre
- Potential for CHCC to provide street trees to enhance public amenity on the old Pacific Highway route.

FIG 3.10 **AGRICULTURE**

3.10 Agriculture

Historically, Coffs Harbour was a grazing landscape before bananas began being grown on the steep lands around the Coffs Harbour urban area and on land to the north and south along the coastal strip. Northern NSW was the home of the first major commercial banana plantations in Australia and in the 1950's and 1960's, Coffs Harbour was the major banana producing LGA in Australia.

Over the past 10-15 years the banana industry has reduced as the blueberry sector has had a major increase in production. Blueberries are now the most significant agriculture in the Coffs Harbour LGA.

Opportunities

- Incorporate this important agrarian landscape through an integrated planting design that complements the existing patterned landscape
- Ensure the landscape integrates and responds to the adjacent land use patterns.

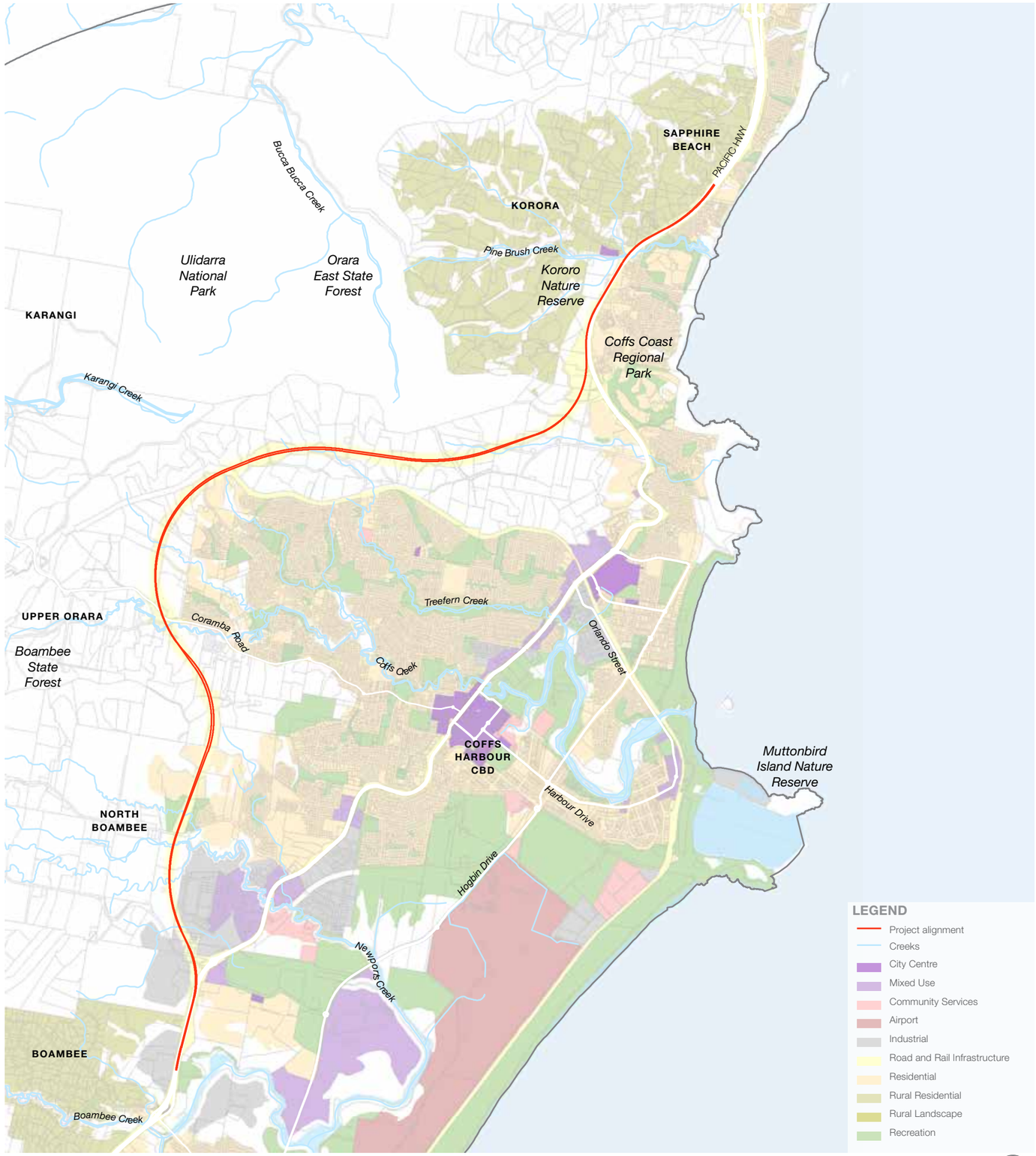


FIG 3.11 **SETTLEMENTS AND ACTIVITIES**

3.11 Settlements and built form

The land use surrounding the project contributes to its landscape character and is influenced by the physical constraints of topography and drainage.

Coffs Harbour is predominantly a rural area, with expanding residential, rural-residential, including resort areas, and industrial and mixed use land uses. Settlement is based around the Coffs Harbour CBD, and the townships of Coramba, Boambee and Korora. Much of the rural area is used for timber production and agriculture, particularly banana and blueberry plantations.

A more detailed summary of the land use classifications has been provided over leaf.

Opportunities

- Ensure the project minimises effects on adjacent land uses
- Create varied views and vistas to rural landscape, forest and residential areas.
- Provide visual mitigation through urban and landscape design to low/medium density and large lot residential close to the project
- Recognise and strengthen the legibility of the north coast regional urban and rural structure through species treatments, which differentiate urbanised areas from the more rural and forested areas
- Manage views to and from the highway to rural residential and residential areas through provision of landscape screening to minimise visual impacts on these in more visually sensitive areas
- Manage views of residents with elevated views that look over the highway through provision of landscape screening
- Ensure the landscape integrates and responds to the adjacent land use patterns.

Rural Residential Areas

There are four main low/medium density residential areas located close to the alignment, these are; Korora, Coramba, Boambee and Toormina. These are located east and west of the project close to the three interchanges. In the north the project follows the existing Pacific Highway alignment with the residential low/medium density areas located to the east and large lot residential to the west.

Coffs Harbour CBD - city centre

The CBD has two major shopping centres, Park Beach Plaza, Coffs Central with Toormina Gardens Shopping Centre located south of the CBD in Toormina. It is one of the largest urban centres in the North Coast region. It is located to the east of the project and will not be directly impacted. Indirectly, there would be less regional traffic through the CBD which would provide opportunities for CHCC to create a more pedestrian friendly and focused CBD that may enable greater active uses along the former Pacific Highway.

Industrial and Mixed Use Areas

The southern end of the project defines the southern extent of the Coffs Harbour urban area, and provides an entry into Coffs Harbour. The land use is a combination of industrial and commercial uses and is zoned Mixed Use and Industrial. Car yards and large box warehouse type developments are the dominant built form and use.

FIG 3.12 **PROTECTED LANDSCAPES**

3.12 Cultural and protected landscapes

The project is located adjacent to some large forest areas; the Ulidarra National Park, Coffs Coast Regional Park, Orara East State Forest and Kororo Nature Reserve in the north; and Boambee State Forest in the south. The project also passes through some smaller patches and corridors of forest, some of which are centred around waterways. These forests are predominately native species with some areas being habitats for endangered wildlife.

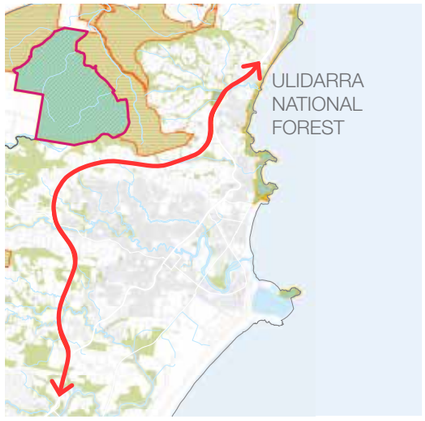
Solitary Islands Marine Park

Solitary Islands Marine Park extends north from Coffs Harbour to Sandon River, stretching approximately 75km of the coastline. The park was established in January 1998 (prior to that it was a marine reserve since 1991) and is designed to protect the diverse habitats, including estuaries, beaches, intertidal rocky shores, sub-tidal reefs and open oceans. The area contains more than 550 reef fish, 90 hard coral and 600 molluscs (shelled animals) species. North Solitary Island has the park's highest reef fish diversity. South Solitary is renowned for its large pelagic fish, turtles and is also rich in shelled animals, with many marine snails and slugs, especially on the western side. It is the northern most breeding site recorded for the giant cuttlefish. The park's northern estuaries are some of the state's most pristine, largely because the majority of adjacent land is located in Yuraygir National Park.

Ulidarra National Park

Ulidarra National Park is located on the north-west outskirts of Coffs Harbour. The park covers an area of approximately 680 hectares and adjoins Bruxner Park Flora Reserve to the east and Orara East State Forest to the north and north-west. A Crown reserve abuts part of the southern boundary of the park. Private property adjoins most of the southern, the south western and part of the northern boundary. The predominant land uses surrounding the park include forestry, cattle grazing, light agricultural activities, banana plantations and rural settlement.

ULIDARRA NATIONAL PARK



The park's name is a derivation of the Gumbaynggirr word for the first Hero Ancestor or "The Dreaming" (Morelli 2008; G. Williams, Muurrbay Language Centre, pers. comm. 2008). It is also closely associated with the name of the local conservation group (the Ulidarra Conservation Society) which campaigned for the park's protection. Ulidarra National Park is culturally significant to the Gumbaynggirr people and lies within the area of the Coffs Harbour and District Local Aboriginal Land Council.

The park comprises land formerly part of the Orara East State Forest. It is part of an important forested corridor linking the plateau and coastal forests, and is part of the dramatic forested backdrop to Coffs Harbour. Much of the park is rugged and remote, supporting moist forest communities such as rainforest and wet sclerophyll forest. A long-term study of the fauna found in the park and the neighbouring flora reserve has revealed a high diversity of animals.

The park is located close to the growing regional and tourist centre of Coffs Harbour. It, and particularly the neighbouring Bruxner Park Flora Reserve, have significant and growing visitation. Currently only one commercial tour operator is licensed to use Ulidarra National Park, for motor bike touring.

Access to the park is mainly from the Pacific Highway at Korora (approximately four kilometres north of Coffs Harbour) via Bruxner Park Road and Swans Road through Bruxner Park Flora Reserve. From the west, there is vehicular access from the Coramba Road at Karangi via Convincing Ground Road through Orara East State Forest. The two park roads, Swans and Shelter roads, are the only public access roads through the park, and are generally maintained to two wheel drive dry weather standard within the park.

CHCC is facilitating a project aimed at transforming Bruxner Park Flora Reserve into a significant nature-based tourism destination (CHCC 2009). National Parks and Wildlife Service (NPWS) has assisted CHCC in contributing towards the feasibility assessment of this proposal, and to undertake planning and develop a detailed business case. NPWS has also recognised opportunities to complement the existing facilities in Bruxner Park Flora Reserve, as part of this Bruxner Park Ecotourism Proposal (also known as the Bruxner-Ulidarra Ecotourism Proposal).

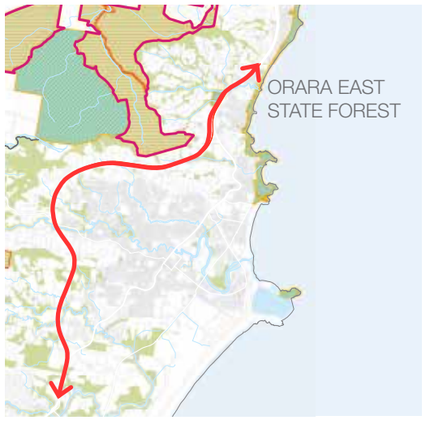
Management purpose and principles

National Parks are reserved under the National Parks and Wildlife Act 1974 (NPW Act) to protect and conserve areas containing outstanding or representative ecosystems, natural or cultural features or landscapes or phenomena that provide opportunities for public appreciation and inspiration and sustainable visitor or tourist use.

Under the NPW Act (section 30E), national parks are managed to:

- Conserve biodiversity, maintain ecosystem functions, protect geological and geomorphological features and natural phenomena and maintain natural landscapes
- Conserve places, objects, features and landscapes of cultural value; protect the ecological integrity of one or more ecosystems for present and future generations
- Promote public appreciation and understanding of the park's natural and cultural values
- Provide for sustainable visitor or tourist use and enjoyment that is compatible with conservation of natural and cultural values
- Provide for sustainable use (including adaptive reuse) of any buildings or structures or modified natural areas having regard to conservation of natural and cultural values; and provide for appropriate research and monitoring.

ORARA EAST STATE FOREST - SEALY LOOKOUT



Orara East State Forest

Orara East State Forest provides a range of lookout points and walking trails throughout the forest. A summary of the key facilities and destinations is provided below.

Sealy Lookout

Sealy Lookout is located within Bruxner Park Flora Reserve and was originally developed for visitor use in 1968. In 1970, during a tour marking the Captain Cook Bicentenary, the royal yacht Britannia docked in Coffs Harbour and Queen Elizabeth II visited the lookout to enjoy the panorama.

Forest Sky Pier

The Forest Sky Pier at Sealy Lookout is located on an escarpment 310m above Coffs Harbour. A pier extends approximately 21m out from the escarpment, offering an expansive view encompassing Coffs Harbour's CBD, its foreshore and marina, Solitary Islands Marine Park, surrounding mountain ranges and the coastline.

Treetop Adventure Park

A treetop adventure park has recently opened at Sealy lookout, in Orara East State Forest at Bruxner Park. The park provides opportunities for visitors to weave through the tree tops on self-guided rope courses.

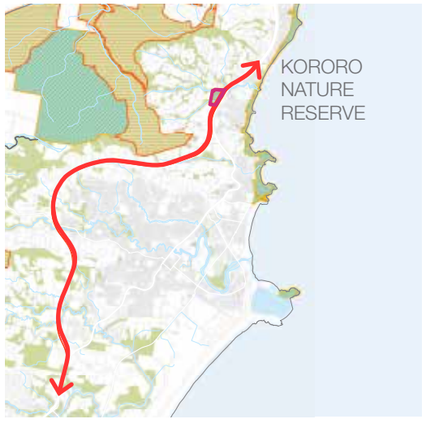
Korora Lookout and Gumgali Pathway

Korora lookout offers views to the coastline from a viewing deck. Gumgali Track is a short one-way walking track that follows the ridge line from Korora Lookout carpark through to Korora Lookout itself. The track offers artwork and sculptures that relate to the story of Gumgali, the Black Goanna, a part of the local Gumbaynggirr culture.

Walking tracks

Orara East State Forest provides maintained and signposted walking through the rainforest, with some sections including short, steep hills with a varying amount of steps. All walking tracks showcase beautiful rainforest flora and fauna.

KORORO NATURE RESERVE



Kororo Nature Reserve

Kororo Nature Reserve is situated to the north of Coffs Harbour and covers an area of approximately 11 hectares. The area was gazetted in 1967 for the protection, care, propagation and promotion of the study of fauna, particularly koalas.

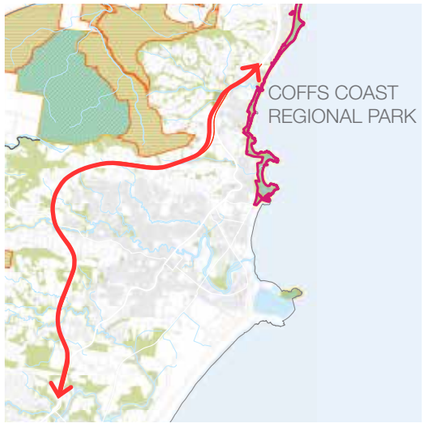
Vegetation in the reserve comprises tall open forest with a rainforest understorey. The dominant tree species within the reserve is tallowwood, but also present are Sydney blue gum and brush box which are tree species favoured by koalas.

The reserve forms part of a regionally significant koala habitat corridor that also includes Boambee State Forest, Bruxner Park Flora Reserve and Orara East State Forest.

Nature reserves are reserved under the NPW Act to protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena.

Under the NPW Act, nature reserves are managed to:

- Conserve biodiversity, maintain ecosystem functions, and protect geological and geomorphological features and natural phenomena
- Conserve places, objects, features and landscapes of cultural value
- Promote public appreciation, enjoyment and understanding of the reserves natural and cultural values
- Provide for appropriate research and monitoring.



COFFS COAST REGIONAL PARK

Coffs Coast Regional Park

Coffs Coast Regional Park stretches along the coast from northern Coffs Harbour to near Corindi and encompasses headlands, dune systems, coastal creeks and estuaries and other coastal features. The park's headlands are its dominant feature, and support a range of important values and offer spectacular views of the coast, hinterland and the Solitary Islands.

Biological significance

The park supports a range of coastal vegetation formations, including heaths, grasslands and littoral rainforest. The vegetation in the park provides habitat for a range of threatened and significant species and populations, including the only population of the endangered low-growing form of the small shrub ***Zieria smithii*** that is found only in the regional park. More than 40% of the vegetation in the park is one of several threatened ecological communities.

The park provides important resources for a range of native fauna, including nectar and fruit resources, old-growth forests, and shorebird roosting and breeding habitats. Headland grassland in the park provides the northernmost known habitat of the endangered black grass-dart butterfly (***Ocybadistes knightorum***) and Floyd's grass (***Alexfloydia repens***).

Aboriginal culture and heritage

The park is within the traditional Country of the Gumbaynggirr People and has been a place of significance for Aboriginal people for many thousands of years. The Aboriginal culture and heritage values in the park are significant.

There are a number of sites of particular Aboriginal significance in the park, including; particular headlands, resource areas, tool-making sites, meeting and ceremonial places, and spiritual and mythological landscapes. Local Aboriginal people still harvest wild resources from the park for use as bush foods and medicines, and hold community and education events in the park.

Shared heritage

The coastline has played a vital role in the history of Coffs Harbour, providing a focus for settlement, industry, transport, recreation and holidaying. There is evidence that areas of the park were used for a variety of agricultural pursuits, such as growing bananas and sugar cane. The park and its adjacent beaches have long been a focus for seaside holidays and recreation for locals and visitors alike, and the Coffs coastline continues to provide these opportunities.

Recreation and tourism

The park provides opportunities for recreation and leisure in a natural coastal setting of headlands, dunes, creeks, diverse coastal vegetation and adjacent sandy beaches. Popular nature-based activities in the park include walking, birdwatching, sightseeing, whale watching and nature appreciation. The Solitary Islands Coastal Walk provides a high-quality nature-based tourism asset for the Coffs Harbour LGA, and day use areas in the park provide visitors with a suite of facilities including picnic areas and playgrounds. The park also provides visitors with opportunities for cycling, dog walking, horse riding and adventure activities, and access to adjacent beaches.

A number of commercial activities occur in the park including surfing schools and parachute landings. Opportunities for further commercial development of low-impact and ecologically sustainable visitor services in the park need to be investigated.

Research and education

The park is an important educational resource for local and visiting schools, colleges and universities. The NPWS Discovery program, the Coffs Ambassador program (CHCC) and other educational programs are conducted in the park and, in relation to activities in the adjacent Solitary Islands Marine Park, from the park. Research within the park provides data to assist in the management of the park's values.

Management purposes and principles

Regional parks are reserved under the NPW Act to protect and conserve areas in a natural or modified landscape that are suitable for public recreation and enjoyment. Under section 30H of the NPW Act regional parks are managed to:

- Provide opportunities for recreation and enjoyment in natural or modified landscapes
- Identify, interpret, manage and conserve the park so as to maintain and enhance significant landscape values
- Conserve natural and cultural values
- Promote public appreciation and understanding of the park's natural and cultural values
- Provide for sustainable visitor or tourist use and enjoyment that are compatible with conservation of natural and cultural values
- Provide for sustainable use (including adaptive reuse) of any buildings or structures or modified natural areas having regard to conservation of natural and cultural values.

Regional parks are established for the purpose of providing recreational opportunities while protecting natural, cultural and landscape values.

Chapter 4

Urban design strategy

(blank page)

04

Urban design strategy

The purpose of this section is to identify the urban and landscape design response and how this will be manifested on the ground in a cohesive and integrated experience, for users and those who will become its neighbours.

4.1 The strategy

Vision and objectives

The overarching strategy of the project is to ensure that the project is sensitively, both physically and visually, integrated with its surrounding topography, landscape and urban setting, seeking to minimise visual impact and maximise the scenic and dramatic road user journey experience.

The Design adopts this strategy as follows:

Vision

"A bypass which expresses the interfaces between the Great Dividing Range and the Pacific Highway, concealed from view from Coffs Harbour."

Provide a flowing road alignment that is responsive and integrated with the landscape

Where possible, the design of the project will accentuates the landscape character throughout the journey, enhances the views and experiences and ties seamlessly into the surrounding topography through shaping of the road landform.

Provide a well vegetated, natural road reserve

Considering the wider landscape and remnant native forests looking for opportunities to create ecological connections along the highway corridor while enhancing the visual integration of the highway into the landscape with revegetation responding to adjacent plant communities.

Provide an enjoyable, interesting highway with varied views and vistas of the landscape

A highway that enhances and draws attention to the changing landscape characters across the journey and frames dramatic and scenic views of escarpment and coastline as the highway twists and turns.

Value the communities and towns along the road

Identifying impacts that the project would have on existing properties located in the area and designing the project to be integrated into the landscape, mitigating visual and aural impacts including providing distinctive gateways for the Regional Centre of Coffs Harbour on the highway journey.

Provide consistency with variety in road elements

Designing a consistent suite of road elements that is cohesive in material, form and colour with the overall Pacific Highway in order to enhance driver legibility and simplify route navigation.

Provide a simplified and unobtrusive road design

A road that seeks to provide a unified suite of elements, bridges, retaining walls, noise walls, earthworks and fencing that blend seamlessly with the landscape character.

Urban design principles

The principles described below are derived from the Roads and Maritime urban design manual *Beyond the Pavement*, the *Pacific Highway Urban Design Framework* and detailed analysis of the project corridor and its context.

The road and its neighbours

Ensure that the urban and landscape design of the project delivers a safe, positive, functional, and pleasing visual experience for traffic, pedestrians, cyclists, people with disabilities, and the corridor's neighbours. This also includes ensuring the highway is plugged in as seamlessly as possible to the local road and transport network while mitigating any visual impacts to adjacent residences, neighbourhoods and commercial centres.

Lateral integration

Ensure the project responds to its immediate context, whether natural or man-made, by relating visual and other sensory experiences to the neighbouring environment and character. Lateral integration ensures that once the highway has been established it fits into the varying landscape characters that it runs through, this can mean visual integration as well as environmental, topographical, transport and built form.

Linear identity

Establish a consistent and cohesive language for the full length of the project through the design of the highway and the highway elements. While the landscape should be rich in diversity and interest, the road should have its own identity that is sympathetic to the landscape but familiar to travelers on the highway. It is important that the road elements along the corridor have a simple but distinctive character so that the experience on the road is legible yet memorable.

Route diversity

Route diversity creates a road experience that is visually interesting and continually changing, highlighting the range of landscape and urban conditions present along the project. Differentiation along the project assists users in orienting themselves. Through accentuation of views, enhancement and preservation of landscape character, layering of plants to create views into the forests and design of key road structural elements, route diversity can be used to enhance the user experience.

Landmarks

The identification of existing and creation of new memorable landmark features along the project is a further means of increasing route diversity as well as facilitating user orientation and aesthetic enhancement. The highway presents opportunities for artistic works and design elements to draw attention to and celebrate physical, historical and cultural landmarks.

Connection to country and Aboriginal and non-Aboriginal heritage

Acknowledging that elements of the landscape have cultural and heritage significance to local indigenous people as well as historical patterns of land use around Coffs Harbour. Identifying locations along the project of cultural and heritage importance and exploring opportunities for co-design with local Aboriginal community to highlight them to the road users adding to the richness of the road experience.

Residual land

Land within the corridor which is not required for the road, structures or shared path and their associated engineering works (cuttings, embankments and interchanges) will not change in use or zoning after completion of the project.

Landscape connection

Using the introduction of the highway not as a disruptor but as an opportunity to enhance and create connections within the landscape, both visual and environmental. Using native forest planting (a combination of tall open forest species and low shrub species) that is consistent with the remnant native vegetation to enhance the ecological value and maintain a visual 'depth' into the forest. This also applies to watercourses and riparian planting, using the linearity of streams to enhance ecological quality and provide connections through the landscape.

4.2 Landscape design approach

This section describes the Landscape Design approach in response to the strategy presented in Chapter 4.1. The landscape design approach is guided by the Roads and Maritime Services Landscape Guideline (2019). Key criteria has been established and is categorised under three different landscape principles below.

Revegation and preservation

- Maintain, retain and preserve indigenous vegetation, habitats and wildlife corridors in collaboration with the local Aboriginal community
- Use resilient trees, shrubs and groundcover that are climate resilient, provide shade and ameliorate potential heat island effects, to provide valuable amenity for the broader community
- Design landscape treatments to provide a strong, legible and structured plantings that reinforce spatial connectivity with adjacent areas and enhance environmental quality, visual continuity, identity and landscape character
- Consider how maintenance and irrigation can be kept to a minimum with the use of native species in 'natural' informal planting arrangements as the predominant plant matrix
- Use screen planting to help mitigate the visual impact of retaining structures, noise walls, ventilation and highway facilities
- Augment existing vegetation patterns and connect patches of remnant vegetation across the highway.

Mitigation of excavations

- Maintain natural ridgelines
- Work with existing land form.

Integration with built form and roads

- Use safe design principles i.e. Crime Prevention Through Environmental Design (CPTED)
- Maintain sight lines and safety through responsive landscape design
- Enhance long distance and district wide views
- Visually and physically connect the banana and blueberry plantations.

FIG 4.1 **ARTIST IMPRESSION OF GATELYS ROAD TUNNEL**

Landscape approach — revegetation and preservation

Highway integration through revegetation and preservation of existing landscape patterns can be supported through the landscape design. There are three landscape typologies experienced across the corridor. These include:

- Existing watercourses
- Main alignment
- Raised highway.

Within these typologies, key design criteria have been established and consider:

- Revegetation of watercourses, overland flow paths and ephemeral streams through identifying highway development opportunities to achieve enhanced habitat, biodiversity and better outcomes for water quality
- Infill of planting between patches of remnant native forests to reduce edge to core ratio, enhancing biodiversity and resilience of remnant native forest
- Infill of planting to expand and enhance pathways for habitats, flora and fauna
- Preservation of existing landscape character such as rural pasture land, riparian zones and native forests through selection and structuring of planting
- Respect of natural geography and ridgelines.

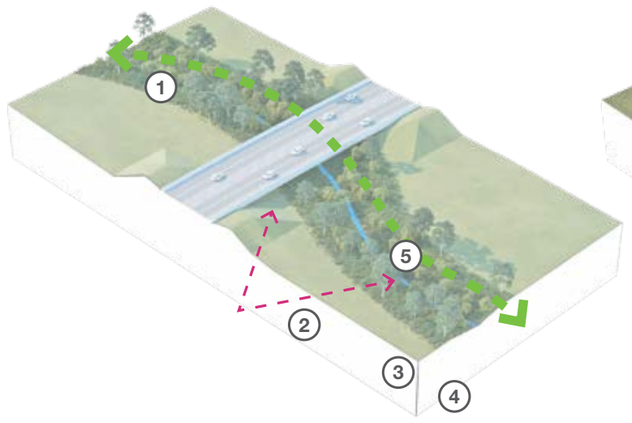


FIG 4.2 **EXISTING WATERCOURSES TREATMENT**

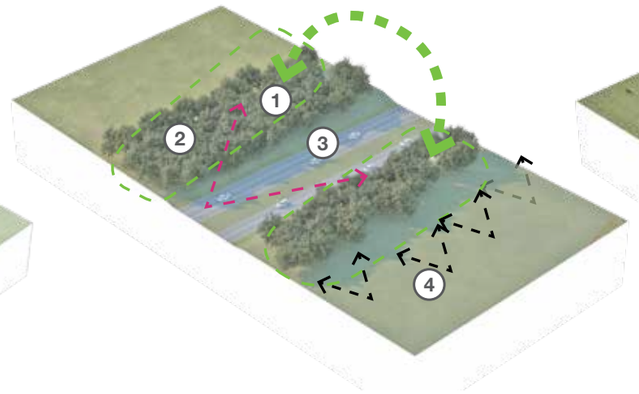


FIG 4.3 **MAIN ALIGNMENT TREATMENT**

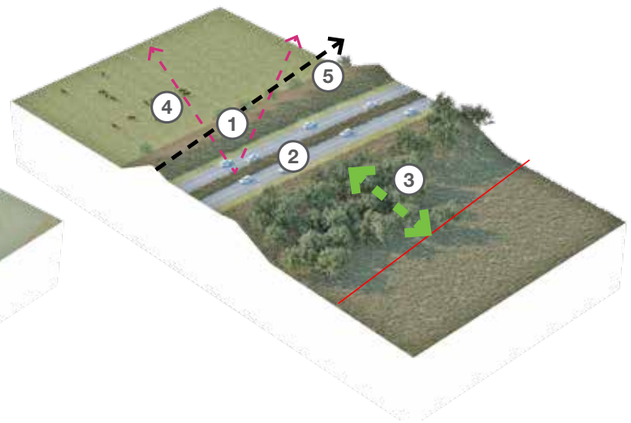


FIG 4.4 **RAISED HIGHWAY TREATMENT**

Design criteria

Existing watercourses

1. Minimise impacts to existing watercourses both through design of structures and during construction
2. Design of structures to be sympathetic to landscape and context through use of natural materials and simply designed forms
3. Opportunities to enhance watercourses through riparian planting and shading of water courses
4. Revegetated and protected watercourses provide fauna pathways under the highway
5. Flatter (2H:1V) slopes that can be re-vegetated to present a green appearance

Main alignment treatment

1. Connecting remnant pockets of vegetation through infill planting where existing native forest is already present
2. Retain significant large trees and existing patches of native vegetation where possible
3. Vegetated median planted with frangible species to match existing environment
4. Dense planting along edges of adjacent residential neighbourhoods to screen the highway

Raised highway

1. Planting along edge of highway to frame or filter views to rural landscapes
2. Vegetated median planted with frangible species to match existing environment
3. Large rock fill and cut batters will comprise mostly grasses and small shrubs. In some areas where it is not feasible to revegetate rock batters these could be used as feature element of the project with local native tree plantings at base of large rock fill batters to soften visual impact.
4. Retain rural landscape character through preservation of views from highway and ensuring gentle slope grades vegetated with low planting
5. Integration of vegetated mounding to address potential noise issues associated with project

Landscape approach — mitigation of excavations

Highway integration through mitigation of excavations, cut faces and raised structures can be supported through the landscape design. There are three landscape typologies experienced across the corridor. These include:

- Highway with cuts
- On/off ramps
- Half cut, half raised highway.

Within these typologies, key design criteria have been established and consider:

- Slope, excavation and fill management to achieve optimal planting conditions
- Slope, excavation and fill management to integrate with and tie into the surrounding landscape natural form, e.g. use 'feathering' technique
- Retention of significant and mature trees or remnant native forest
- Avoid shotcrete on steep slopes and use natural stone or rock if stable, or use batter stabilisation techniques such as seeded compost blanket where possible (refer *Guideline for Batter Surface Stabilisation using vegetation* (Roads and Maritime Services, 2015)
- Utilisation of plants and mounds for visual screening of cut faces from the road and from neighbouring properties.

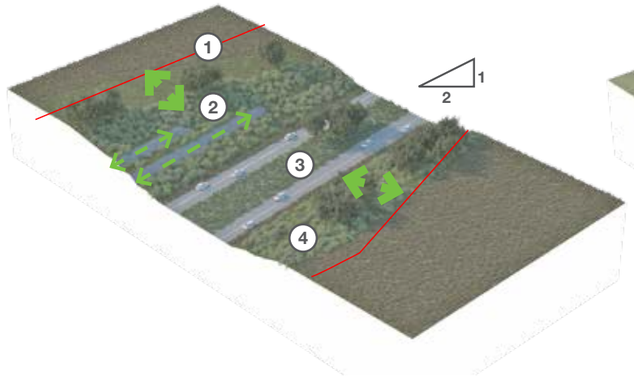


FIG 4.5 **HIGHWAY WITH CUTS**

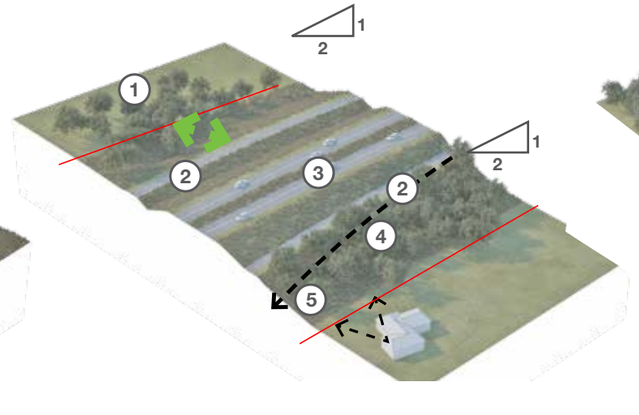


FIG 4.6 **ON / OFF RAMP TREATMENTS**

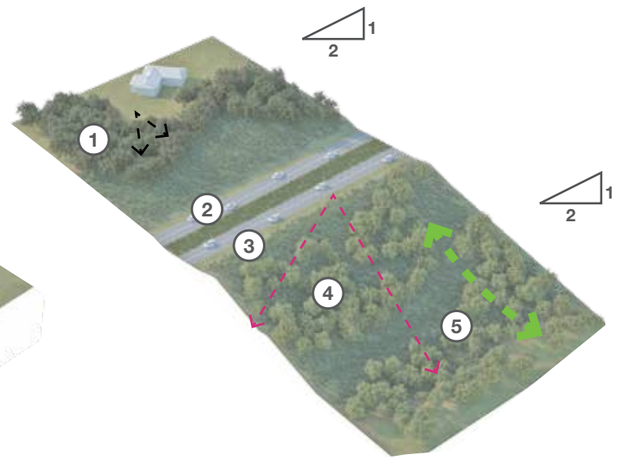


FIG 4.7 **HALF CUT HALF RAISED HIGHWAY TREATMENTS**

Design criteria

Highway with cuts

1. All slopes to be revegetated to project boundary where grade allows.
2. Leave rocks exposed where possible. If shotcrete is required, the colour and texture should match and blend with the natural rock appearance.
3. Vegetated median planted with frangible species to match existing environment.
4. Where possible steep slopes should be eased to 2H:1V and revegetated.

On/off ramps

1. All slopes to be revegetated to project boundary where slope grade allows planting.
2. Approaches to and from interchanges to be consistent language of mounded and structured planting.
3. Vegetated median to match interchange planting.
4. Delineation of road curves and changes with vertical elements such as trees to provide visual cues for drivers.
5. Dense tree planting to screen adjacent properties and mitigate impacts of highway and structures.

Half cut half raised highway

1. Properties elevated above the highway to be screened with planted vegetation.
2. Steeper slopes to be vegetated with shrubs and grasses.
3. Vegetated median planted with frangible species to match existing environment.
4. Tree planting below the highway to be structured in a way that frames views and vistas.
5. Denser infill planting below the view line of the highway to tie into existing remnant forest, where it exists.

Landscape approach — integration with built form and roads

Highway integration with built form, existing roads and the existing highway can be supported through the landscape design. There are two landscape typologies experienced across the corridor. These include:

- Urban highway with structures
- Urban highway with local roads.

Within these typologies, key design criteria have been established and consider:

- Grades and vegetation around urban built-up areas sympathetic to the surrounding landscape
- Adequate space for planting to the front of retaining walls to soften their appearance
- Opportunities for colour and/or patterning to precast panel surfaces of noise and retaining walls
- Planting and materials integration of the project with existing Pacific Highway
- Screening for urban areas adjacent to the project to mitigate adverse visual impact of the project
- Different treatments between local roads and highways to support a self-explaining road environment.

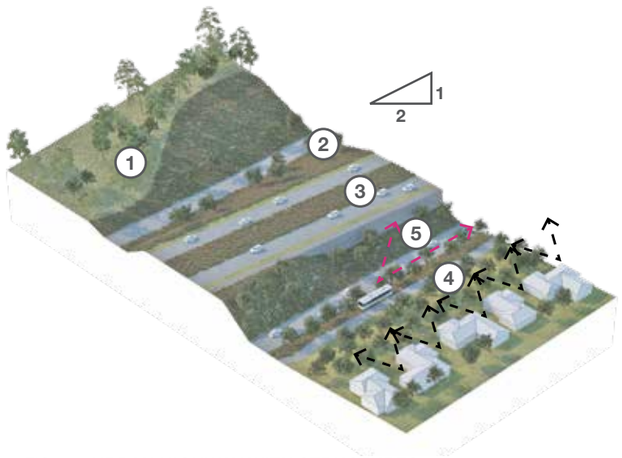


FIG 4.8 **URBAN HIGHWAY WITH STRUCTURES**

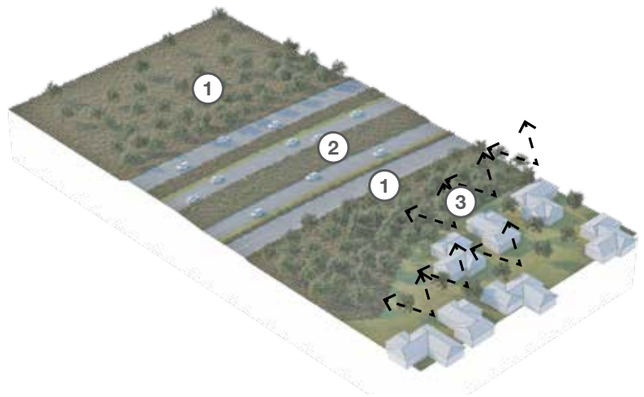


FIG 4.9 **HALF CUT HALF RAISED**

Design criteria

Urban highway with structures

1. Planted clumps of trees and revegetation to be consistent with character of large lot residential properties.
2. 2H:1V grades and planting from local roads to elevated highway where possible.
3. Vegetated median planted with frangible species to match existing environment.
4. Retaining walls to be sympathetic to context through restrained use of materials and patterning, soften walls with planting along front.
5. Planted clumps of trees to add visual interest and frame views.

Urban highway with local roads

1. Local roads to be screened and planted to ensure consistent character with adjacent streets.
2. Vegetated median planted with frangible species to match existing environment.
3. Dense planting adjacent to neighbourhoods to screen highway and structures.
4. Screening using noise walls, planting and mounds used to mitigate highway visual impact

Earthworks, landform and slope stabilisation

The design has focused on the integration of cutting and embankment slopes to respond to the surrounding topography where possible. The design acknowledges the potential geological constraints in this regard and explores opportunities to vary the surface finish. This allows topsoil to be retained on slopes and vegetation to be established over time.

Earthworks and slope design will be refined during detailed design based on additional environmental, engineering and property constraints. Batter stabilisation techniques aligned with *Guideline for Batter Surface Stabilisation using vegetation* (Roads and Maritime Services, 2015) will be used.

There are two earthworks typologies experienced across the corridor. These include:

- Fill embankments
- Cut batters.

Across both typologies all slopes and batters should to be revegetated from the edge of the indicative road corridor to the construction footprint, where reasonable and feasible, to integrate the project with the surrounding landscape.

Fill embankments

The integration of fill embankments will been undertaken across the project. Fill embankments should have 2H:1V batters, or flatter, for stability, maintainability and vegetation establishment. In small, isolated and constrained areas where steeper batters are employed, they will be constructed using localised planting with erosion control matting or rock abutments.

Cut batters

Cut batters would generally be at a slope of 2H:1V. While steeper slopes may be achievable from a stability perspective, flatter slopes have been adopted where possible to provide maintenance and vegetation establishment while also seeking to replicate the surrounding natural topography and to balance cut and fill. The bottoms of cuttings will allow adequate space for planting to soften the immediate impact of the cutting where possible.

Where cut batters are located in hard rock or where required to be steeper than 2H:1V, these would be left as natural rock where stable.

Cut batters in hard rock

Cut batter treatments have been extended to deep cuttings in medium and high-strength rock that requires blasting. Where possible, earthworks would over blast the rock and backfill to achieve a 2H:1V gradient. This approach would avoid rock faces requiring shotcrete and rock bolts, regarded as a major visual improvement for the project.

Batter benches can be used to assist with stability, geotechnical and maintenance considerations.

Engineered slopes and batters

Engineered slopes and batters may be necessary throughout the project where minimising construction extents are required. All options should be explored to minimise any use of shotcrete as a solution to steep engineered slopes. Shotcrete is visually intrusive, particularly in rural and natural landscapes.

Shotcrete should be minimised across the project. The use of shotcrete is discouraged as a landscape treatment due to the adverse visual impact on the surrounding landscapes.

FILL EMBANKMENTS TO HAVE 2H:1V BATTERS OR FLATTER FOR STABILITY (PHOTO: BERRY BYPASS)

ROUNDING OF EMBANKMENTS AT THE BASE AND AT THE TOP OF FILL (PHOTO: BERRY BYPASS)

Shotcrete avoidance and mitigation strategy

Through the concept design for the project, exposed areas of sprayed concrete (shotcrete) have been avoided as far as possible. During future design development, every effort should be made to achieve batter stabilisation without the use of shotcrete. Where the use of shotcrete cannot be avoided, the following criteria applies.

- Minimise the extent of shotcrete
- Avoid overspray through masking edges
- Match the colour and texture of the shotcrete to the adjacent rock batter (test panels would be provided) or be a dark recessive colour
- Recess areas of shotcrete along rock seams to allow the exposed rock to visually dominate
- Use a wood float finish or natural appearance and avoid a gun finish
- Recess soil nails and rock bolts to supporting shotcrete and use a wood float finish
- Use stone pitching using locally won rock in areas of exposed weak rock during construction to infill the weak areas
- Use planting to screen shotcrete where possible
- Discourage visibility of shotcrete from areas around the abutments of bridges
- Comply with *Shotcrete design guideline Design guideline to improve the appearance of shotcrete in NSW* (Roads and Maritime Services, 2016).

EXTENT OF SHOTCRETE TO BE MINIMISED

COLOUR AND TEXTURE OF SHOTCRETE TO MATCH COLOUR AND TEXTURE OF ADJACENT ROCK BATTER

4.3 Interchanges approach

Self explaining road environments can be strengthened through using interchanges as markers on the road journey. Interchanges provide key entry/exit points to Coffs Harbour and are points along the highway where landscape design can be used to enhance these key junctions. For the design of interchanges, key design criteria have been established:

- Provide an aesthetically pleasing, contextually responsive interchange design
- Use unique characteristics to distinguish the interchanges in the road journey
- Maximise visual and physical connectivity for all users at interchanges
- Minimise environmental impacts and displacement of flora and fauna
- Integrate the surrounding natural landscape with new structures and built elements
- Ensure that materials, finishes and colours are contextually responsive
- Provide grade-separated connections to assist with safety and vehicular movement.

FIG 4.10 **FOCUSED VIEW OF ENGLANDS ROAD INTERCHANGE**

FIG 4.11 **FOCUSED VIEW OF KORORA HILL INTERCHANGE**

FIG 4.12 **FOCUSED VIEW OF CORAMBA ROAD INTERCHANGE**

4.4 Noise attenuation approach

Noise attenuation can be achieved through landscape design treatments. The preferred treatment for the project, vegetated noise mounds, provide a more sympathetic response to the existing landscape character whilst creating a natural visual buffer.

Design criteria for noise attenuation is categorised under the following four noise attenuation typologies experienced across the corridor. In order of priority, these are:

- Vegetated noise mounds
- Combination mound/noise wall
- Transparent noise walls
- Solid noise walls.

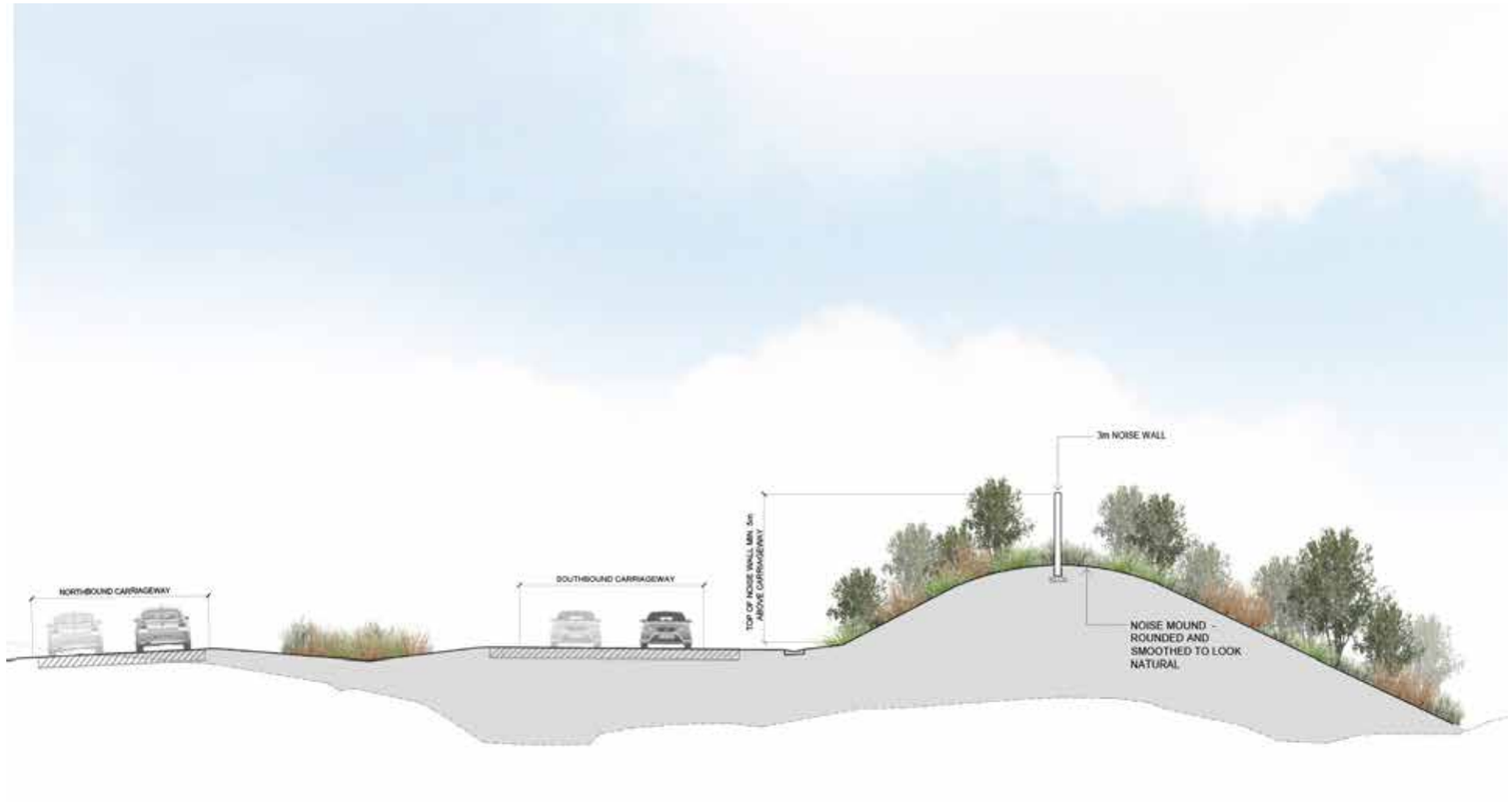


FIG 4.13 **TYPICAL VEGETATED MOUND WITH NOISE WALL TREATMENT**

Vegetated noise mounds and combined noise wall/ mounds

Noise attenuation can be achieved through using vegetated mounds where space allows. They provide a low visual impact and support the transition between new and existing landscape. Vegetated mounds assist to form seamless corridor topography and a “green” corridor journey experience. They also provide an opportunity for re-use of excavated material and screen planting.

