Appendix I

Urban design concept report

Heathcote Road Bridge

Urban Design Concept

Transport for NSW | November 2020

NSW GOVERNMENT | Transport for NSW

This report has been prepared:

FOR:

NSW GOVERNMENT | Transport for NSW

BY:

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A	30.10.2020	Draft Report	MW	JVG
B	20.11.2020	Final Report	MW	JvG
C	24.11.2020	Final Report	CF	MW

November 2020

CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

Transport for NSW is planning the to widen the existing Bridge over the Woronora River, including the approaches along Heathcote Road in Engadine, NSW.

Heathcote Road is a major arterial road in the south of Sydney. It runs from Newbridge Road in Liverpool to the Princes Highway in Heathcote.

Construction of the bridge widening would enhance safety for road users and revitalise the existing structure and enhance the connectivity between Heathcote and areas further south with Liverpool and other areas to the north west.

The bridge has a history of community concern for motorist safety due to its restricted width.

The road was originally constructed during the second World War as a military route which used the ridge lines and a causeway crossing of the Woronora River. The bridge was built in 1942 as a concrete structure with twin girders and cross beams.

Fig 1.1 Existing bridge

1.2 PURPOSE OF THIS REPORT

The purpose of this work is to provide urban design input into the development of the concept design to guide the subsequent work phases of the proposal and to achieve a holistic and cohesive urban design outcome. This strategy provides project urban design objectives that have been developed following a contextual analysis that included landform, surrounding land uses and connectivity, heritage areas, built form, and scenic values to identify key issues and considerations.

The strategy also seeks to provide a consistent urban and landscape design approach with future network upgrades. A preliminary landscape character and visual impact assessment has been prepared to inform the project of key issues to be considered in the design. See Figure 2.1 for the extent of the Study Area.

1.3 STRUCTURE OF THE REPORT

This report is structured as follows:

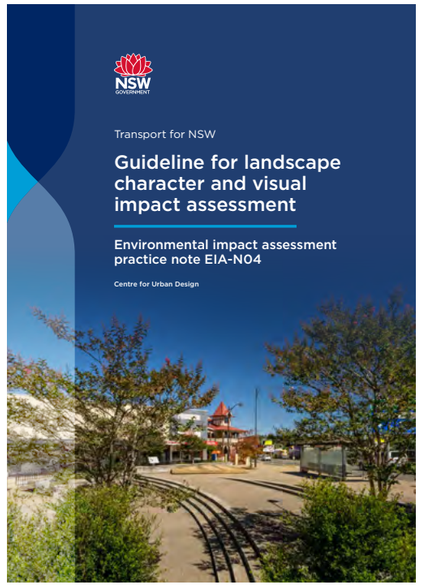
- Chapter 1: Introduction and background information
- Chapter 2: Contextual analysis, a succinct description of the study area. Identification of landscape character zones
- Chapter 3: Corridor strategy that describes the overriding urban design objectives and principles
- Chapter 4: Landscape Concept Design, describing key landscape design strategies to integrate the proposal in its setting and minimise impacts to the surrounding area
- Chapter 5: Bridge Widening Concept Design, describing the design strategies to achieve a sensitive outcome for the bridge widening
- Chapter 6: Landscape Character and Visual Impact Assessment, identifying key impacts to the surrounding are
- Chapter 7: Conclusion, summary comments and identification of important strategies to consider in the next phases of the design.