Vegetated mounds do require a significant width of land to provide a barrier of reasonable height and are limited in application to where there is sufficient space between the noise receiver and the highway. In situations where space is constrained, a combined noise wall/mound solution may be required. For the design of noise mounds, key design criteria have been established:

- Avoid built structures in non-urban areas to minimise visual impact
- Provide planted noise mounds in areas where the landscape character is vegetated, riparian or rural
- Minimise visual impact
- Design mound slopes to not exceed 2H:1V
- Use vegetation to minimise the need for slope reinforcement and to avoid potential erosion issues
- Gradually grade back mounds as close to the project boundary as possible, allowing for space for maintenance/ access tracks as required
- Retain significant vegetation and manage slopes to mitigate adverse impacts to these areas
- Consider maintenance access requirements that do not disrupt traffic functions.

VEGETATED NOISE MOUND AT BERRY BYPASS

VEGETATED NOISE MOUND AT BERRY BYPASS

Transparent noise walls

Transparent noise walls allow permeability across the corridor and support the visual connectivity of places. They can be used where views from the roadway are available, on bridges to enable views out over the landscape or to the ocean and where scenic views are to be retained for residents. Transparent noise walls can also be used to mitigate any overshadowing of new works to adjacent properties. For the design of transparent noise walls, key design criteria have been established:

- Use steel posts with transparent panels and fix posts to the top of the traffic barrier
- Provide an overlap of solid to transparent walls to visually transition walls
- Use transparency as a solution to overshadowing issues
- Consider and mitigate avifauna strike.

THE DESIGN SHOULD COMPRISE STEEL POSTS WITH TRANSPARENT PANELS.

TRANSPARENT WALLS ENABLE VIEWS OUT FROM THE HIGHWAY TO THE SURROUNDING CONTEXT

OVERLAP SOLID AND TRANSPARENT WALLS TO PROVIDE A SEAMLESS VISUAL TRANSITION

Solid noise walls

Solid noise walls are used in areas where there is not enough space for mounds, there are no significant views to landscape or landmark features. They are also used when there is a need to restrict views to the highway for visual amenity reasons. For the design of noise walls, key design criteria have been established:

- Design noise walls to respond to the existing landscape or urban context
- Use an aesthetically pleasing design for both road users and road neighbours i.e. provide a quality design finish applied to both sides of the wall where visible
- Use appropriate planting behind noise walls to discourage vandalism
- Consider a robust, durable and low maintenance design that provides longevity and visual appeal over time
- Minimise noise wall height through using a mounding within the design
- Walls should not exceed four metres in height wherever possible. If higher walls are required, consider using transparent panels above four metres height
- Use neutral colours consistent with existing noise walls in rural settings and the adjacent Sapphire to Woolgoolga Upgrade
- Avoid overshadowing
- Use a horizontal alignment parallel to the outside edge of the road carriageways, where practicable
- Angle walls outwards by a minimum of five degrees to offset the visual vertical height of the noise walls
- Conceal fixings and footings
- Position support posts out of sight from the adjacent travel lanes
- Transition the ends of noise walls to ground level and provide a flowing edge to the top of the wall elevation
- Provide a simple plan alignment using straights or large curves
- Maximise landscaping at the base of noise walls
- Use an anti-graffiti, anti-vandal finish
- In more urban areas, such as the northern section north of Korora Hill interchange, consider distinctive design features such as coloured walls, shape or patterning to provide variety and interest for the road journey. In addition, distinguish the northern entry to Coffs Harbour CBD.

INTEGRATE NOISE MOUNDS WITH NOISE WALLS WHERE POSSIBLE.

MINIMISE THE VISUAL IMPACT OF THE WALLS BY MINIMISING HEIGHT AND PROVIDE PLANTING TO SCREEN WALLS (SAPPHIRE TO WOOLGOOLGA)

PATTERNING OF WALLS AT BRUNSWICK TO YELGUN UPGRADE PROVIDES VARIETY AND INTEREST AND THE HORIZONTAL PATTERN MINIMISES THE BULK AND SCALE.

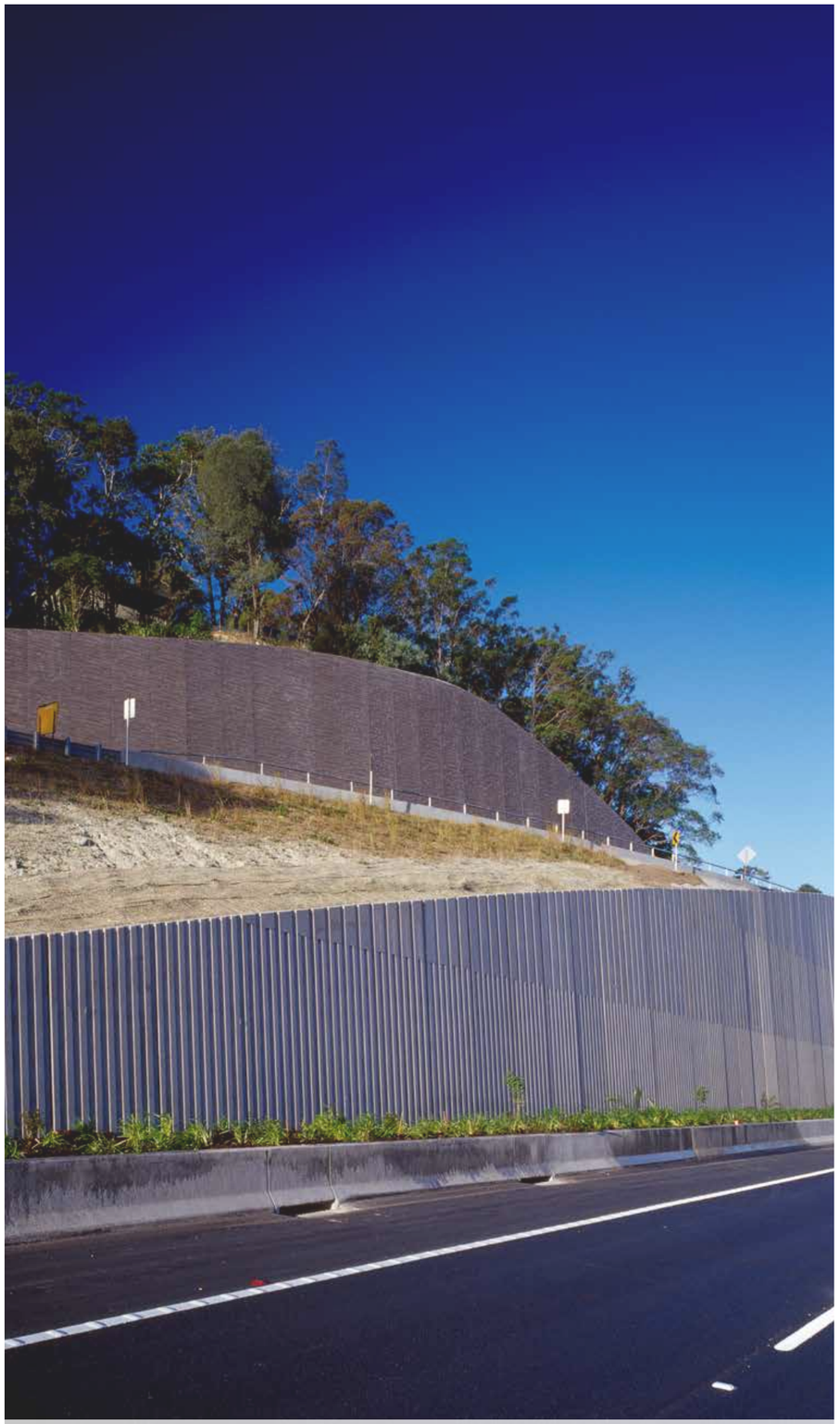
PATTERNING OF WALLS ON THE HUNTER EXPRESSWAY REFERENCES THE ADJACENT VINEYARD CONTEXT.

FEATURE WALLS ON THE M4 HIGHWAY USE COLOUR AND PATTERNING TO IDENTIFY KEY ENTRY AND EXIT POINTS. THE COLOUR REFERENCES THE HARDENBERGIA FLOWER FROM THE ADJACENT NATIVE PLANT COMMUNITY.

4.5 Retaining walls approach

Retaining walls are used in road corridors where slopes and landform requires support to be maintained. Re-grading and extending landform into the existing landscape is preferenced over the use of retaining walls. Where they are required, retaining walls are often designed to seamlessly fit in with the surrounding context to avoid visual impact and disturbance in the road journey. For the design of retaining walls, key design criteria have been established:

- Use a design for individual walls or a class of walls that responds to the immediate surrounding context
- Use residential scale finishes where walls are required in rural contexts e.g. blockwork
- Minimise the visual impact of the retaining walls by minimising height and providing planting to screen walls
- Where retaining walls over one metre high are visible from the road, tilt no less than five degrees vertical, outwards from the base to minimise perceived height
- Maximise landscaped area between the road shoulder and the base of the retaining wall allowing a minimum 500mm topsoil clearance to top of wall footings for planting
- Top edges of the retaining wall should provide a smooth flowing elevation (no stepping)
- Avoid kinks and bends in the design
- Use a consistent approach to colour, texture, pattern and material as one element, particularly where a noise wall sits on top of a retaining walls present both elements seamlessly
- Use concrete panel finish with pattern or texture where walls face or sit on top of a bypass
- Integrate wall cappings, drainage channels, barriers, noise walls, noise mounds and headlight screens
- Provide safety railings on top of walls and integrate into the design when needed
- Use anti-graffiti finishes in accessible areas.



AT BRUNSWICK TO YELGUN UPGRADE, RETAINING WALLS AND NOISE WALLS USED A PANEL FINISH

TEXTURE AND PATTERNING DISCOURAGE VANDALISM ON WALLS FACING OFF HIGHWAY.

TOP EDGES OF THE RETAINING WALL TO PROVIDE A SMOOTH FLOWING ELEVATION (NO STEPPING)

CLASSES OF WALLS MUST RESPOND TO THEIR IMMEDIATE CONTEXT

4.6 Bridges approach

The design of bridges should demonstrate holistic, coherent and symmetrical structures considering the proportion of all elements of the structure. It should respond to its degree of visibility within its location and context to maximise urban design visual outcomes.

The design of bridges will comply with *'Bridge Aesthetics, Roads and Maritime Centre for Urban Design 2012'.* A consistent family of bridges, complimenting the existing Pacific Highway bridges will help create an identity across the project. Simplicity and elegance are principles that will help to complement the natural landscape setting.

There are five bridge typologies experienced across the corridor. Key criteria has been established and is categorised under these typologies that include:

- Bridges over the highway
- Bridges over local roads
- Highway bridges over creeks and property access
- Landmark bridges
- Shared path bridges

Note, the bridge over North Coast Railway and Luke Bowen footbridge will require careful design considerations due to being highly visible, landmark and/or located in sensitive locations.

CORAMBA ROAD INTERCHANGE ARTIST IMPRESSION

Bridges over the highway

Bridges over the highway are highly visible from the bypass. They generally occur at interchanges and property access roads. For design of bridges over the highway, key design criteria have been established:

- Design vertical bridge alignment to be parallel to the highway
- Design horizontal bridge alignment perpendicular to the highway
- Provide visual consistency to the design of median piers with other highway overbridges
- For the higher elevation local road and property access bridges, bridge piers will be taller and more visible from further away and would require careful design
- Design visually integrated and elegant headstocks and piers
- Proportion the design of piers where there are several
- In general, provide spill through abutments at 1.5H:1V to maximise views through and beyond and provide an open appearance
- Use walled abutments only where spill through abutments are not possible
- On walled abutments, incorporate a 5 degree tilt from the base of the wall (top towards retained material)
- Provide a paved hard surface treatment to spill-through abutments for a higher quality finish
- Provide visual consistency with other highway overbridges
- Provide parapets with a smooth finish and clean lines and sufficient height to conceal utility pipes and fittings
- Provide transparent steel mesh throw screens attached by steel posts to the top edge of parapets
- Avoid fixing to the parapet face to provide an uninterrupted smooth clean bridge elevation.

Bridges over local roads

Bridges over local roads have a high visibility as they typically occur over main entry/exit points around Coffs Harbour. They require a more considered design of structure. For the design of bridges over the local roads, key design criteria have been established:

- Design visually integrated and elegant headstocks and piers
- In general, provide spill through abutments at 1.5H:1V to maximise views through and beyond and provide an open appearance
- Use walled abutments only where spill through abutments are not possible
- On walled abutments, incorporate a 5 degree tilt from the base of the wall (top towards retained material)
- Provide a paved hard surface treatment to spill-through abutments for a higher quality finish.

BRIDGES OVER HIGHWAY PRECEDENT - SHOWING A PARTS PIER BRIDGE DESIGN

HIGHWAY BRIDGES OVER LOCAL ROAD PRECEDENT

Highway bridges over creeks and property access points

Highway bridges over creeks and property access points are vital to connect two portions of land. These bridges are generally less visible and pass over creeks or provide property access under the highway.

For the design of highway bridges over creeks and property access points, key design criteria have been established:

- Use reinforced concrete headstock beams supported on circular piers
- Provide 1.5V:1V spill through abutments to maximise openness and views along creeklines or visibility beyond for local road users
- Provide a scour rock protection to abutments to prevent erosion.

HIGHWAY BRIDGES OVER CREEKS PRECEDENT

Landmark bridges

Landmark bridges are prominent in the landscape. They typically traverse large expanses over rivers, valleys and undulating landscapes connecting either side. These bridges require a higher quality of design due to their sensitive and/or prominent locations.

For the design of landmark bridges, key design criteria have been established:

- For bridges in scenic locations such as valleys, minimise the bridge profile to allow the enhance views of the surrounding scenic landscape
- Minimise the number of piers through selection of structures that provide greater spacing capacity
- Use spill through abutments to provide a vegetated appearance that blends into the adjacent landscape
- Avoid high abutment walls that would increase visual impact
- Design elegant and simple pier shapes to maximise views and minimise visual impact
- Test pier shapes in the design process to determine the best visual outcome for the project.

MOONEY MOONEY BRIDGE

MOONEY MOONEY BRIDGE

WORONORA RIVER BRIDGE

PONT MENTHUE MAUGETTAZ

Shared path bridges

Shared path bridges allow pedestrians and cyclists to cross the highway safely and easily. As these bridges are less frequent along the highway and are a smaller scale with different safety requirements, opportunities become available for alternatives to the bridge design that would still compliment the family of bridges. The design should integrate with other Coffs Harbour bridges such as the existing Luke Bowen footbridge or the Lloyd Ponting Bridge at Billinudgel.

For the design of shared path bridges, key design criteria have been established:

- Provide a high quality and elegant design that considers the view setting and provides a visual landmark for the Coffs Harbour entry/exit journey
- Integrate the design of adjacent noise wall and bridge to present a unified appearance
- Provide a generous three metre width path to allow stopping and viewing without significantly interrupting pedestrian and cycle movement and to avoid a caged feeling
- Provide visual transparency for users as well as views out for safety and a scenic vista
- Provide ramps so that they are as short as possible and land as close as possible to the intended destination
- Integrate and unify the design of ramp and bridge in accordance with the disability access requirements
- Design ramps so they do not dominate views or detract from the expression of the bridge span
- Use planting to integrate ramps with their surroundings and reduce their visual impacts
- Provide a fully enclosed safety screen for improved safety due to the predominant use by school children at Luke Bowen footbridge
- Provide safety screens to shared path bridges only above roadways
- Design enclosure that promotes openness, transparency and the safety experience
- Consider the design composition of details such as the hand rails, safety screens and materials as they are appreciated at close proximity
- Design the bridge and screen design to meet CPTED standards
- Provide feature lighting to make the crossing attractive and well lit.

Note, the shared path/pedestrian bridge replacing Luke Bowen footbridge at Kororo Public School would provide access for pedestrians and cyclists across both the service road and the project.

VISUAL TRANSPARENCY ON THE PARRAMATTA ROAD OVERBRIDGE, SYDNEY LIGHT RAIL

PERFORATED METAL SCREEN WITH INTERPRETIVE ART WORK AT HAWTHORNE STATION, SYDNEY LIGHT RAIL

ENCLOSED SCREEN ON LLOYD PONTING SHARED PATH BRIDGE AT BILLINUDGEL RETAINS FEELING OF OPENNESS.

LLOYD PONTING SHARED PATH BRIDGE AT BILLINUDGEL.

4.7 Tunnels approach

Tunnels help to minimise disturbance and provide continuous landscape and environmental corridors above the project. Flora and fauna connectivity can be retained as above ground is minimally disturbed. Tunnel design has been considered in line with *Tunnel urban design guideline* (Roads and Maritime Services, 2017) Tunnel design and length would be confirmed during detailed design and developed in line with key design criteria below:

- Ensure portals are designed in accordance with the ***Tunnel urban design guideline - design guideline to improve the customer and community experience of road tunnels***, (Roads and Maritime Services, May 2017)
- Design all tunnel features as a suite of elements with distinct 'whole of project' identity and tie in with surrounding landscape and natural features
- Provide attractive, welcoming tunnel entrances that fit into the local built and natural fabric
- Include the use of texture, colour and external feature lighting to visually reduce the bulk and mass of the portal area and incorporate some design variance
- Design portal areas to minimise disturbance and provide continuous landscape and environmental corridors above the project.
- Designed to add value to the community and adjacent landowners by retaining the major vegetated ridges within the Coffs Harbour basin to maximise user experience of the landscape before entering the tunnel
- Provide neat, simple and refined design features and provide considered integration of design elements, to avoid 'clutter'
- Design tunnel transitions to reduce sudden contrasts in light conditions
- Design tunnel lining to be subtle and simple to avoid distraction
- Provide a distinct physical and visual indication of the tunnel's arrival and departure corridors well in advance through recognisably different corridor features and clear signage
- Effectively integrate signage to avoid a cluttered tunnel entrance
- Retain or reinstate vegetation, trees or other green infrastructure as part of the approach and to the portal area to maximise the user's experience of the landscape before entering the tunnel
- Minimise impacts to cultural sites Potential Archaeological Deposits (PADS), Sealy Point Pathway and Roberts Hill pathway as much as reasonable and feasible.

ST HELENA TUNNEL - AERIAL VIEW

ST HELENA TUNNEL

ENGELBERG TUNNEL

Chapter 5

Urban design context

(blank page)

05

Urban design concept

This section describes the design of the built elements for the project alignment. Each urban design element has unique functions and features which integrate into the urban and landscape design vision and objectives of the project.

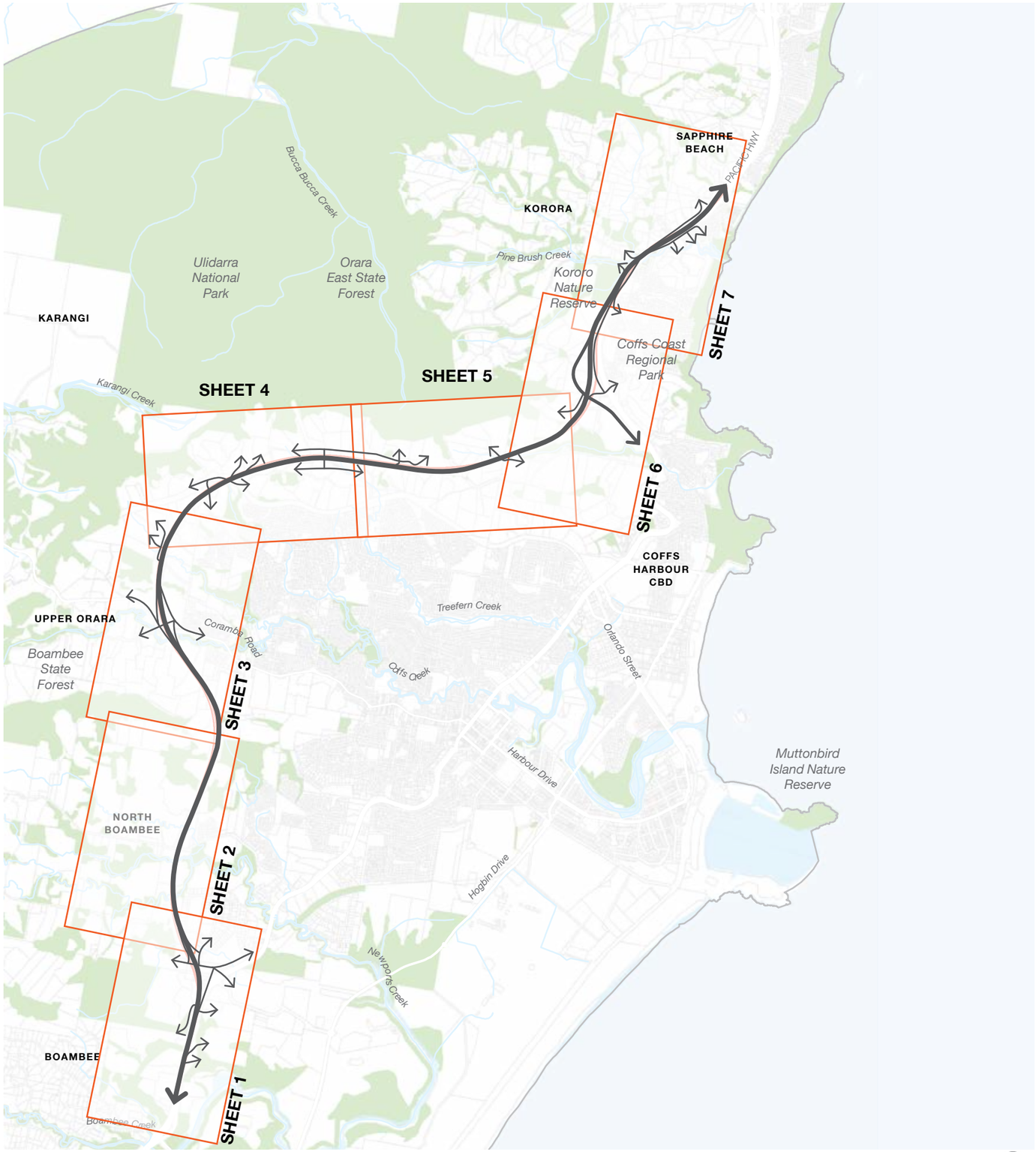


FIG 5.1 KEY PLAN OF CONCEPT PLANS

5.1 Concept plan

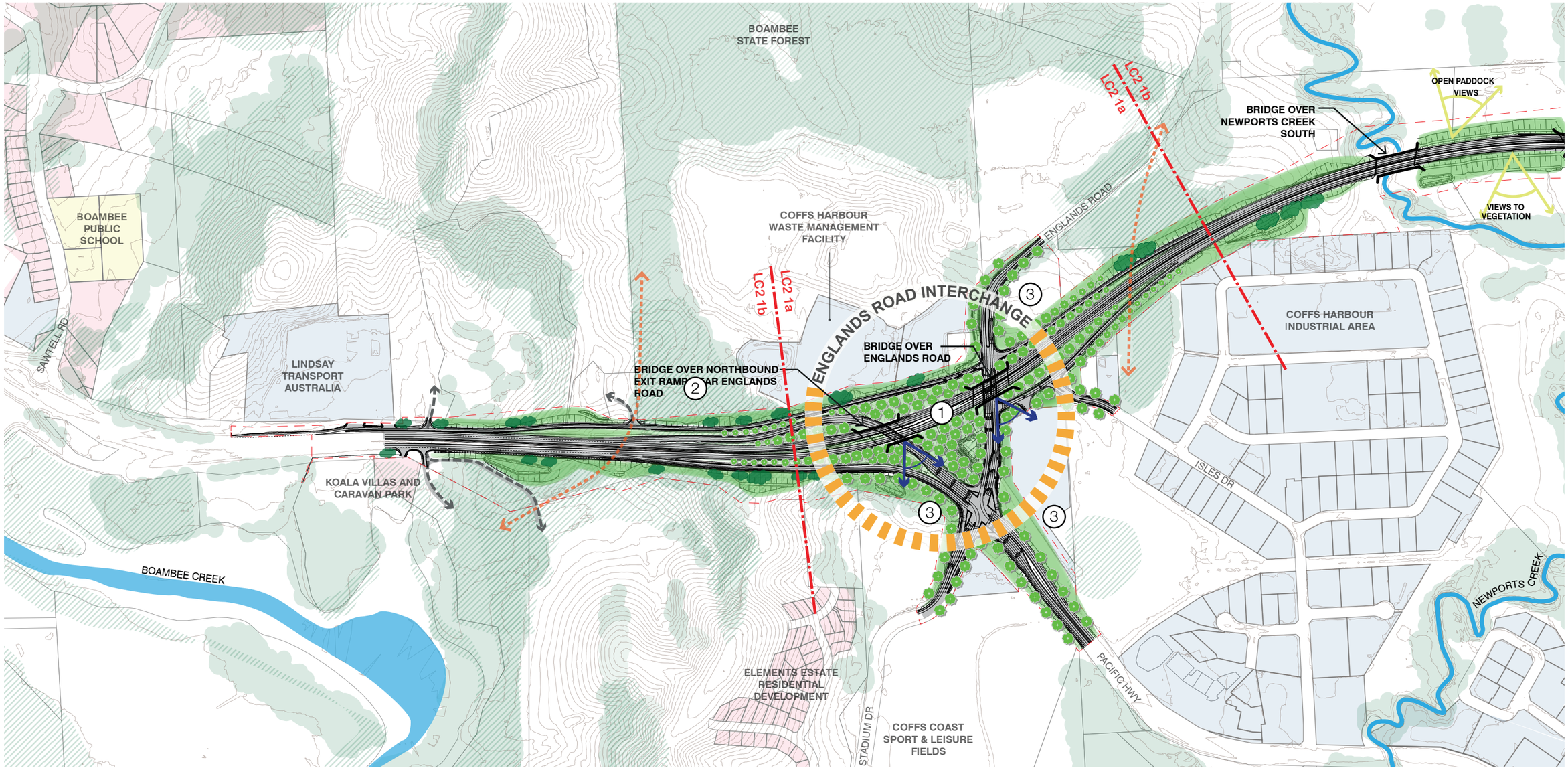
This section describes the concept applying the overall strategy, approach and typologies.

The concept design capitalises on the experience of the east coast and ranges simultaneously, by utilising earthform and shaping to help integrate the highway sensitively into the landscape. The undulating setting and surrounding land uses have been considered through the design to implement place-sensitive strategies and mitigate potentially adverse visual impacts of the project.

A primary aim of the project is to minimise visual impacts and maximise a green vegetated outcome. Built elements would be unobstructive, simple and refined and fit in as a recognisable ‘family’ with other upgrades.

Each plan following identifies the key features along the project. The plans implement the strategy through forming the concept design for the project.

Concept plan



1 Englands Road interchange

Establish the southern gateway to Coffs Harbour to create a sense of arrival or departure. Opportunity to provide landscape mounds integrated with planting as a gateway landscape feature. Enhance views from ramp structures through position of mounding vegetation, to frame vistas and enhance user experience

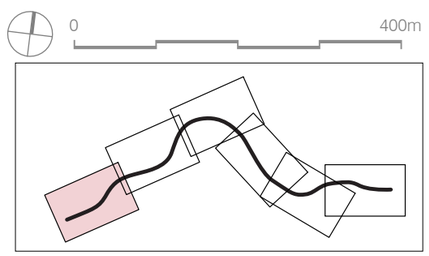
2 Boambee State Forest

Use species for surrounding remnant forest and transition into new vegetation to connect planting.

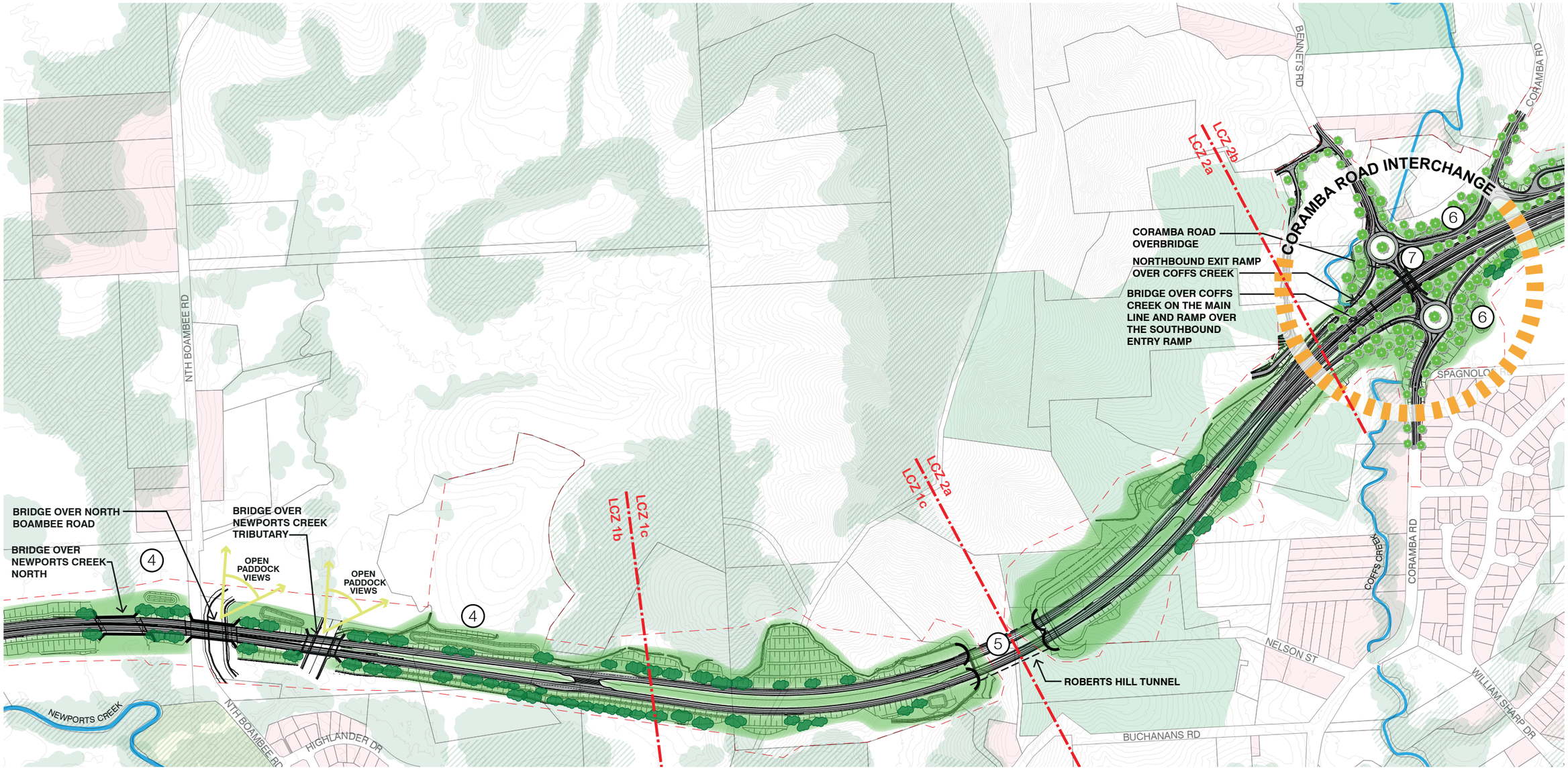
3 Pacific Highway and Englands Road

Integrate design with the landscape setting and provide sufficient screening of structure and new roads where visible from surrounding residential properties

- PROJECT BOUNDARY
- CADASTRAL
- 2M CONTOURS
- CREEKS
- NORTH COAST RAILWAY
- EXISTING VEGETATION
- ENVIRONMENTAL CONSERVATION AREA
- BRIDGE
- TUNNEL
- VIEWS FROM HIGHWAY
- VIEWS TO OCEAN
- COMMERCIAL/ LIGHT INDUSTRIAL
- RESIDENTIAL
- SCHOOL
- RESORT/HOLIDAY ACCOMMODATION
- PLANTATION
- PROPOSED BYPASS
- LANDSCAPED AREA
- BUFFER PLANTING
- TREES
- LANDSCAPE CHARACTER ZONE
- LOCAL ROAD ACCESSWAY
- GATEWAY



Concept plan



④ Newports Creek and North Boambee Valley

Retaining open views to rural pasture-land through low ground cover/grassland planting. 2H:1V vegetated cutting and batters. Use vegetation to frame the highway and enhance driver legibility of the road.

⑤ Roberts Hill tunnel

Vegetating the 2H:1V portal facade of the tunnel.

⑥ Bennetts Road and Coramba Road

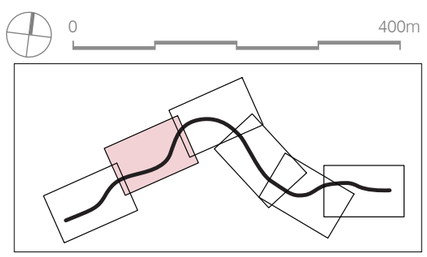
Integrate design with landscape setting and provide sufficient screening at structures and new roads where visible from surrounding residential properties.

⑦ Coramba Road interchange

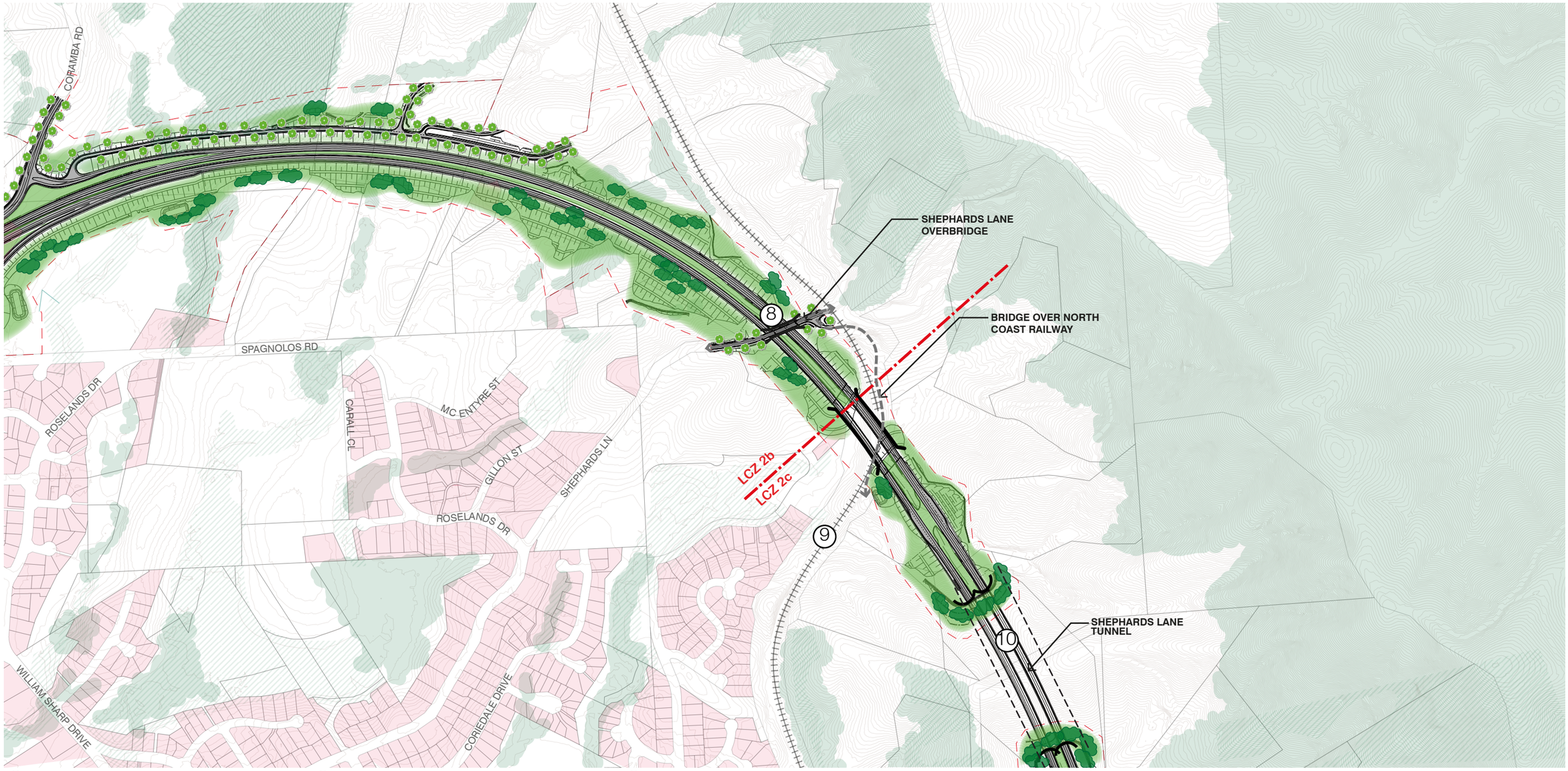
Provide a more low-key natural designed approach.

Provision of planting materials and species to be sympathetic to the local area reflecting the landscape typologies that can be experienced from the road.

- PROJECT BOUNDARY
- CADASTRAL
- 2M CONTOURS
- CREEKS
- NORTH COAST RAILWAY
- EXISTING VEGETATION
- ENVIRONMENTAL CONSERVATION AREA
- BRIDGE
- TUNNEL
- VIEWS FROM HIGHWAY
- VIEWS TO OCEAN
- COMMERCIAL/ LIGHT INDUSTRIAL
- RESIDENTIAL
- SCHOOL
- RESORT/HOLIDAY ACCOMMODATION
- PLANTATION
- PROPOSED BYPASS
- LANDSCAPED AREA
- BUFFER PLANTING
- TREES
- LANDSCAPE CHARACTER ZONE
- LOCAL ROAD ACCESSWAY
- GATEWAY



Concept plan



⑧ Local road connection

Bridge to be integrated within the landscape setting and provide sufficient screening of structures where visible from surrounding residential properties.

⑨ North Coast Railway

Provide open visual connection under the bridge to ensure views are retained to the foot hills and valley beyond for residents underneath the bridge.

⑩ Shephards Lane tunnel

Vegetating 2H:1V tunnel portals with species found in the local remnant patches to create a continuous ecological corridor.

PROJECT BOUNDARY
CADASTRAL
2M CONTOURS
CREEKS
NORTH COAST RAILWAY

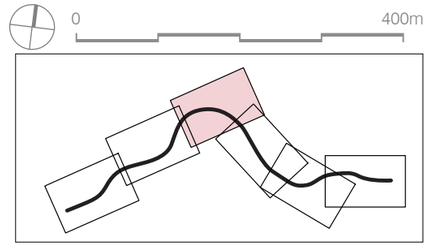
EXISTING VEGETATION
ENVIRONMENTAL CONSERVATION AREA
BRIDGE
TUNNEL

VIEWS FROM HIGHWAY
VIEWS TO OCEAN
COMMERCIAL/ LIGHT INDUSTRIAL

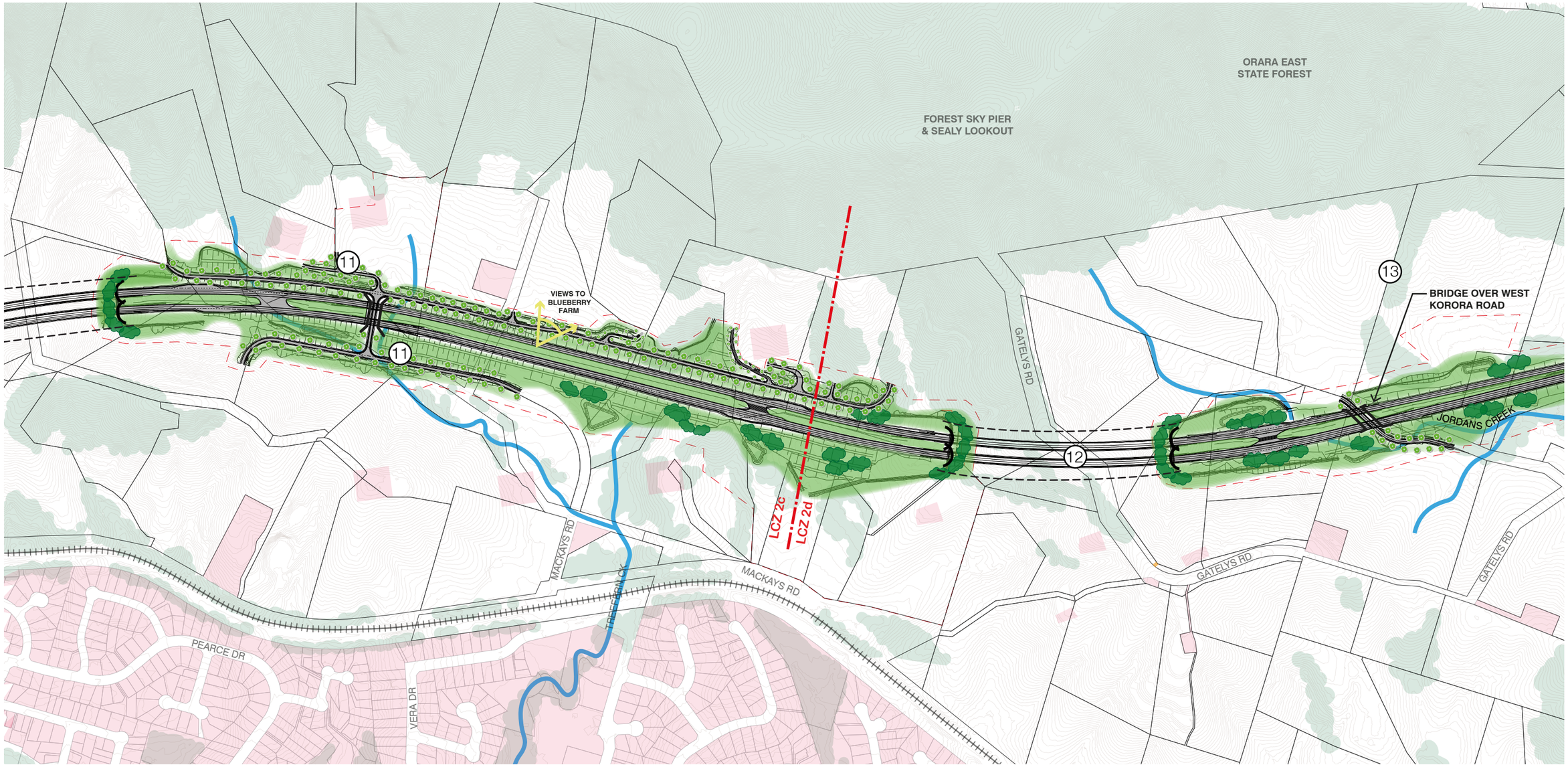
RESIDENTIAL
SCHOOL
RESORT/HOLIDAY ACCOMMODATION
PLANTATION

PROPOSED BYPASS
LANDSCAPED AREA
BUFFER PLANTING
TREES

LANDSCAPE CHARACTER ZONE
LOCAL ROAD ACCESSWAY
GATEWAY



Concept plan



11 Local roads and bridges

Views to and under the bridges to enhance driver experience and connect local road users to the surrounding landscape.

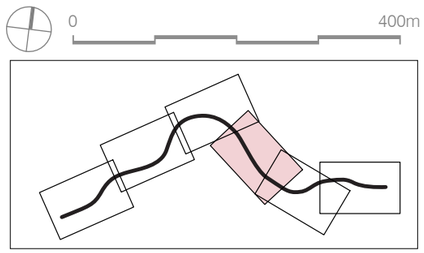
12 Gatelys Road tunnel

Providing a vegetated 2H:1V portal that connects the landscape together visually, physically and ecologically. Use of materials sympathetic to the local surroundings. Grade surrounding topography to transition easily from tunnel to ground.

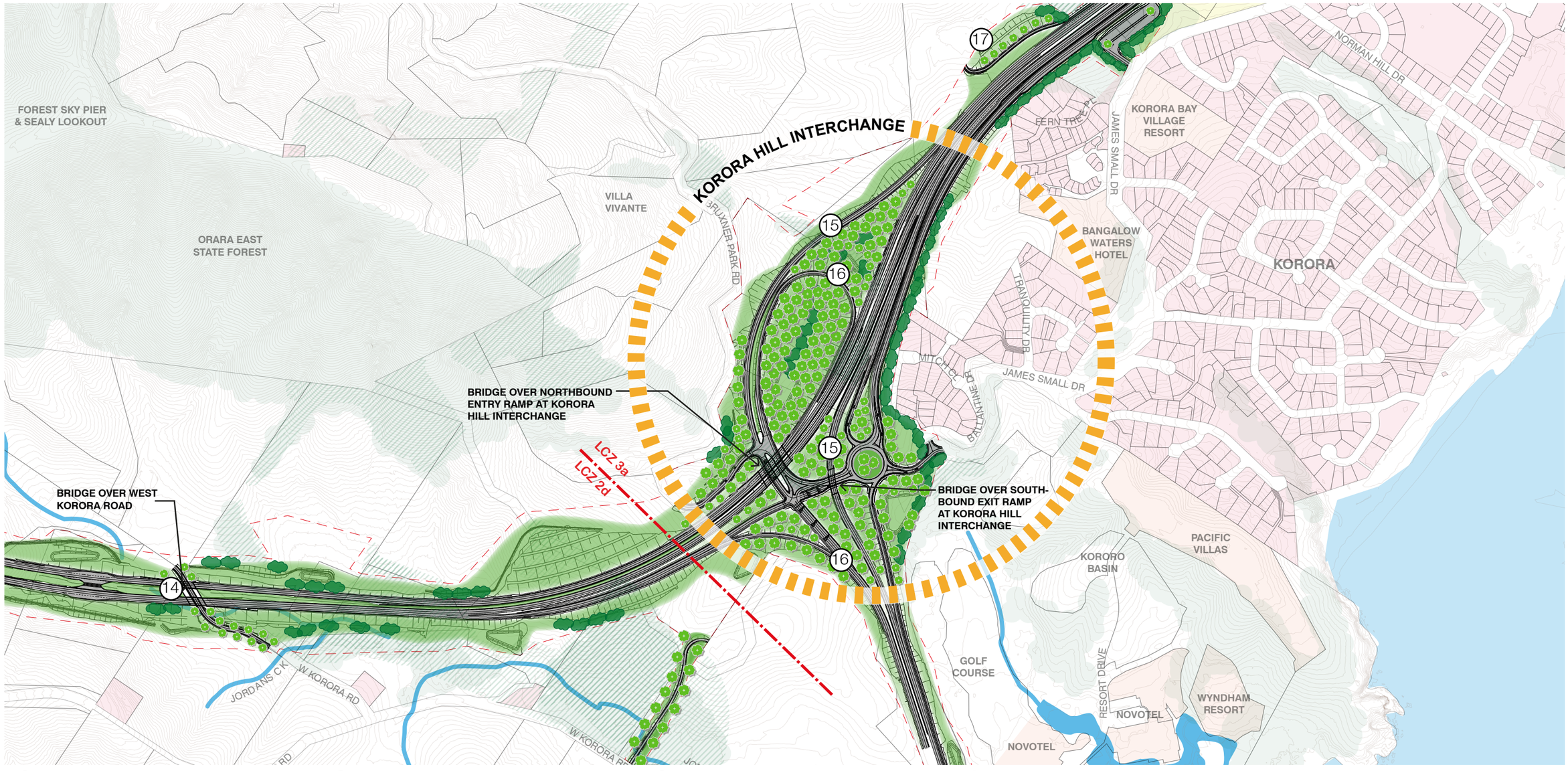
13 Orara East State Forest

Use species from surrounding remnant forest to forge ecological connection and increase ecological value.

- PROJECT BOUNDARY
- CADASTRAL
- 2M CONTOURS
- CREEKS
- NORTH COAST RAILWAY
- EXISTING VEGETATION
- ENVIRONMENTAL CONSERVATION AREA
- BRIDGE
- TUNNEL
- VIEWS FROM HIGHWAY
- VIEWS TO OCEAN
- COMMERCIAL/ LIGHT INDUSTRIAL
- RESIDENTIAL
- SCHOOL
- RESORT/HOLIDAY ACCOMMODATION
- PLANTATION
- PROPOSED BYPASS
- LANDSCAPED AREA
- BUFFER PLANTING
- TREES
- LANDSCAPE CHARACTER ZONE
- LOCAL ROAD ACCESSWAY
- GATEWAY



Concept plan



(14) Bridge over West Korora Road

Views to and under the bridge to enhance driver experience and road users to the landscape.

(15) Korora Hill interchange

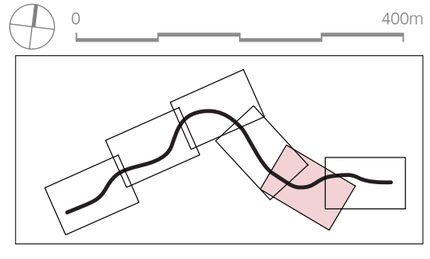
Creating a sense of arrival or departure and establishing the Northern Gateway to Coffs Harbour. The landscape design narrative will interpret the escarpment meeting the coastline through plant selection and arrangements. Walls to provide identifiable gateway to Coffs Harbour.

(16) Korora Hill interchange on and off ramps

Enhancing views from ramp structures through positioning of vegetation, mounding and artworks to frame/enhance user experience.

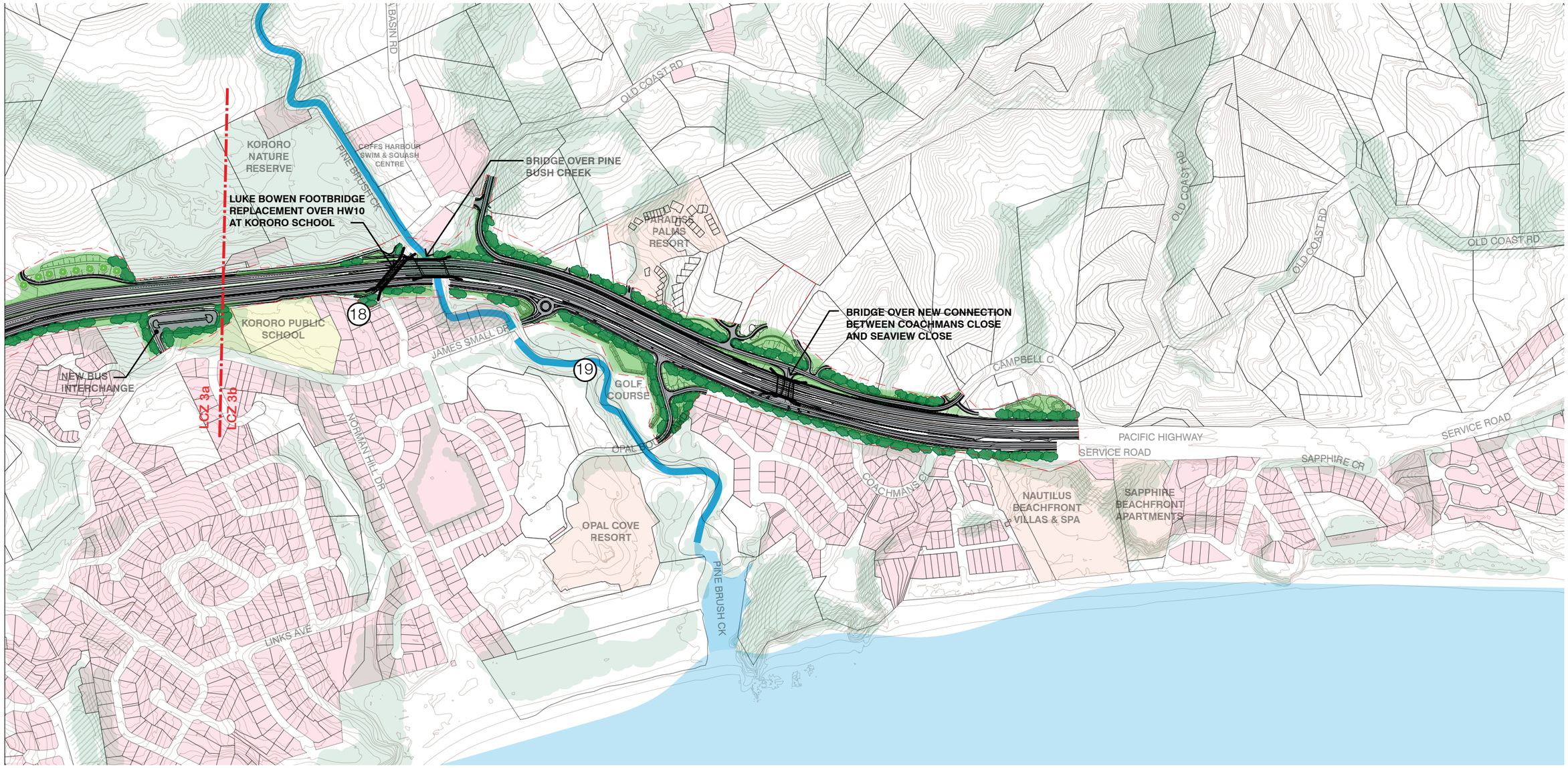
(17) Connecting Ecological Corridors: Ulidarra to Kororo Reserve

Revegetating slopes with species found in the local remnant forest patches to create a continuous ecological corridor from Ulidarra to Kororo Nature Reserve.



- PROJECT BOUNDARY
- CADASTRAL
- 2M CONTOURS
- CREEKS
- NORTH COAST RAILWAY
- EXISTING VEGETATION
- ENVIRONMENTAL CONSERVATION AREA
- BRIDGE
- TUNNEL
- VIEWS FROM HIGHWAY
- VIEWS TO OCEAN
- COMMERCIAL/ LIGHT INDUSTRIAL
- RESIDENTIAL
- SCHOOL
- RESORT/HOLIDAY ACCOMMODATION
- PLANTATION
- PROPOSED BYPASS
- LANDSCAPED AREA
- BUFFER PLANTING
- TREES
- LANDSCAPE CHARACTER ZONE
- LOCAL ROAD ACCESSWAY
- GATEWAY

Concept plan



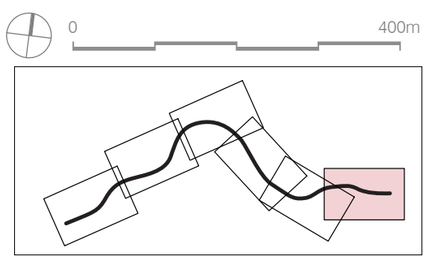
18 Luke Bowen footbridge

Architecturally designed bridge to provide link across highway to Kororo Public School and bus interchange. A landmark and gateway to Coffs Harbour. Enhanced safety and connectivity with a interchange facility.

19 Pine Bush Creek

Oportunities to integrate ecological enhancements. Consider wider landscape to identify areas of remnant native forest or habitats. Provide ecological value through the use of fish baffles and nesting boxes. Use locally sourced rocks, logs and stumps around water courses to recreate and enhance habitats.

- PROJECT BOUNDARY
- CADASTRAL
- 2M CONTOURS
- CREEKS
- NORTH COAST RAILWAY
- EXISTING VEGETATION
- ENVIRONMENTAL CONSERVATION AREA
- BRIDGE
- TUNNEL
- VIEWS FROM HIGHWAY
- VIEWS TO OCEAN
- COMMERCIAL/ LIGHT INDUSTRIAL
- RESIDENTIAL
- SCHOOL
- RESORT/HOLIDAY ACCOMMODATION
- PLANTATION
- PROPOSED BYPASS
- LANDSCAPED AREA
- BUFFER PLANTING
- TREES
- LANDSCAPE CHARACTER ZONE
- LOCAL ROAD ACCESSWAY
- GATEWAY



THIS PAGE WAS INTENTIONALLY LEFT BLANK

5.2 Landscape planting design

The approach to the landscape planting design seeks to replicate and maintain the natural character, with an emphasis on revegetating with vegetation communities endemic to the area. Building upon the concept plans, the design promotes:

- Retention and enhancement of existing and endemic vegetation
- Framing views along the corridor
- Providing feature planting at key areas of interest, gateway or interchange
- Use planting to screen areas of visual sensitivity and impact where possible
- Strengthen flora and fauna connectivity
- Retention of existing ridgelines and vegetation where possible.

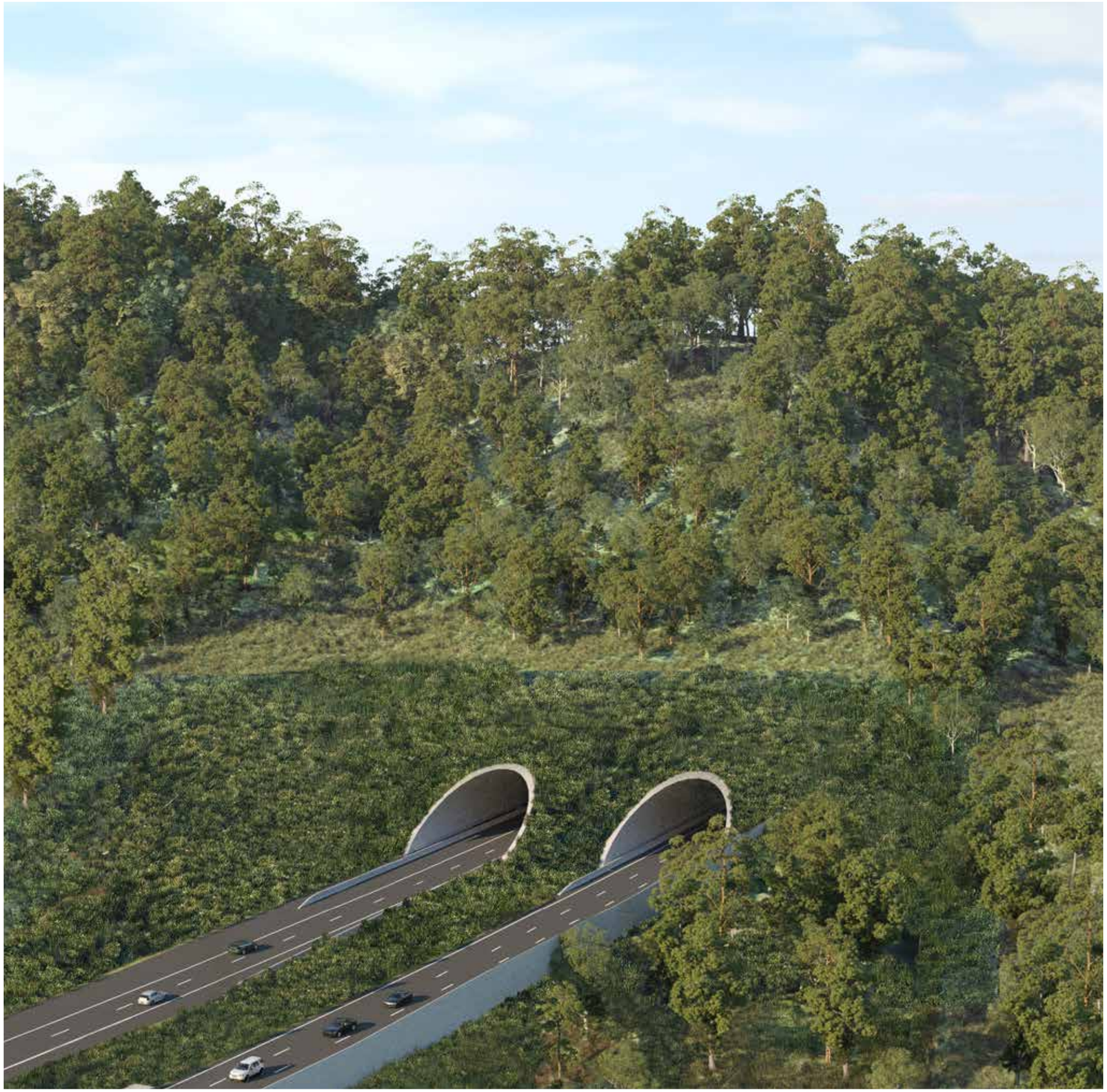


FIG 5.2 ARTIST IMPRESSION OF GATELYS ROAD TUNNEL SOUTHERN

Planting strategy and selection

Existing vegetation protection

Minimising clearing of existing vegetation during project works helps to mitigate environmental and visual impacts. The strategy for reducing clearance and protecting vegetation includes:

- Retaining and enhancing native and endemic vegetation communities, in particular the rainforest, open forest and riparian communities where possible
- Maintaining the biodiversity, habitat potential and protecting and enhancing the riparian ecosystem
- Maintaining and improving soil stability and salinity levels
- Contributing to water quality
- Enhancing the visual quality and landscape character
- Maintaining established landscape views for road users.

Revegation

Revegetation is required where works are required to remove existing vegetation. Revegetation will be undertaken using either planting or seeding and prioritised for areas experiencing the highest visual and environmental impact. Revegation sites also consider the impact on surrounding residences and is required to satisfy road safety and clear zone requirements. Planted vegetation typically includes mass planted trees, feature trees, shrubs, grasses and groundcovers. Seeding is used in larger areas and on slopes or sites where access is challenging. Revegetation is an important connector of vegetation and helps to stabilise slopes or establish green quickly using cover crops.

Planting priority areas include:

- Interchanges
- Off and on ramps
- Reforestation of Lowland Rainforest Areas and open forest areas
- Soft-cutting embankments where soil depth exists to support vegetation communities
- Riparian zones
- Screen and safety planting areas.

Planting selection is based on nine plant communities identified in the biodiversity assessments and verified on site. The following communities are identified as being relevant to the project.

Wet Sclerophyll

Black Booyong Subtropical Rainforest

Blackbutt Open Forest

Sydney Blue Gum Open Forest

Paperbark Swamp Open Forest

Tallowwood Dry Open Forest

Turpentine Ironbark Open Forest

White Booyong Fig Subtropical Rainforest

Tallowwood Moist Open Forest

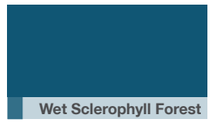
Pictorial representation of plant communities

Wet sclerophyll mix

The replanting of open forest vegetation would provide vital links to the remnant pockets of existing vegetation, increase biodiversity and habitat potential, while creating an aesthetic green corridor effect. The revegetation of open forest would provide a continuation canopy, diversifying the driver experience and providing a sense of scale that would aid in reducing the potential impact of the road upon both the driver and the surrounding communities.

The wet sclerophyll forests occur predominately in high rainfall areas and are characterised by a tall, open tree canopy dominated by eucalyptus species. The understorey is abundant with soft-leaved shrubs and ferns made up of mainly rainforest species.


Eucalyptus microcorys


Wet Sclerophyll Forest


Angophora costata


Eucalyptus grandis


Lophostemon confertus


Corymbia intermedia


Callicoma serratifolia


Synoumglandulosumsubsp. glandulosum


Tabernaemontana pandacaqui


Rhodamnia rubescens


Cryptocarya glaucescens


Archontophoenix cunninghamiana


Allocasuarina torulosa


Blechnum cartilagineum

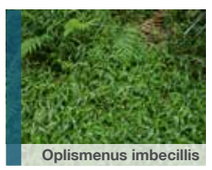

Cordyline stricta


Viola banksii


Lomandra longifolia


Calochlaena dubia


Cyathea australis


Oplismenus imbecillis

Botanic Name	Common Name
Trees	
Angophora costata	Smoothbarked Apple
Corymbia intermedia	Pink Bloodwood
Eucalyptus grandis	Flooded Gum
Eucalyptus microcorys	Tallowwood
Eucalyptus pilularis	Blackbutt
Eucalyptus saligna	Sydney Blue Gum
Lophostemon confertus	Brush Box
Syncarpia glomulifera	Turpentine
Shrubs	
Allocasuarina torulosa	Forest Oak
Archontophoenix cunninghamiana	Bangalow Palm
Archirhodomyrtus beckleri	Rose Myrtle
Callicoma serratifolia	Black Wattle
Cryptocarya glaucescens	Jackwood
Cryptocarya microneura	Murrogun
Cryptocarya rigida	Forest Maple
Rhodamnia rubescens	Scrub Turpentine
Synoum glandulosum subsp. glandulosum	Scentless Rosewood
Tabernaemontana pandacaqui	Banana Bush
Grasses and Groundcovers	
Blechnum cartilagineum	Gristle Fern
Calochlaena dubia	False Bracken
Cordyline stricta	Palm Lily
Cyathea australis	Tree Fern
Dianella caerulea	Blue Flax-lily
Lomandra longifolia	Spiny-headed Mat-rush
Oplismenus imbecillis	Creeping Beard Grass
Pseuderanthemum variabile	Pastel Flower
Pteridium esculentum	Bracken Fern
Viola banksii	Native Violet

Note: The planting list is indicative only. Planting selection to be confirmed during detailed design.

Lowland rainforest mix

The replanting of lowland rainforest would provide vital links to the remnant pockets of existing vegetation, increase biodiversity and habitat potential, while creating an aesthetic green corridor effect. The revegetation of non-frangible lowland rainforest would provide a continuous canopy, diversifying the driver experience and providing a sense of scale that would aid in reducing the potential impact of the road upon both the driver and the surrounding communities.

The rainforests of this region are subtropical and widespread throughout gullys and riparian areas from the lower foothills to escarpments. They are characterised by a closed and continuous tree canopy compromised of a variety of broad-leaved evergreen trees.


Heritiera actinophylla

Lowland Rainforest


Caldcluvia paniculosa


Sloanea woollsii


Sloanea australis


Neolitsea dealbata


Cyathea australis


Linospadix monostachya


Pittosporum revolutum


Cordyline stricta


Cordyline petiolaris


Cyathea leichhardtiana


Tasmannia insipida


Adiantum hispidulum


Lastreopsis acuminata


Adiantum silvaticum


Lomandra hystrix


Lastreopsis acuminata


Pothos longipes


Alpinia caerulea

Botanic Name	Common Name
Trees	
Archontophoenix cunninghamiana	Bangalow Palm
Caldcluvia paniculosa	Soft Cordwood
Cinnamomum oliveri	Oliver's Sassafras
Diploglottis cunninghamii	Native Tamarind
Geissois benthamiana	Red Carabeen
Heritiera actinophylla	Black Booyong
Heritiera trifoliolata	White Booyong
Litsea reticulata	Bolly Gum
Mischocarpus pyriformis subsp. pyriformis	Pear-fruited Tamarind
Neolitsea dealbata	Hairy-leaved Bolly-gum
Sloanea australis	Maiden's Blush
Sloanea woollsii	Yellow Carabeen
Shrubs	
Cordyline stricta	Palm Lilies
Cordyline petiolaris	Palm Lilies
Cyathea australis	Tree Fern
Cyathea leichhardtiana	Tree Fern
Linospadix monostachya	Walking Stick Palm
Pittosporum revolutum	Hairy Pittosporum
Tasmannia insipida	Brush Pepperbush
Grasses and Groundcovers	
Adiantum hispidulum	Rough Maidenhair
Adiantum silvaticum	Maidenhair Fern
Alpinia caerulea	Native Ginger
Blechnum patersonii	Tree Fern
Lastreopsis acuminata	Creeping Shield Fern
Lomandra hystrix	Spiny-headed Mat-rush
Piper hederaceum var. hederaceum	Pepper Vine
Pothos longipes	Pothos
Ripogonum album	White Supple-jack
Trophis scandens	Burny Vine

Note: The planting list is indicative only. Planting selection to be confirmed during detailed design.

Pictorial representation of plant communities

Open forest mix

The replanting of open forest vegetation would provide vital links to the remnant pockets of existing vegetation, increase biodiversity and habitat potential, while creating an aesthetic green corridor effect. The revegetation of open forest would provide a continuous canopy, diversifying the driver experience and providing a sense of scale that would aid in reducing the potential impact of the road upon both the driver and the surrounding communities.

This planting mix represents dry sclerophyll forest vegetation predominately the coast and escarpment blackbutt dry forest community. It is characterised by a tall open canopy of Blackbutt (Eucalyptus piluaris) with a grassy understorey.


Eucalyptus saligna

Dry Sclerophyll Forest


ucalyptusresiniferasubsp. hemilampra


Eucalyptus pilularis


Syncarpia glomulifera


Eucalyptus propinqua


Cryptocarya glaucescens


Elaeocarpus reticulatus


Archirhodomyrtusbeckleri


Persoonia stradbrokensis


Acacia melanoxylon


Dodonaea triquetra


Leucopogon lanceolatus


Dianella caerulea


Pratia purpurascens


Imperata cylindrica


Lomandra longifolia


Entolasia stricta


Hibbertia scandens

Botanic Name	Common Name
Trees	
Allocasuarina torulosa	Forest Oak
Angophora costata	Smooth-barked Apple
Corymbia intermedia	Pink Bloodwood
Eucalyptus carnea	Thick-leaved Mahogany
Eucalyptus microcorys	Tallowwood
Eucalyptus pilularis	Blackbutt
Eucalyptus propinqua	Small-fruited Grey Gum
Eucalyptus resinifera subsp. hemilampra	Red Mahogany
Eucalyptus saligna	Sydney Blue Gum
Eucalyptus siderophloia	Grey Ironbark
Eucalyptus signata	Scribbly Gum
Syncarpia glomulifera	Turpentine
Shrubs	
Archirhodomyrtus beckleri	Rose Myrtle
Cryptocarya glaucescens	Jackwood
Dodonaea triquetra	Hop Bush
Elaeocarpus reticulatus	Blueberry Ash
Leucopogon lanceolatus	Lance Beard-heath
Persoonia stradbrokensis	Geebung
Polyscias sambucifolia	Ash Elderberry
Grasses and Groundcovers	
Calochlaena dubia	Soft Bracken
Dianella caerulea	Flax Lily
Entolasia stricta	Wiry Panic
Hibbertia scandens	Guinea Flower
Imperata cylindrica	Blady Grass
Lomandra longifolia	Spiny-headed Mat-rush
Oplismenus aemulus	Basket Grass
Pratia purpurascens	White Root

Note: The planting list is indicative only. Planting selection to be confirmed during detailed design.

Water quality basins

Water quality basins are proposed to be implemented as a means of protecting the existing waterways and vegetation remnants from the potential detrimental effects of the sedimentation and silt that may occur throughout the construction period. Post construction, the water quality basins would also treat the runoff from the highway, prior to discharge into the waterway systems. Where possible, post construction, the banks of the water quality basins would be stabilised using soft engineering methods and mass planted with littoral species. Riparian species would border the water quality basins to naturalise the form.

Grass mix

The grass mix would strengthen the existing character of surrounding pasture by continuing this dominant landscape aesthetic. The mix of grass species would provide a low maintenance and frangible design response to softening the road infrastructure.


Bolboschoenus fluviatilis

Water Quality Basins


Poa labillardieri

Native Pasture Grass Mix


Eleocharis acuta


Ficinia nodosa


Capillipedium spicigerum


Dietes grandiflora


Juncus usitatus


Schoenoplectus validus


Bothriochloa macra


Lomandra tanika


Lomandra hystrix


Microlaena stipoides


Chloris truncate

Botanic Name	Common Name
Water Quality Basin Seed Species Breakdown	
Gahnia aspera	Rough Saw-Sedge
Rytidosperma tenuius	Short-awn Wallaby-grass
Microlaena stipoides	Weeping Grass
Eleocharis sphacelata	Tall Spike Rush
Lomandra hystrix	Mat Rush
Bolboschoenus fluviatilis	Ditch Clubrush
Cyperus exaltatus	Giant Sedge
Eleocharis acuta	Common Spike Rush
Ficinia nodosa	Knobby Club Rush
Juncus usitatus	Mat-Rush
Schoenoplectus validus	Club Rush River
Grasses Mix	
Dietes grandiflora	Wild Iris
Lomandra tanika	Tanika Mat Rush
Bothriochloa macra	Red leg Grass
Chloris truncata	Windmill Grass
Capillipedium spicigerum	Scented-top grass
Panicum effusum	Hairy Panic
Paspalidium distans	Watercrown Grass
Poa labillardierei	Tussock Grass
imperata cylindrica	Cogon Grass

Note: The planting list is indicative only. Planting selection to be confirmed during detailed design.

Pictorial representation of plant communities

Riparian mix creek planting

The revegetation of the riparian corridors bordering the creeks would aid in stabilising the creek banks, while providing greater habitat and biodiversity potential. The planting would also protect the creek from potential silt and sedimentation erosion as a result of construction works. The riparian corridors would provide the driver with visual clues of creek crossings, diversifying the project experience, while increasing environmental awareness of the area's waterways.

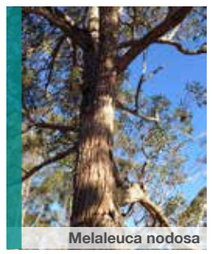
This riparian mix is characterised by a coastal paperbark swamp community where the landscape is affected by permanent or temporary inundation. The mix is dominated by sclerophyllous trees (Eucalypts, tea-trees, paper barks, she-oaks) and shrubs and sedges.


Melaleuca sieberi


Riparian Mix


Hakea actites


Eucalyptus robusta


Melaleuca nodosa


Allocasuarina littoralis


Callistemon pachyphyllus


Banksia spinulosa var. collina


Notelaea ovata


Rhodamnia rubescens


Banksia oblongifolia


Pultenaea villosa


Allocasuarina torulosa

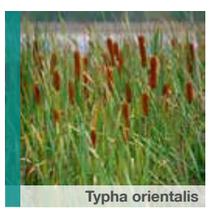

Xanthorrhoea fulva


Pimelea linifolia


Eleocharis acuta


Gleichenia dicarpa


Epacris microphylla


Typha orientalis


Lepironia articulata

Botanic Name	Common Name
Trees	
Allocasuarina littoralis	Black She Oak
Eucalyptus robusta	Swamp Mahogany
Hakea actites	Mullaway Needle Bush
Lophostemon suaveolens	Swamp Box
Melaleuca nodosa	Prickly-leaved Paperbark
Melaleuca sieberi	Sieber's Paperbark
Shrubs	
Banksia oblongifolia	Hairpin Banksia
Banksia spinulosa var. collina	Fern-leaved Banksia
Callistemon pachyphyllus	Wallum Bottlebrush
Notelaea ovata	
Pultenaea villosa	
Grasses and Groundcovers	
Drosera spatulata	Spoon-leaved Sun Dew
Eleocharis acuta	Common Spike Rush
Eleocharis sphacelata	Tall Spike Rush
Epacris microphylla	Tree Fern
Gleichenia dicarpa	Coral Fern
Lepironia articulata	Giant Sedge
Pimelea linifolia	Rice Flower
Typha orientalis	Broadleaf Cumbungi

Note: The planting list is indicative only. Planting selection to be confirmed during detailed design.

Local road mix

Plantings of trees, shrubs and groundcovers are proposed to line local roads and underpasses that traverse the highway. This would create a streetscape hierarchy differentiating and identifying the minor roads from the main highway. The local road planting mix would enhance the wooded lane character appropriate in shape and form to the surrounding pastoral landscape.

Median planting mix

The feature median planting design would provide the driver with a visual indication of an upcoming interchange, highlighting turnoffs to adjoining townships that are bypassed by the new road alignment. The feature planting is proposed to be a mix of low maintenance native and cultural species, and as per the RMS guidelines. Only low growing frangible species would be used, to ensure driver safety.


Acmena smithii

Local Road Mix


Backhousia citriodora


Hymenosporum flavum


Caesalpinia ferrea


Banksia integrifolia


Brachychiton acerifolius


Melicope elleryana


Cupaniopsis anarcardioides


Syzygium australe


Brachychiton discolor


Lomandra longifolia

Median Planting Mix


Leucopogon lanceolatus


Pratia purpurascens


Trochocarpa laurina


Dianella caerulea


Persoonia stradbrokensis

Botanic Name	Common Name
Trees	
Acmena smithii	Lilly Pilly
Backhousia citriodora	Lemon Scented Myrtle
Banksia integrifolia	Coastal Banksia
Brachychiton acerifolius	Illawarra Flame Tree
Brachychiton discolor	Lace Bark
Caesalpinia ferrea	Leopard Tree
Cupaniopsis anarcardioides	Tuckeroo
Hymenosporum flavum	Native Frangipani
Melicope elleryana	Pink Melicope
Syzygium australe	Brush Cherry
Understorey	
Dianella caerulea	Flax Lily
Hibbertia scandens	Guinea Flower
Leucopogon lanceolatus	Lance Beard-heath
Lomandra longifolia	Mat Rush
Persoonia stradbrokensis	Geebung
Pratia purpurascens	White Root
Trochocarpa laurina	Tree Heath

Note: The planting list is indicative only. Planting selection to be confirmed during detailed design.

Pictorial representation of plant communities

Feature and Portal planting

Englands Road interchange

The interchange feature planting design would provide the driver with a visual indication that an interchange is approaching, highlighting turnoffs to adjoining townships that are bypassed by the new road project.

The Englands Road interchange 'locational' planting encompasses a dry sclerophyll palette and includes specific flora species from the ecological communities within the location.


Angophora costata

England Road Interchange


Eucalyptus signata


Eucalyptus pilularis


Corymbia intermedia


Syncarpia glomulifera


Elaeocarpus reticulatus


Leucopogon lanceolatus


Persoonia stradbrokensis


Notelaea longifolia


Dodonaea triquetra


Polyscias sambucifolia


Imperata cylindrica


Pteridium esculentum


Dianella caerulea


Lomandra longifolia


Blechnum cartilagineum


Calochlaena dubia

Botanic Name	Common Name
Korora Intrerchange - Coastal Forest	
Trees	
Angophora costata	Smoothbarked Apple
Corymbia intermedia	Pink Bloodwood
Eucalyptus pilularis	Blackbutt
Eucalyptus resinifera subsp. hemilampra	Red Mahogany
Eucalyptus signata	Scribbly Gum
Syncarpia glomulifera	Turpentine
Understorey	
Blechnum cartilagineum	Gristle Fern
Calochlaena dubia	Soft Bracken
Dianella caerulea	Flax Lily
Dodonaea triquetra	Hop Bush
Elaeocarpus reticulatus	Blueberry Ash
Imperata cylindrica	Blady Grass
Leucopogon lanceolatus	Beard Heath
Lomandra longifolia	Spiny-headed Mat-rush
Notelaea longifolia	Mock Olive
Persoonia stradbrokensis	Geebung
Polyscias sambucifolia	Ash Elderberry
Pteridium esculentum	Bracken Fern

Note: The planting list is indicative only. Planting selection to be confirmed during detailed design.

Coramba Road interchange

The interchange feature planting design would provide the driver with a visual indication that an interchange is approaching, highlighting turnoffs to adjoining townships that are bypassed by the project. This interchange provides a more low key naturally designed approach.

The Coramba Road interchange 'locational' planting encompasses a wetland landscape character and includes specific flora species from the ecological communities within the location.


Coramba Road Interchange


Eucalyptus microcorys


Eucalyptus grandis


Eucalyptus saligna


Lophostemon confertus


Syncarpia glomulifera


Cyathea australis


Tabernaemontana pandacaqui


Synoumglandulosumsubsp. glandulosum


Callicoma serratifolia


Archontophoenix cunninghamiana

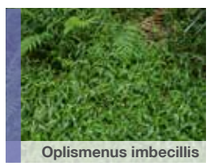

Allocasuarina torulosa


Cryptocarya rigida


seuderanthemumvariabile


Viola banksii


Cissus hypoglauca


Oplismenus imbecillis


Cordyline stricta


Calochlaena dubia


Blechnum cartilagineum

Botanic Name	Common Name
Wet Sclerophyll	
Trees	
Eucalyptus grandis	Flooded Gum
Eucalyptus microcorys	Tallowwood
Eucalyptus saligna	Sydney Blue Gum
Lophostemon confertus	Brush Box
Syncarpia glomulifera	Turpentine
Understorey	
Allocasuarina torulosa	Forest Oak
Archontophoenix cunninghamiana	Bangalow Palm
Blechnum cartilagineum	Gristle Fern
Callicoma serratifolia	Black Wattle
Calochlaena dubia	False Bracken
Cissus hypoglauca	Water Vine
Cordyline stricta	Palm Lily
Cryptocarya rigida	Forest Maple
Cyathea australis	Tree Ferns
Pseuderanthemum variabile	Pastel Flower
Synoum glandulosum subsp. glandulosum	Scentless Rosewood
Tabernaemontana pandacaqui	Banana Bush
Trochocarpa laurina	Tree Heath
Viola banksii	Native Violet

Note: The planting list is indicative only. Planting selection to be confirmed during detailed design.

Pictorial representation of plant communities

Korora Hill interchange planting

The interchange feature planting design would provide the driver with a visual indication that an interchange is approaching, highlighting turnoffs to adjoining townships that are bypassed by the project. The landscape design narrative is to interpret the escarpment meeting the coastline through the planting selection and arrangements.

This northern section of the project traverses patterns of banana and blueberry plantations that comprise part of the important agricultural industry of the region. Playing on this concept, grids of feature trees are to be located along the north-facing slopes of the interchange as a means of reflecting and interpreting the surrounding agricultural landscapes. Low maintenance feature tree species have been selected to mimic the plantation.


Eucalyptus microcorys

Korora Hill Interchange


Syncarpia glomulifera


Eucalyptus pilularis


Lophostemon confertus


Strelitzia nicolai

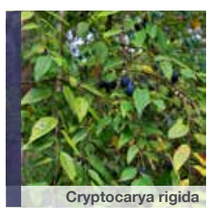

Archirhodomyrtus beckler


Synoum glandulosum ssp. glandulosum


Cryptocarya microneura


Cryptocarya glaucescens


Rhodamnia rubescens


Cryptocarya rigida


Cyathea australis


Dianella caerulea


Imperata cylindrica


Lomandra longifolia


Pteridium esculentum


Pseuderanthemum variabile


Blechnum cartilagineum

Botanic Name	Common Name
Coastal Forest	
Trees	
Eucalyptus microcorys	Tallowwood
Eucalyptus pilularis	Blackbutt
Lophostemon confertus	Brush Box
Strelitzia nicolai	Giant Bird of Paradise
Syncarpia glomulifera	Turpentine
Understorey	
Archirhodomyrtus beckler	Rose Myrtle
Blechnum cartilagineum	Gristle Fern
Cryptocarya glaucescens	Jackwood
Cryptocarya microneura	Murrogun
Cryptocarya rigida	Forest Maple
Cyathea australis	Tree Ferns
Imperata cylindrica	Blady Grass
Lomandra longifolia	Mat Rush
Synoum glandulosum ssp. glandulosum	Scentless Rosewood
Pseuderanthemum variabile	Pastel Flower
Pteridium esculentum	Bracken Fern
Rhodamnia rubescens	Scrub Turpentine

Note: The planting list is indicative only. Planting selection to be confirmed during detailed design.

Pictorial representation of plant communities

Portal planting

The portal planting design would include species that mimic the distinct character of the adjoining planting, whilst giving consideration to ongoing maintenance and management requirements. In locations where portals are situated within area of existing banana plantations, species such as *Strelizia nicholai*, *philodendron martianum* and *calathea lutea* will be considered, complementing the form and scale of the adjoining banana plantation. As the planting transitions from the adjoining vegetation towards the road, the planting palette will consider hard tussocky grass species, such as *Lomandra longifolia*. The planting design at these locations will be given careful consideration during detailed design to ensure a sympathetic design response.


Strelitzia nicolai

Portal Planting


Calathea lutea


Lomandra longifolia


Philodendron Congo


Philodendron martianum

Planting design concept plans

The following plans at 1:4000 scale illustrate the proposed planting for the project.

The planting concepts plans do not include ancillary sites, however it is assumed that these areas will be reinstated to their current condition on completion of the project.