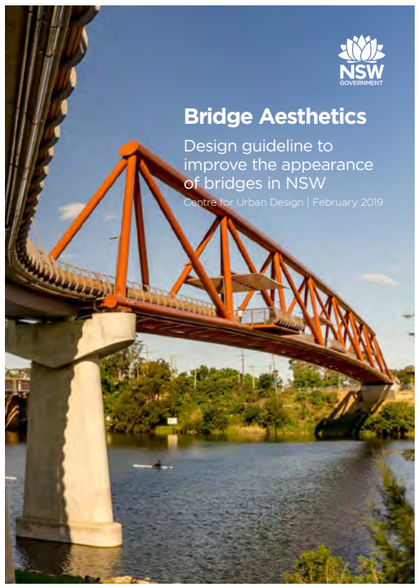
1.4 REFERENCE DOCUMENTS

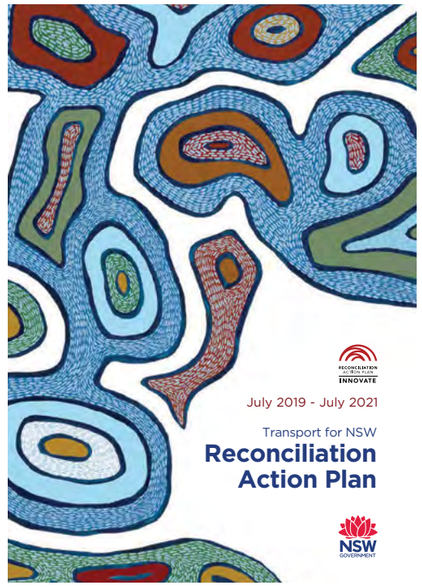
Key reference documents for development of the urban design concept include the following documents:

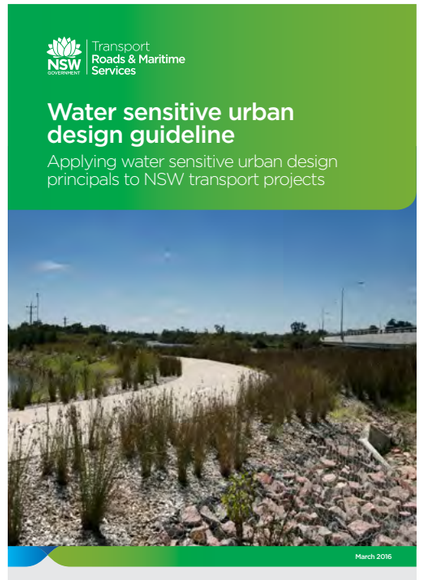
Other reference documents include the following Transport for NSW design Guidelines:

- ‘Beyond the Pavement – Urban design policy, procedures and design principles’, Roads and Maritime Services, updated August 2020
- ‘Bridge Aesthetics – Design guideline to improve the appearance of bridges in NSW’, Centre for Urban Design,February 2019
- ‘Landscape design guideline- Design guideline to improve the quality, safety and cost effectiveness of green infrastructure in road corridors,’ Roads and Maritime, December 2018
- ‘Guidelines for landscape character and visual impact assessment No. EIA-N04’, Version 2.2 Issue Date August 2020
- “Water sensitive urban design guideline- Applying water sensitive urban design principles to NSW transport projects,’ March 2016
- Reconciliation Action Plan 2019-2021









2 CONTEXTUAL ANALYSIS

2.1 SITE CONTEXT

2.1.1 Regional Context

The study area is located in the Sutherland Shire, on the outskirts of Engadine and Heathcote, 22 kilometres south of Sydney's CBD.

Heathcote Road is a major arterial road linking Liverpool and Heathcote, providing an important access to Sydney's motorway network for the southern suburbs of the metro area.

The study area is situated in dense bushland setting, surrounded by national parks. The sandstone vegetation setting provides a unique backdrop to the bridge spanning over the Woronora River, a tributary to the Georges River.

Heathcote is a southern suburb in the outskirts of Sydney's metro area, with a population of about 6,000 while Engadine, to the east, has more than 17,000 people.

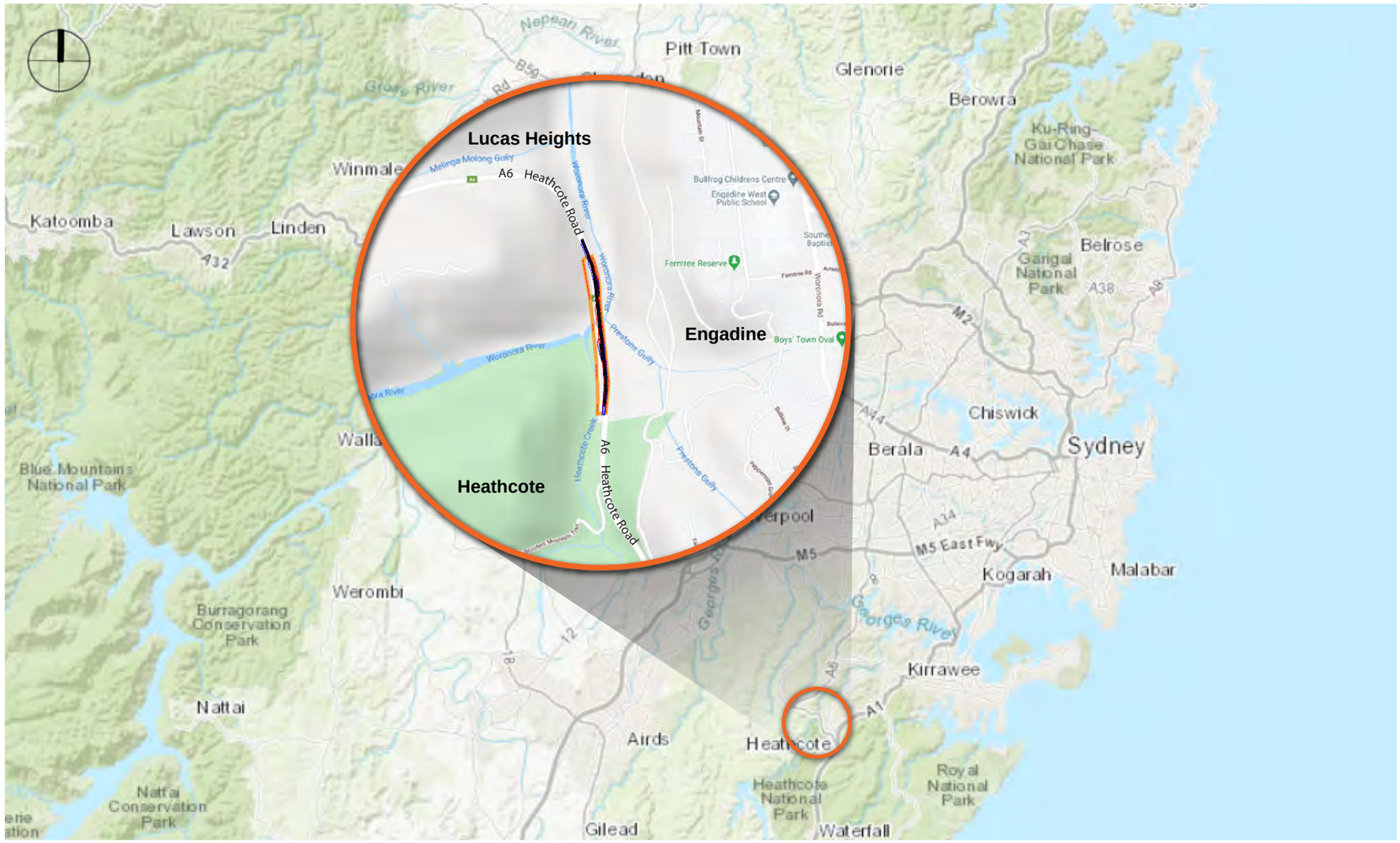


Figure 2.1 Locality map of the study Area

2.1.2 Description of the Study Area

Due to the remoteness of the site and minimal disturbance, this site is one of natural beauty- its vegetation, rocks, water quality and overall environmental quality is high. As outlined in the Biodiversity report, the Woronora River has excellent water quality and supports movement of wildlife through the region.

To the west, the confluence of the Woronora River and Heathcote Creek meet, with beautiful natural scenery- water, plants, rock outcrops.