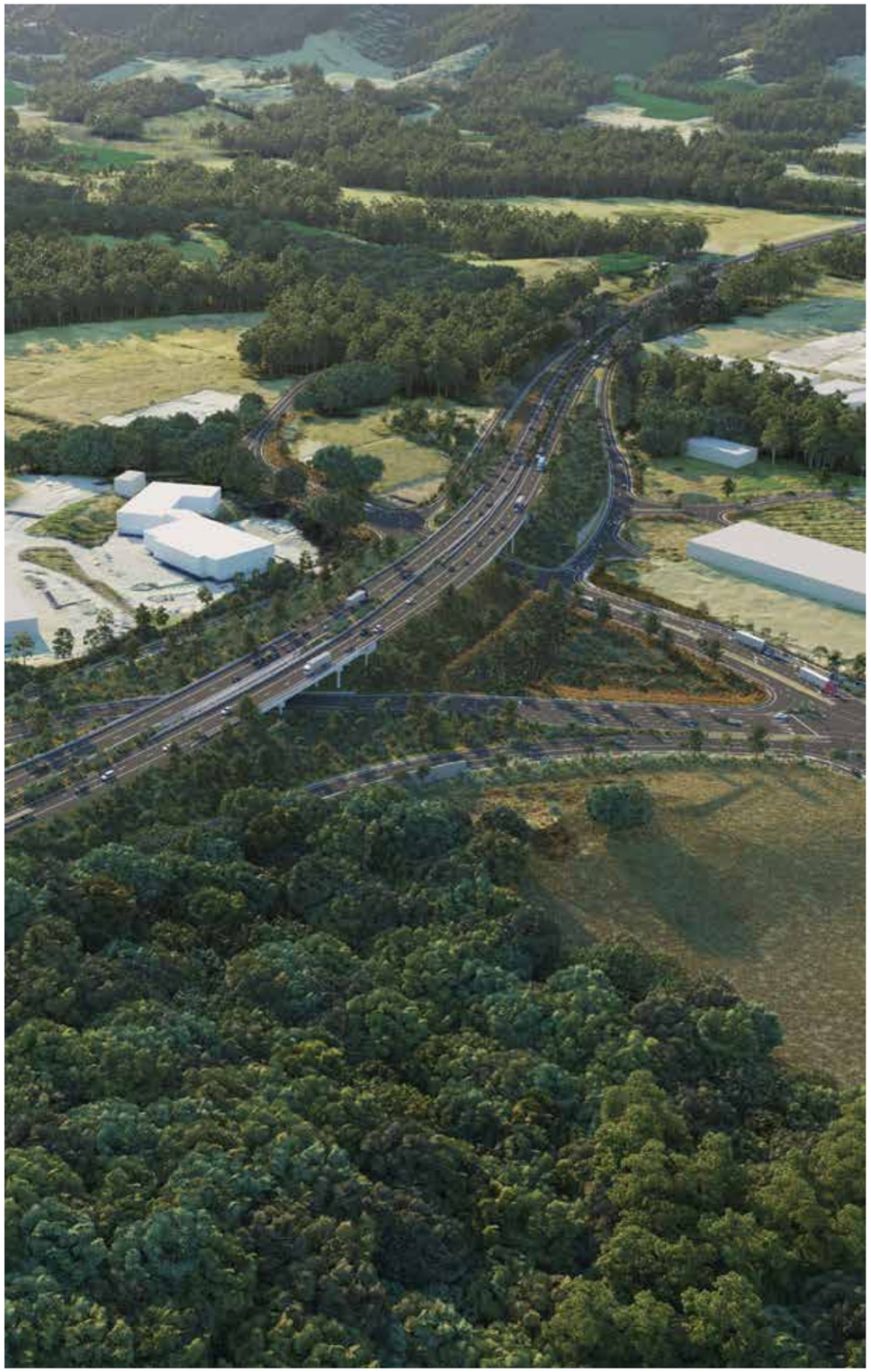
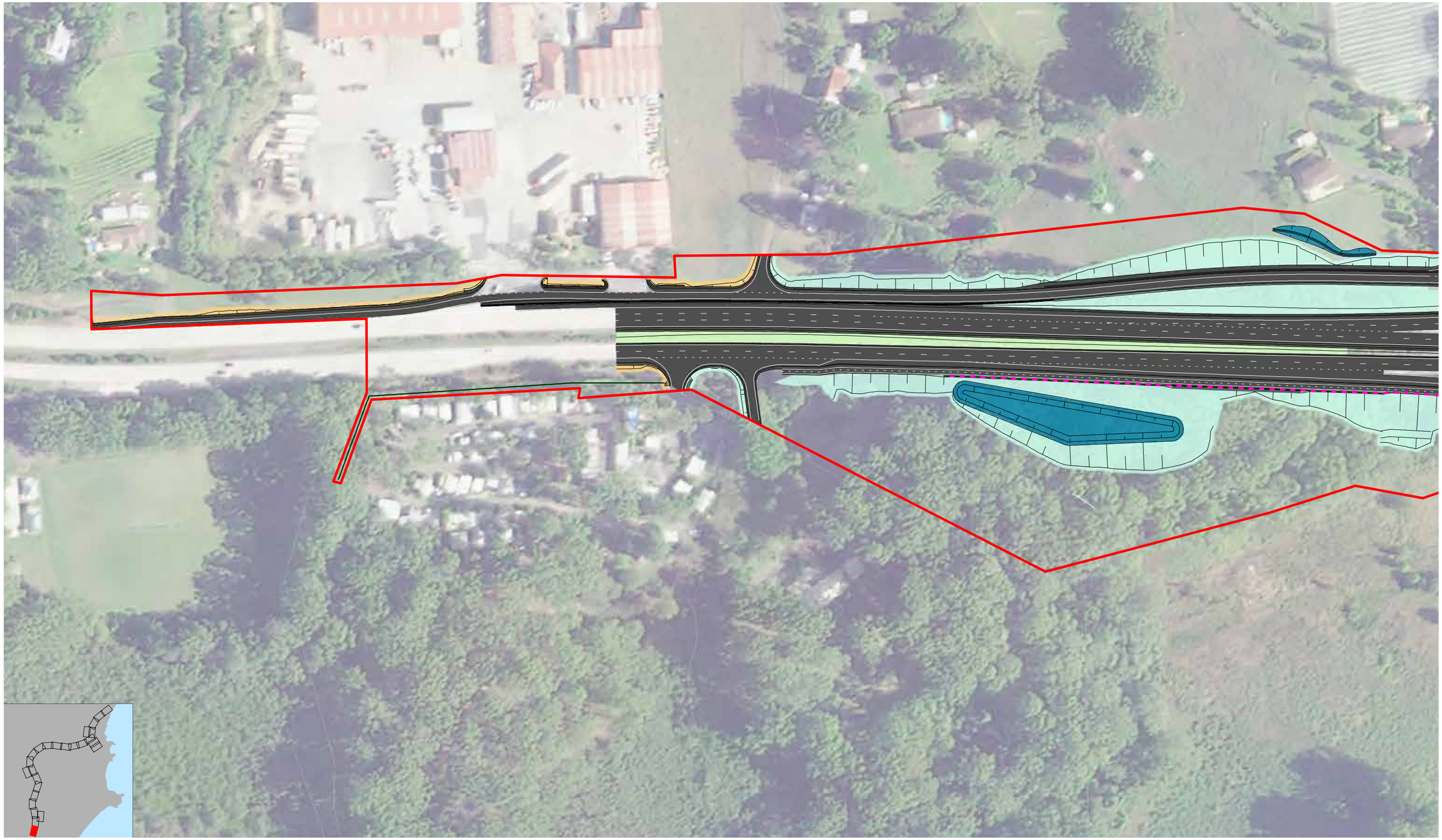


FIG 5.3 ARTIST IMPRESSION OF ENGLANDS ROAD INTERCHANGE

Planting design concept plan



Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping

Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting

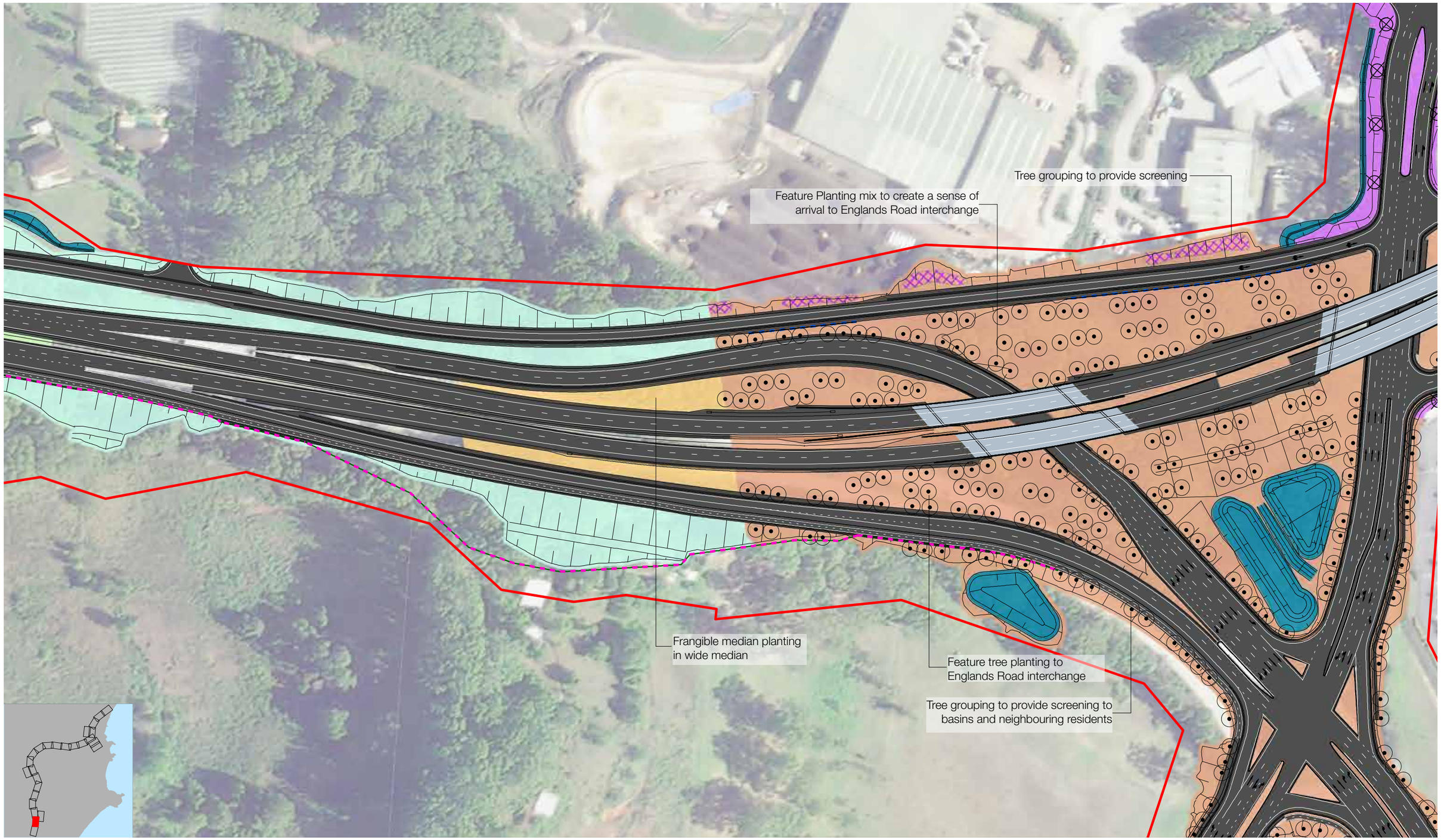
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix

Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan



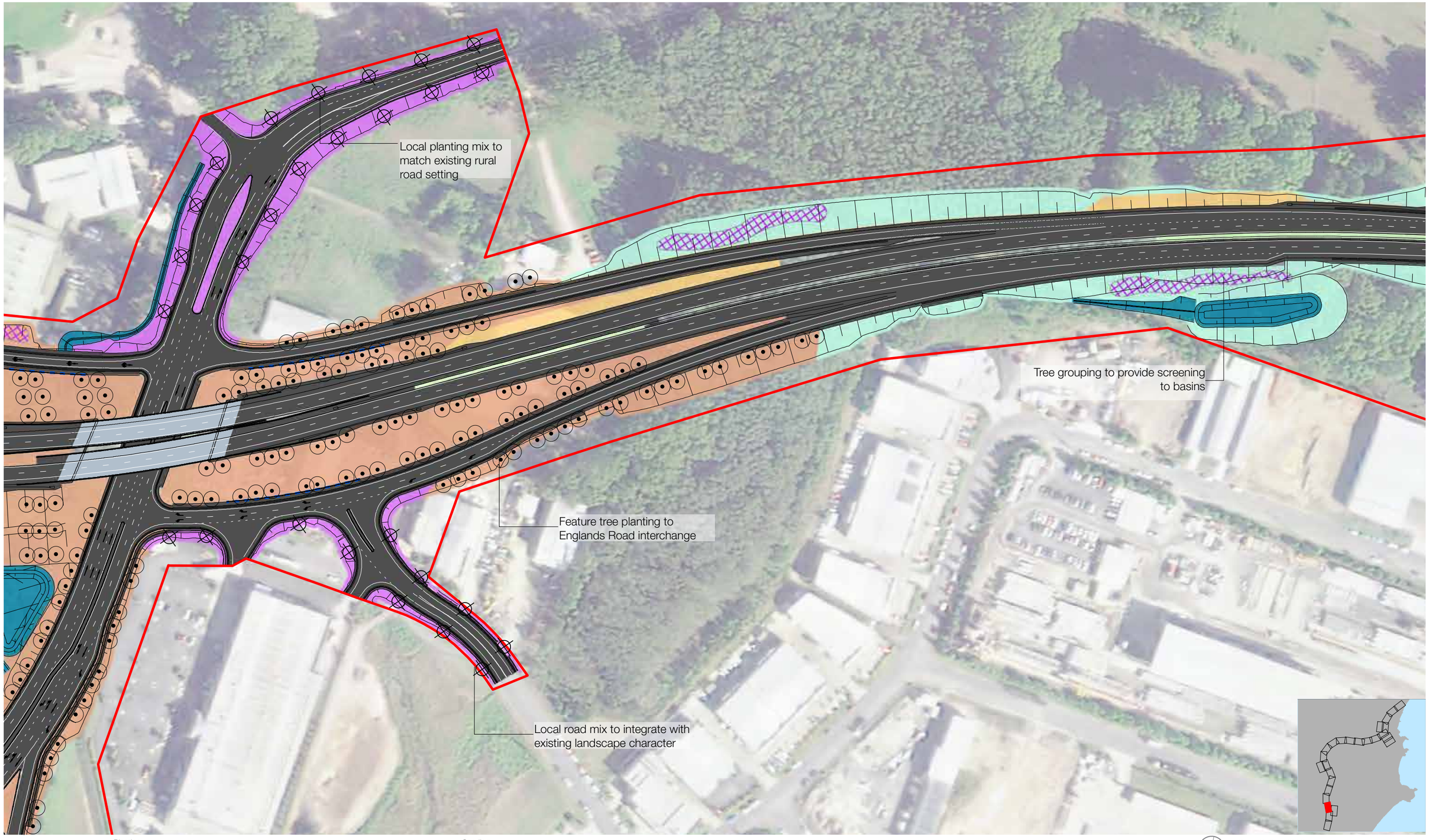
Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

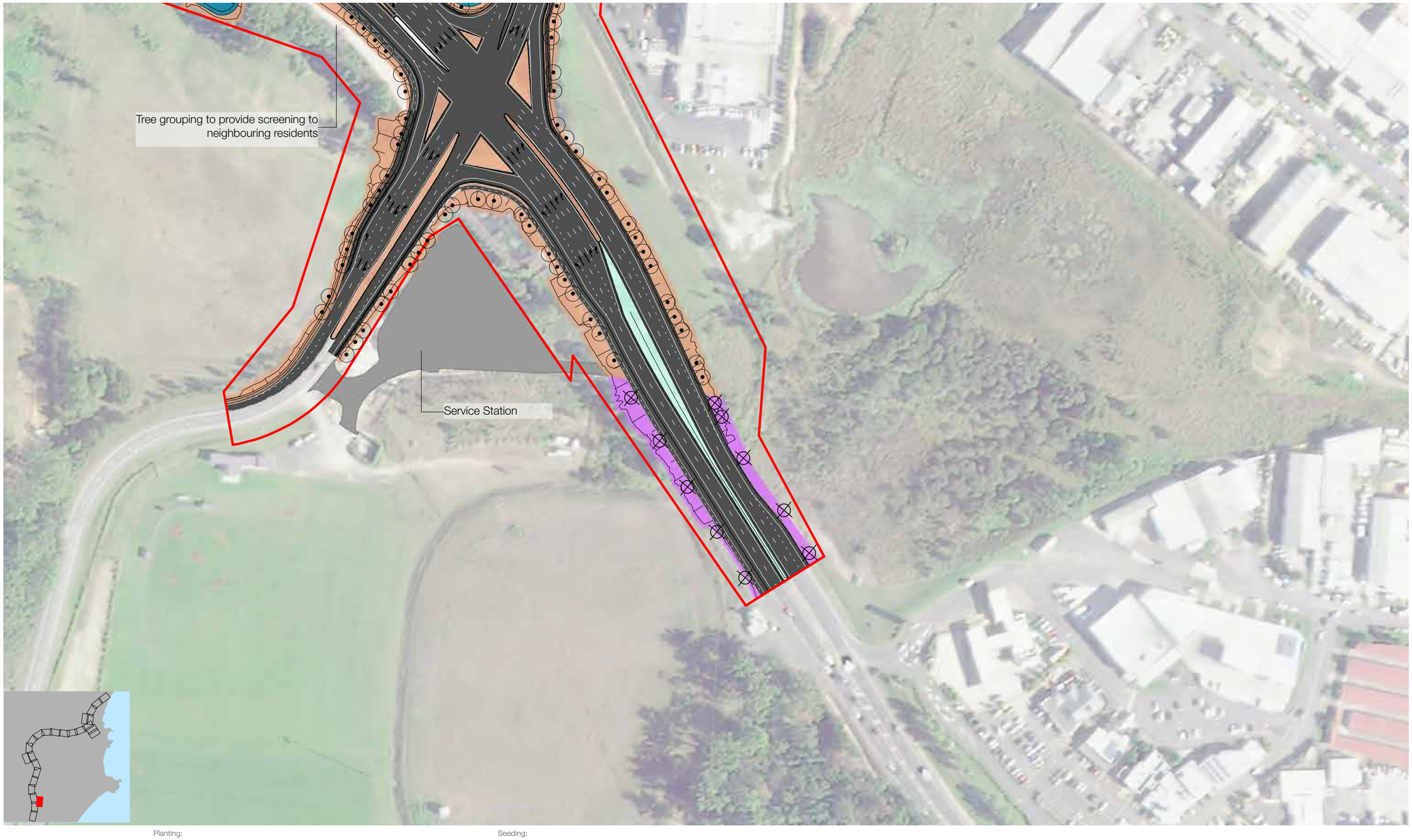
Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan



Planting design concept plan



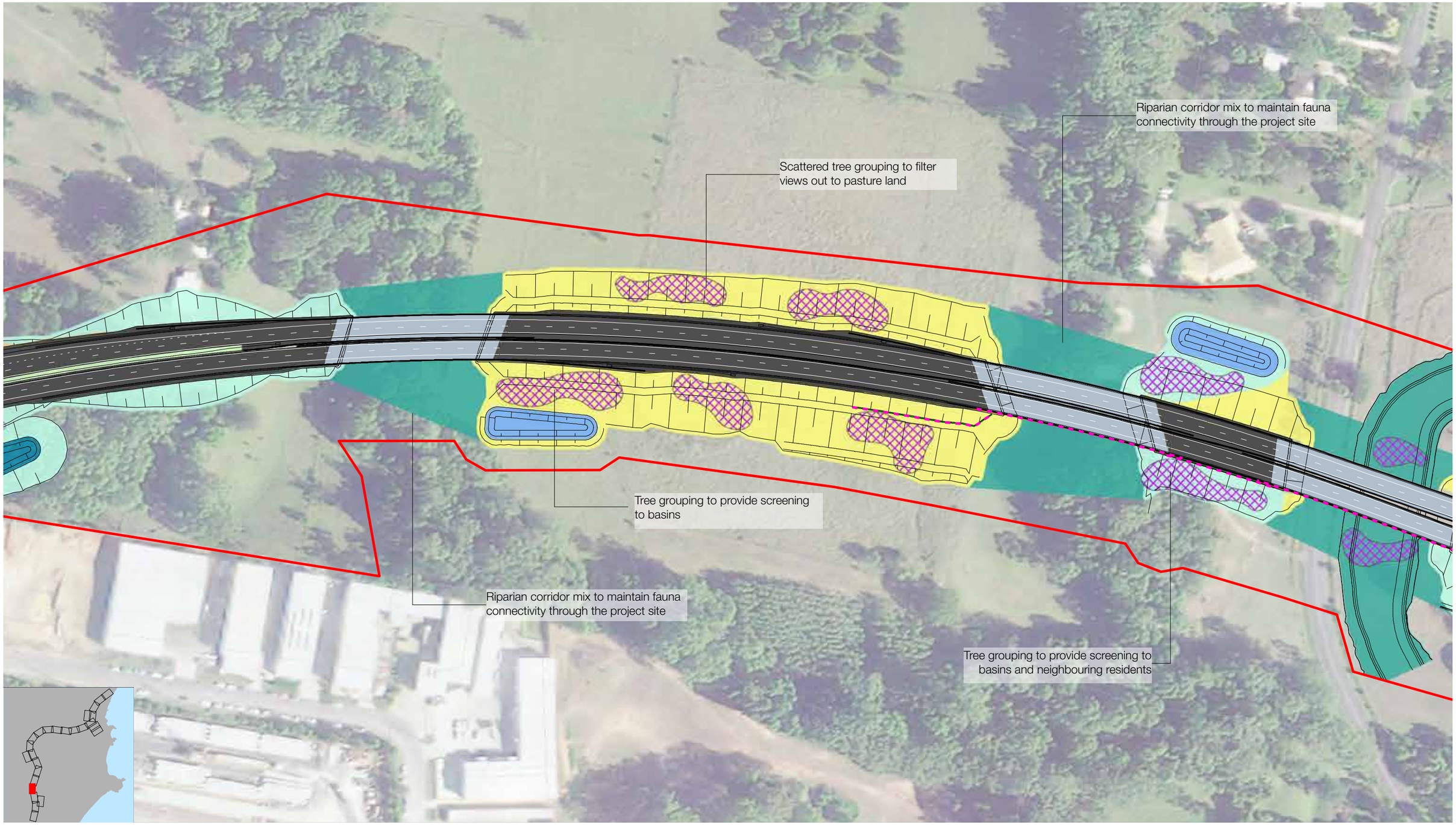
Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan



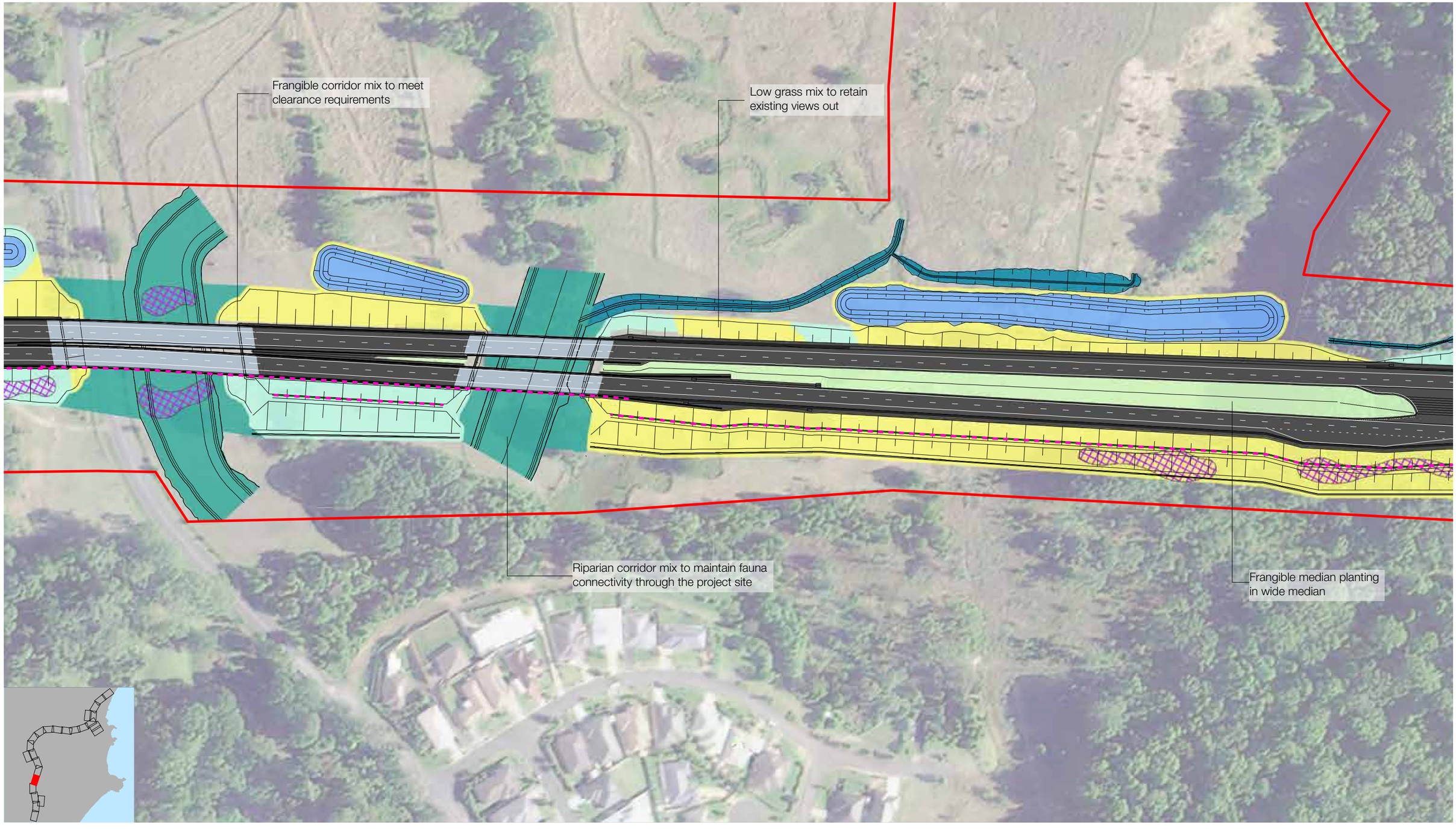
Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan



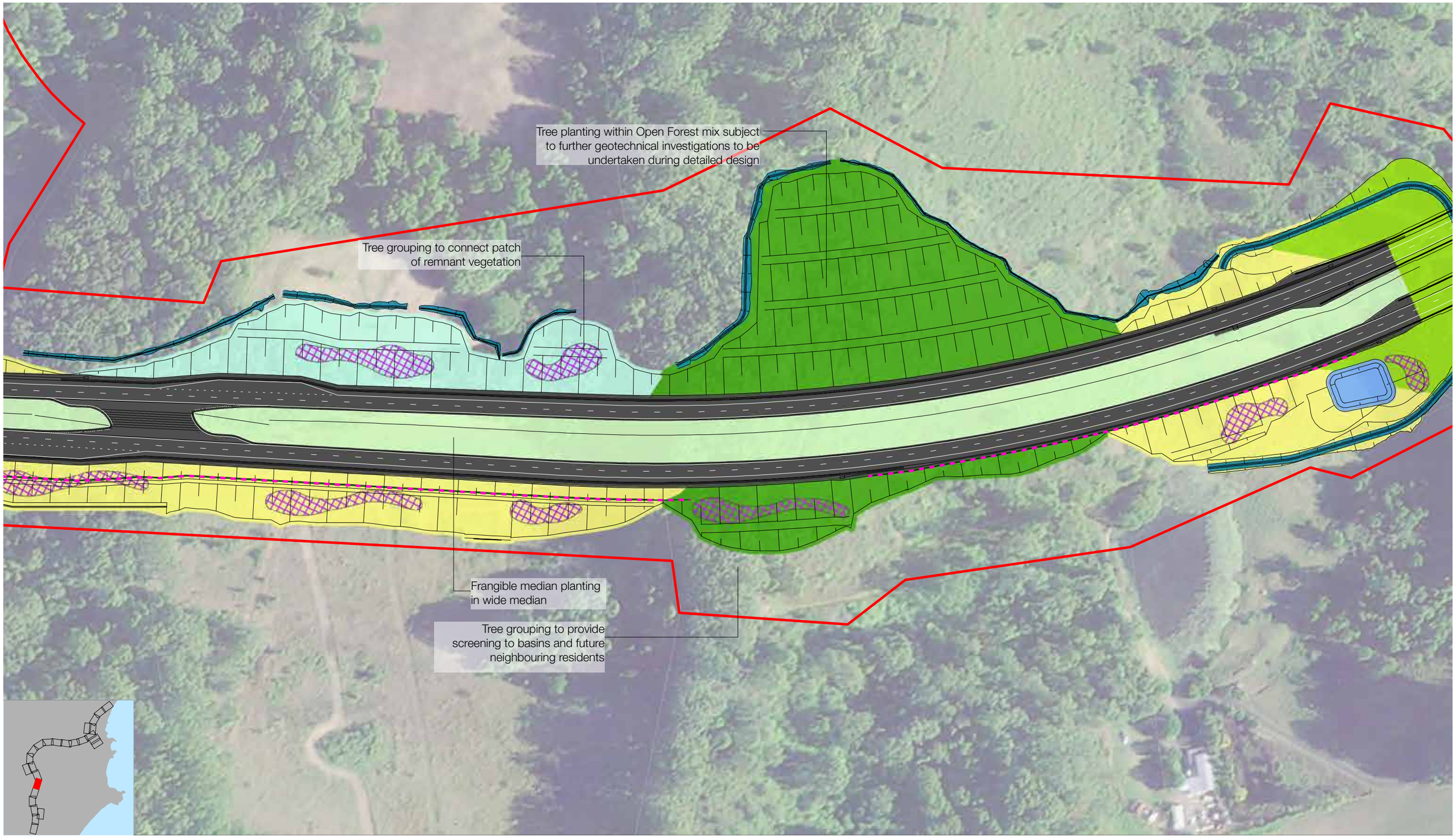
Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan



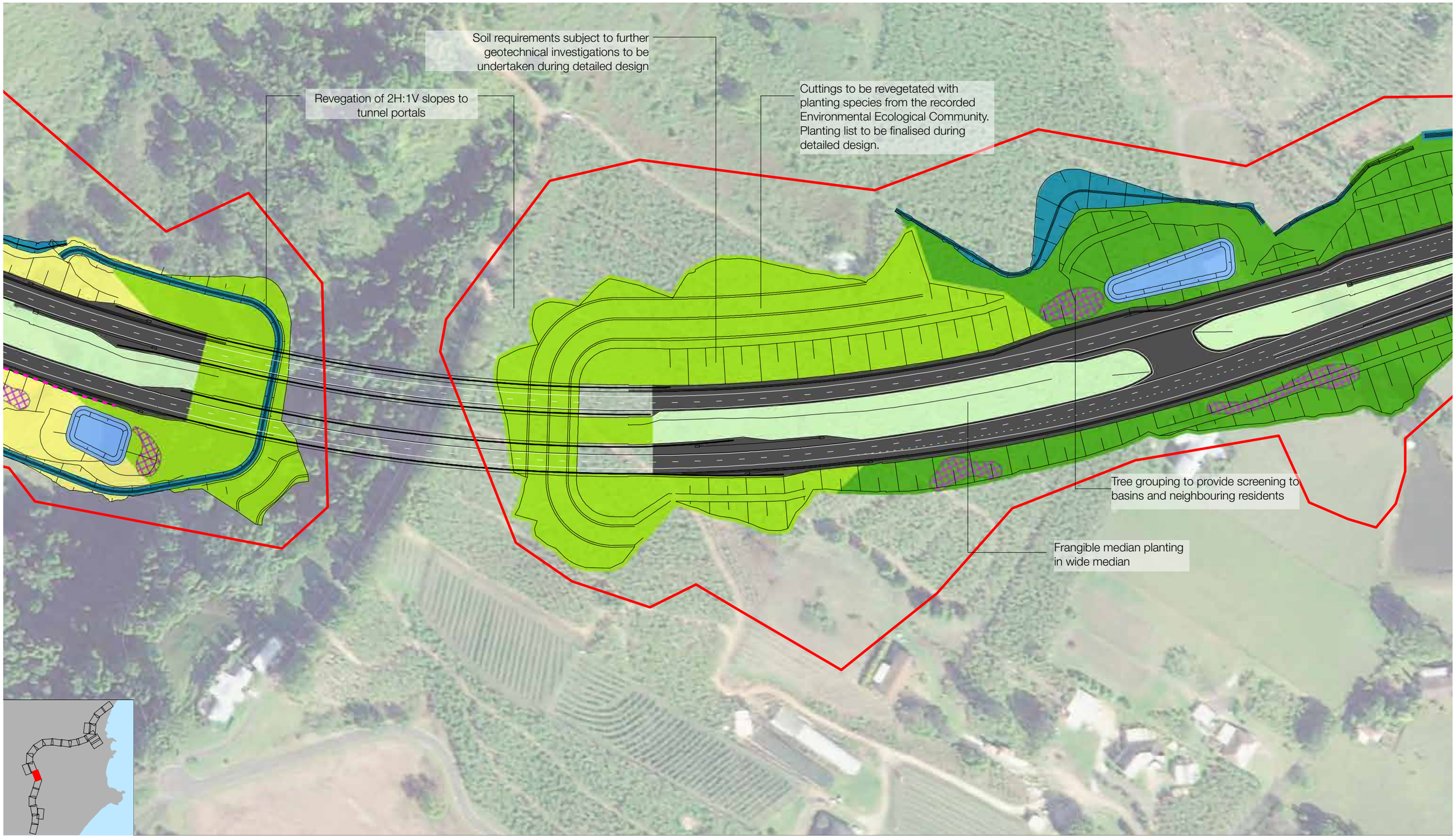
Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan



- Retaining Wall
- Noise Wall

Planting:
- Feature Trees
- Street Trees
- Tree Grouping
- Urban Corridor Planting Mix
- Local Road Planting Mix
- Median Planting
- Feature Planting
- Riparian Corridor
- Swale Planting
- Basin Planting Mix
- Portal Planting

Seeding:
- Lowland Rainforest Mix
- Wet Sclerophyll Forest Mix
- Open Forest Mix
- Grass Mix
- Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan

Local planting mix to match existing country road setting

Riparian corridor mix to maintain fauna connectivity through the project site

Tree grouping to provide screening to basins and neighbouring residents

Feature tree planting to Coramba Road interchange

Frangible median planting in wide median

Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan

Local planting mix to match
existing country road setting

Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan

Feature tree planting to Coramba Road interchange

Tree grouping to provide screening to basins and neighbouring residents

Re-establishment of lowland rainforest mix

- Retaining Wall
- Noise Wall

Planting:
- Feature Trees
- Street Trees
- Tree Grouping
- Urban Corridor Planting Mix
- Local Road Planting Mix
- Median Planting
- Feature Planting
- Riparian Corridor
- Swale Planting
- Basin Planting Mix
- Portal Planting

Seeding:
- Lowland Rainforest Mix
- Wet Sclerophyll Forest Mix
- Open Forest Mix
- Grass Mix
- Corridor Frangible Mix

SCALE @A3 - 1:2000

0 50 100m

Planting design concept plan

Tree planting mix subject to further geotechnical investigations to be undertaken during detailed design

Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan

NORTH COAST RAILWAY

Local planting mix to match existing rural road setting

Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan

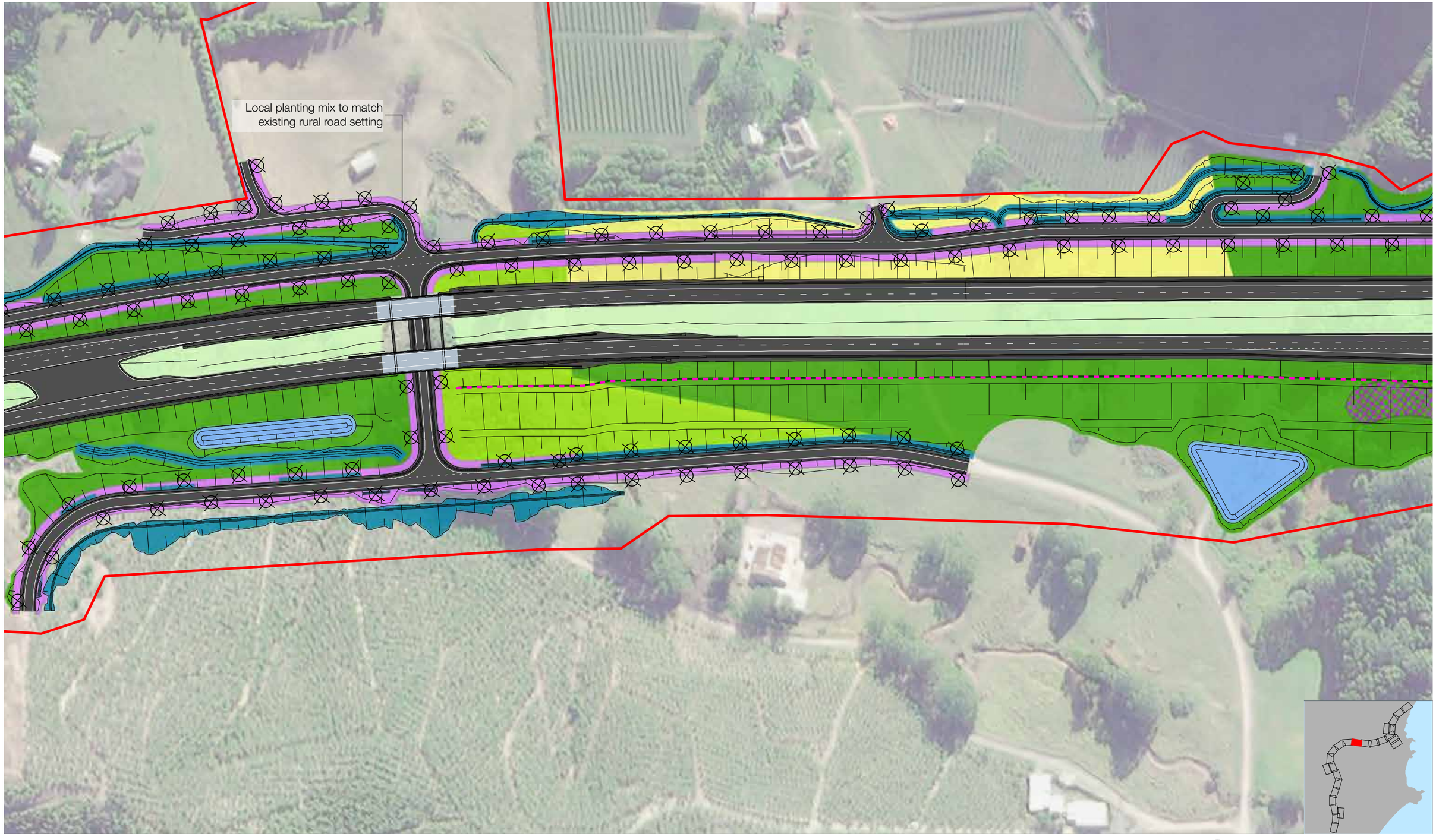
Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan



Planting design concept plan

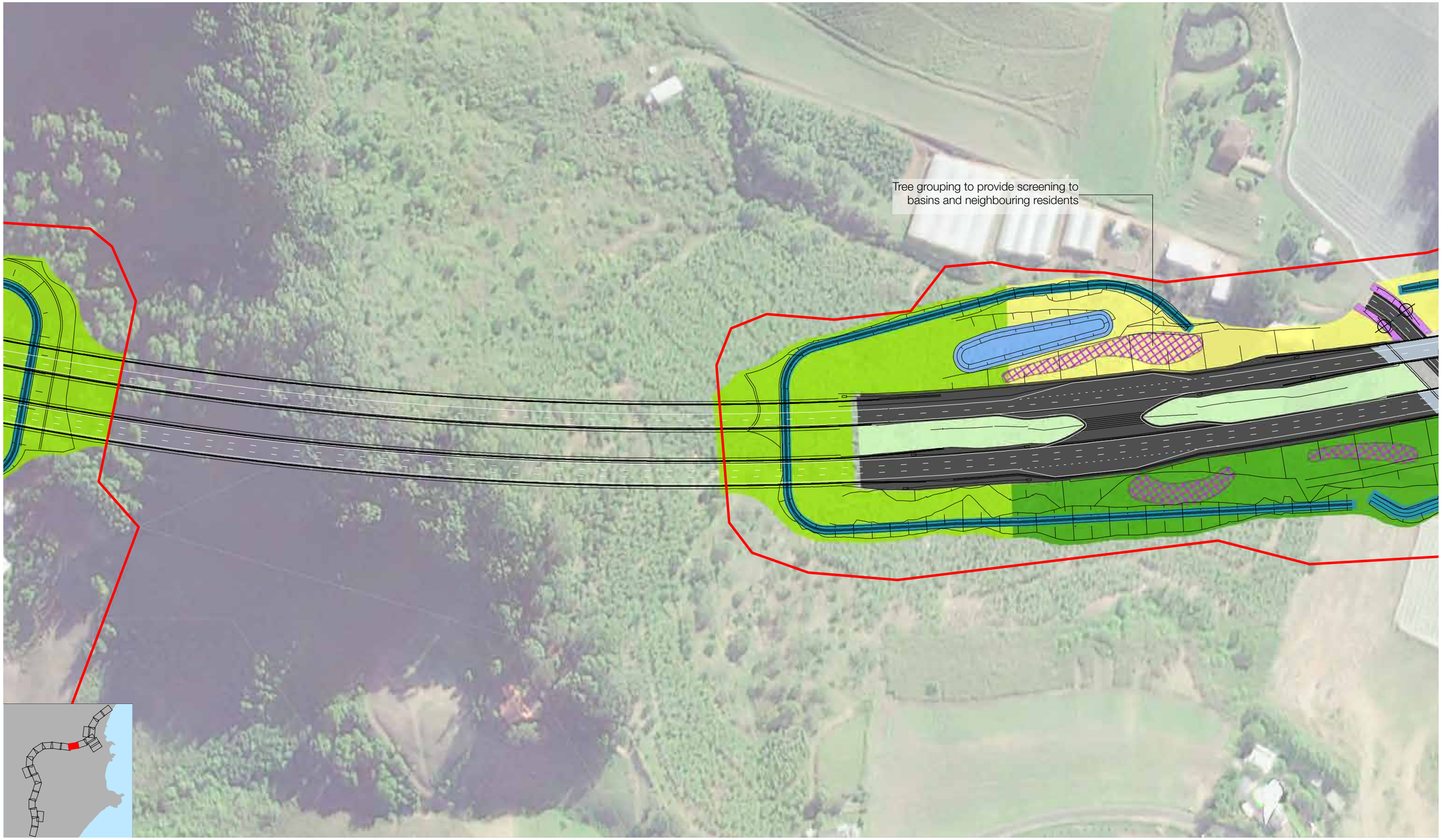
Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

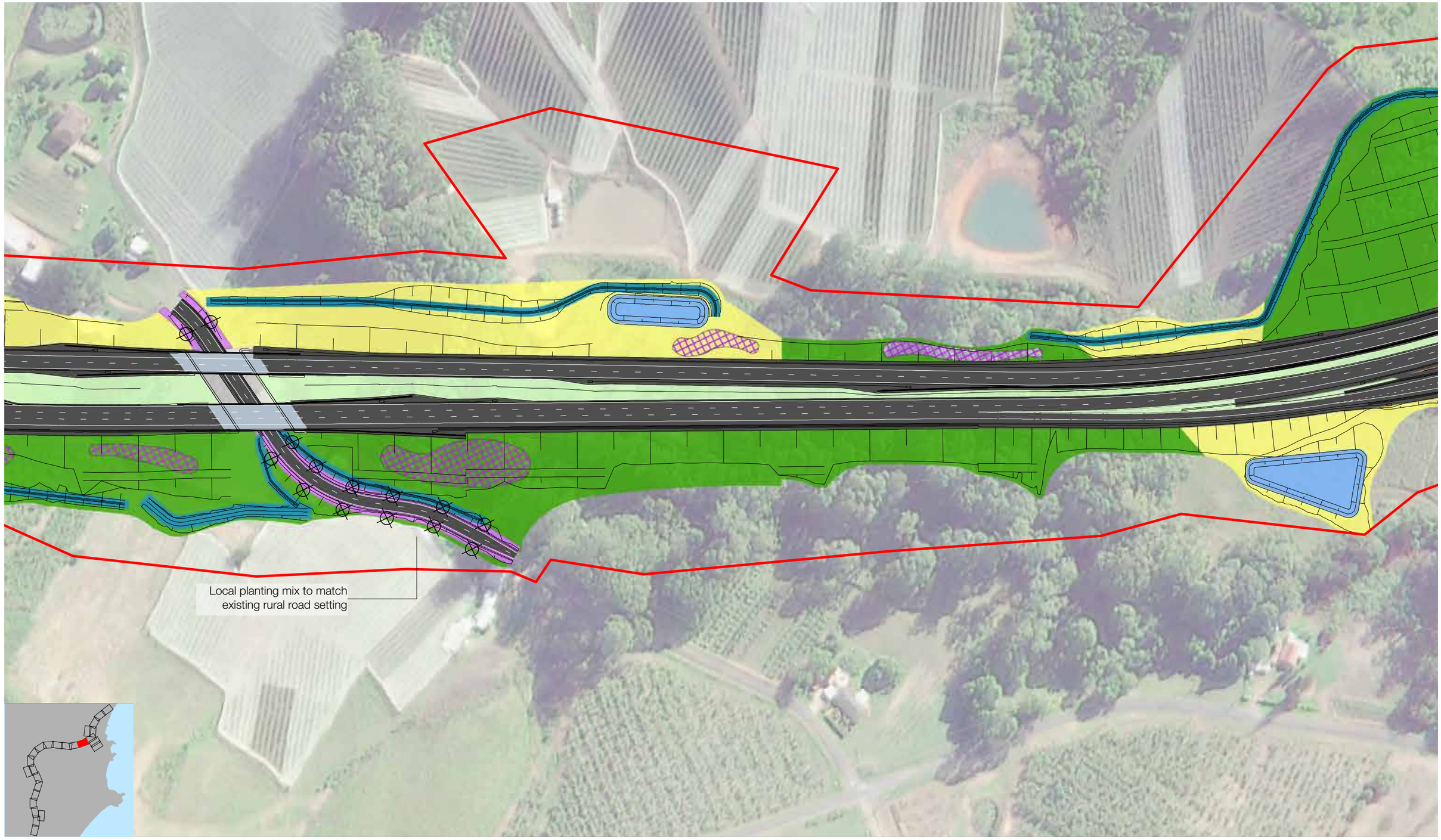
Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan



Planting design concept plan



Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan

Soil requirements subject to further geotechnical investigations to be undertaken during detailed design

Tree grouping to provide screening to basins and neighbouring residents

Feature tree planting to Korora Road interchange

Local planting mix to match existing rural road setting

Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan

Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan

Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping

Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting

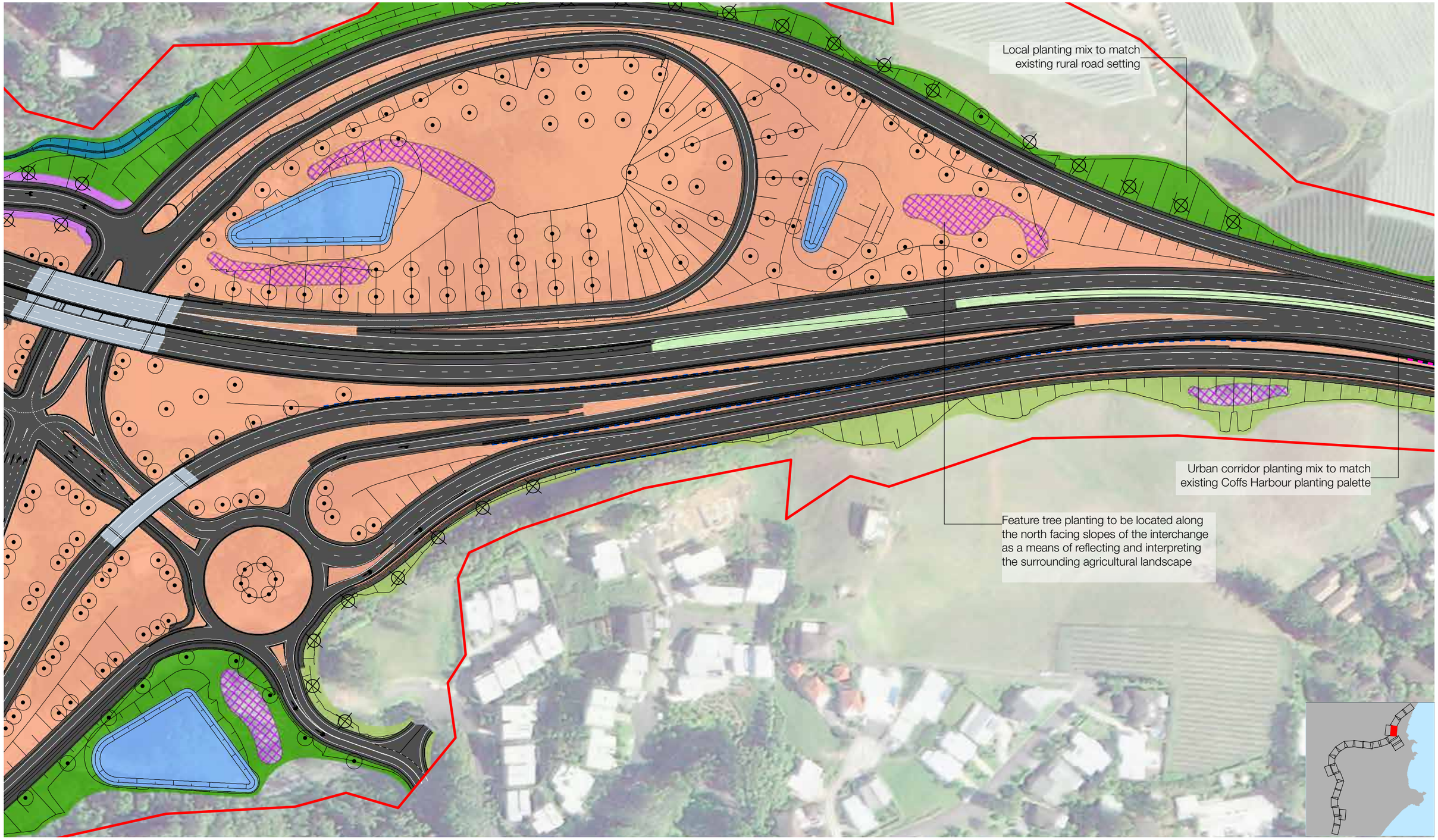
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix

Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan



Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan

Planting design concept plan

Local planting mix to match existing rural road setting

Urban corridor planting mix to match existing Coffs Harbour planting palette

Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan

Riparian corridor mix to maintain fauna connectivity through the project

Urban corridor planting mix to match existing Coffs Harbour planting palette

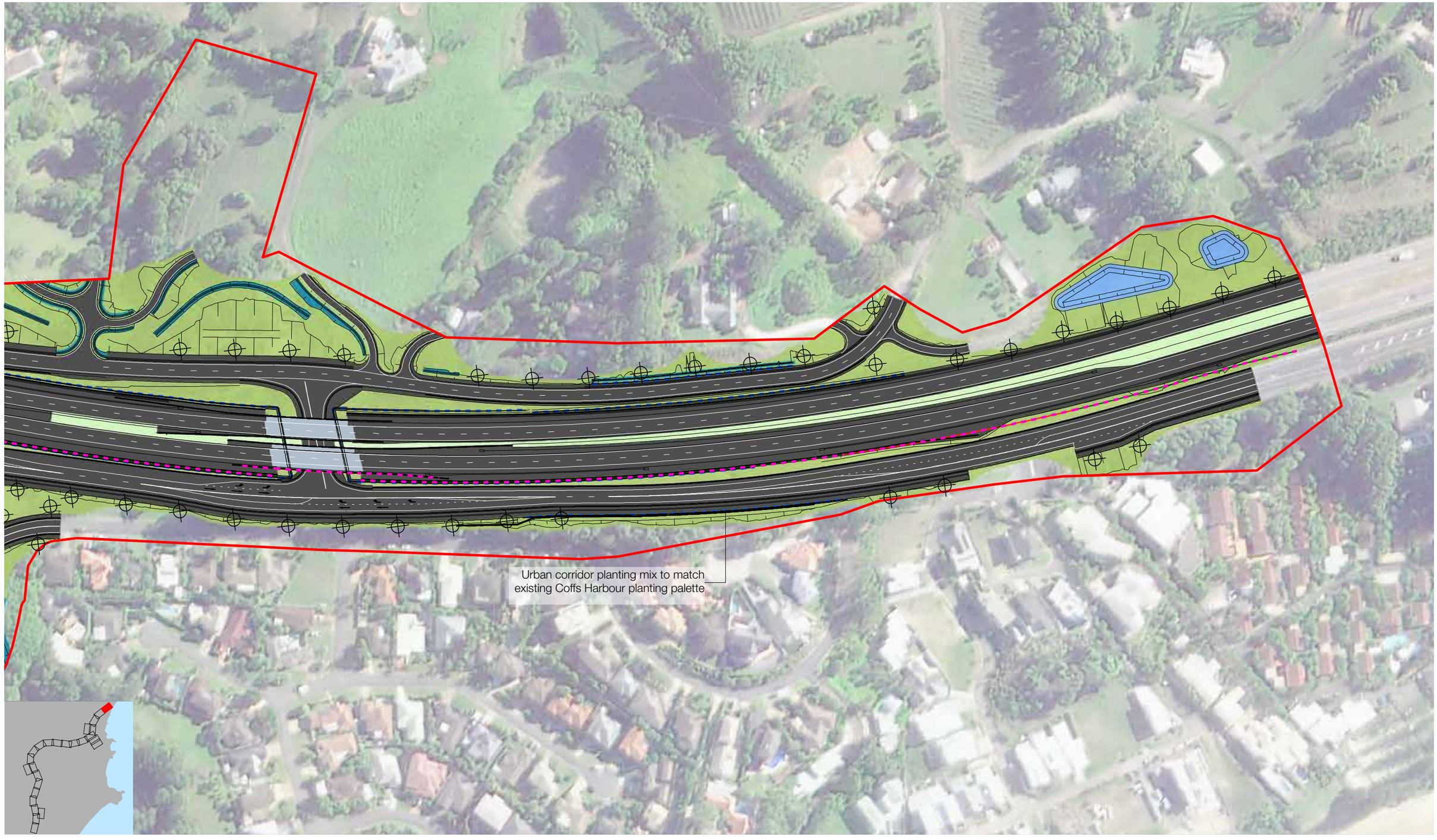
Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Planting design concept plan



Retaining Wall
Noise Wall

Planting:
Feature Trees
Street Trees
Tree Grouping
Urban Corridor Planting Mix
Local Road Planting Mix
Median Planting
Feature Planting
Riparian Corridor
Swale Planting
Basin Planting Mix
Portal Planting

Seeding:
Lowland Rainforest Mix
Wet Sclerophyll Forest Mix
Open Forest Mix
Grass Mix
Corridor Frangible Mix

SCALE @A3 - 1:2000
0 50 100m

Landscape design typical sections

The following typical landscape cross sections illustrate where grasses, frangible shrubs and non-frangible shrubs are proposed to be used. The below clearances have been used in the planting design to achieve optimal sight-lines and views across the corridor. These include:

- Non-frangible vegetation at a minimum 11m from the edge of travel lane
- Frangible shrubs at a minimum of 6m from the edge of travel lane
- 2m grass strip at the carriageway edge of medians
- 4.3m wide frangible shrubs in median when in forested areas or where required to mitigate headlight glare
- No shrubs in the 1.7m deflection zone behind wire rope barriers
- Grasses only within 3m of the away-from-highway side of the fauna fence and 1m to the highway side to allow for maintenance access
- Vegetation on benches in cuttings or fills.