Being located within the Sydney Cataract sub-region of the Sydney Basin Bioregion, the study area is within the Mitchell landscape known as the Woronora Plateau which is developed on Triassic quartz sandstone and has a general elevation of 400 to 500 m. Rock outcrops are common on ridgelines and in creeks.

Figure 2.2 View looking towards the bridge set in dense bushland. As a result, the visual exposure of the bridge is limited.

2.1.3 Description of the Bridge

The Bridge was completed in 1942 and is listed on the Transport for NSW section 170 heritage register, and is recognised as having state significance.

The 75 year old bridge is a continuous five-span reinforced concrete structure, 126m in length, with 21.9m end spans and 27.4m internal spans.

The overall width of the bridge is 7.6m and the piers are strongly skewed with the deck at 42 degrees to align with the Woronora River.

The superstructure comprises of two main reinforced concrete girders which are haunched at the pier location. Concrete cross girders spaced at 4.5m centres support the deck structure.

The piers consist of twin octagonal slightly tapered columns, positioned directly under the line of the beams. Transverse beams tie the columns at the top and mid height.

The abutment walls consist of reinforced concrete retaining walls. The abutment return walls include mortared sandstone block facing.

In 1990, works were undertaken to upgrade the barrier system, with the kerb and railing being replaced with a precast twin rail barrier system.

The bridge's heritage significance is driven by its historic military heritage, its technical execution as a concrete structure and its aesthetic significance with the haunched girders typical of its time.

2.1.4 Vegetation of the Study Area

The vegetation of the Woronora Plateau is typified by woodlands with a shrubby understorey of Silvertop Ash Eucalyptus sieberi, Sydney Peppermint Eucalyptus piperita, Old Man Banksia Banksia serrata, Smooth-barked Apple Angophora costata, on ridges. Shrublands of Heath Banksia Banksia ericifolia, Hairpin Banksia Banksia spinulosa, Dagger Hakea Hakea teretifolia, She-oak Allocasuarina spp. and Soft Geebung Persoonia mollis with Gahnia spp. on slopes and extensive hanging swamps in saturated organic sands on the lowest slopes and valley floors with heath of; Hakea spp., Swamp Banksia Banksia robur, Button Grass Gymnoschoenus sphaerocephalus and grass trees Xanthorrhoea spp. Contour parallel patterned ground of ridges and trenches is common.

The study area is subject to disturbance from Heathcote Road, but otherwise contains relatively high quality habitat due to the topography of the locality and limited access.

Vegetation is comprised of sandstone vegetation of upper slopes, with riparian scrub and wetland species within the water body and low lying areas near the river. The upper slopes are dominated by Sydney Peppermint Eucalyptus piperita, Smooth-Barked Apple Angophora costata and Black She-Oak Allocasuarina littoralis. Riparian vegetation was dominated by Water Gum Tristaniopsis laurina and Black She-Oak Allocasuarina littoralis. Aquatic vegetation comprised of Bare Twig-rush Baumea juncea, Tall Sedge Carex appressa, and Cyperus polystachyos.