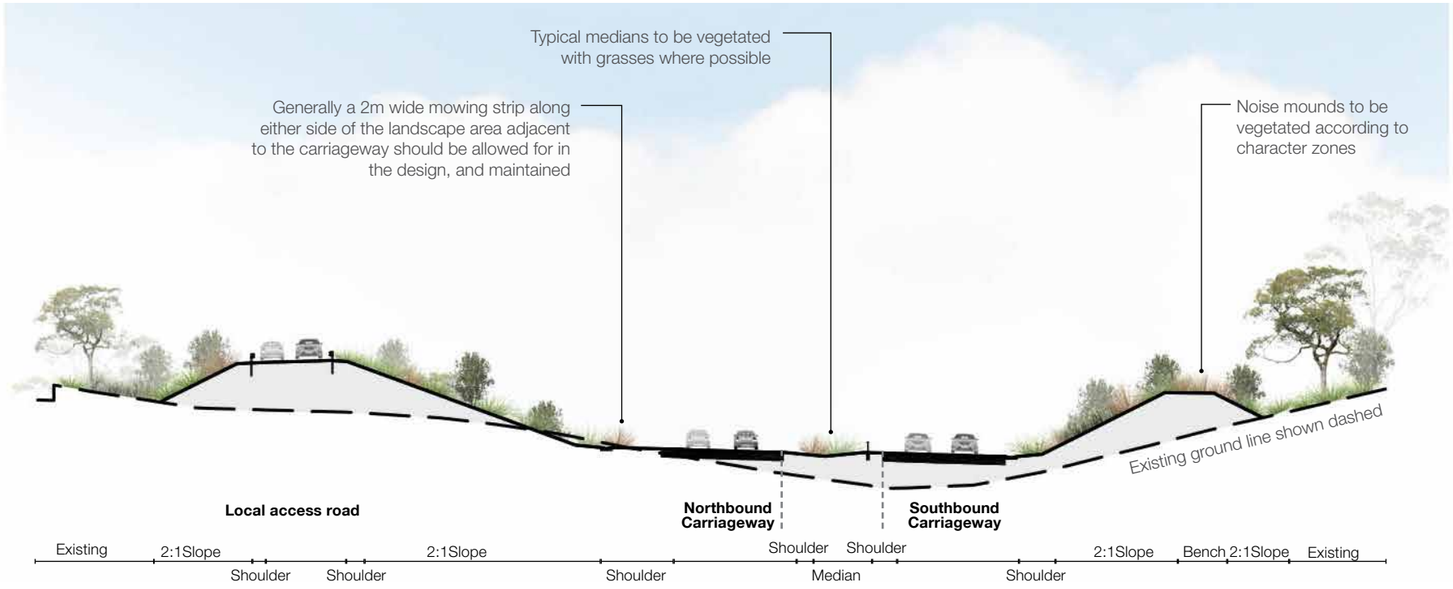


FIG 5.4 SECTION THROUGH MAIN CARRIAGEWAY WITH A TYPICAL MEDIAN - CH15350 (MCN1)

SCALE 1:500

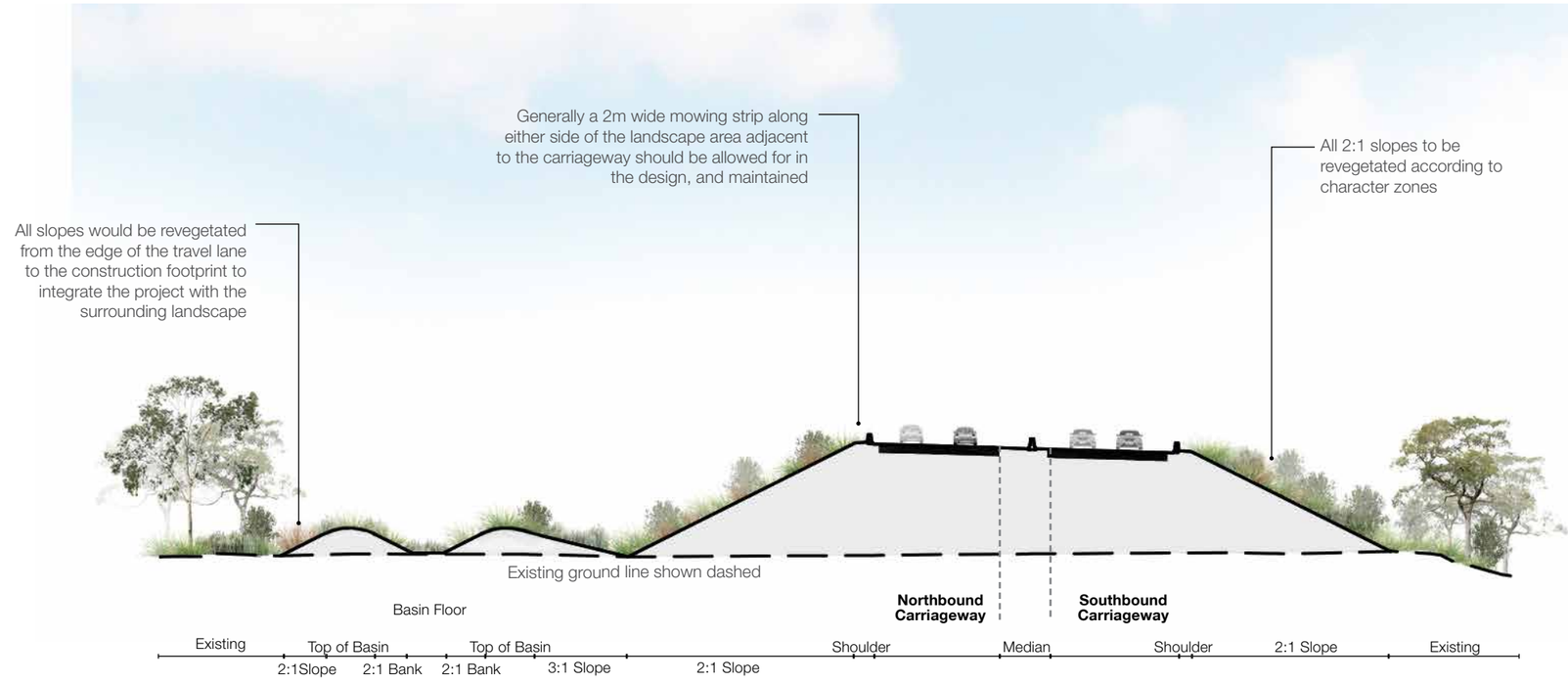


FIG 5.5 SECTIONTHROUGHMAINCARRIAGEWAYONFILLAPPROACHINGBRIDGE-CH12100(MCN1)

SCALE 1:500

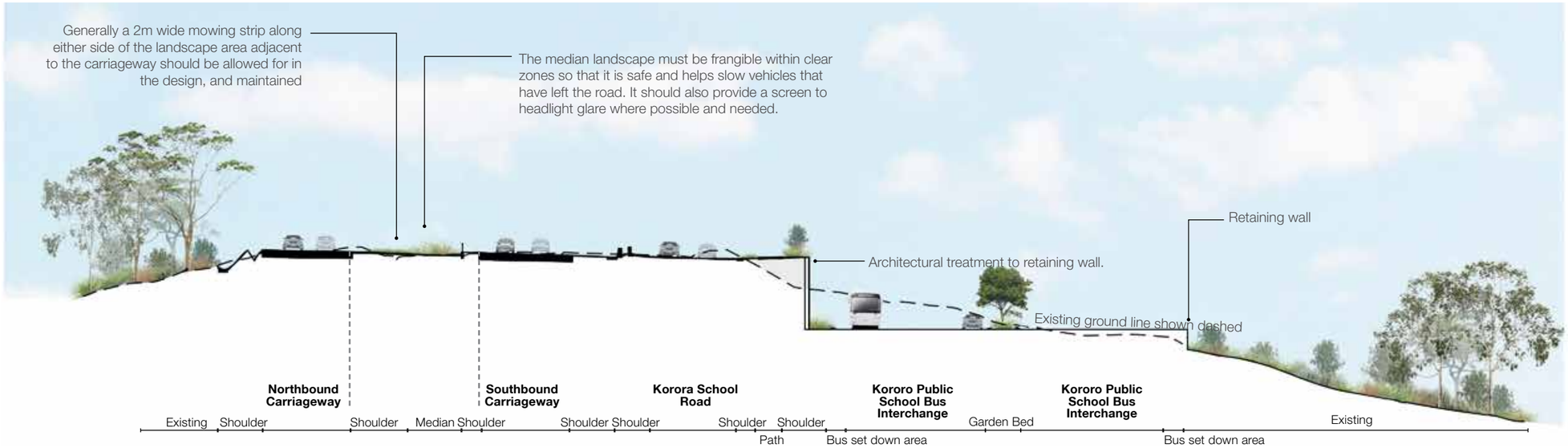


FIG 5.6 SECTION THROUGH MAIN CARRIAGEWAY AT THE KORORO PUBLIC SCHOOL BUS INTERCHANGE

SCALE 1:500

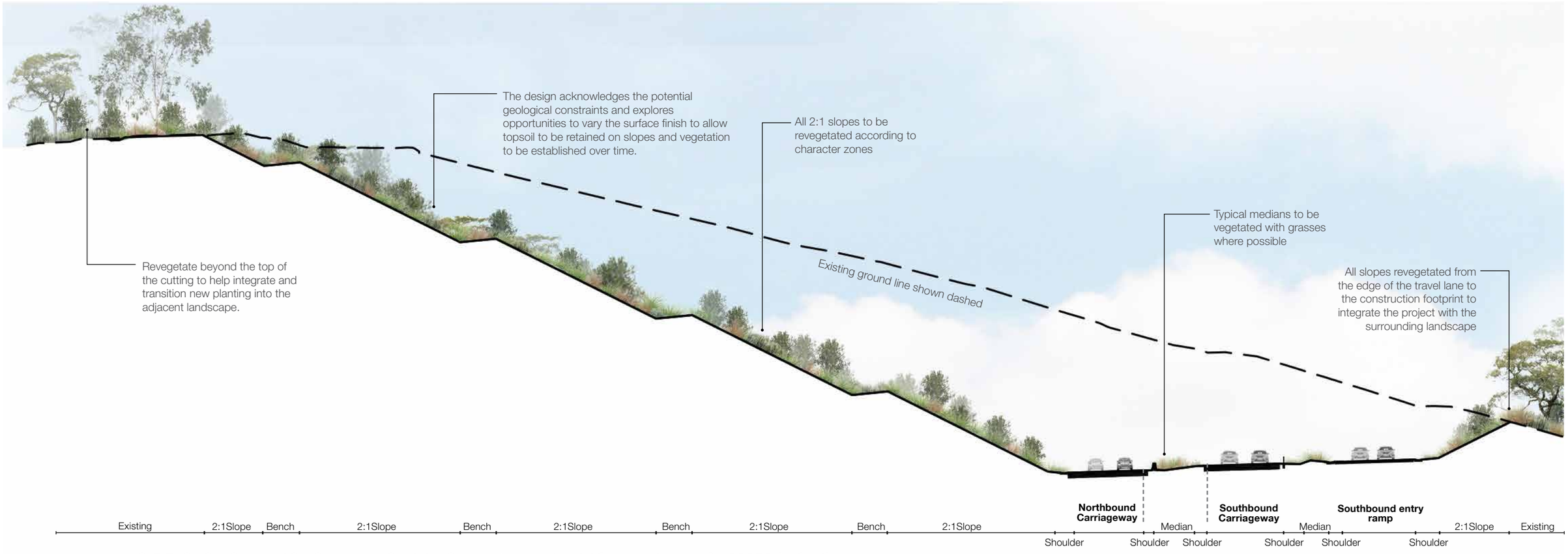


FIG 5.7 SECTION THROUGH MAIN CARRIAGEWAY WITH NARROW MEDIAN - CH20350 (MCN1)

SCALE 1:500

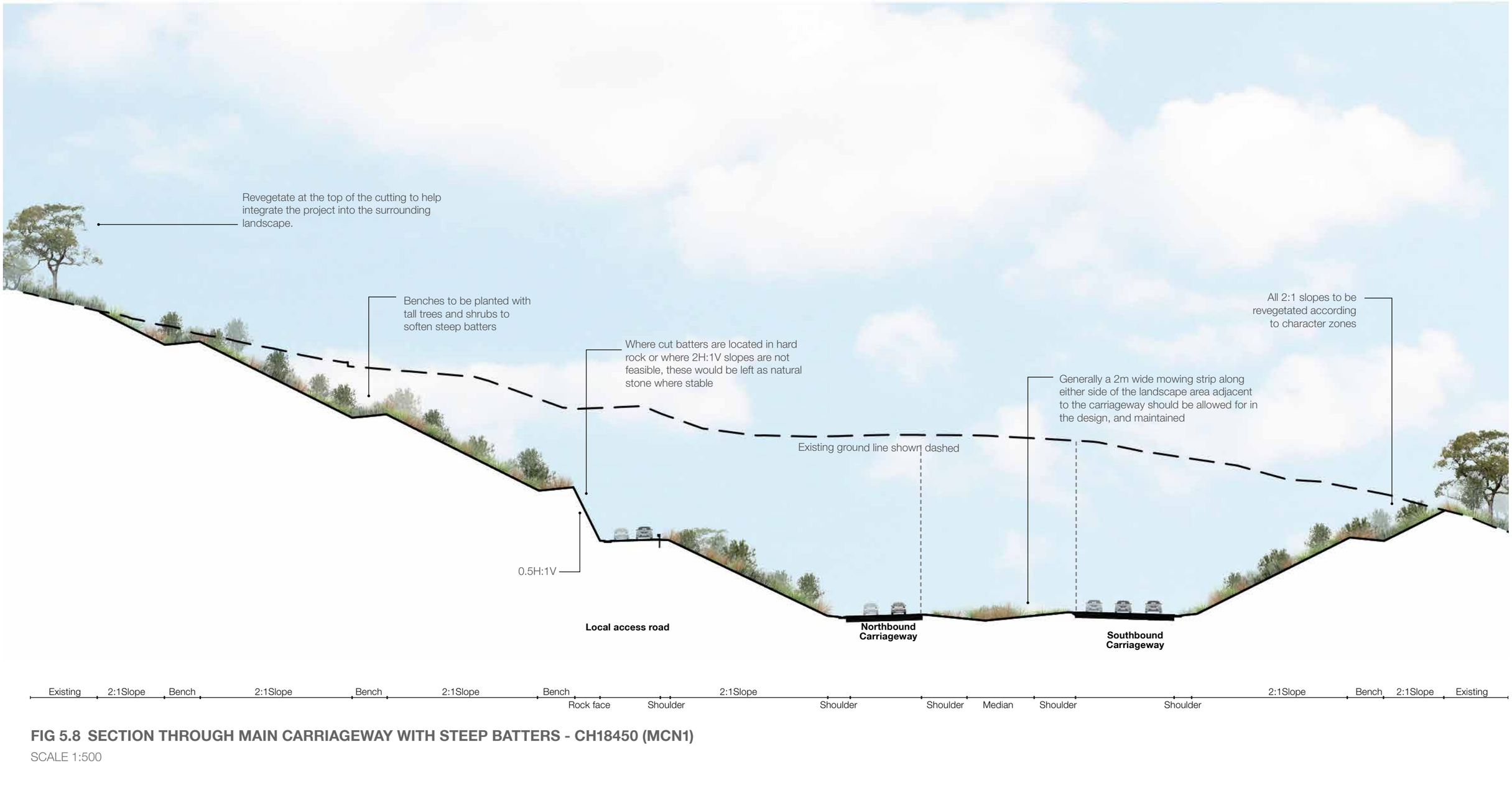


FIG 5.8 SECTION THROUGH MAIN CARRIAGEWAY WITH STEEP BATTERS - CH18450 (MCN1)

SCALE 1:500

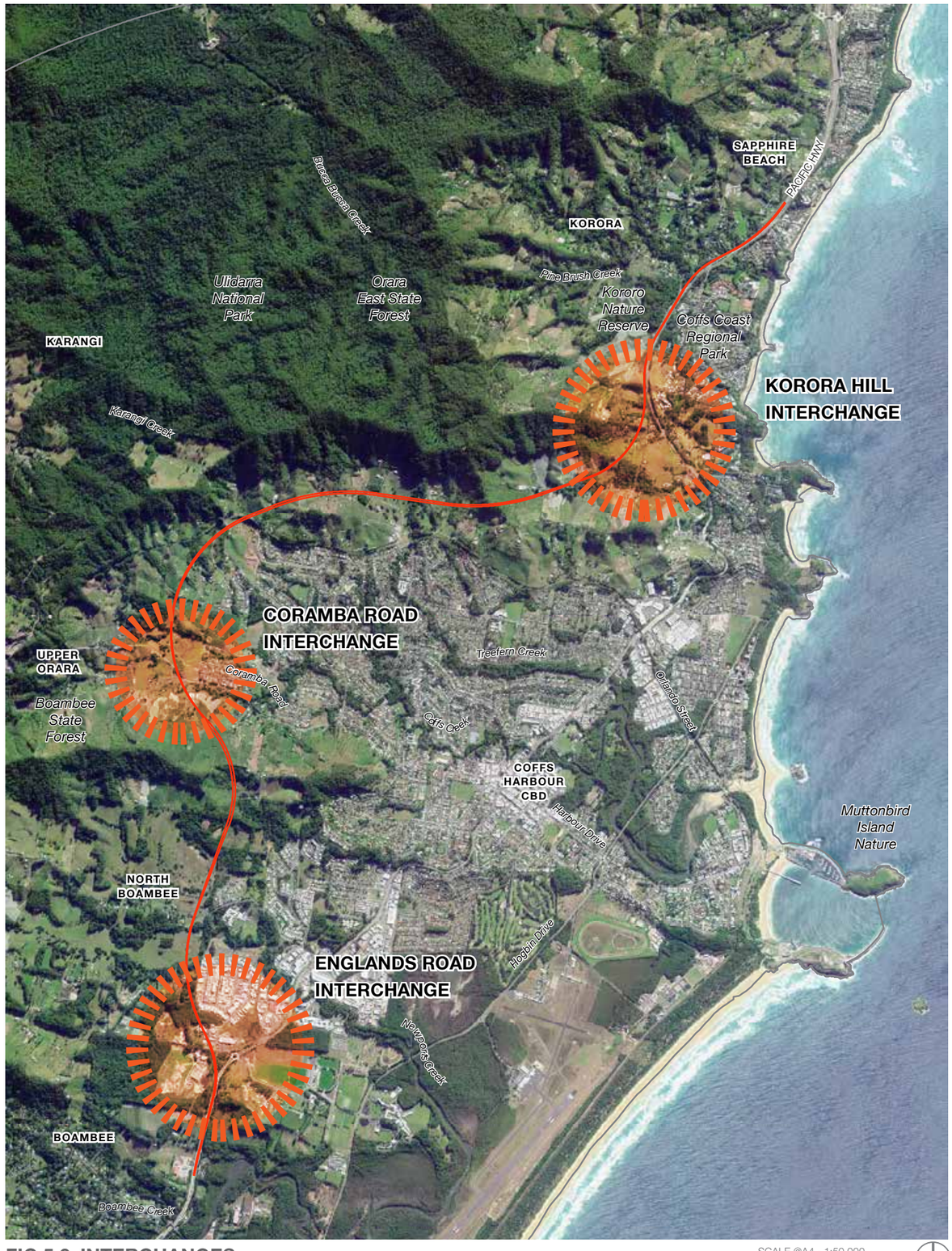
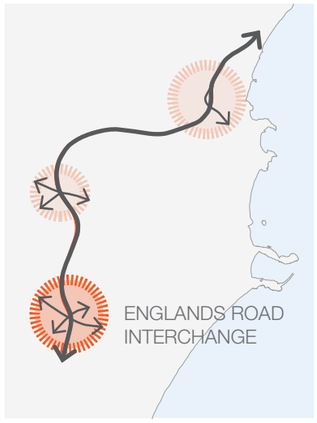


FIG 5.9 INTERCHANGES

5.2 Interchange design

Interchanges are important markers on the road journey and will provide gateways to Coffs Harbour. Through considerate urban and landscape design, the interchange can exhibit an identity and unique features that help integrate the road into the surrounding environment, complimenting the themes of this project.

The urban design strategy in Chapter 4 outlines strategic considerations that inform the urban and landscape design of the interchange.



Englands Road interchange

"The Southern Gateway on Coffs Harbour Coast"

The Englands Road interchange is the southern entry for northbound motorists to Coffs Harbour and is a key landmark on the Pacific Highway journey. The concept considers the provision of sculpted landscape mounds planted to continue the green corridors. There is an opportunity for the mounds to be formed with the excess soil from road construction works.

Framing views from the highway out over the interchange and generating a sense of arrival are also considered in the concept design. Within the interchange there is opportunity to integrate an interpretive feature inspired by the surrounding natural environment of the area, in particular the ocean tides, ripples of water and sand of the coastal Coffs Harbour setting.

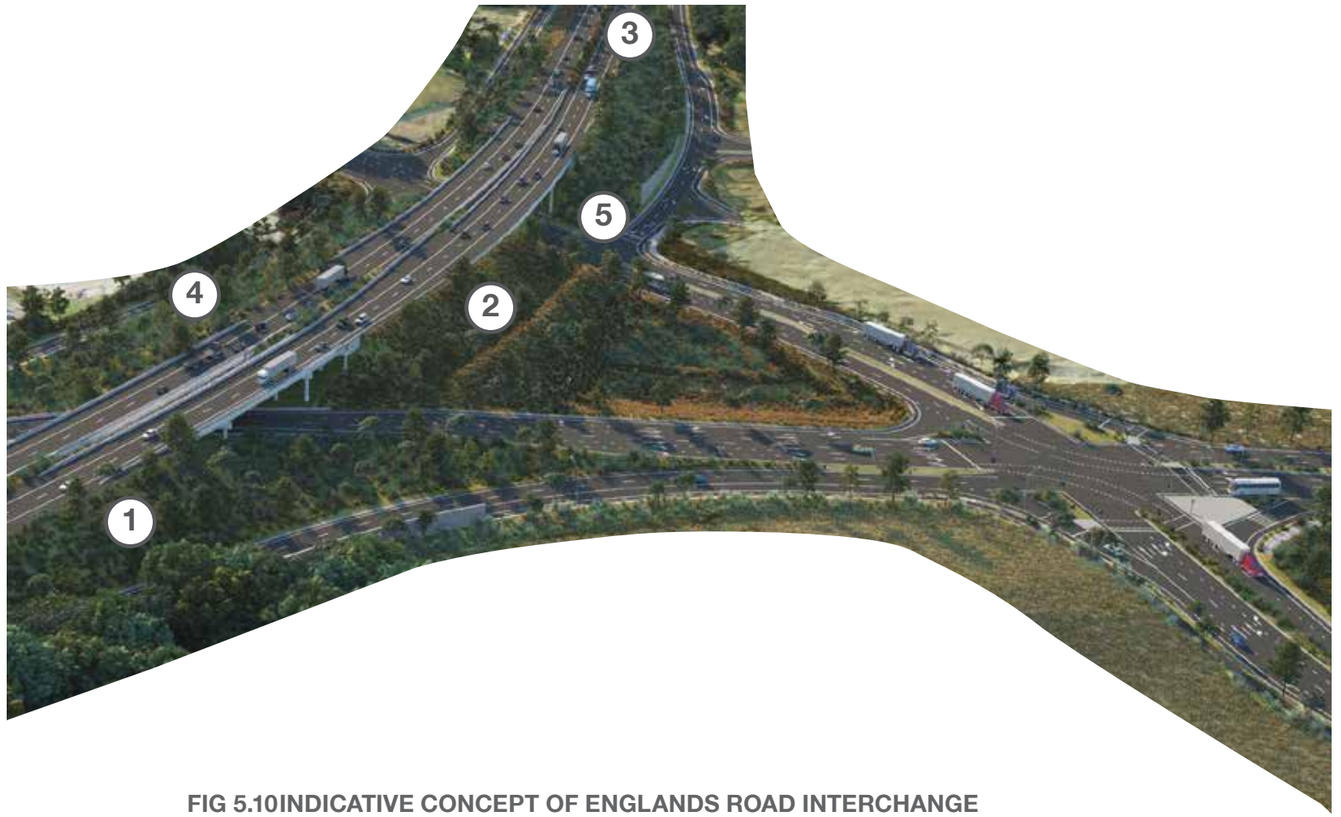
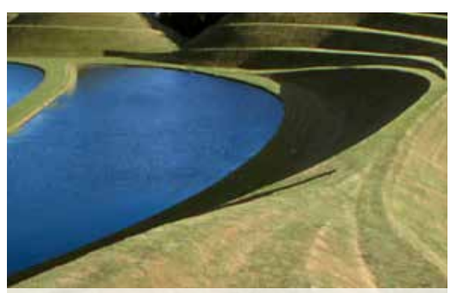


FIG 5.10INDICATIVE CONCEPT OF ENGLANDS ROAD INTERCHANGE

Key

1. Vertical planting along edge of roads to delineate road curves and turns
2. Structured clumps of trees (different species mix to other interchanges) laid out geometrically or in a pattern throughout interchanges to signify gateway and transitions and frame views where possible
3. Vegetated median to match interchange planting
4. Elevated slopes laid out with patterned planting and mounded topographies. Tree planting to be kept below level of highway to allow views across wider landscape
5. Under highway bridge structures to provide a gateway experience and be sympathetic to the context through use of materials and design of structural forms

LANDSCAPE MOUND PRECEDENT
(LINDSAY PRYOR NATIONAL ARBORETUM)

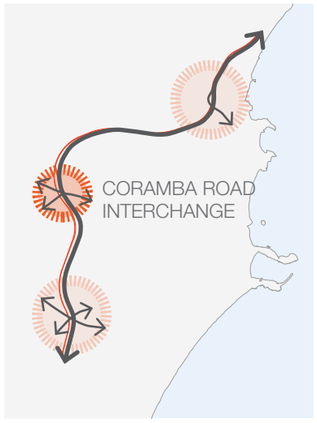


LANDSCAPE MOUND PRECEDENT
(GARDEN OF COSMIC SPECULATION)

LANDSCAPE MOUND PRECEDENT
(GARDEN OF COSMIC SPECULATION)

LANDSCAPE MOUND INSPIRATION
(JAPANESE ZEN GARDEN)

DRY SCLEROPHYLL VEGETATION

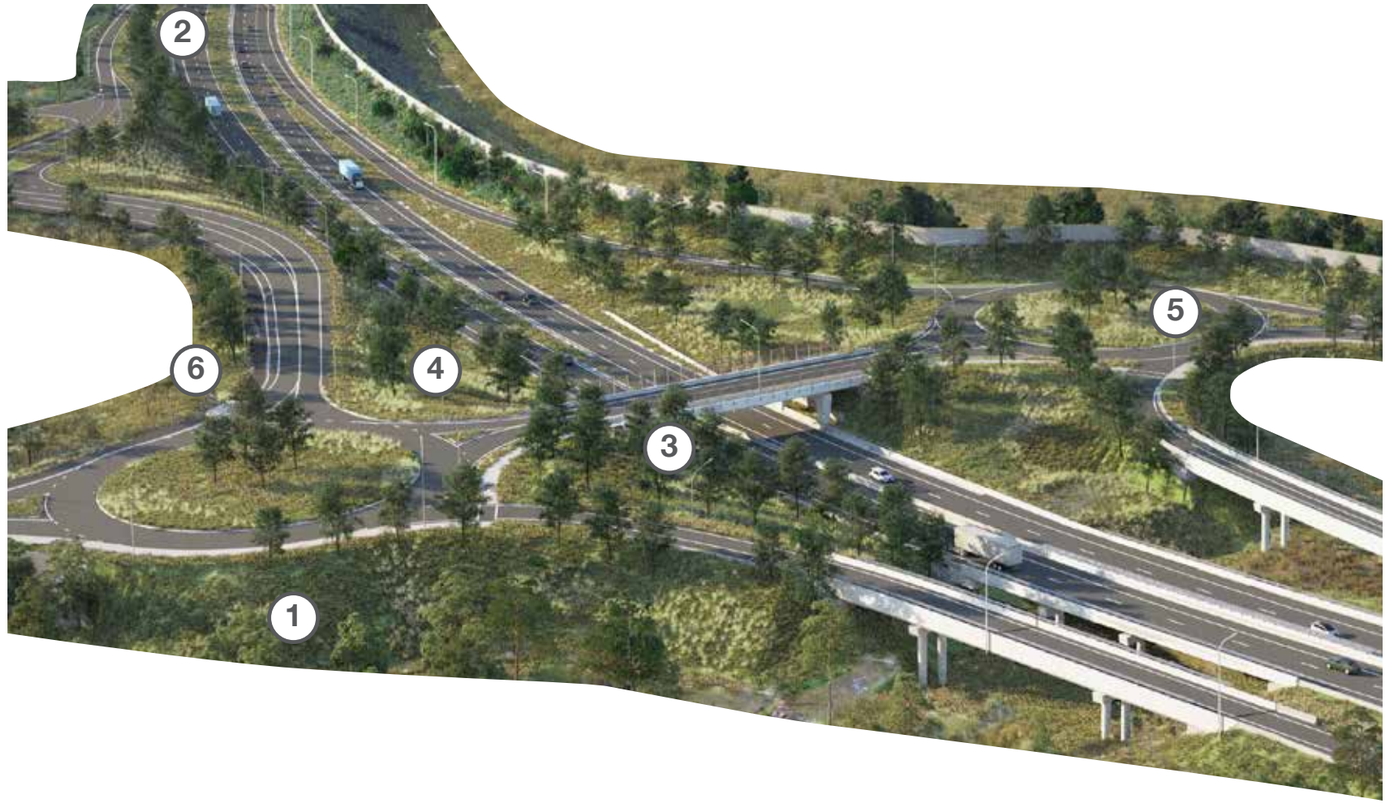


Coramba Road interchange

“A local gateway”

Coramba Road interchange is located adjacent to the western Coffs Harbour residential fringe, in the northern footslopes of Roberts Hill, and bridging over Coffs Creek. It is primarily used by residents accessing the west of Coffs Harbour CBD and the Orara Valley.

The concept design of this interchange takes a natural approach utilising landforms that responds to the existing natural wetland/riparian landscapes. The planting, materiality and views sympathetic to the local area reflect landscape typologies that can be experienced from the road.



1. Vegetated batters to match interchange planting.
2. Vegetated median to match interchange planting.
3. Design of structures to be sympathetic to landscape and context through use of materials and design of forms.
4. Structured clumps of trees (different species mix to other interchanges) laid out geometrically or in a pattern throughout interchanges to signify gateway and transitions.
5. Vegetated roundabout with subtle mounding and structured planting to create restrained ‘local’ feel to interchange.
6. Opportunity for water retention and treatment.

FIG 5.11 INDICATIVE CONCEPT OF CORAMBA ROAD INTERCHANGE

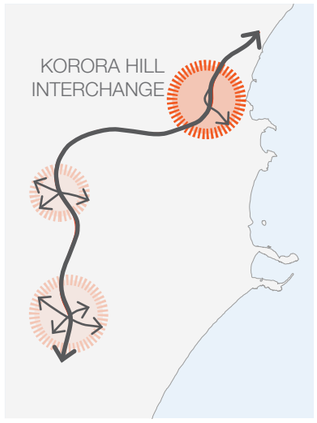

LANDFORM WILL RESPOND TO THE NATURAL WETLAND/ RIPARIAN SETTING


PLANTING, MATERIALITY AND VIEWS SYMPATHETIC TO THE LOCAL AREA PRECEDENT


OPPORTUNITY TO INTEGRATE WATER RETENTION BASINS IN THE INTERCHANGE


LANDSCAPE PRECEDENT (ONEWA ROAD INTERCHANGE)


LANDSCAPE PRECEDENT (ONEWA ROAD INTERCHANGE)



Korora Hill interchange

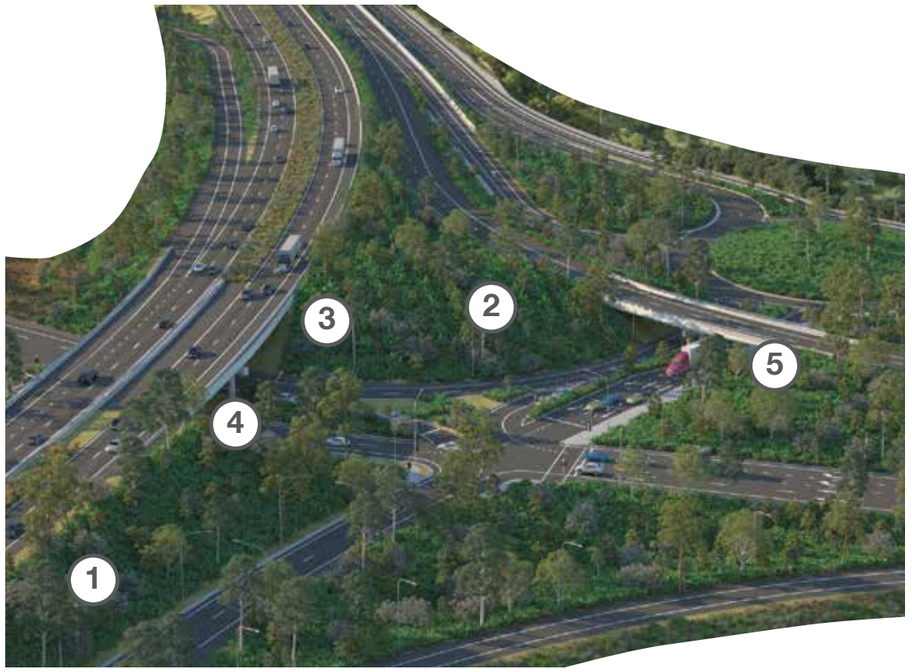
"The Northern and City Centre Gateway"

The Korora Hill interchange is the major northern interchange for Coffs Harbour, the CBD and coastal resorts. It is considered a key landmark on the Pacific Highway journey. The concept design at this interchange reflects a more urbanised environment due to the complex traffic movements required, adjacent urban development and connection into the CBD.

Elements including retaining walls, noise walls, feature planting and median design will be considered as a composition that provides road users with a sense of arrival as they approach the interchange.

The landscape design narrative at this interchange references local landscapes, particularly the escarpment meeting the coastline. Drawing from indigenous references, the place name Korora which translates to "stormy seas" and "where the waves make a loud noise" inspires the urban and landscape design through plant selection and planting arrangement. The concept design aims to maximise landscape planting widths where possible, for example, where retaining walls are located adjacent to on/off ramps to soften hard elements.

Views of Coffs Harbour and the Ulidarra National Park are to be retained whilst views from adjacent residents to the road should be screened where possible.



Key

1. Structured clumps of trees (different species mix to other interchanges) laid out geometrically or in a pattern throughout interchanges to signify gateway and transitions
2. Revegetation between structures where possible to soften visual impact
3. Retaining walls to be sympathetic to context through restrained use of materials and patterning, soften walls with planting along front
4. Architectural lighting or installations under overpass to reduce overshadowing effect and mitigate visual impacts of structures
5. Design of structures to be sympathetic to landscape and context through use of materials and design of forms

FIG 5.12INDICATIVE CONCEPT OF KORORA HILL INTERCHANGE


NOISE WALL URBAN TREATMENT PRECEDENT (BRUNSWICK-YELGUN BYPASS)


NOISE WALL URBAN TREATMENT PRECEDENT (HUNTER EXPRESSWAY)


NOISE WALL WITH PLANTING PRECEDENT (BONVILLE)


RETAINING WALL TREATMENT PRECEDENT (BRUNSWICK-YELGUN


RETAINING WALL TREATMENT PRECEDENT (BRUNSWICK-YELGUN BYPASS)

PATTERNED WALLS PROVIDE VISUAL INTEREST THAT CAN RELATE TO CONTEXT AND DISCOURAGE GRAFFITI VANDALISM.

5.3 Noise attenuation

The noise attenuation locations and extents have been determined through a noise and vibration assessment. Based on this information, potential locations for noise walls and mounds have been identified along the project. The exact height, location and design would be further investigated during detailed design.

The following table and plans outline the proposed locations, extents, finish and termination details. Two types of noise attenuation are proposed across the project, depending on their location.

These include:

- Transparent noise walls
- Solid noise walls (with and without vegetated earthmound).