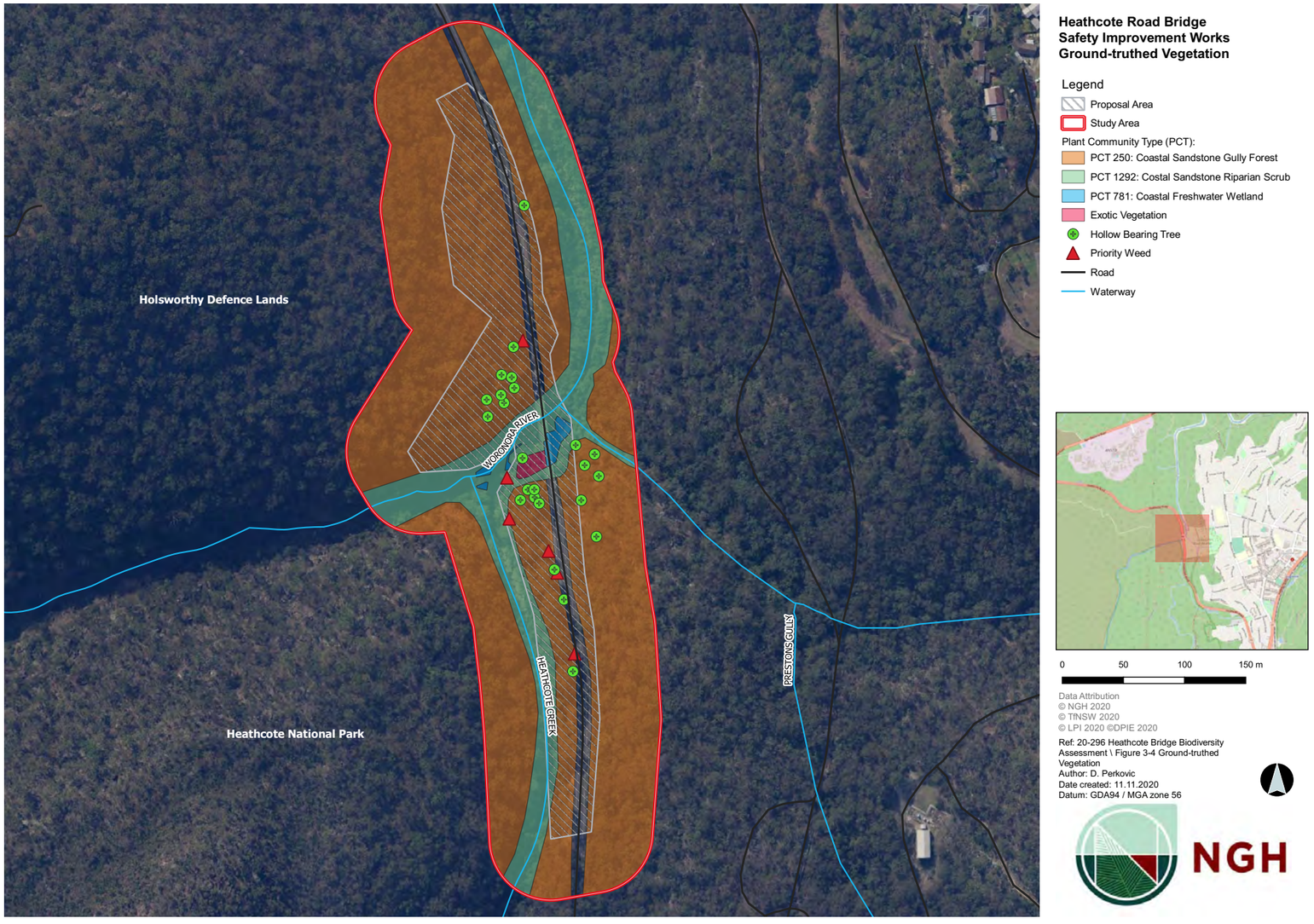


Figure 2.3 Plant community types. Source: Heathcote Bridge - Biodiversity Assessment Report / November 2020

Plant community types

Three (3) plant community types (PCTs) were identified within the proposal site, see figure 2.3:

- PCT 1292- Water Gum-Coachwood Riparian Scrub along Sandstone Streams, Sydney Basin
- PCT 1250- Sydney Peppermint-Smooth-barked Apple-Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin
- PCT 781- Coastal Freshwater Lagoons of the Sydney Basin and South East Corner

2.1.4 Wildlife Movement

The rich, diverse and healthy vegetation and water systems support movement of wildlife through the area. They support natural processes that occur in a healthy environment, including the movement of species to find resources, such as food and water.

Corridors can contribute to the resilience of the landscape in a changing climate and help to reduce future greenhouse gas emissions by storing carbon in native vegetation. Figure 2.4 indicates the green web plan as published by Sutherland Shire, with the project site sitting within the web.