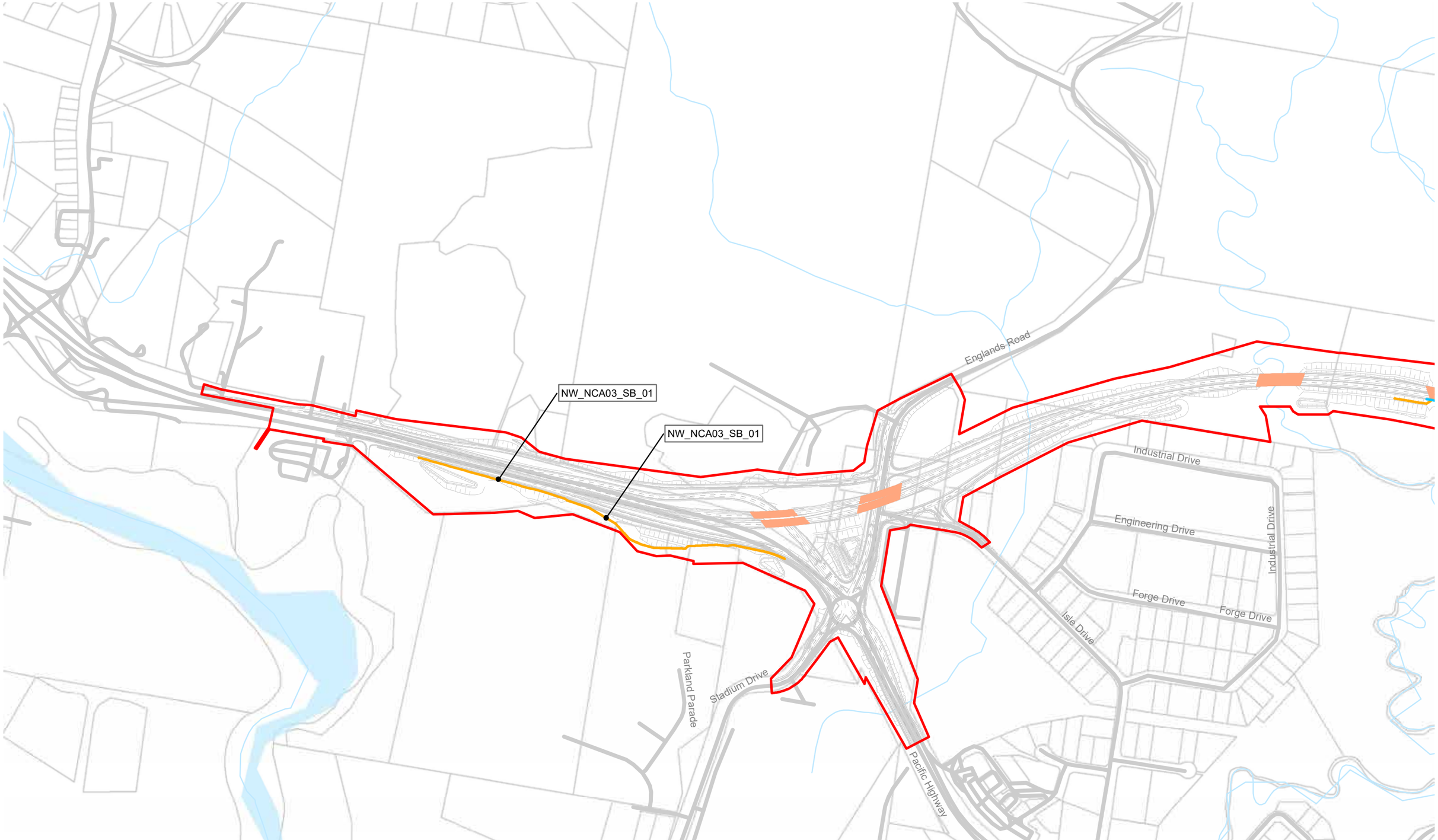
ARTIST IMPRESSION OF THE PROJECT AT GATELYS ROAD ILLUSTRATING THE NOISE ATTENUATION

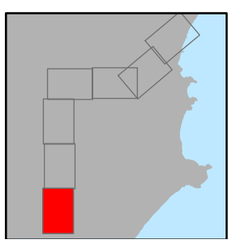
Noise Walls location and category/context

Noise Wall No.	Approx. Chainage	Approx. Length (m)	Height	Construction Type	Proposed Finish (Subject to Detailed Design)
NW_NCA03_SB_01	9830 - 10590	800	5.0	Pre-cast Concrete Vertical Panel, Overlapped to hide Vertical Steel Post on both sides, On ground	Pattern on noise wall to both the highway and residential sides of the wall Vegetated to both sides of wall where possible
NW_NCA06_SB_01	11900 - 13560	1558	5.0	Pre-cast Concrete Vertical Panel, Overlapped to hide Vertical Steel Post on both sides, On ground	Pattern on noise wall to both the highway and residential sides of the wall Vegetated to both sides of wall where possible
NW_NCA13_SB_01	14515 - 15430	1015	3.5	Pre-cast Concrete Vertical Panel, Overlapped to hide Vertical Steel Post on both sides, On ground	Pattern on noise wall to both the highway and residential sides of the wall Vegetated to both sides of wall where possible
NW_NCA14_SB_01	15430 - 16980	1306	4.5	Pre-cast Concrete Vertical Panel, Overlapped to hide Vertical Steel Post on both sides, On ground	Pattern on noise wall to both the highway and residential sides of the wall Vegetated to both sides of wall where possible
NW_NCA14_SB_01	As above.	220	4.5	Transparent clear Panel, Vertical Steel Post facing off highway, On barrier	Transparent
NW_NCA18_SB_01*	17820 - 18870	1100	4.5	Pre-cast Concrete Vertical Panel, Overlapped to hide Vertical Steel Post on both sides, On ground	Pattern on noise wall to both the highway and residential sides of the wall Vegetated to both sides of wall where possible
NW_NCA25_SB_01	21700 - 22150	530	3.0	Existing Pre-cast Concrete noise wall to be relocated	Existing noise wall
NW_NCA26_SB_01*	22150 - 22725	667	5.0	Pre-cast Concrete Vertical Panel, Overlapped to hide Vertical Steel Post on both sides, On ground	Pattern on noise wall to both the highway and residential sides of the wall
NW_NCA28_SB_01*	22725 - 23650	969	3.0	Pre-cast Concrete Vertical Panel, Overlapped to hide Vertical Steel Post on both sides, On ground	Transition from Transparent to Solid at interface with existing Noise Wall

* Opportunity for transparent noise wall pending further review

Table 5.1 NOISE ATTENUATION





Legend

- Construction footprint
- Bridge
- Tunnel

Noise wall type

- Solid
- Transparent
- * Opportunity for combined solid and transparent noise wall

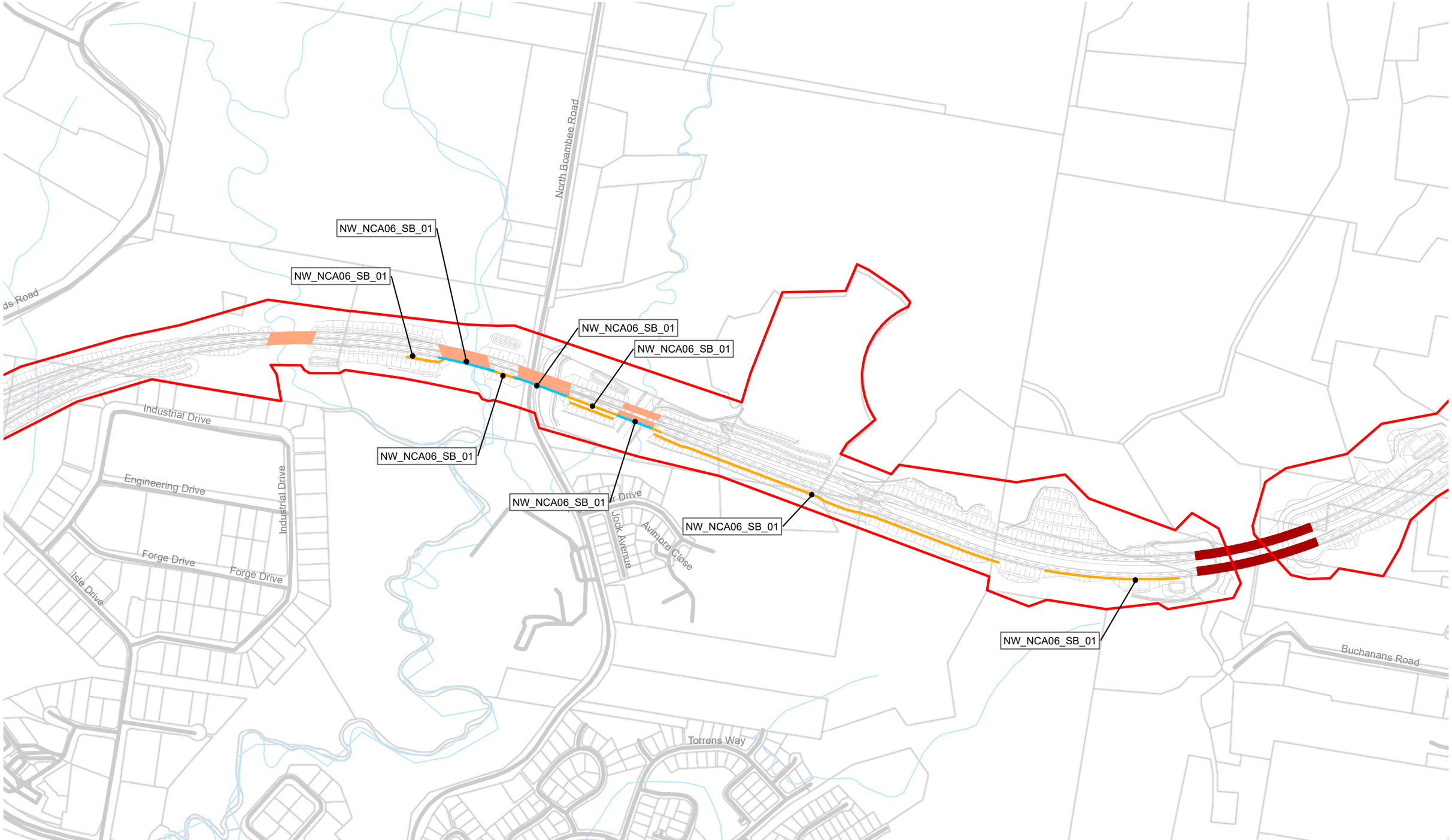
SCALE @A3 - 1:7,500

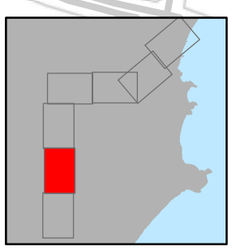
0 200 400 m

Grid: GDA 1994 MGA Zone 56

Noise mitigation location plan

Sheet 1 of 7





Legend

- Construction footprint
- Bridge
- Tunnel

Noise wall type

- Solid
- Transparent

* Opportunity for combined solid and transparent noise wall

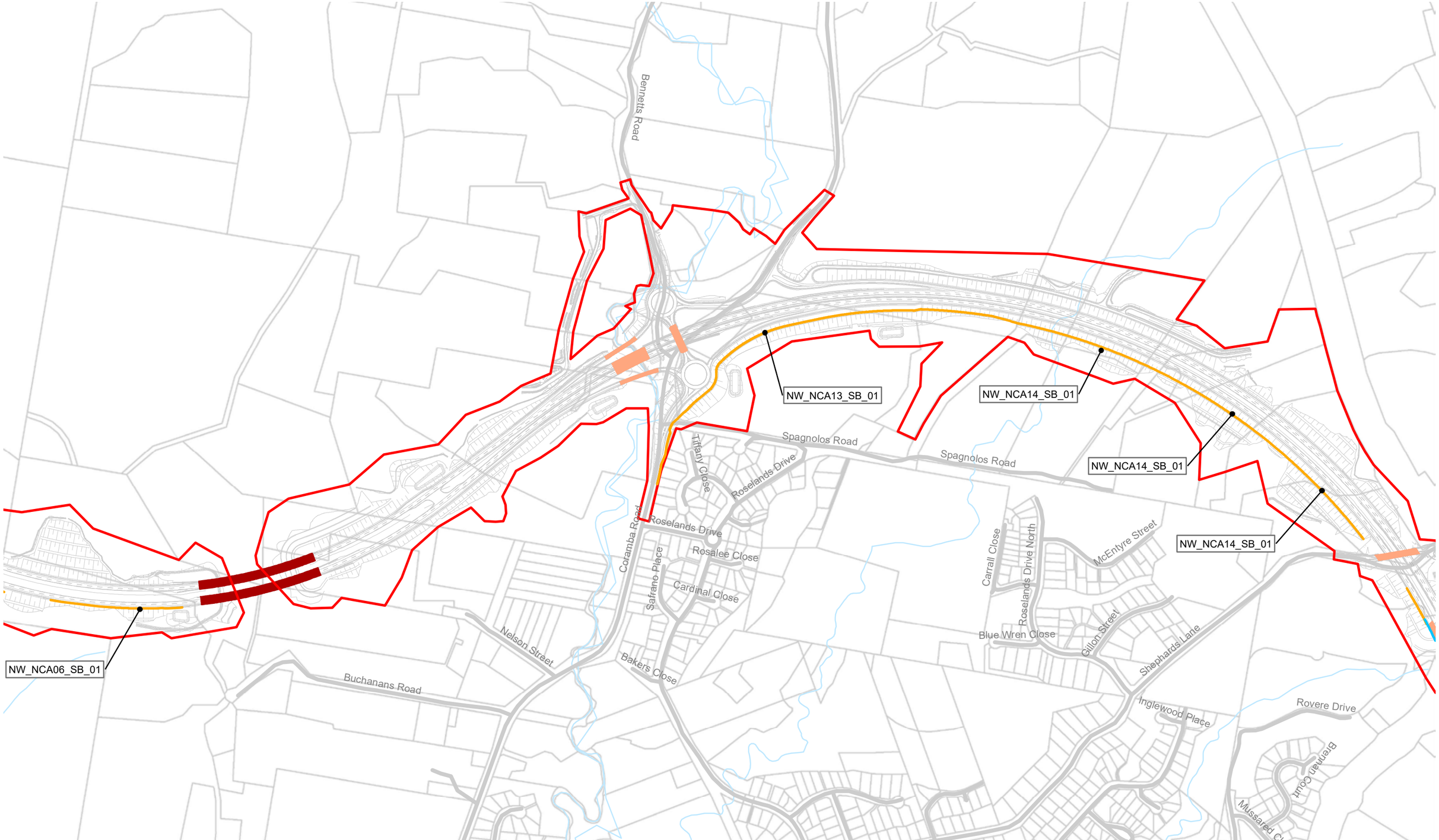
SCALE @A3 - 1:7,500

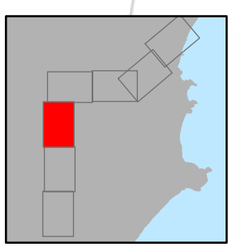
0 200 400 m

Grid: GDA 1994 MGA Zone 56

Noise mitigation location plan

Sheet 2 of 7





Legend

- Construction footprint
- Bridge
- Tunnel

Noise wall type

- Solid
- Transparent
- * Opportunity for combined solid and transparent noise wall

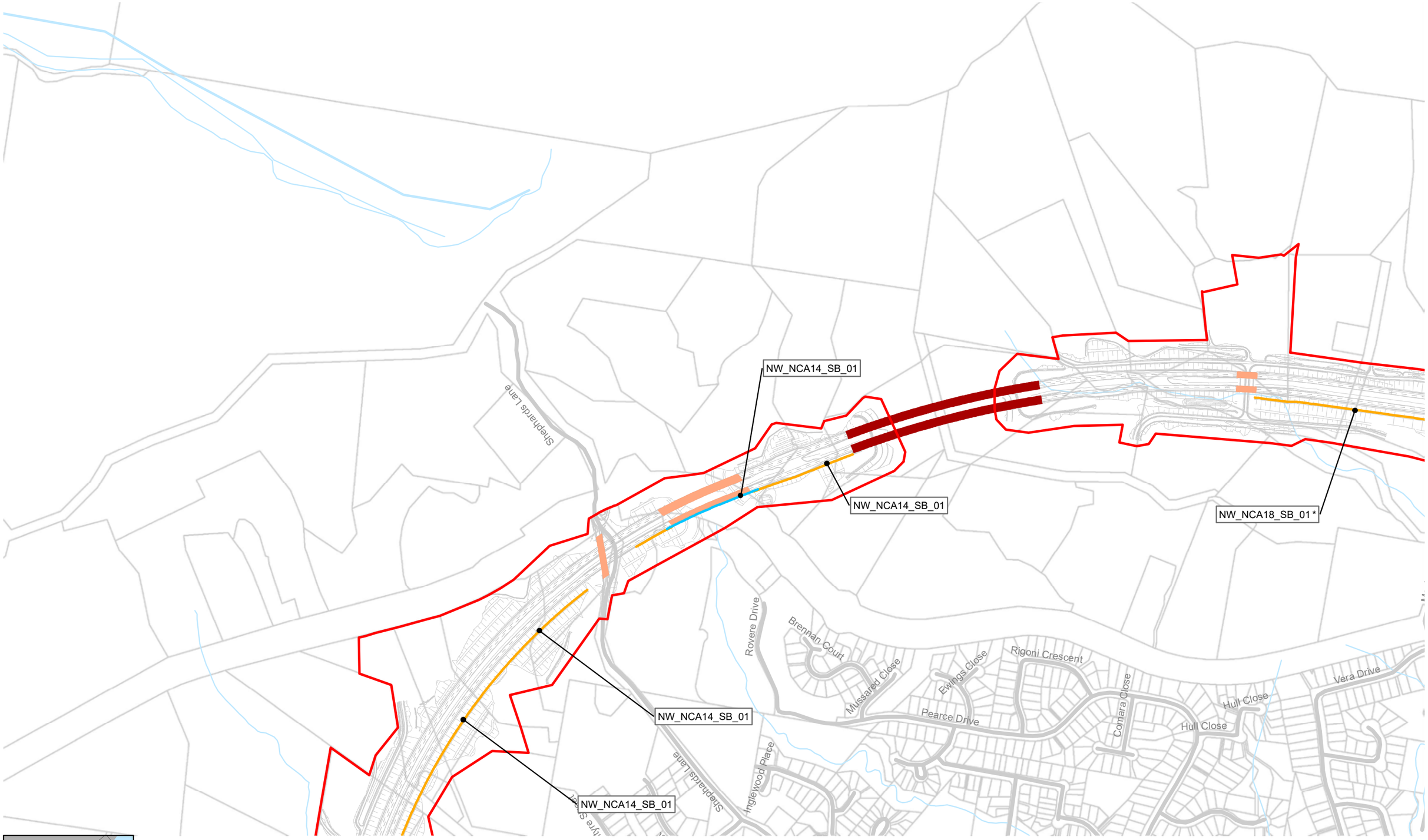
SCALE @A3 - 1:7,500

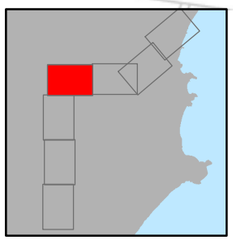
0 200 400 m

Grid: GDA 1994 MGA Zone 56

Noise mitigation location plan

Sheet 3 of 7





Legend

- Construction footprint
- Bridge
- Tunnel

Noise wall type

- Solid
- Transparent

* Opportunity for combined solid and transparent noise wall

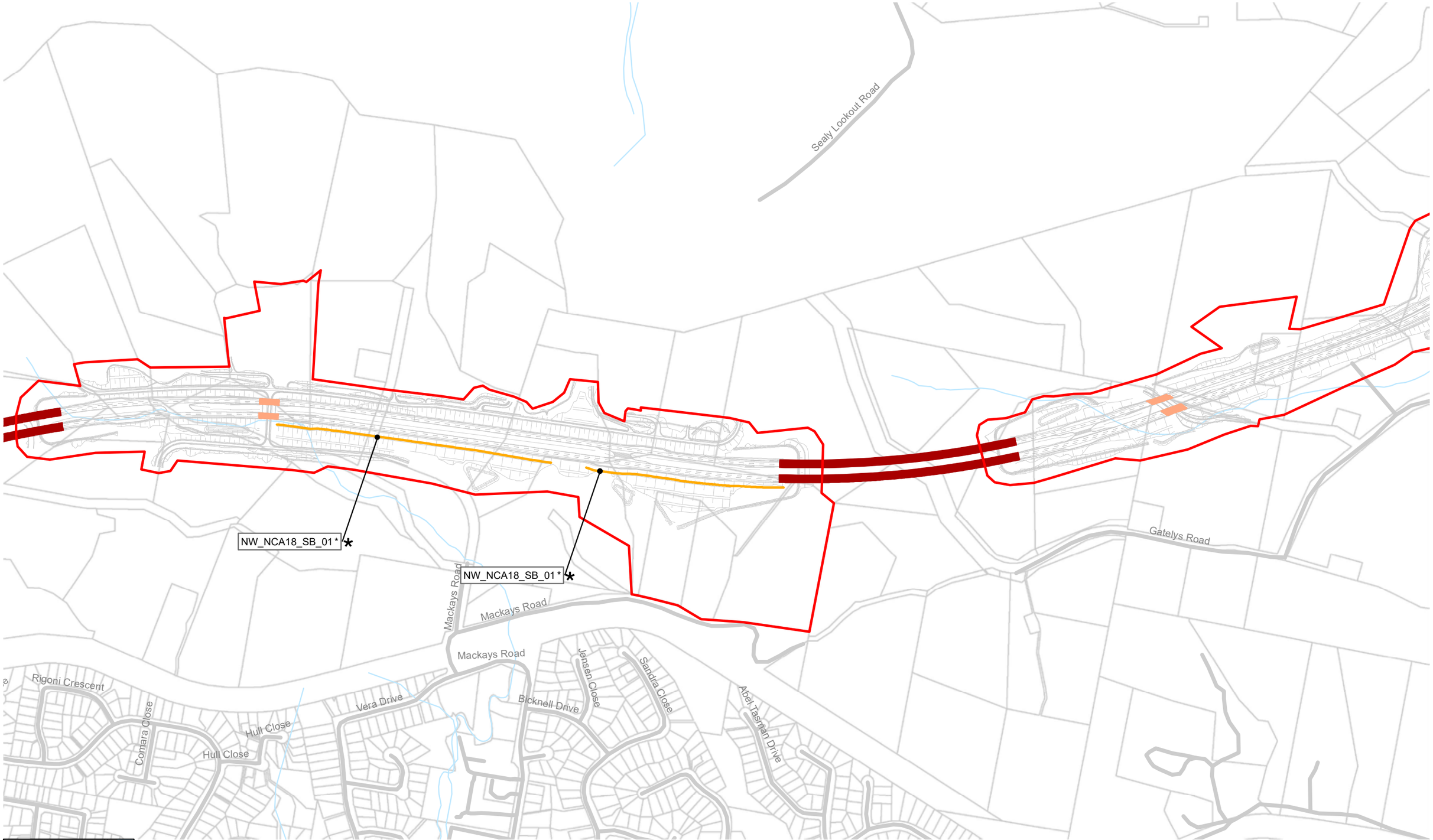
SCALE @A3 - 1:7,500

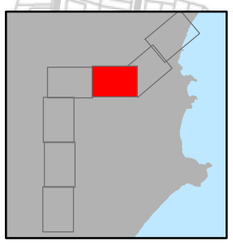
0 200 400 m

Grid: GDA 1994 MGA Zone 56

Noise mitigation location plan

Sheet 4 of 7





Legend

- Construction footprint
- Bridge
- Tunnel

Noise wall type

- Solid
- Transparent

* Opportunity for combined solid and transparent noise wall

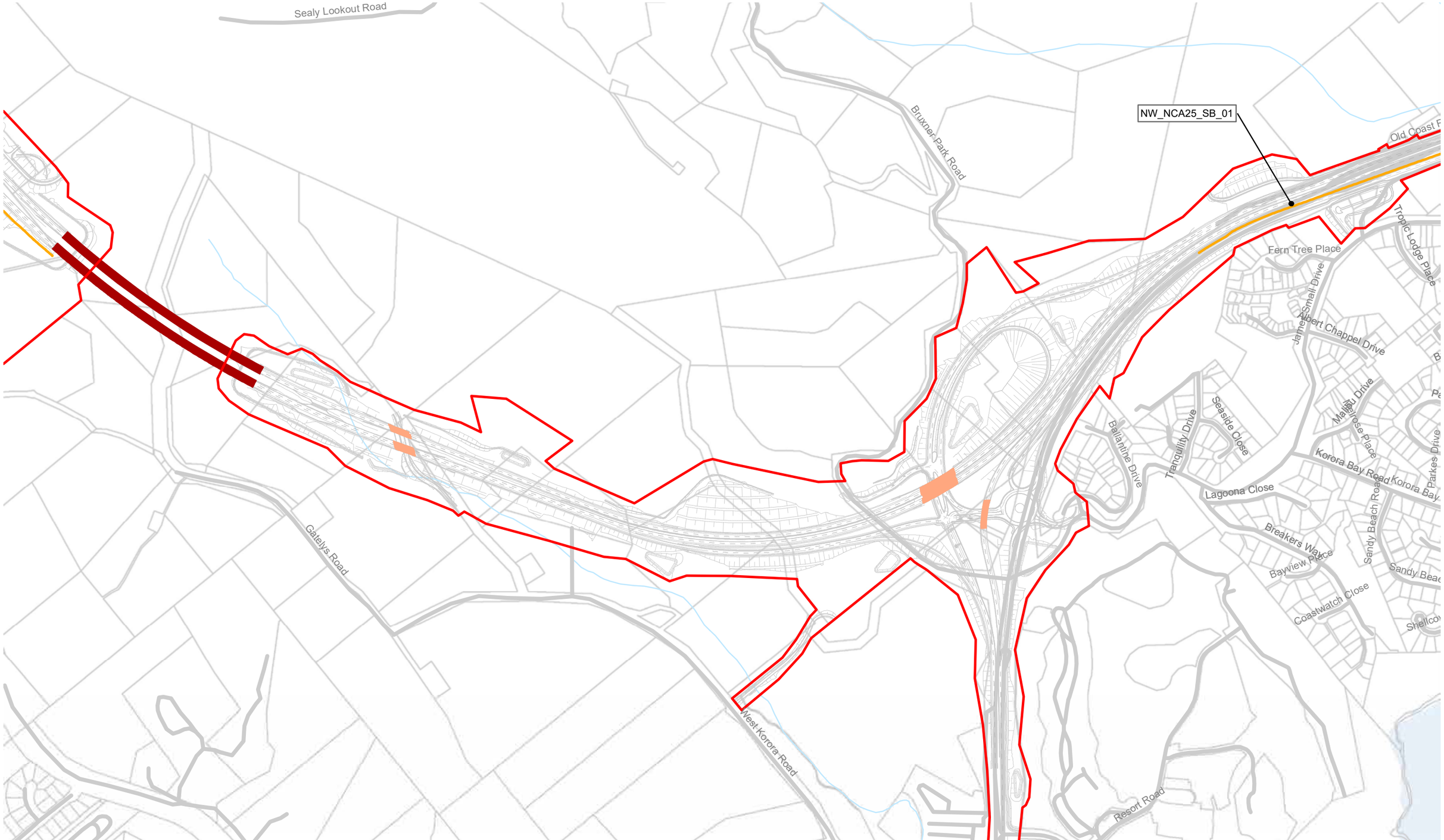
SCALE @A3 - 1:7,500

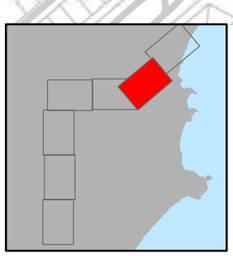
0 200 400 m

Grid: GDA 1994 MGA Zone 56

Noise mitigation location plan

Sheet 5 of 7





Legend

- Construction footprint
- Bridge
- Tunnel

Noise wall type

- Solid
- Transparent

* Opportunity for combined solid and transparent noise wall

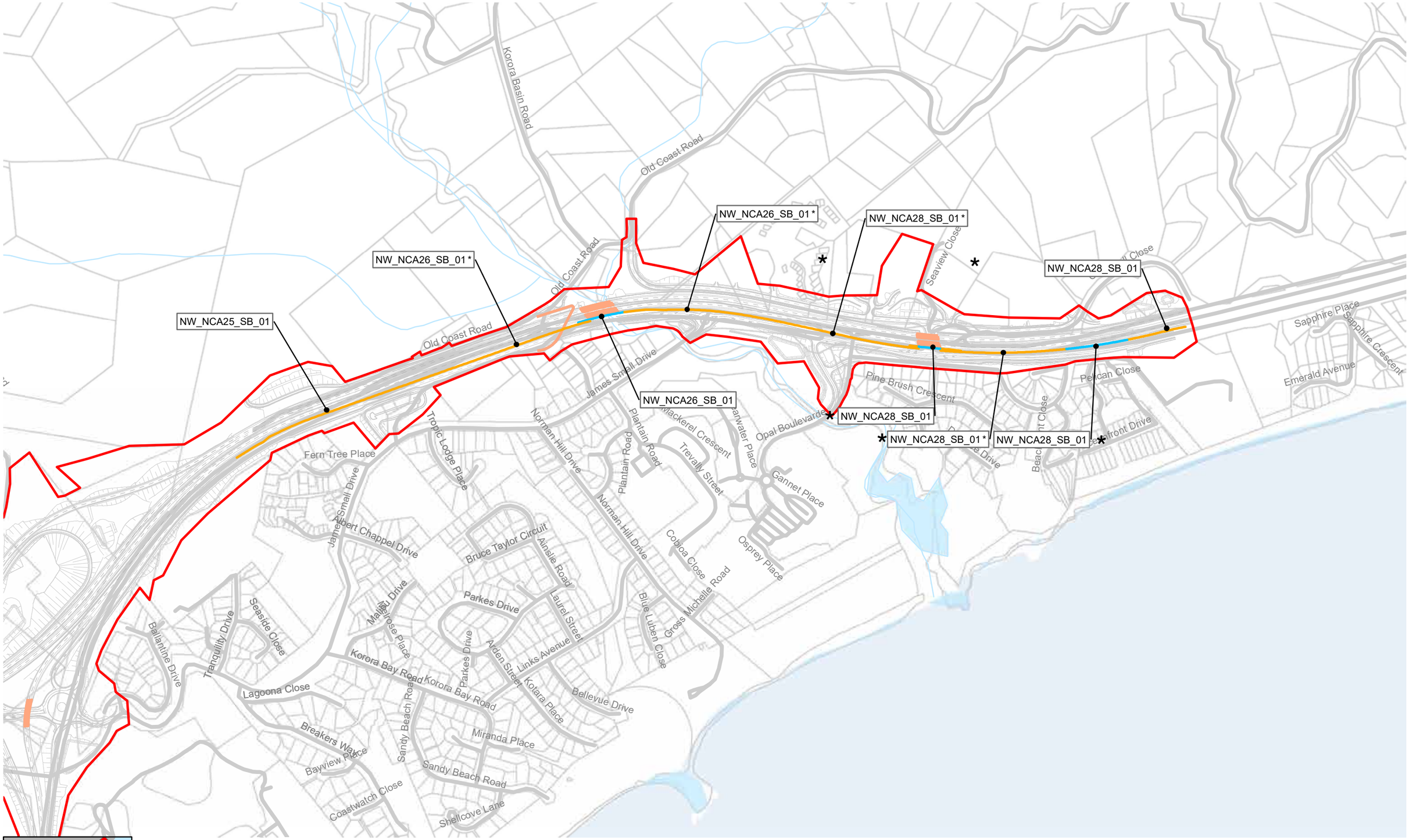
SCALE @A3 - 1:7,500

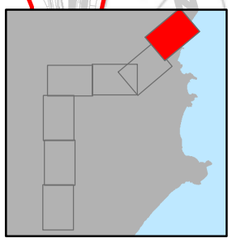
0 200 400 m

Grid: GDA 1994 MGA Zone 56

Noise mitigation location plan

Sheet 6 of 7





Legend

- Construction footprint
- Bridge
- Tunnel

Noise wall type

- Solid
- Transparent

* Opportunity for combined solid and transparent noise wall

SCALE @A3 - 1:7,500

0 200 400 m

Grid: GDA 1994 MGA Zone 56

Noise mitigation location plan

Sheet 7 of 7

Solid noise wall with vegetated mounds

Vegetated mounds help provide a “green” corridor experience sympathetic in character to the adjacent Coffs Harbour landscape. The vegetated mounds also assist in protecting views out from the road corridor and provide visual screening for the adjacent residents.

Combined noise wall and vegetated mounds are used where space constraints prevent the mound reaching the required noise attenuation height. In these situations, mounds are vegetated to soften the noise walls where possible and help to continue the green roadside corridor.

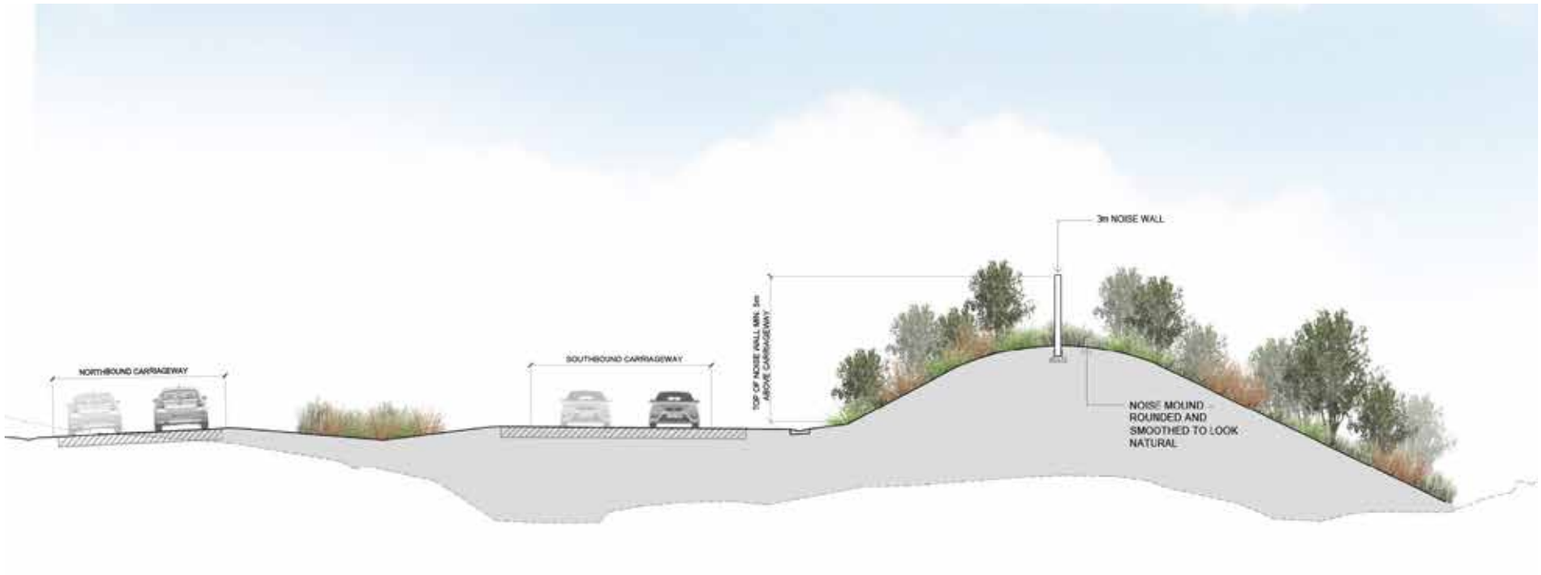


FIG 5.13TYPICAL SECTION OF VEGETATED MOUND WITH NOISE WALL

SCALE 1:250

0 10m

Solid noise walls

On solid walls, patterns create visual interest and help with navigating road corridors. The design references a banana leaf pattern on the solid walls facing the highway, referencing the banana crops particular to the Coffs Harbour region.

Addressing the back side of the wall, facing the urban areas or adjacent landscapes, the wall would be painted with two alternating colour tones. This helps to provide a clean and amenible finish to the noise wall.

Transparent noise walls

Transparent walls are used in areas where views can be observed from the highway to the adjacent landscape or distant coast. Transparent walls are also used on road bridges to minimise the heavy road infrastructure and noise in the adjacent areas. Transparent panels are used on approach to Coffs Harbour to provide identity to the road journey experience. They help to facilitate scenic views across the surrounding landscape.

Both the overshadowing analysis and the coastal views analysis identify opportunities for design refinement of the noise walls during the detailed design stage regarding use of transparent panels. However, the use of transparent panels would need to be considered in conjunction with the Ppotential consideration oforf associated glare impacts which could result in road user safety concerns or nuisance impacts to adjacent residential properties. The potential for glare impacts arising from full length transparent panels will also be considered during this future design stage. In addition, given the alignment of, particularly adjacent to Shephards Lane and Gatelys Road tunnel, the potential for glare impacts associated with the in the morning sun for northbound road users will also be investigated.

Oppportunities during detailed design

Noise walls in urban areas have the potential to create a “canyon” effect by distinctly separating two sides of the road with the high walls. Combined solid and transparent noise walls offer the opportunity of enclosing and screening views from adjacent properties, whilst providing opportunities to soften the road infrastructure and walled experience and visually break down bulk and scale.

Opportunities to consider combined solid and transparent noise walls have been included the noise wall drawings with an asterisk. During detailed design, consideration will be given to combining solid and transparent noise walls with the upper sections of the noise wall being transparent to reduce the extent ot potential overshadowing and with the lower levels remaining as solid to mitigate potential visual impacts of passing vehicles on surrounding properties. Potential consideration of glare impacts arising from full length transparent panels will also be considered during this future design stage.

EXAMPLE OF PATTERNED CONCRETE WALL IN A HIGHWAY CONTEXT

BANANA LEAF PLANTATION AT COFFS HARBOUR

BANANA LEAF PLANTATION AT COFFS HARBOUR

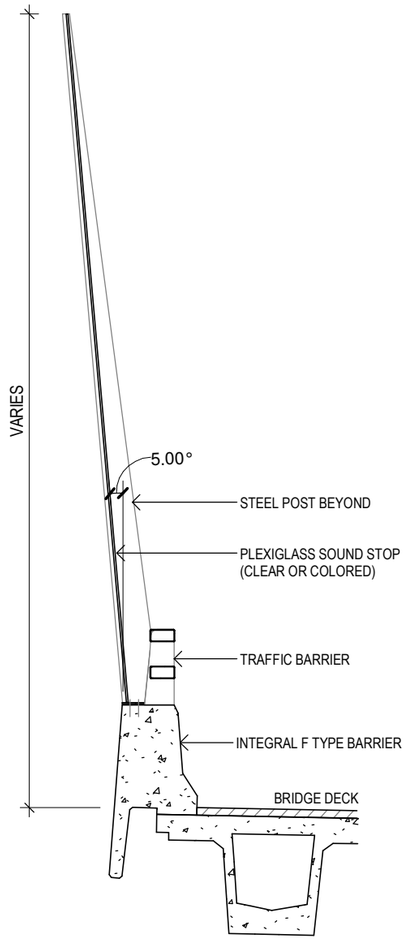


FIG 5.14TYPICAL SECTION

Note: This typical section is indicative only. Design of the transparent noise wall to be confirmed during detailed design and would address the noise wall performance criteria outlined in chapter 4.

0 2500mm

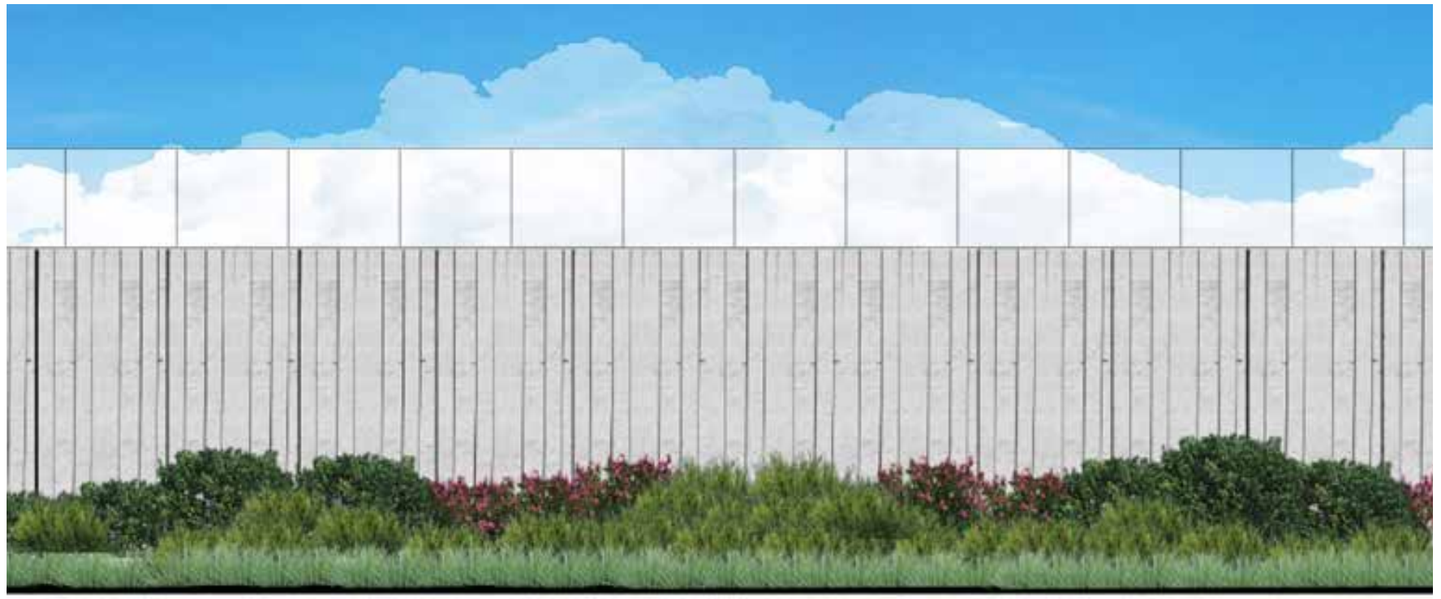


FIG 5.15TYPICAL ELEVATION TRANSPARENT CLEAR PANEL ABOVE SOLID WALL

0 5m

FIG 5.16TYPICAL ELEVATION FROM HIGHWAY - COMBINATION SOLID NOISE WALL

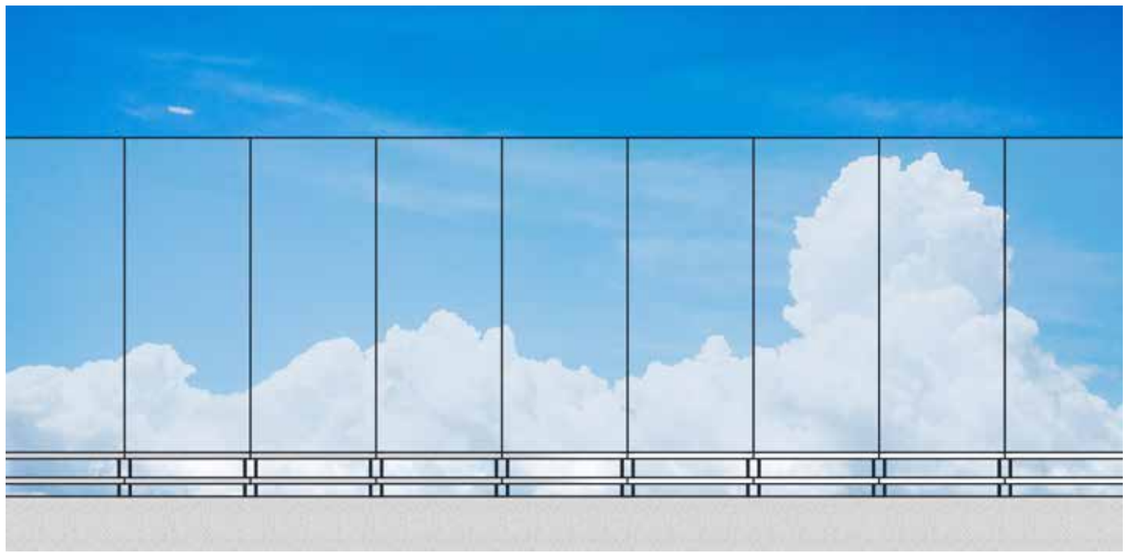


FIG 5.17 TYPICAL ELEVATION TRANSPARENT NOISE WALLS

0 5m

5.4 Retaining walls

The retaining wall extents and locations have been determined through a civil and structural design assessment. Based on this information a concept design has been formulated according to the context of where the wall faces.

There are four types of finishes related to the wall context. The four types are:

- Highway carriageway context: Ribbed groove patterned pre-cast concrete panel finish to match adjacent finishes in other upgrades
- Residential / Industrial context: Smaller scale patterned pre-cast concrete panel finish
- Bridge abutment walls on highway: Rectangular Groove Patterned pre-cast concrete panel finish
- Bridge abutment walls Off highway: Smaller scale patterned pre-cast concrete panel finish.

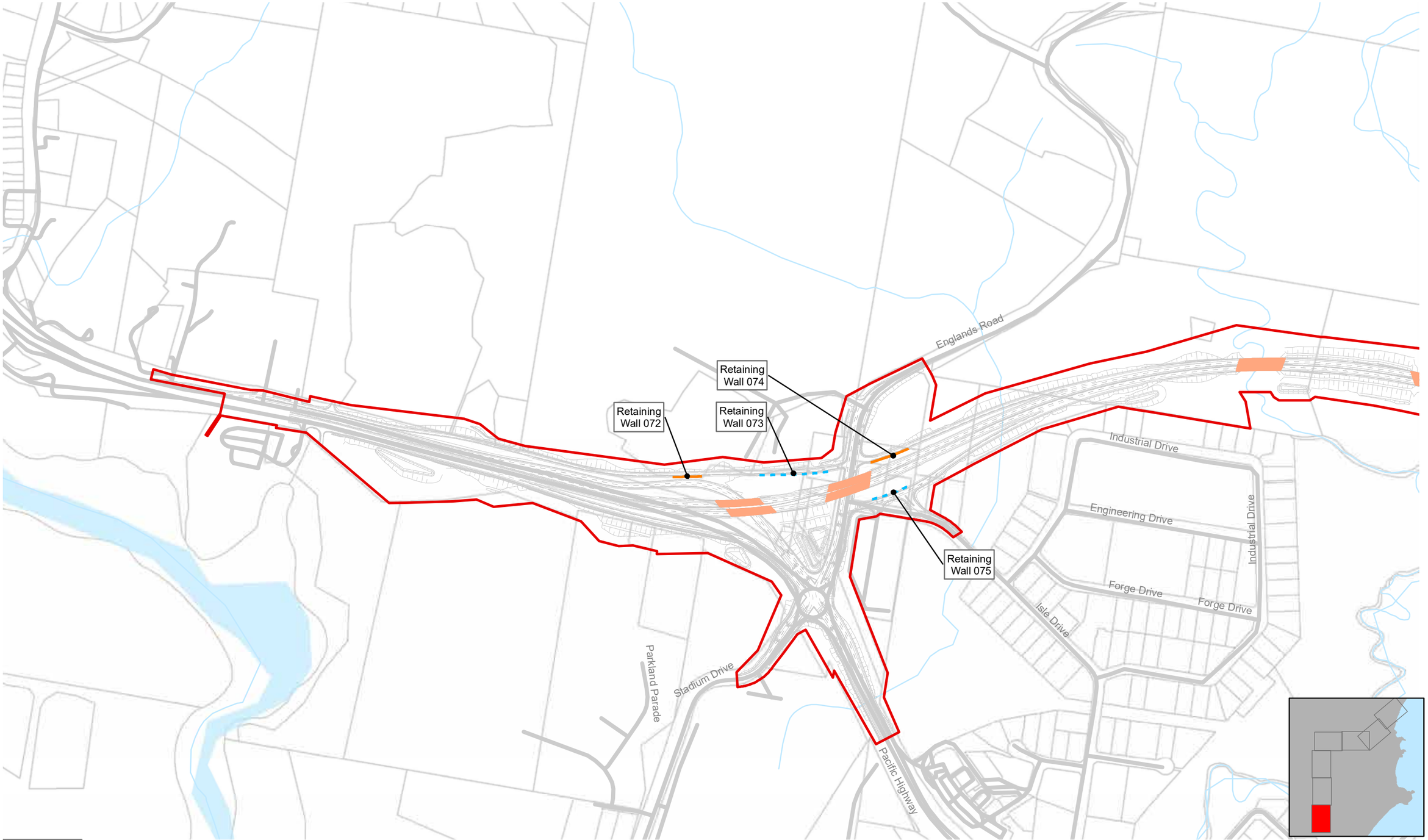
Walls and their location, height, length, context, structural type, proposed finish and context are itemised in the following schedule. These are concept only and would be subject to further design development during detailed design.