The study area is identified as ‘core’ habitat which includes areas containing key habitat areas, key linkages and threatened species, or EECs (Sutherland Shire Council 2001).

The biodiversity records for the locality indicate the area is used as a koala movement corridor.

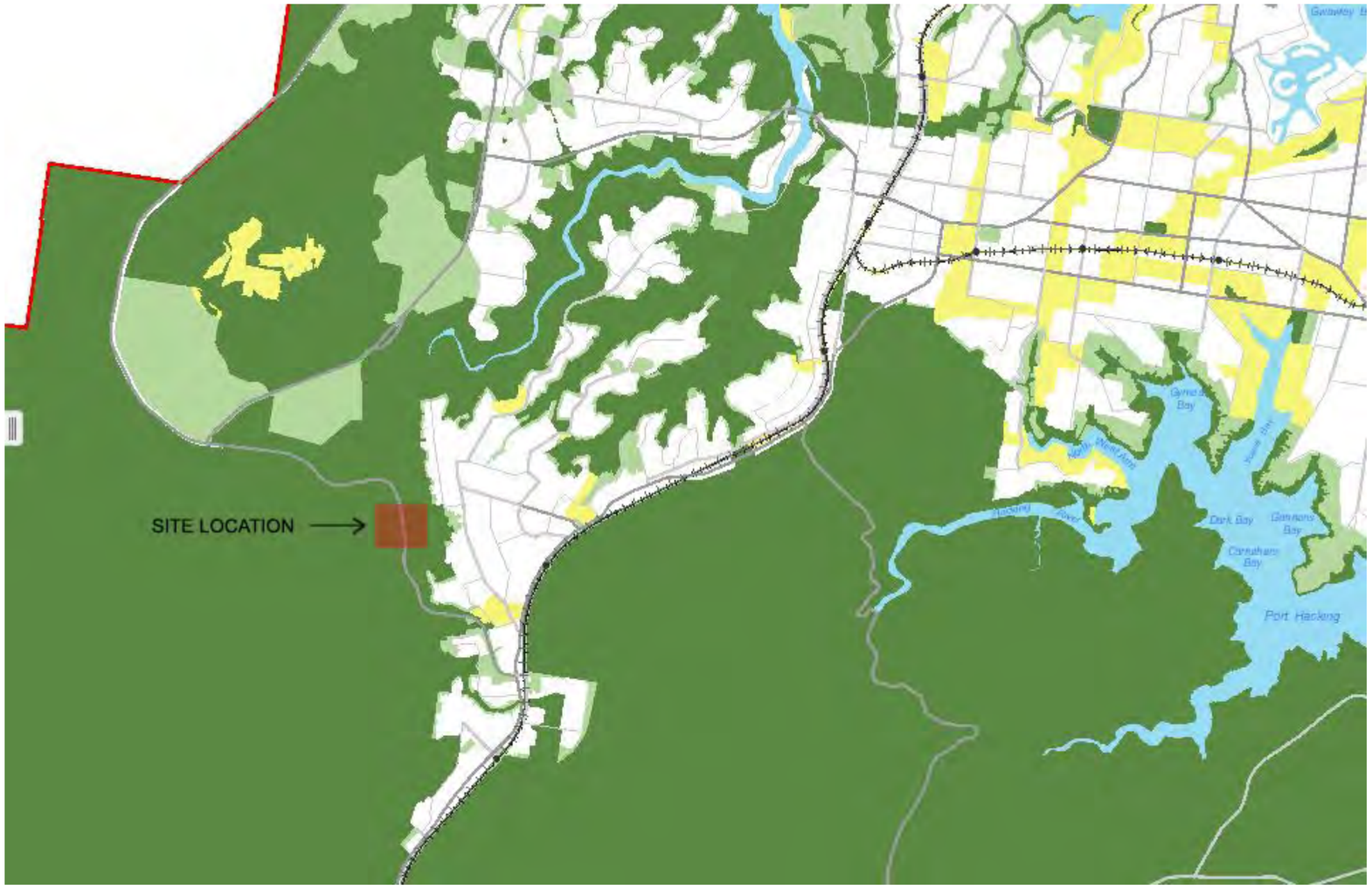


Figure 2.4 Greenweb mapping, Source: Sutherland Shire https://maps.ssc.nsw.gov.au/ShireMaps/