Retaining walls location and category/context

RW No.	Approx. chainage	Approx. length (m)	Max. height approx.	Location description	Structural wall type
RW01	22515 - 23066	544	3.3	Mainline - Western side	Reinforced concrete wall
RW02	23110 - 23210	44	5.5	Mainline - Western side	Reinforced concrete wall
RW03	23210 - 23420	206	7.2	Mainline - Western side	Reinforced concrete wall
RW04	21655-22317	651	3.3	Eastern Service Road	Reinforced concrete wall facing the Highway
RW04	As Above	Combined total of RW04	As Above	As Above	Combined Noise Wall and Retaining Wall
RW05	22900 - 23085	185	8.3	Mainline - Eastern side	Combined Noise Wall and Retaining Wall
RW06	23130 - 23345	217	9.0	Mainline - Eastern side	Combined Noise Wall and Retaining Wall
RW18	23100 (under Bridge 22)	54	8.4	New connecting road (southern side)	Bridge Abutment Walls
RW19	23200 (under Bridge 22)	57	9.7	New connecting road (southern side)	Bridge Abutment Walls
RW40	20980 - 21200	230	7.3	Korora Hill South Bound exit ramp	Reinforced soil wall facing the Highway
RW41	21900 - 22100	189	7.4	Kororo School Bus interchange	Reinforced soil wall facing off the Highway
RW43	21900-22000	128	1.9	Kororo School Bus interchange	Reinforced soil wall facing off the Highway
RW44	21100 - 21200	79	3.9	Eastern Service Road	Reinforced concrete wall facing the Highway
RW45	23250 - 23400	111	7.0	Western Service Road (Seaview Close)	Reinforced concrete wall facing the Highway
RW46	21400 - 21500; 21600 - 21700	260	2.4	Korora Hill South Bound exit ramp	Reinforced concrete wall facing the Highway
RW47	21050 - 21400	324	2.4	Korora Hill South Bound exit ramp	Reinforced concrete wall facing the Highway
RW50	23200 - 23400	179	10	Coachmans Close	Reinforced soil wall facing the Highway
RW72	10450 - 10500	119	1.5	Western side Englands Road	Reinforced concrete wall facing the Highway
RW73	10600 - 10720	138	4.1	Western Service Road (Englands Road)	Reinforced soil wall facing the Highway
RW74	10800 - 10900	82	3.0	Western Service Road (Englands Road)	Reinforced concrete wall facing the Highway
RW75	10800 - 10900	75	4.6	Englands Road South Bound exit ramp	Reinforced soil wall facing the Highway
RW100	14720 (under Bridge 09)	17	1.5	Under Coramba Interchange	Bridge Abutment Walls
RW101	14805 - 14880	76	5.0	Coramba Interchange North Bound entry ramp	Reinforced concrete wall facing the Highway
RW102	14950 - 15100	151	5.0	Coramba Interchange North Bound entry ramp	Reinforced concrete wall facing the Highway
RW106	14730 - 14690	123	10	Southern side of Bennetts Road	Reinforced soil wall facing off the Highway
RW109	18500	48	1.2	Mackays Road	Reinforced concrete wall facing off the Highway

Table 5.2 RETAINING WALLS

Retaining wall location plan



Reinforced concrete wall facing the highway

Reinforced concrete wall facing away from the highway

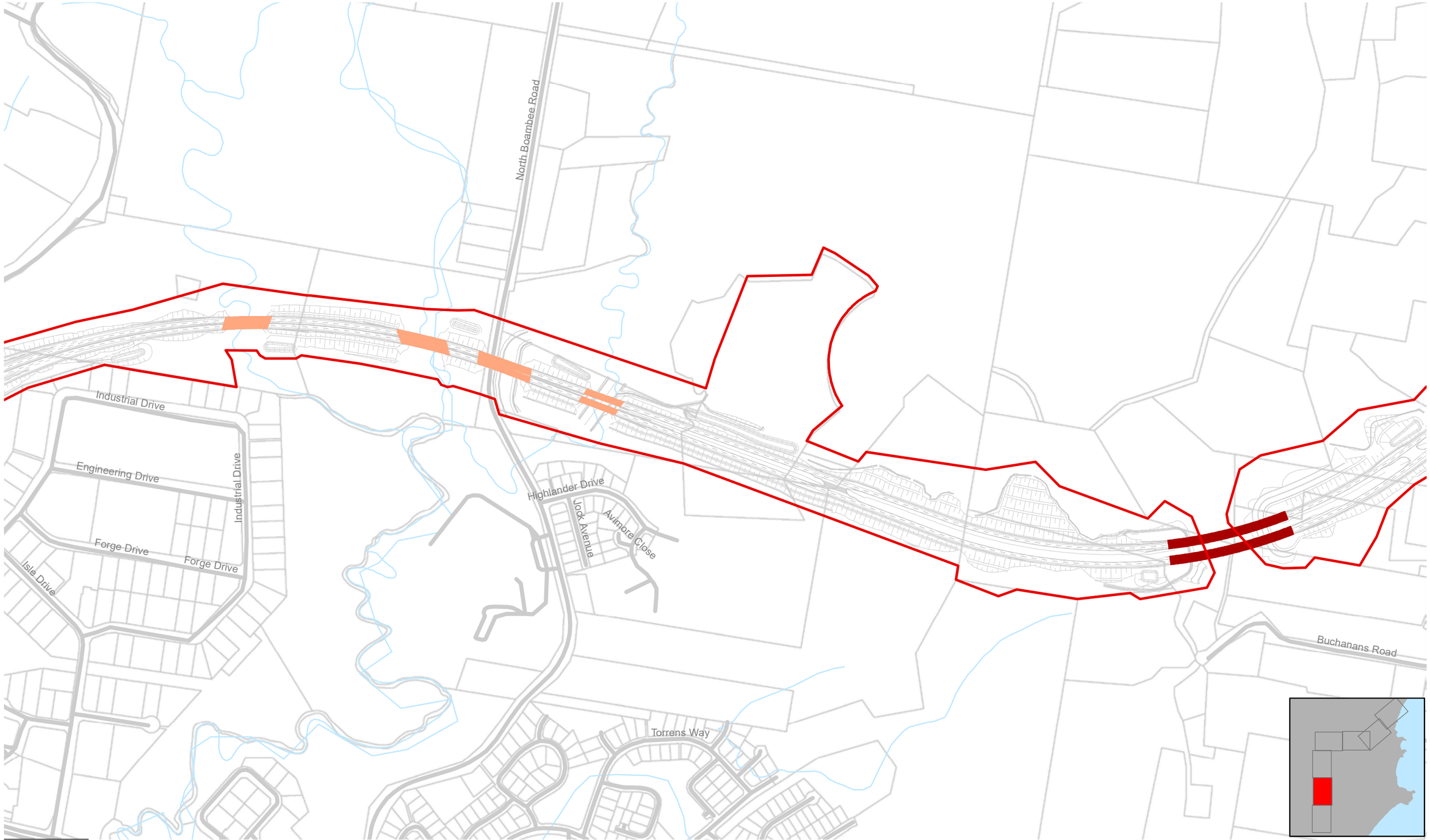
Reinforced soil wall facing the highway

Reinforced soil wall facing away from the way

Bridge portal/abutment walls

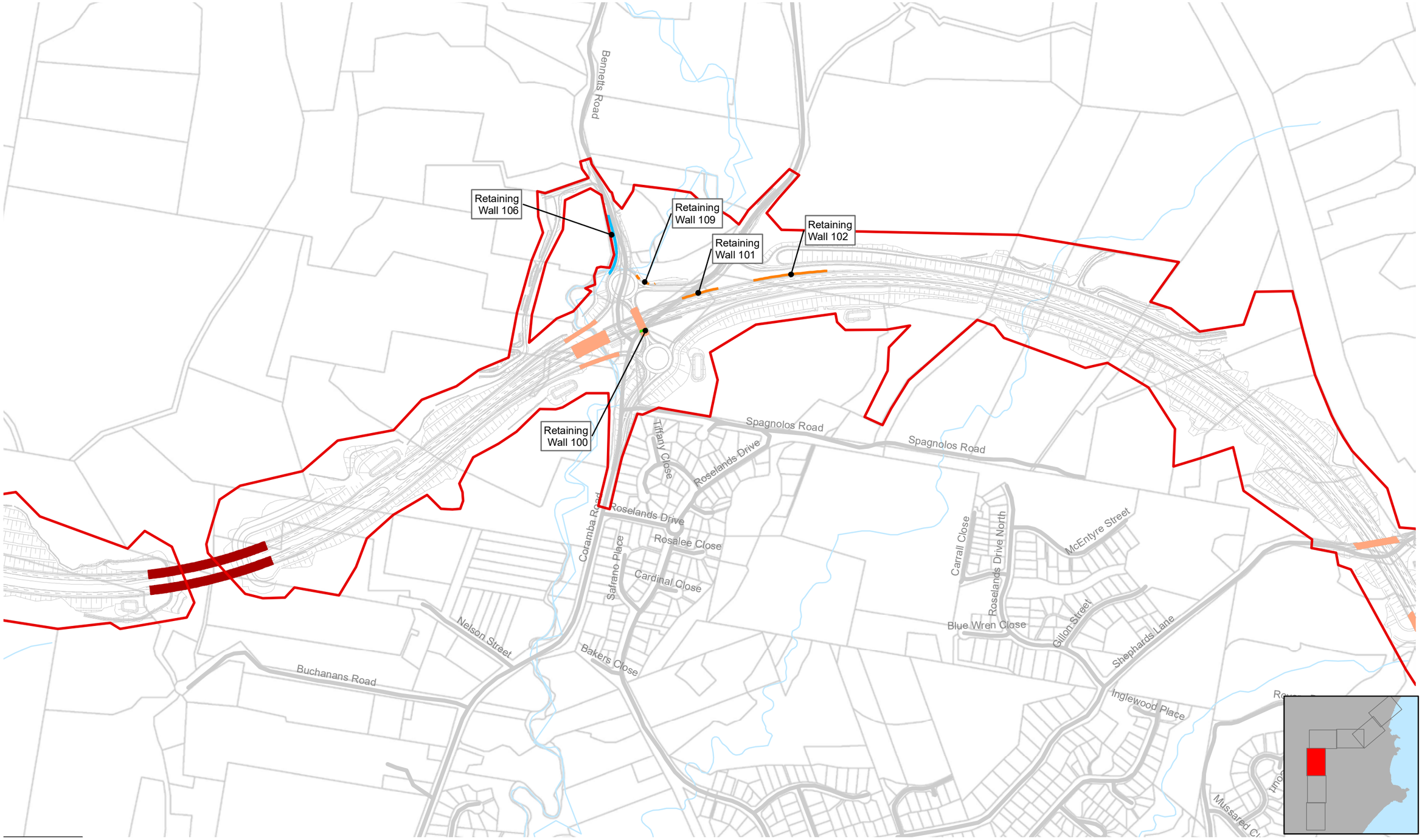
Combined noise wall and retaining wall

Retaining wall location plan



- Reinforced concrete wall facing the highway
- Reinforced concrete wall facing away from the highway
- Reinforced soil wall facing the highway
- Reinforced soil wall facing away from the way
- Bridge portal/abutment walls
- Combined noise wall and retaining wall

Retaining wall location plan



Reinforced concrete wall facing the highway

Reinforced soil wall facing the highway

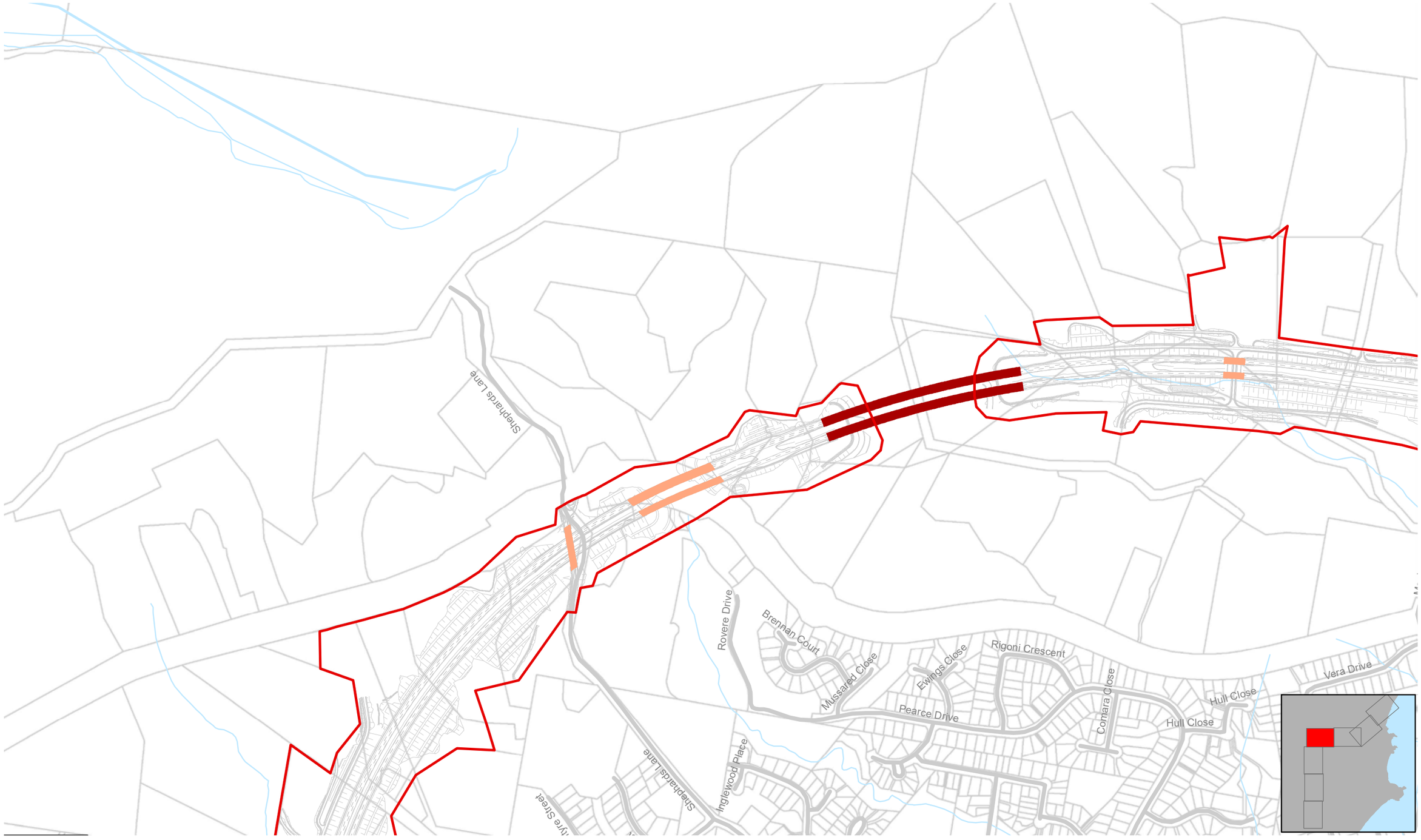
Bridge portal/abutment walls

Reinforced concrete wall facing away from the highway

Reinforced soil wall facing away from the way

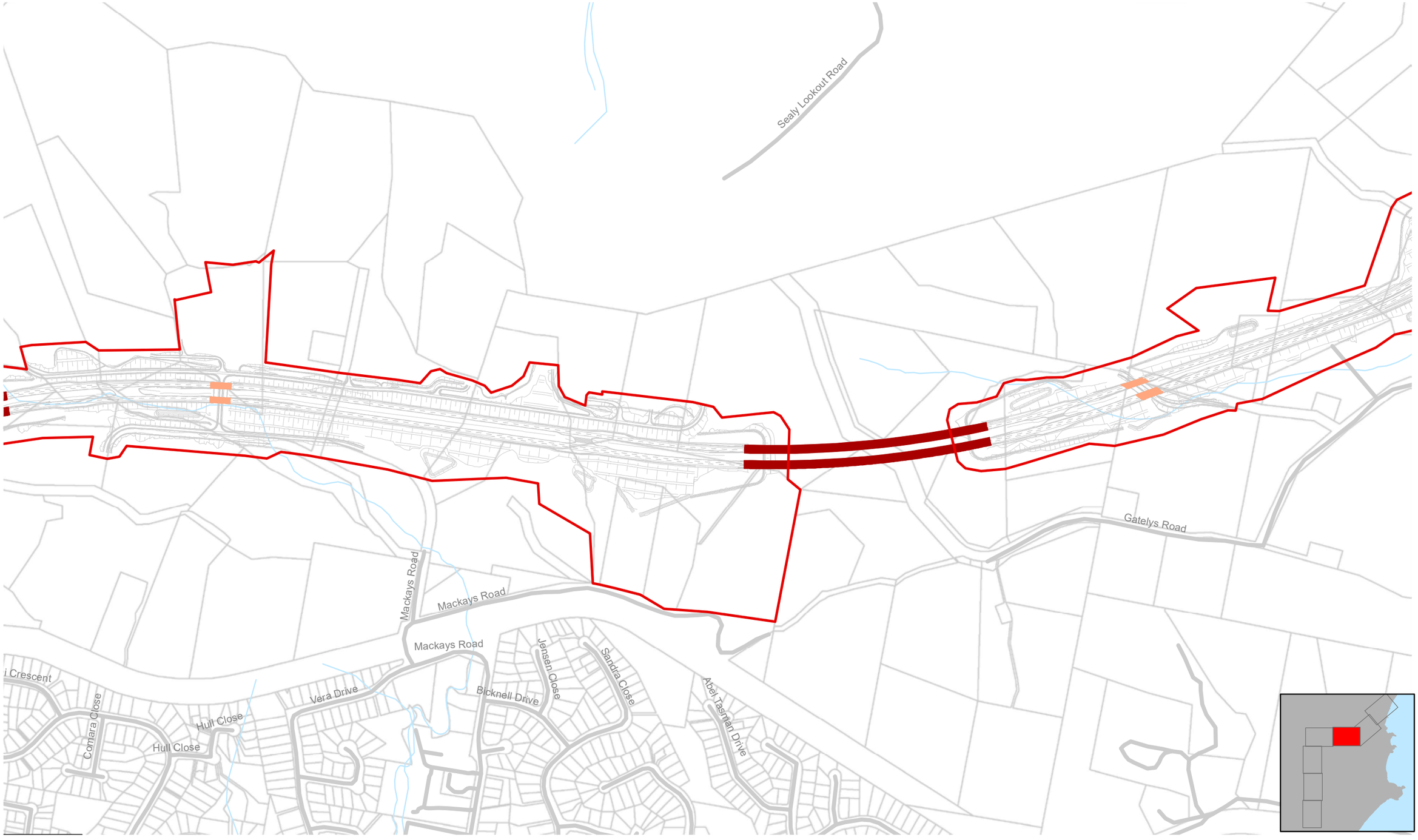
Combined noise wall and retaining wall

Retaining wall location plan



- Reinforced concrete wall facing the highway
- Reinforced concrete wall facing away from the highway
- Reinforced soil wall facing the highway
- Reinforced soil wall facing away from the way
- Bridge portal/abutment walls
- Combined noise wall and retaining wall

Retaining wall location plan



Reinforced concrete wall facing the highway

Reinforced concrete wall facing away from the highway

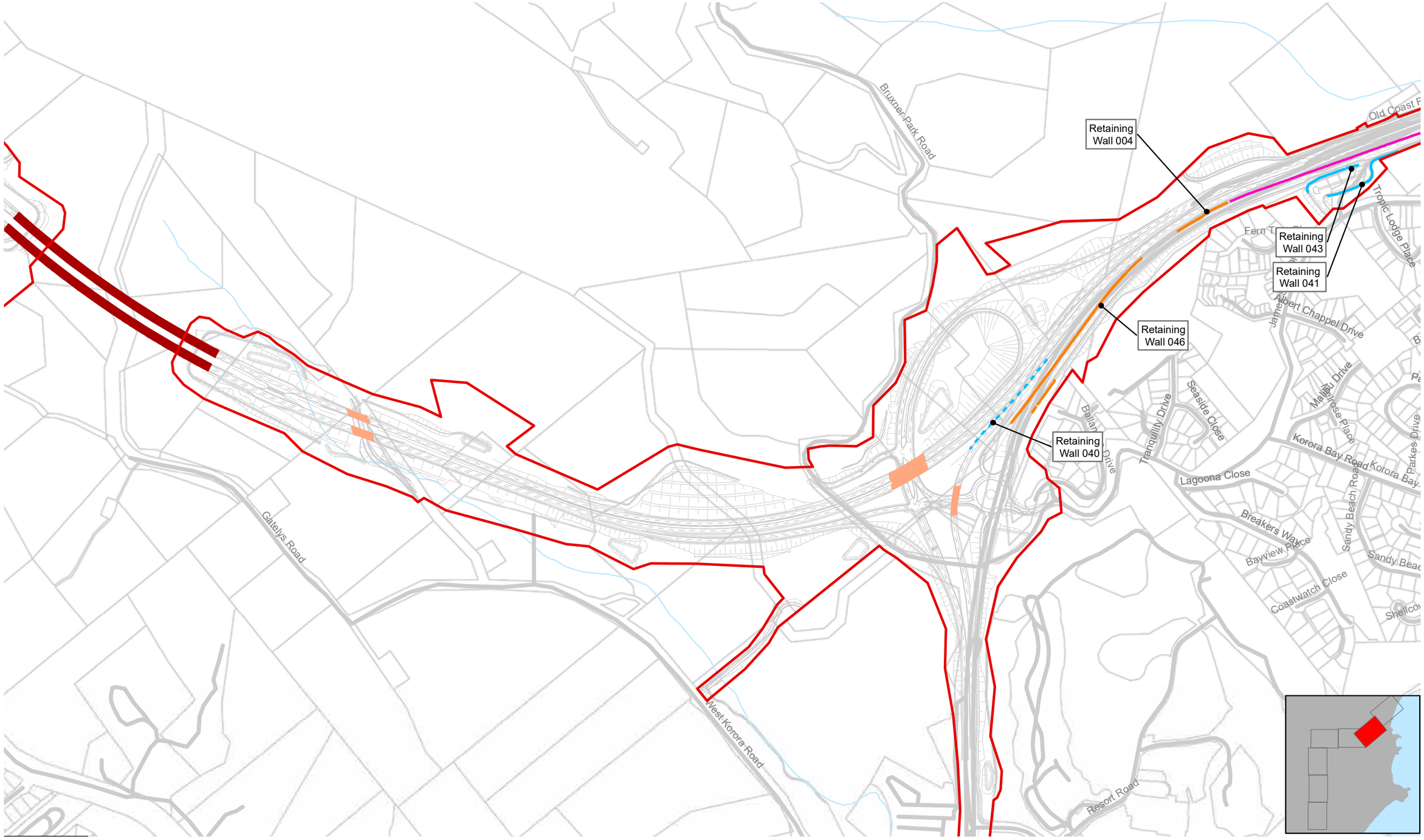
Reinforced soil wall facing the highway

Reinforced soil wall facing away from the way

Bridge portal/abutment walls

Combined noise wall and retaining wall

Retaining wall location plan



Reinforced concrete wall facing the highway

Reinforced concrete wall facing away from the highway

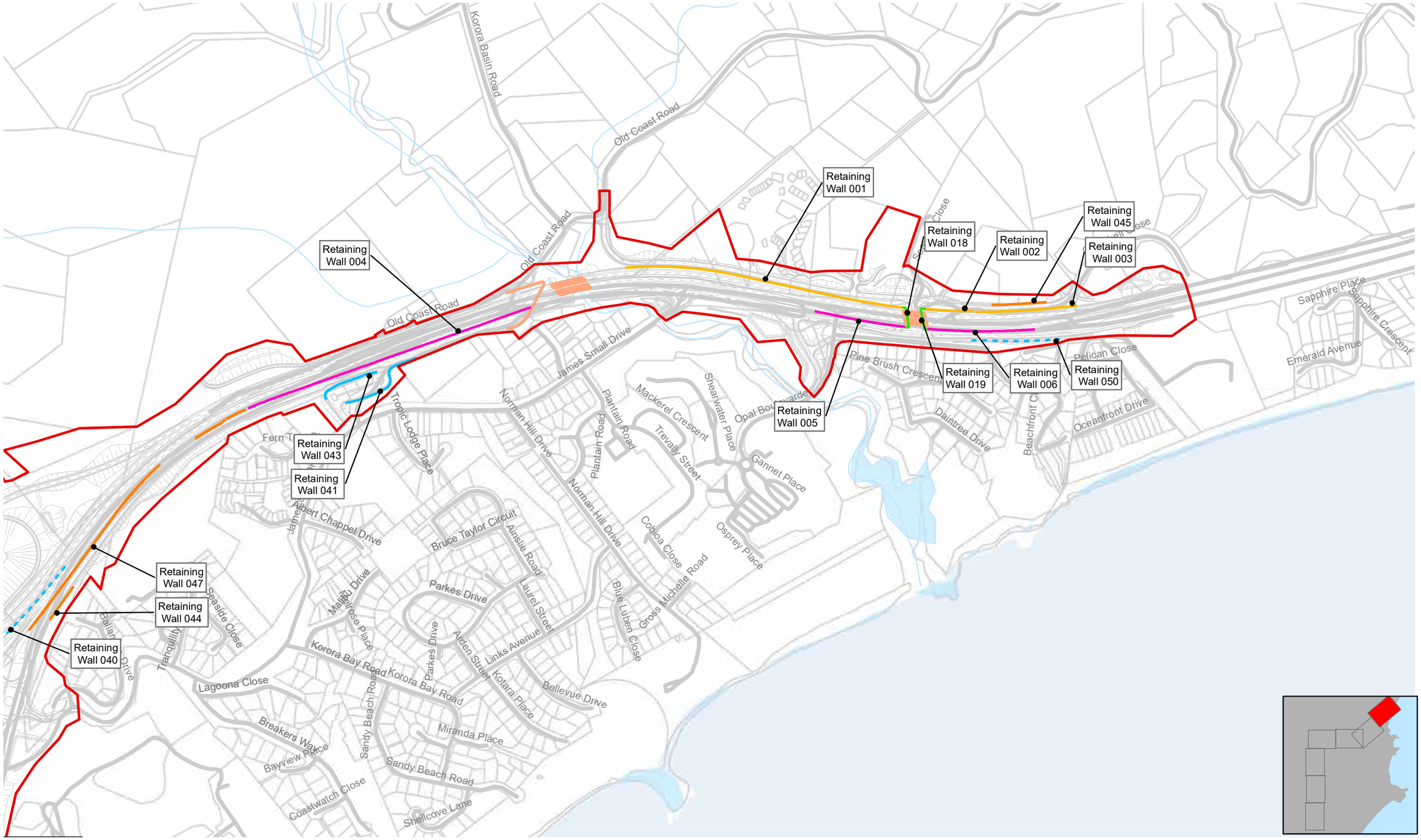
Reinforced soil wall facing the highway

Reinforced soil wall facing away from the way

Bridge portal/abutment walls

Combined noise wall and retaining wall

Retaining wall location plan



Reinforced concrete wall facing the highway

Reinforced soil wall facing the highway

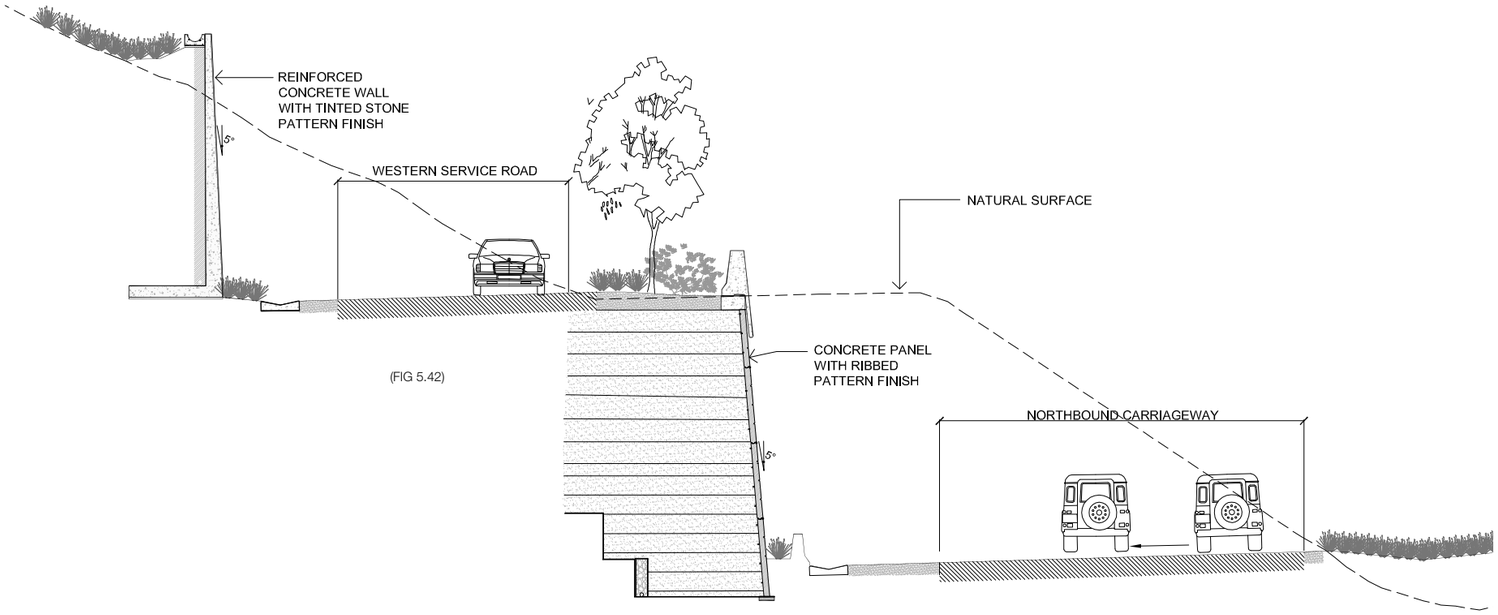
Bridge portal/abutment walls

Reinforced concrete wall facing away from the highway

Reinforced soil wall facing away from the way

Combined noise wall and retaining wall

Retaining wall details



(FIG 5.42)

FIG 5.18TYPICAL SECTION THROUGH HIGHWAY AND RETAINING WALL

0 10m

(FIG 5.43)

WALLED ABUTMENT ON BRUNSWICK TO YELGUN UPGRADE

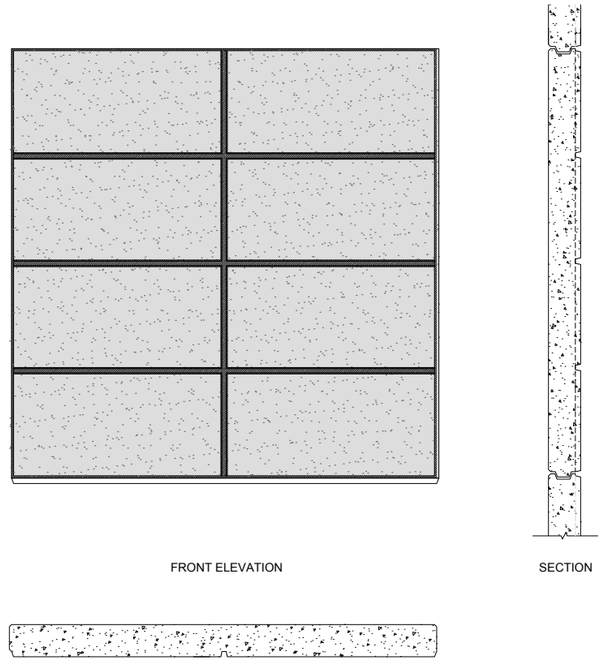


FIG 5.19RETAINING WALL DETAIL - BRIDGE ABUTMENTS ON HIGHWAY - TINTED STONE FINISH

0 1000mm

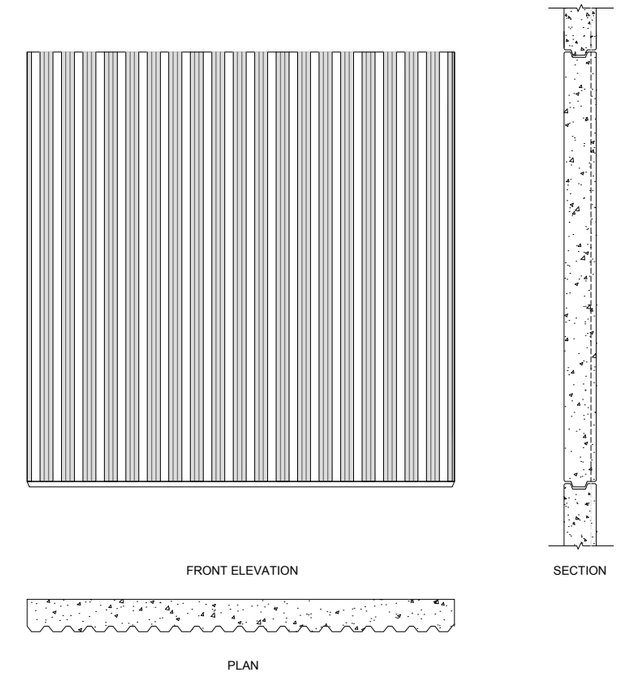


FIG 5.20 RETAINING WALL DETAIL - RIBBED PATTERN FINISH

0 1000mm

Retaining wall details

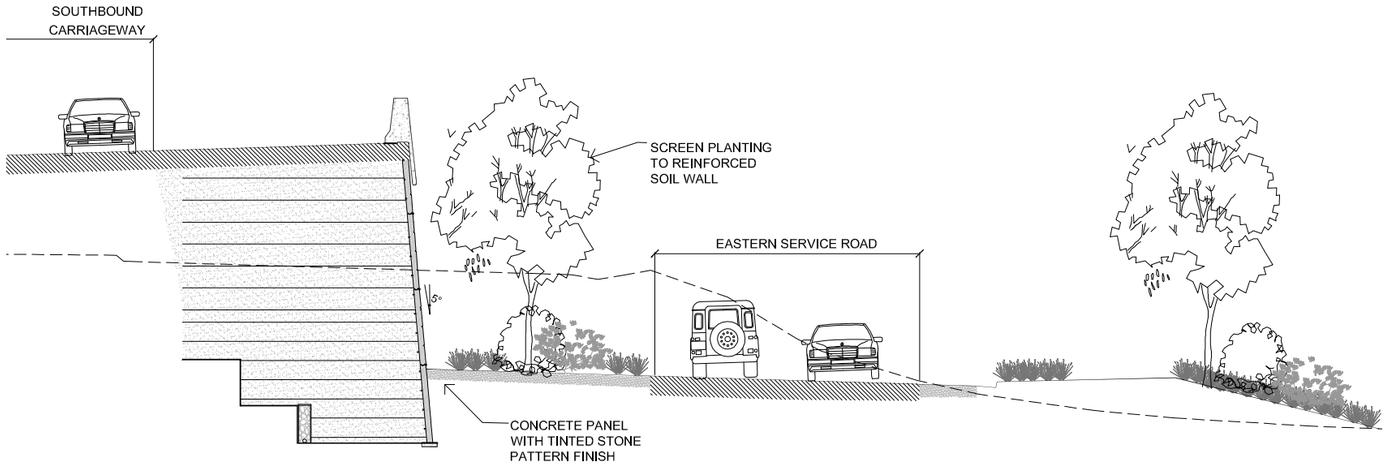


FIG 5.21 TYPICAL SECTION THROUGH RETAINING WALL WITH ADJACENT PLANTING

0 10m

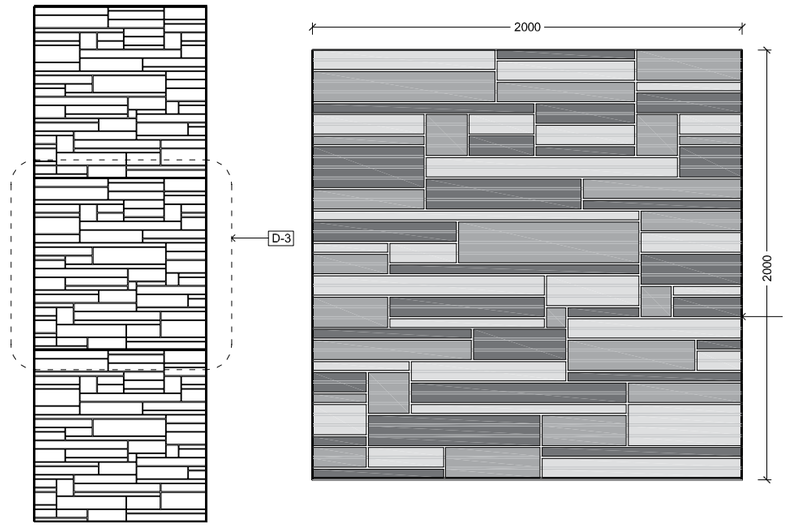


FIG 5.22 RETAINING WALL DETAIL FACING RESIDENTIAL CONTEXT

0 1000mm

STONE PATTERN TEXTURE USED ON LIVERPOOL TO PARRAMATTA TRANSITWAY.

FIG 5.23 CORAMBA ROAD INTERCHANGE

5.5 Bridges

The proposed concept designs for bridges respond to the degree of visibility of the bridge to maximise urban design visual outcomes. The urban design strategy for bridges is described in Chapter 4 and aims to form a suite of bridge elements that are sensitive to the surrounding context and landscape character across the the project.

There are 19 new bridges located along the project alignment. In general, there are four types of bridges which corresponded to their location and degree of visibility. Higher visibility bridges span over the project, local roads or key landscape settings, with lower visibility sometimes over creeks.

The four types are:

- Landmark bridge
- Bridge over the highway
- Highway bridge over local roads
- Highway bridge over creeks.

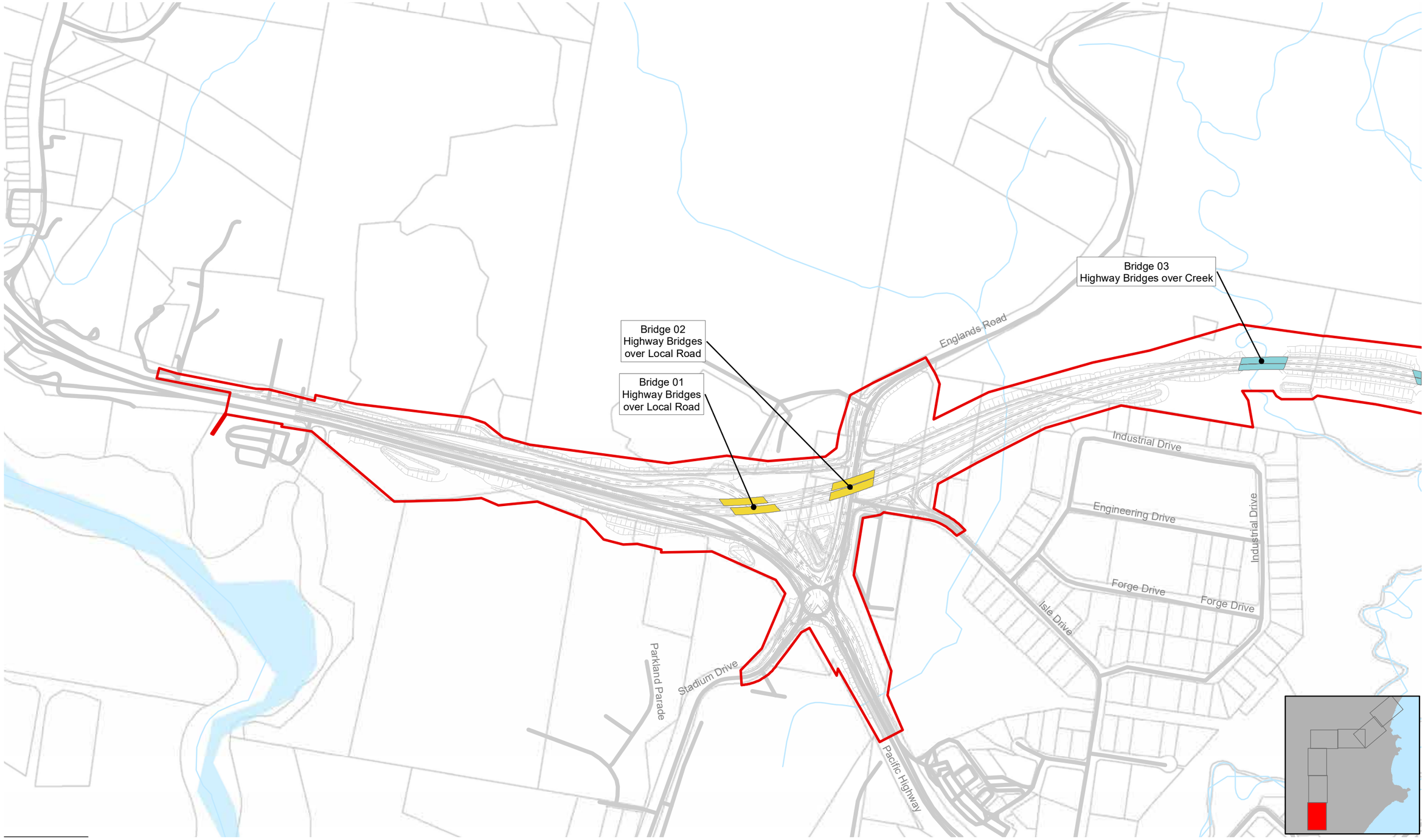
The following table and plans detail the proposed bridge locations and their visibility from south to north.

Bridge Location and category/context

Bridge No.	Bridge name	Bridge category/type/context	Fauna crossing	Noise wall
BR01	Bridge over northbound exit ramp at Englands Road interchange	Highway bridges over local road	No requirement for fauna passage	NIL
BR02	Bridge over Englands Road	Highway bridges over local road	No requirement for fauna passage	NIL
BR03	Bridge over Newports Creek (south) near Industrial Drive	Highway bridge over creeks	Fauna underpasses	NIL
BR23	Bridge over Newports Creek north of B03	Highway bridge over creek	Fauna underpasses	NIL
BR04	Bridge over North Boambee Road	Highway bridges over local road	Fauna underpasses	Noise wall (south bound only)
BR05	Bridge over creek near Highlander Drive	Highway bridge over creeks	Fauna underpasses	Noise wall (south bound only)
BR06	Bridge over Coffs Creek at Coramba Road interchange	Highway bridge over creeks	Fauna underpasses	NIL
BR07	Northbound exit ramp bridge over Coffs Creek at Coramba Road interchange	Highway bridge over creeks	Fauna underpasses	NIL
BR08	Southbound entry ramp bridge over Coffs Creek at Coramba Road interchange	Highway bridge over creeks	Fauna underpasses	NIL
BR09	Bridge over Pacific Highway on Coramba Road	Bridge over the highway	No requirement	NIL
BR11	Bridge over Pacific Highway on Shephards Lane	Bridge over the highway	No requirement	NIL
BR12	Bridge over North Coast Railway near Shephards Lane	Landmark bridge	Fauna underpasses	Noise wall (south bound only)
BR13	Bridge at unnamed local road, south of Mackays Road	Highway bridge over creeks	Fauna passage included with access road underpass	NIL
BR16	Bridge over West Korora Road (2.9 km north of Coffs Harbour CBD)	Highway bridge over local road	Combined road bridge incorporating fauna underpass	NIL
BR17	Twin bridges over Northbound Entry Ramp at Korora Hill Interchange	Highway bridge over local road	No requirement	NIL
BR19	Bridge over Southbound Exit Ramp at Korora Hill Interchange	Highway bridge over local road	No requirement	NIL
BR20	Existing bridge over Pine Brush Creek on Service Road	Highway bridge over creek		
BR21	Twin bridges over Pine Brush Creek on Service Road	Highway bridge over creeks	No requirement	NIL
BR22	Bridge over new connection between Coachmans Close and Seaview Close	Highway bridge over local road	No requirement	Noise wall (south bound only)
BR24	Luke Bowen footbridge at Kororo Public School	Shared path bridge over the highway		

Table 5.3: BRIDGE LOCATIONS

Bridge location plan



Bridges over the highway

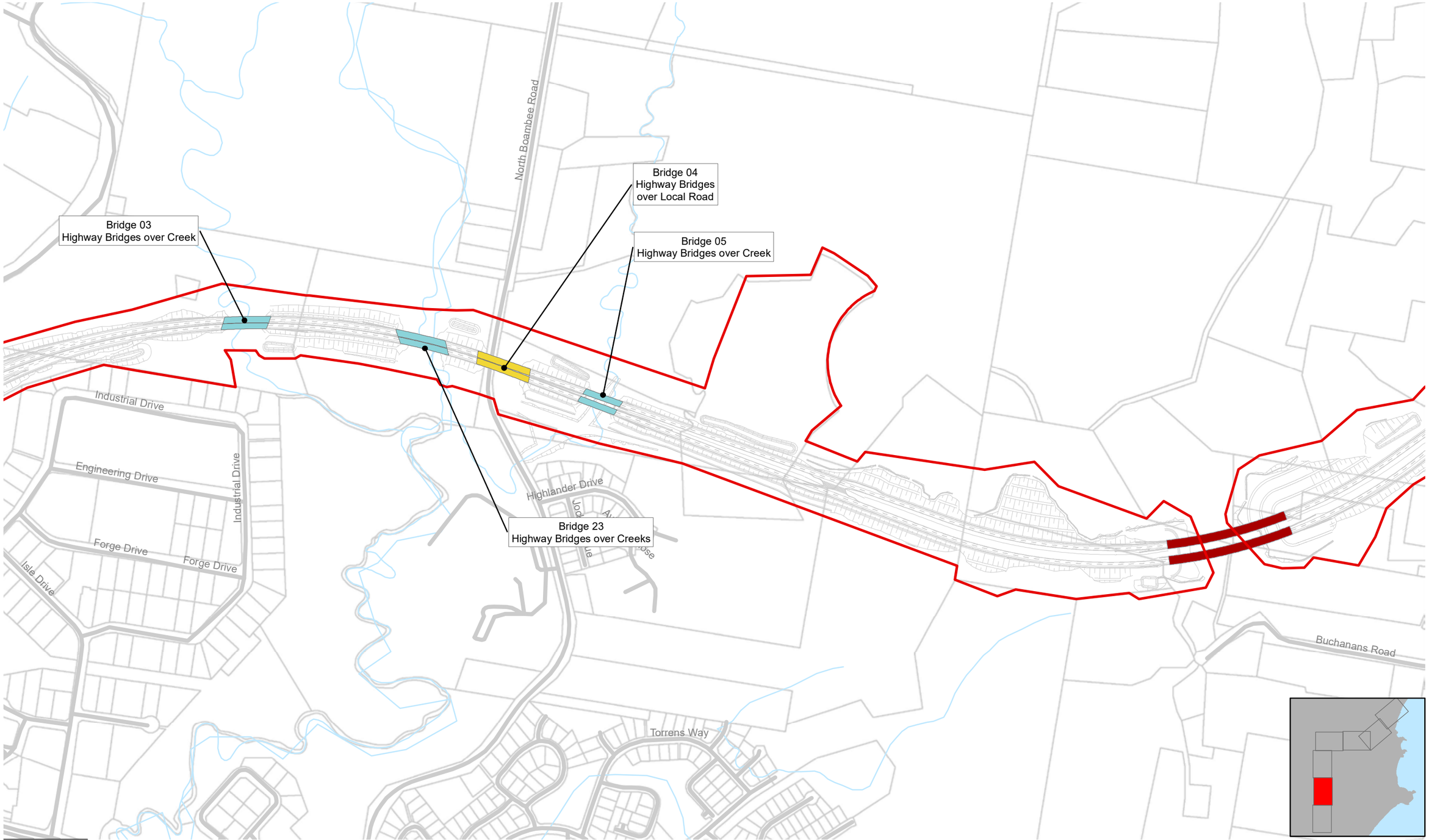
Highway bridge over creeks

Tunnels

Highway bridges over local roads

Landmark bridges

Bridge location plan



Bridges over the highway

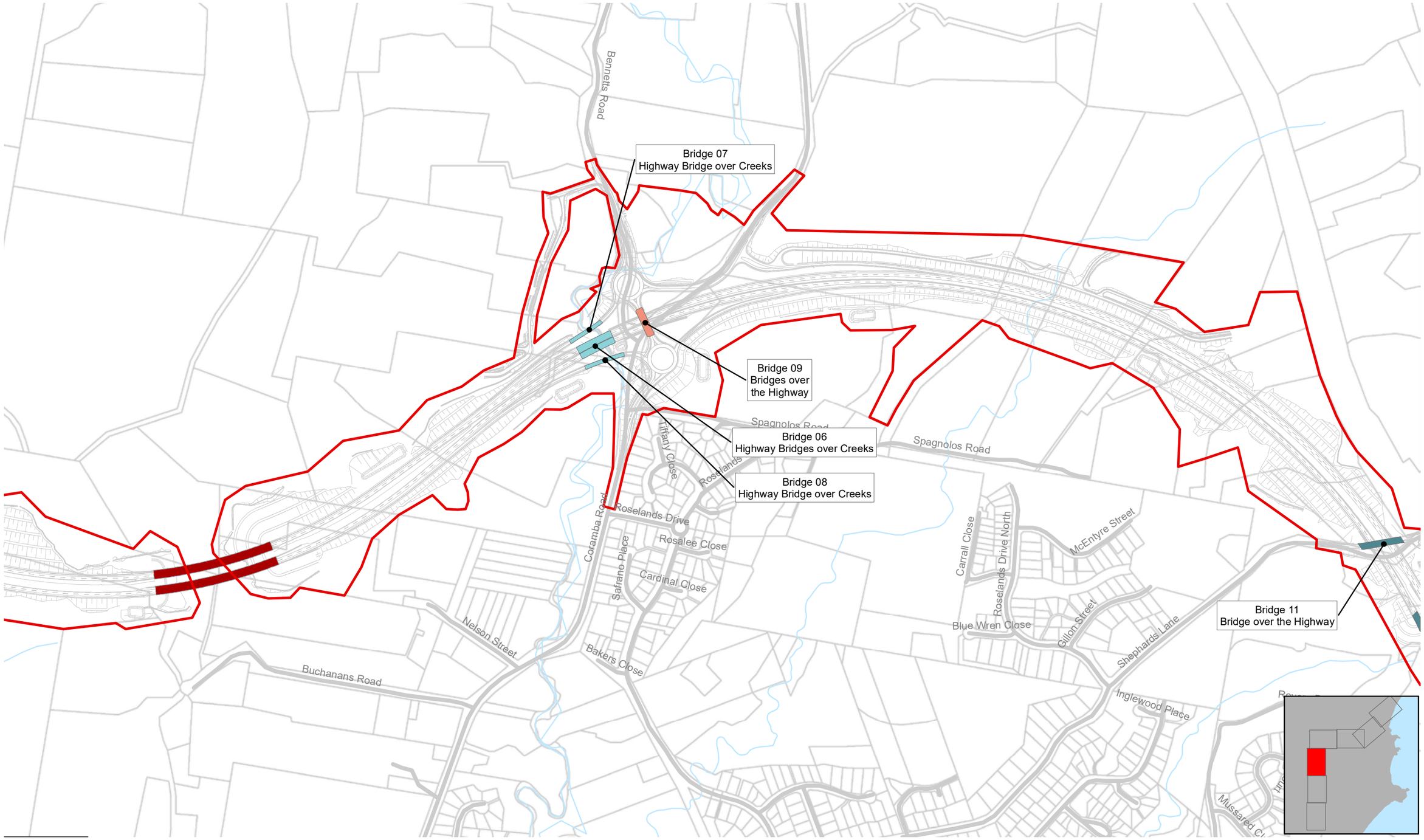
Highway bridge over creeks

Tunnels

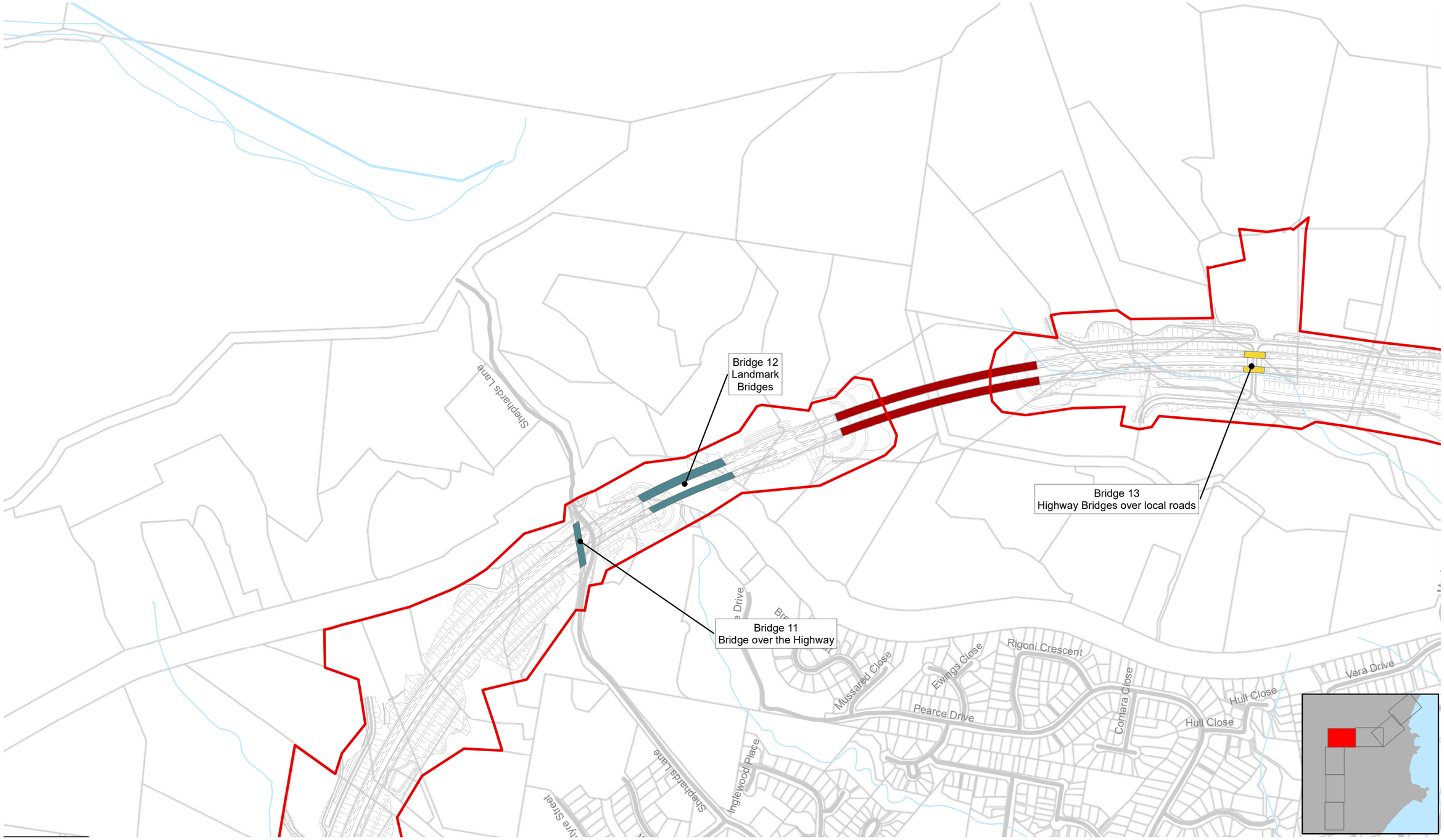
Highway bridges over local roads

Landmark bridges

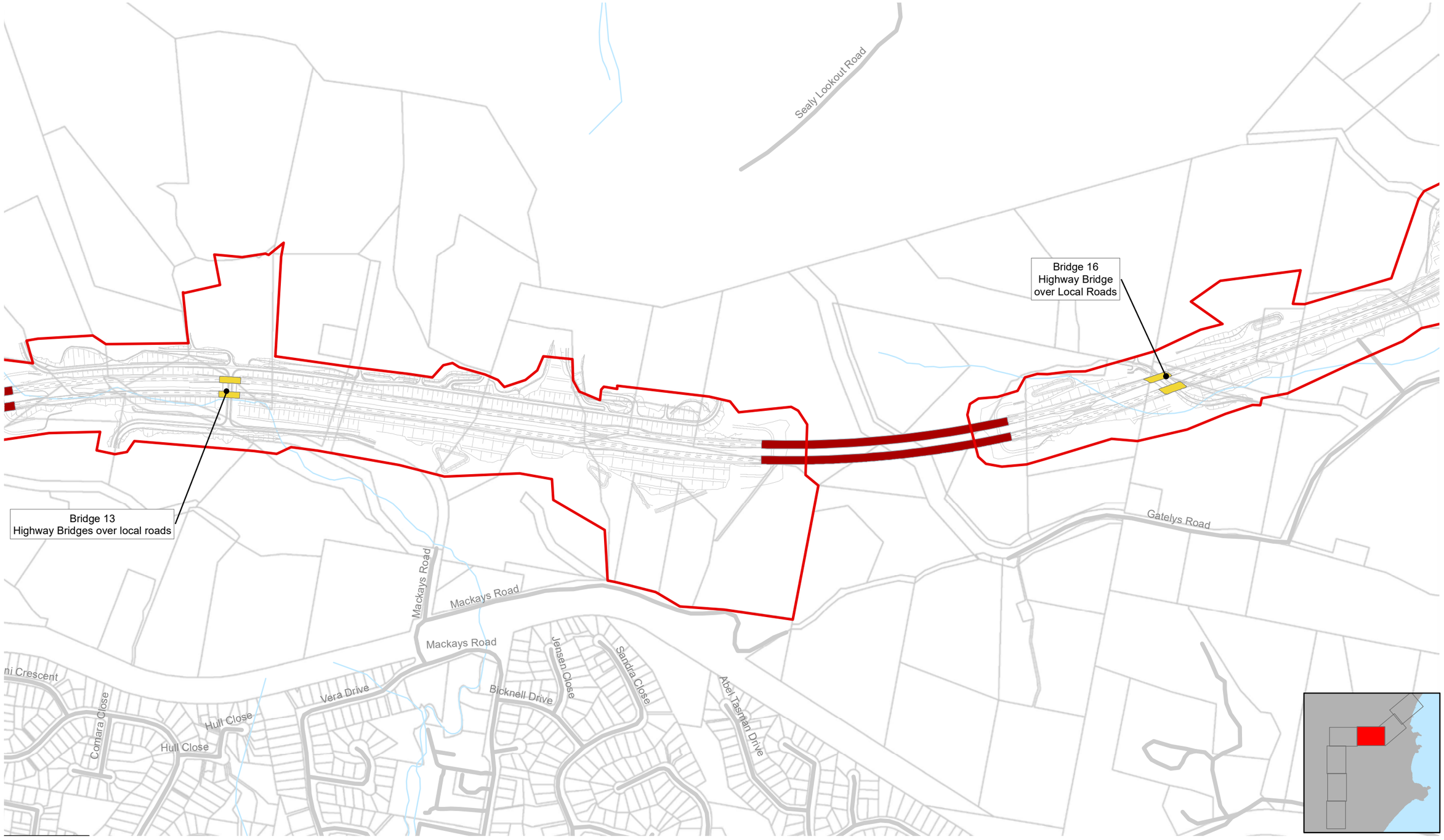
Bridge location plan



Bridge location plan



Bridge location plan



Bridges over the highway

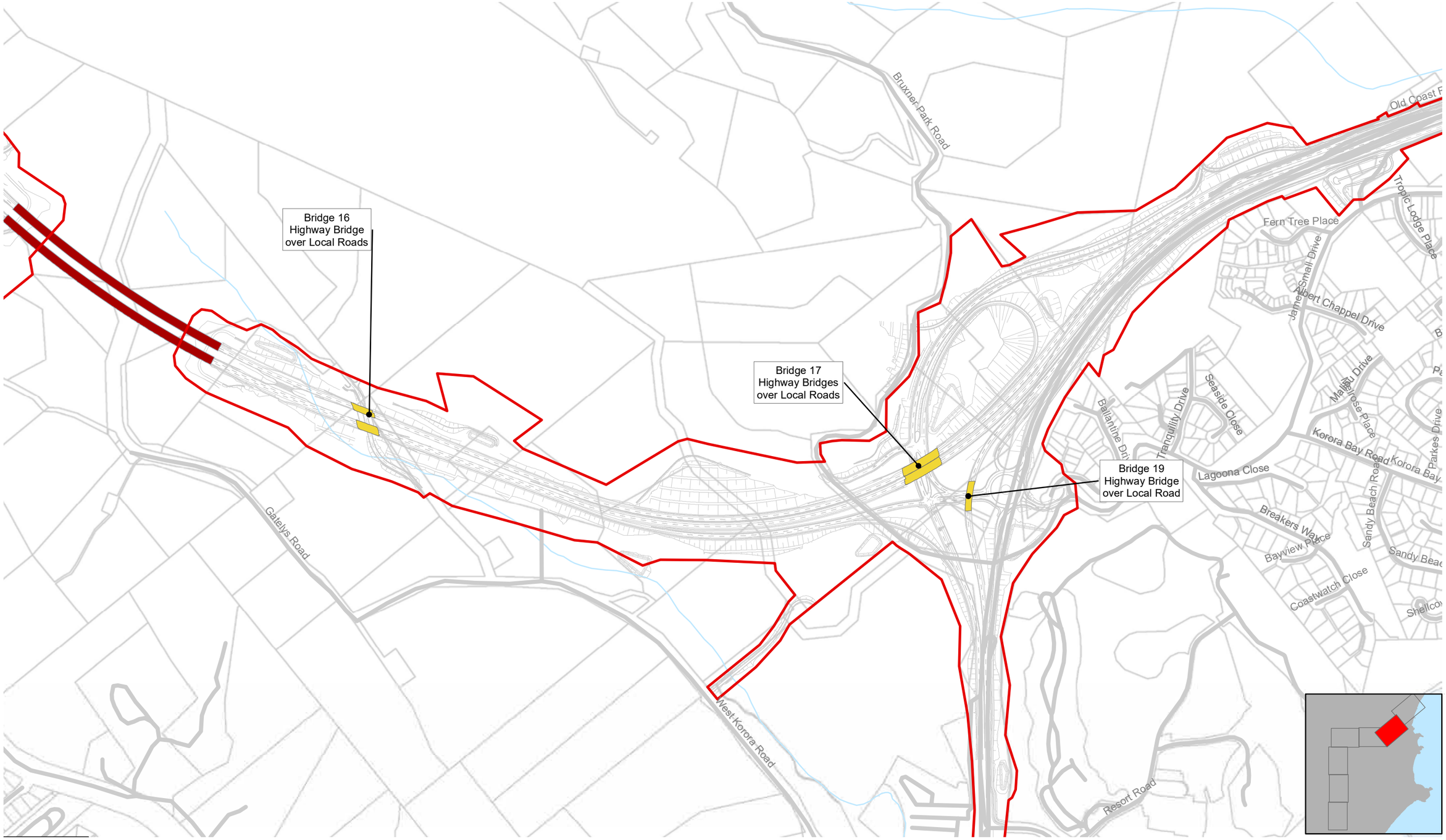
Highway bridges over local roads

Highway bridge over creeks

Landmark bridges

Tunnels

Bridge location plan



Bridges over the highway

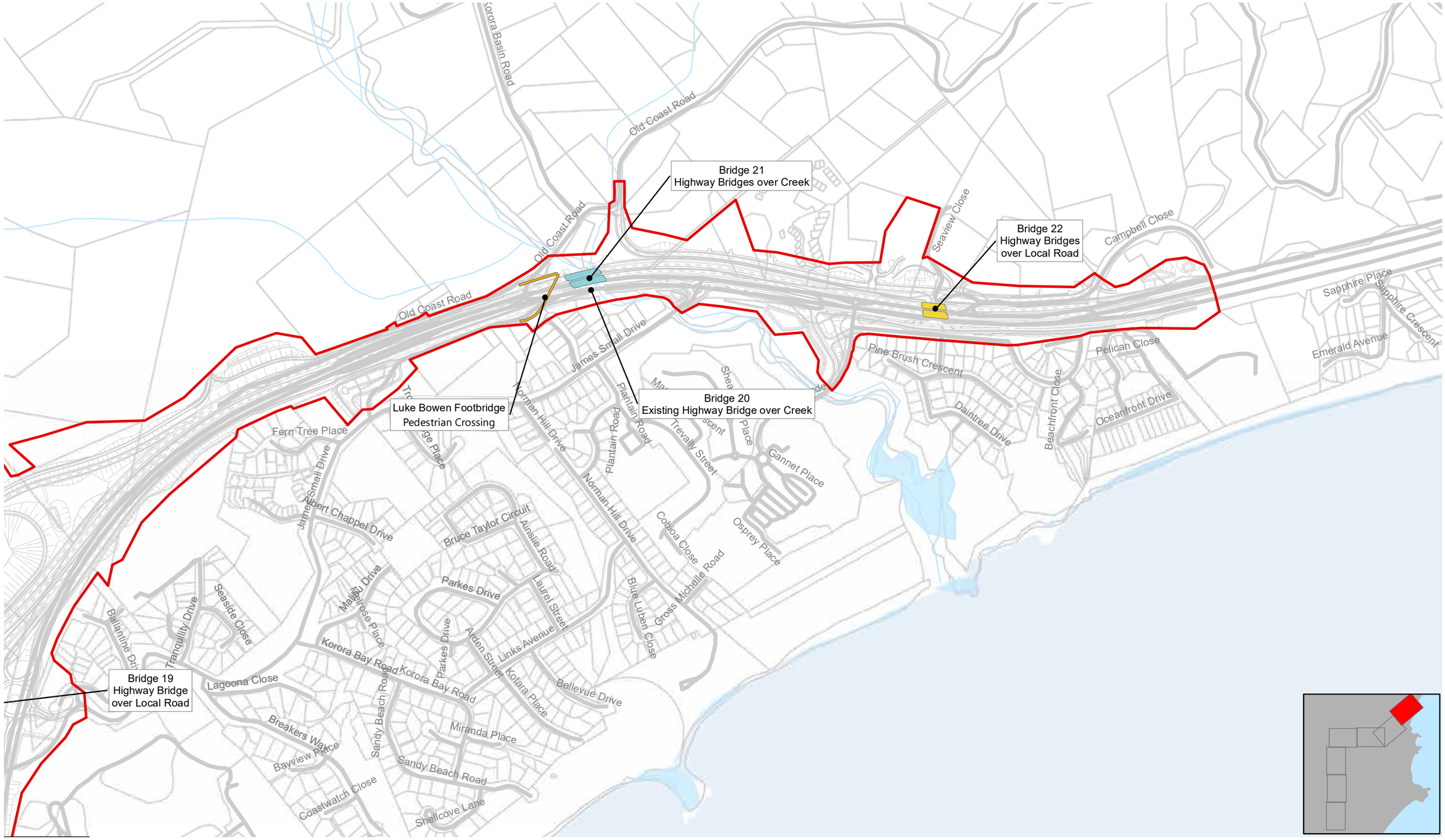
Highway bridges over local roads

Highway bridge over creeks

Landmark bridges

Tunnels

Bridge location plan



Bridges over the highway

Highway bridges over local roads

Highway bridge over creeks

Landmark bridges

Tunnels

Bridges over the highway

Bridges over the highway would be highly visible from the project and would generally occur at interchanges and property access. These bridges are identified as:

- BR09 bridge over HW10 on Coramba Road
- BR11 bridge over HW10 on Shephards Lane.

BR09 bridge over HW10 on Coramba Road

The proposed concept design is a three span Super T bridge with paved spill through abutments at 1.5H:1V to maximise views through and beyond and would provide an open appearance. The pier design should provide visual consistency with other Pacific Highway overbridges. The narrow median width discounted the use of a two span central pier bridge at this location. Parapets would provide a smooth finish and clean lines and conceal utility pipes and fittings. Curved section transparent mesh throw screens with steel posts attached to the top edge of parapets, visible to the highway below.

BR11 bridge over HW10 on Shephards Lane

The proposed concept design comprises a two span voided concrete slab with paved spill through abutments at 1H:1V. This bridge type was selected to reduce the visual prominence of the structure on the approach and departure of the Shephards Lane tunnel portal. The concrete voided slab also allows for larger spans, eliminating the need for retaining walls adjacent to the highway. A single circular column supports the bridge and would be integrated into the deck providing a clean soffit to the structure. Throw screens are provided to the bridge parapets, visible from the highway.

BRIDGES OVER HIGHWAY PRECEDENT - SHOWING A PARTS PIER BRIDGE DESIGN

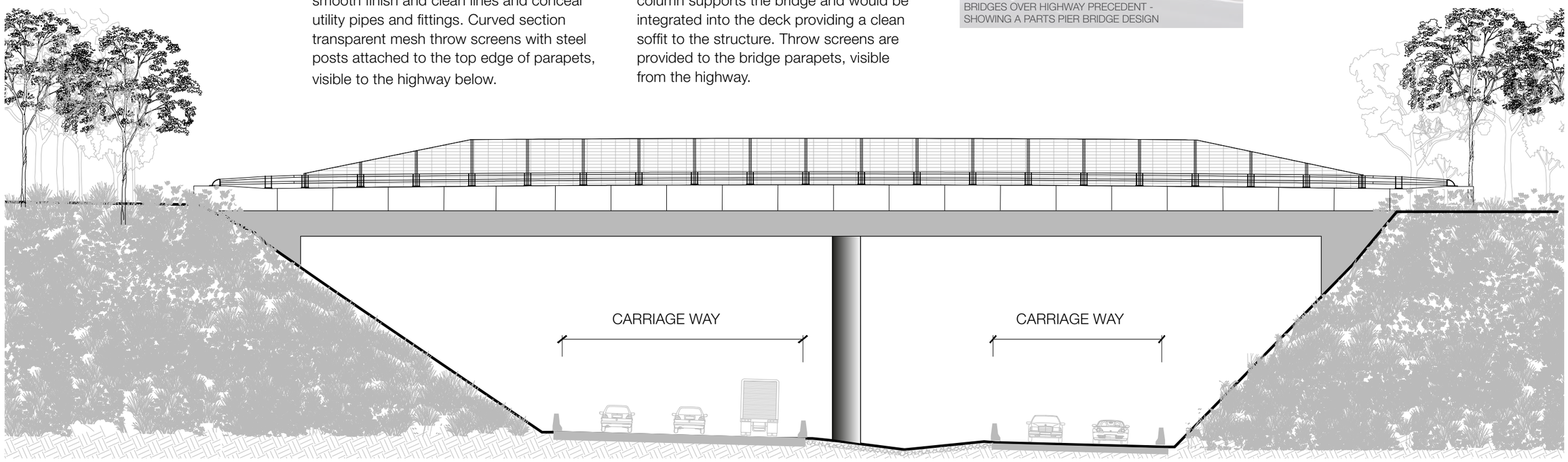


FIG 5.24 BR11 BRIDGE OVER HW10 ON SHEPHARDS LANE

Highway bridges over creeks

Highway bridges over creeks are generally less visible and pass over creeks. These bridges are identified as:

- BR03 twin bridges over Newports Creek South
- BR23 twin bridges over Newports Creek North
- BR05 twin bridges over Newports Creek Tributary
- BR06 twin bridges over Coffs Creek
- BR07 and BR08 over Coffs Creek
- BR20 existing bridge over Pine Brush Creek on Service Road
- BR21 twin bridges over Pine Brush Creek.

In general, proposed designs would comprise one to three span Super T bridges with spill through abutments and rock scour protection. The exception is BR06 that would comprise a four span plank bridge design with rock scour spill through abutments. Reinforced concrete headstock beams are supported on circular piers.

HIGHWAY BRIDGE OVER CREEKS PRECEDENT

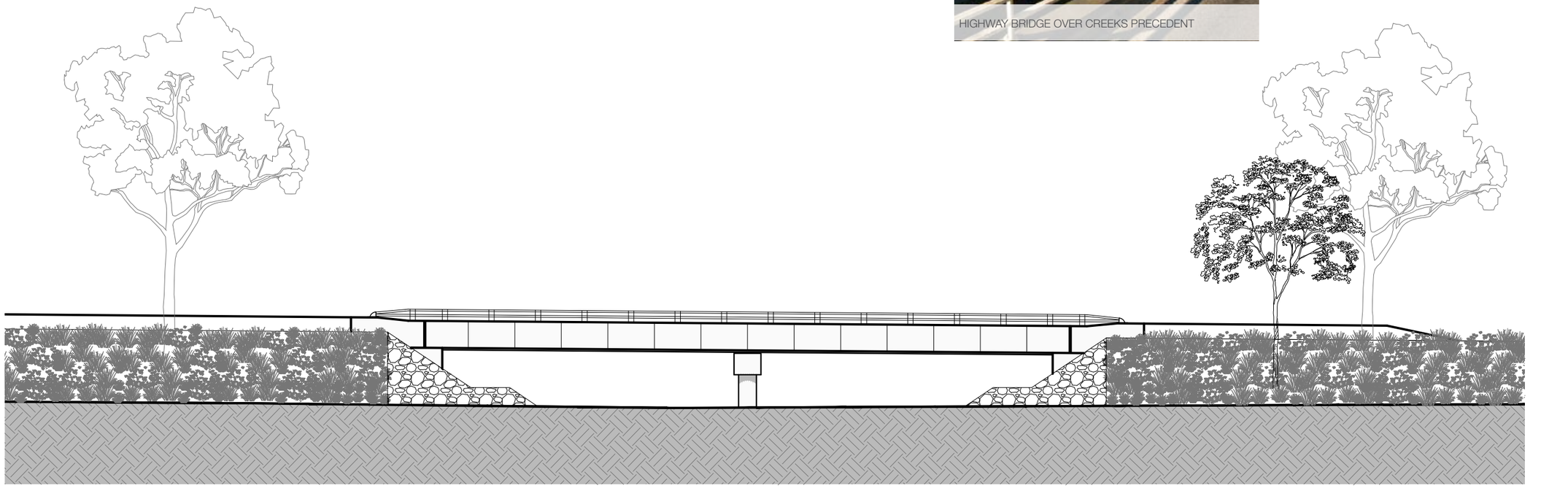


FIG 5.25 BR05 TWIN BRIDGES OVER NEWPORTS CREEK TRIBUTARY

0 10m

Highway bridges over local roads

Highway bridges over local roads have a higher visibility as they occur either over main entry/exit points to Coffs Harbour or over local roads or are visible adjacent to the highway. As such they require a more considered design of structure.

Bridges include:

- BR01 twin bridges over Northbound Exit Ramp near Englands Road
- BR02 twin bridges over Englands Road
- BR04 twin bridges over North Boambee Road
- BR13 bridge over unnamed local road, south of Mackays Road
- BR16 bridge over West Korora Road
- BR17 twin bridges over Northbound entry ramp at Korora Hill interchange
- BR19 bridge over Southbound exit ramp at Korora Hill interchange
- BR22 twin bridges over connection between Coachmans Close and Seaview Close.

BR01 twin bridges over northbound exit ramp near Englands Road and BR02 twin bridges over Englands Road

The proposed concept design for both bridges is a three span Super T bridge with paved spill through abutments at 1.5H:1V. There is a retaining wall along the southern northbound abutment for BR01. Spill through abutments would maximise openness and views for this key southern gateway. Headstocks and piers provide an integrated and elegant visual outcome. For BR01, due to the skewed road alignment below relative to the bridge alignment above, the piers would not able to be aligned in plan.

The patterned retaining wall along the southern northbound abutment of BR01 would have a five degree tilt from the base of the wall to reduce the overall perceived height.

BR04 twin bridges over North Boambee Road

The proposed concept design comprises a three span bridge with paved spill through abutments at 1.5H:1V. A solid noise wall would be located adjacent the southbound carriageway.

BR13 and BR16 bridge over West Korora Road

The proposed concept design comprises a single span Super T bridge with paved spill through abutments at 1.5H:1V. Spill through abutments enable views through to the hills and valley surrounds. Headstocks and piers provide an integrated and elegant visual outcome.

BR17 twin bridges over northbound exit ramp at Korora Hill interchange and BR19 bridge over southbound exit ramp at Korora Hill interchange

The proposed concept design for both bridges is a two span Super T bridge with paved spill through abutments at 1.5H:1V. Spill through abutments would maximise openness and views for this key northern gateway. Headstocks and piers would provide an integrated and elegant visual outcome.

BR22 twin bridges over new local road connection

The proposed concept design comprises a single span bridge with paved spill through abutments at 1.5H:1V. Solid noise walls are located adjacent to the northbound and southbound carriageways.

HIGHWAY BRIDGES OVER LOCAL ROAD PRECEDENT

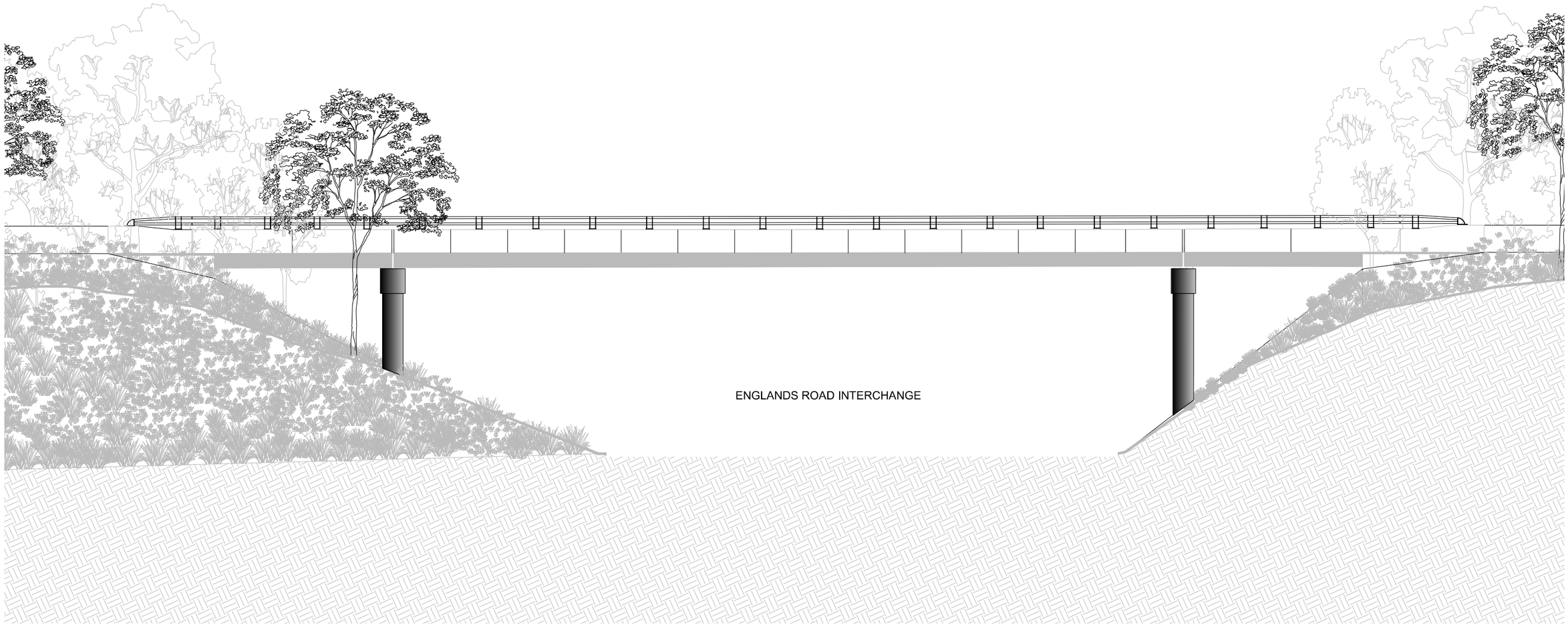


FIG 5.26 **BR01 TWIN BRIDGES OVER NORTHBOUND EXIT RAMP NEAR ENGLANDS ROAD**

0 10m

Landmark bridges: North Coast Railway Bridge

The North Coast Railway Bridge is considered a key bridge due to its elevated alignment and location in the footslopes and valley of the Coffs Harbour Basin, and high visibility to adjacent residential properties. The concept design comprises a three span balanced cantilever bridge with spill through abutments. Refer Figure 5.35.

The balanced cantilever bridge design was chosen to minimise the bridge profile in its setting. The design also minimises the number of piers, providing an open visual connection under the bridge which allows views to be retained to the footslopes and valley beyond. This also enhances and promotes views of the landscape valley, appreciated from all viewpoints.

The bridge piers are designed to be slightly offset and skewed by 15 degrees to the main carriageway. Pier design comprises a twin blade pier arrangement which would minimise the pier's visual bulk and provide a structurally efficient and elegant visual outcome. The piers are located at a distance that mitigates risk of train crashes.

Different pier design shapes were tested during the concept design process to determine the best visual outcome for the project. Refer images below. The twin blade pier was chosen as it best minimised the visual bulk and provided an integrated and seamless girder/pier relationship for all pier locations.

Promoting the natural environment, spill through abutments have been designed to provide a vegetated appearance that blends into the adjacent landscape.

Promoting views and connection with the surrounding landscape, a transparent noise wall is included in the design. It would be located along the southbound carriageway on the outer left edge of the bridge. This wall enhances ocean views to the east and minimises the bulk in elevation when viewed from the east from the valley below.

FIG 5.27 PIER OPTION 1 - AXE HANDLE

FIG 5.28 PIER OPTION 2 - ROUNDED ENDS

FIG 5.29 PIER OPTION 3 - CANDLESTICK

Preferred option

FIG 5.30 PIER OPTION 4 - TWIN BLADES ROTATED

FIG 5.31 PIER OPTION 5 - TAPER

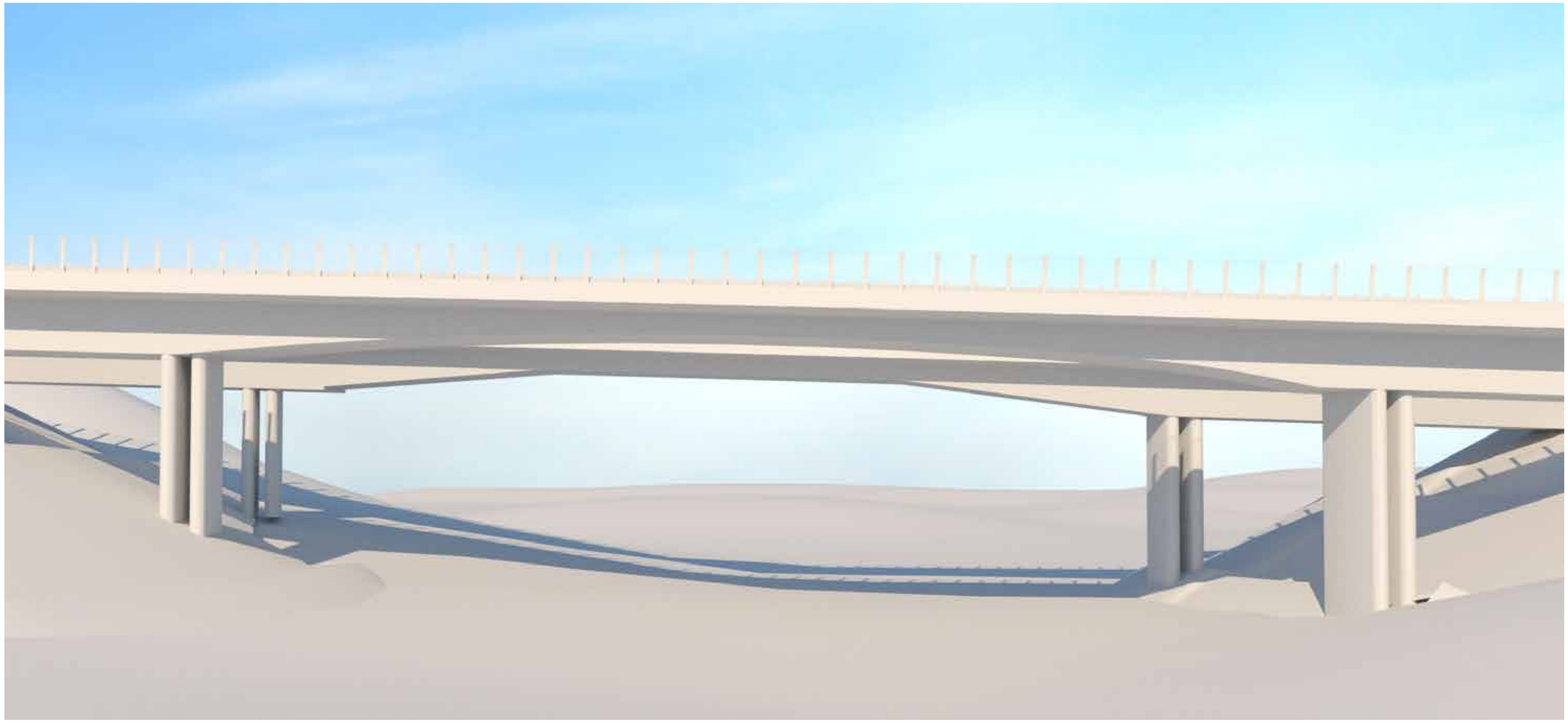


FIG 5.32 NORTH COAST RAILWAY BRIDGE - ARTIST IMPRESSION

Landmark bridges:
BR 24 pedestrian bridge over the Pacific Highway at Kororo Public School: Luke Bowen footbridge

A replacement bridge for the existing Luke Bowen footbridge steel arch bridge provides the opportunity for an enhanced landmark bridge design supporting the existing bridge traits. The existing bridge is a highly visible local landmark on the current highway journey. It provides a vital pedestrian/ cyclist connection to Kororo Public School. The new structure would continue to provide a local landmark, regional gateway and accessibility across the highway to Coffs Harbour.

The concept design continues the family of bridges that includes the Lloyd Poynting Pedestrian Bridge at Billinudgel. The design requires a single span structure connecting both sides of the highway with safety screens. The bridges' vertical alignment would slope from east to west providing an accessible path and ramp. The final design would undergo a detailed design process.

EXISTING LUKE BOWEN FOOTBRIDGE

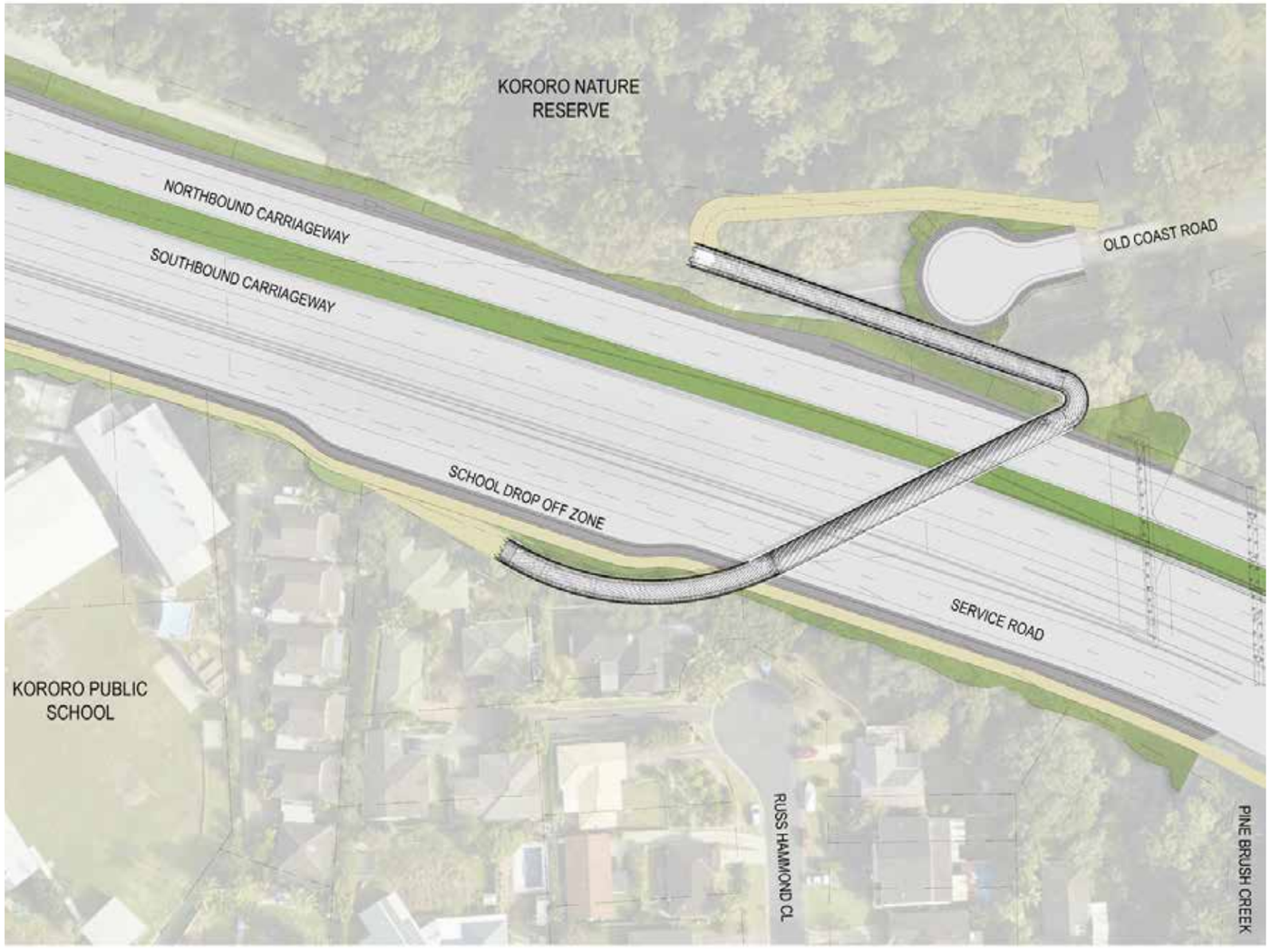


FIG 5.33 PLAN OF PROPOSED LUKE BOWEN FOOTBRIDGE

EPPING ROAD PEDESTRIAN BRIDGE SYDNEY

HOGE BRUGE PEDESTRIAN AND CYCLIST BRIDGE

MARKEY PEDESTRIAN BRIDGE

5.6 Tunnels

There are three tunnels proposed along the project. These are; Roberts Hill, Shephards Lane and Gatelys Road.

Tunnel portals would be designed to sympathetically tie back into the natural landscape adjacent to the portal, retaining existing vegetation where possible and enabling flora and fauna connections along existing ridgelines.

Slopes above the portals are to be a minimum 2H:1V slope and achieve a consistent established vegetated cover at opening of the project.

The design would consider, but not limited to, the following design applications:

- Planting the batter slopes as early as practical
- Placing topsoil to depth required to achieve planting cover, density and height required
- Using advance sized planting where required to achieve the established vegetation cover of the portal slopes
- The use of specially prepared / detailed planter beds
- The use of a different planting mix / shrub type species including any other good / innovative ideas for achieving landscaping on difficult slopes
- The use of low walls to achieve the 2H:1V slopes that are not visible from road users and the local community.
- Painting of the low walls with a darker recessive colour.

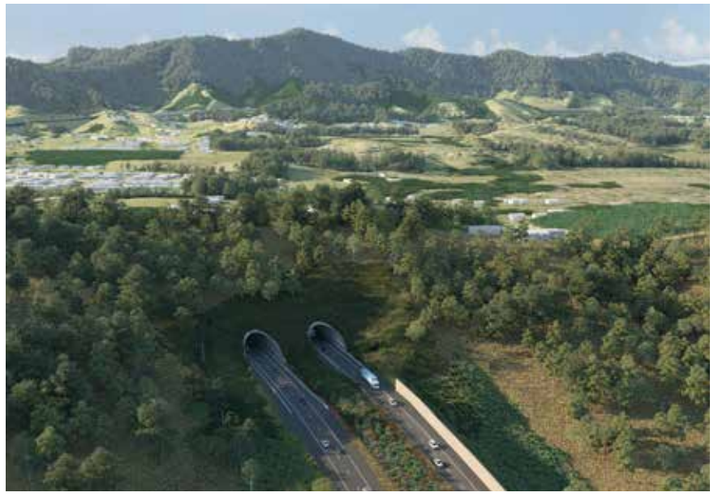


FIG 5.34 ROBERTSHILLTUNNEL-SOUTHERNPORTAL-CONCEPT DESIGN

FIG 5.35 SHEPHERDSLANETUNNEL-SOUTHERNPORTAL-CONCEPT DESIGN

FIG 5.36 GATELYSROADTUNNEL-SOUTHERNPORTAL-CONCEPT DESIGN

Roberts Hill tunnel

Roberts Hill tunnel is approximately 190 metres long and seeks to minimise impacts to the existing ridge line of Roberts Hill.

The portals would be designed as clean symmetrical arches framed by 2H:1V vegetated slopes.

The final design and construction methodology would be confirmed during detailed design.

FIG 5.37 ROBERTS HILL TUNNEL - SOUTHERN PORTAL - CONCEPT DESIGN

FIG 5.38 SHEPHERDS LANE TUNNEL - SOUTHERN PORTAL - CONCEPT DESIGN

Shephards Lane tunnel

The Shehards Lane tunnel is approximately 360 metres long and seeks to minimise impacts to the existing ridge line and protect and retain the vegetation.

The portals would be designed as clean symmetrical arches framed by 2H:1V vegetated slopes.

The final design and construction methodology would be confirmed during detailed design.

Gatelys Road tunnel

The Gatelys Road tunnel is approximately 450 metres long and seeks to minimise impacts to the existing ridge line and protect and retain the vegetation.

The portals would be designed as clean symmetrical arches framed by 2H:1V vegetated slopes.

The final design and construction methodology would be confirmed during detailed design.

FIG 5.39 GATELYS ROAD TUNNEL - SOUTHERN PORTAL - CONCEPT DESIGN

Tunnel lining

The treatment of the lining for the proposed tunnels would be designed to exhibit attractive, safe and functional interior to enhance the road user experience. Safety equipment is required to be highly visible and part of the design composition of the tunnel interior.

Cross passages are clearly demarcated for high visibility in emergency conditions whilst utilities and other equipment are recessive as part of the tunnel interior.

The tunnel interior walls would be painted with light coloured blue–white 60% reflectivity paint to increase reflectivity and create a fresh appearance. The interior would exhibit light coloured finishes that are cleanable, low maintenance and support anti–graffiti materials that reduce vandalism.

The tunnels along the highway would be uniform in design. The arched tunnels interior will be painted in a tessellated pattern, an abstraction of the surrounding landscape that form part of the project's visual narrative.

ST HELENA TUNNEL ENTRANCE

ST HELENA TUNNEL LINING