2.1.5 Non Aboriginal cultural heritage - local history

This area was first settled in the 1830s when the Parish of Heathcote was gazetted. Originally named Bottle Forest, the town was small and laid out in fourteen allotments in 1842. In 1879, the Lieutenant Governor prescribed 7000 hectares of Crown land as National Park. This led to the formation of Heathcote National Park south east to the proposal area.

Later on, with the construction of the Illawara railway line and the discovery of coal beds, the Parish increased in prosperity and growth. Heathcote was formally declared a town in 1933 alongside Engadine and Lucas Heights. The Holsworthy Military Base was also constructed in the 1880s. These developments led to more infrastructure including Kolora Weir (now redundant due to the Woronora Dam) as well as Heathcote Road and subsequent bridge.

Aside from the developing towns, these roads and bridges were more importantly built to support the movement of troops and supplies during WWII. Heathcote Bridge, formally known as Woronora River Bridge provided an important alternate route over the Woronora River to Princes Highway.The Bridge itself carries important heritage significance of the local history and development of Heathcote.

Figure 2.5 Heathcote Road being constructed in 1941. Source: Bridge over Woronora River near Heathcote - SOHI Report | October 2020

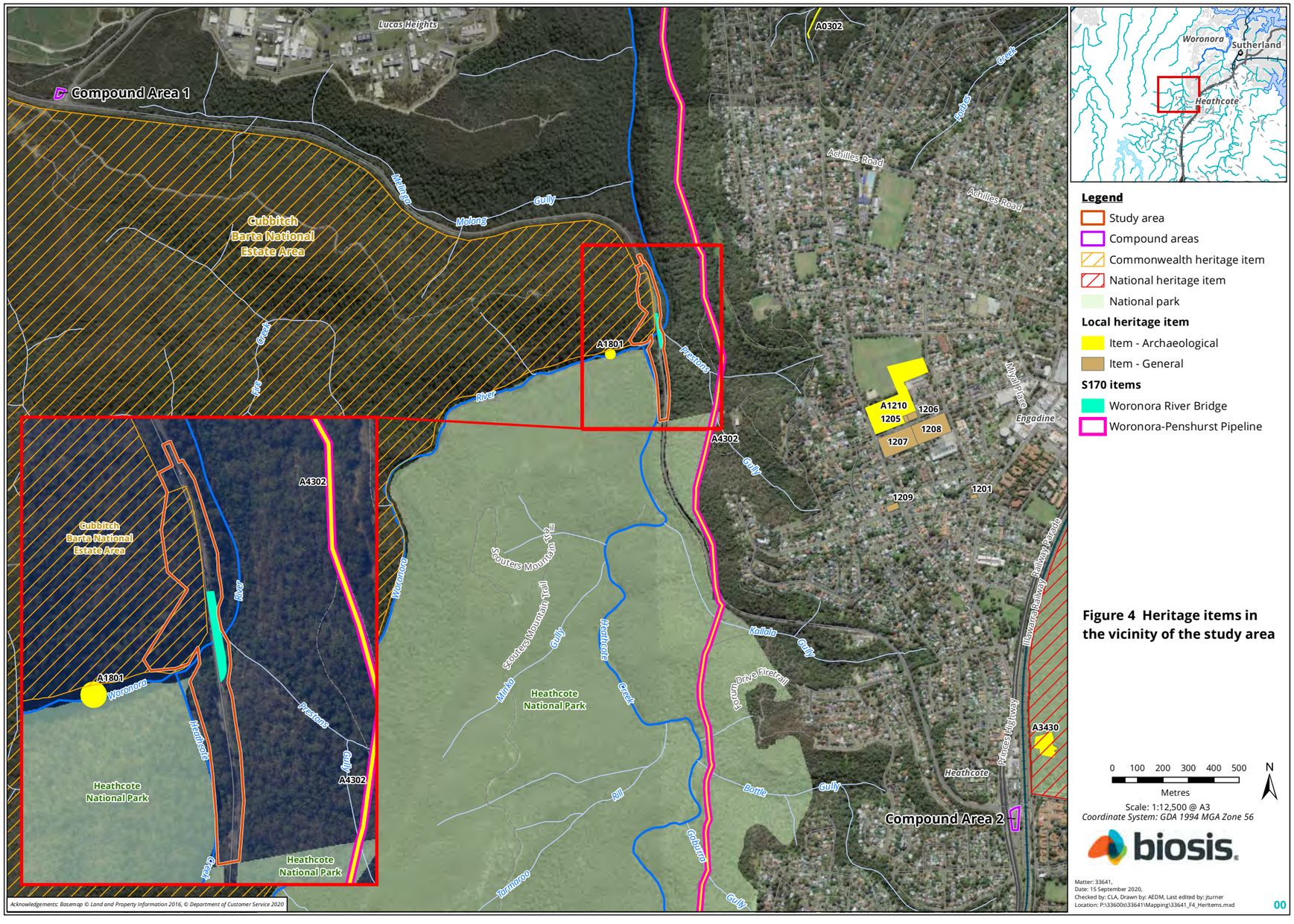


Figure 4 Heritage items in the vicinity of the study area

Figure 2.6 Heritage mapping. Source: Bridge over Woronora River near Heathcote - SOHI Report | October 2020

Figure 2.7 Photo of the natural beauty of the Woronora River, upstream of the bridge

2.1.6 Aboriginal Cultural Heritage

Before European Settlement, the area was inhabited by the Dja Dja Wurrung people. There were sixteen clans all speaking different dialects.

Just north of the site contains the Cubbitch Barta National Estate Area. It is a national heritage listed place for its indigenous, natural and historic values.
The area is intrinsic for members of the local Tharawal Aboriginal Land Council as well as the Dharawal people. It is revered for its symbolic, cultural and social connotations. The Cubbitch Barta National Estate comprises of over 530 archeological sites with 509 further potential sites - it is representative of a vast and complex Aboriginal cultural landscape that once existed.

Sites throughout the area include rock paintings, drawings, engravings, artefacts, grinding grooves and sacred trees. In a country that has been completely uprooted by European settlement, the Cubbitch Barta National Area (recognised by Commonwealth heritage listing) serves as an important connection between the first people and their past.

Fortunately, the proposed works are in an area which contains no Aboriginal objects. However, careful consideration of the sensitivity of this space should be applied moving forward as the proposed site is still within the vicinity of the Cubbitch Barta National Estate Area.

Source: Bridge over Woronora River near Heathcote - SOHI Report | October 2020

2.3 LANDSCAPE CHARACTER ASSESSMENT

The purpose of identifying landscape character zones is to identify areas of similar character to facilitate assessment and provide a description of each zone, giving the proposal its context and interface.

This section also discusses the sensitivity values for each landscape character zone. The sensitivity assessment has been based on Transport for NSW's Environmental Impact Assessment Practice Note - Guidelines for Landscape Character and Visual Impact Assessment No. EIA-N04, Version 2.2, issue (August 2020).

The sensitivity value refers to the qualities of a particular character zone, which may include the number and type of receivers and how sensitive the existing character of the setting is to the proposed change. For example a pristine natural environment will be more sensitive to change than a built up industrial area.

Four Landscape Character Zones (LCZs) have been identified surrounding the study area (refer figure 2.6). These are Heathcote National Park, the Holsworthy Military Reserve, the Engadine bushland and Heathcote Road.

It should be noted, that even though some of these landscape character zones may have a similar visual quality, their use and access is different; hence the distinction.

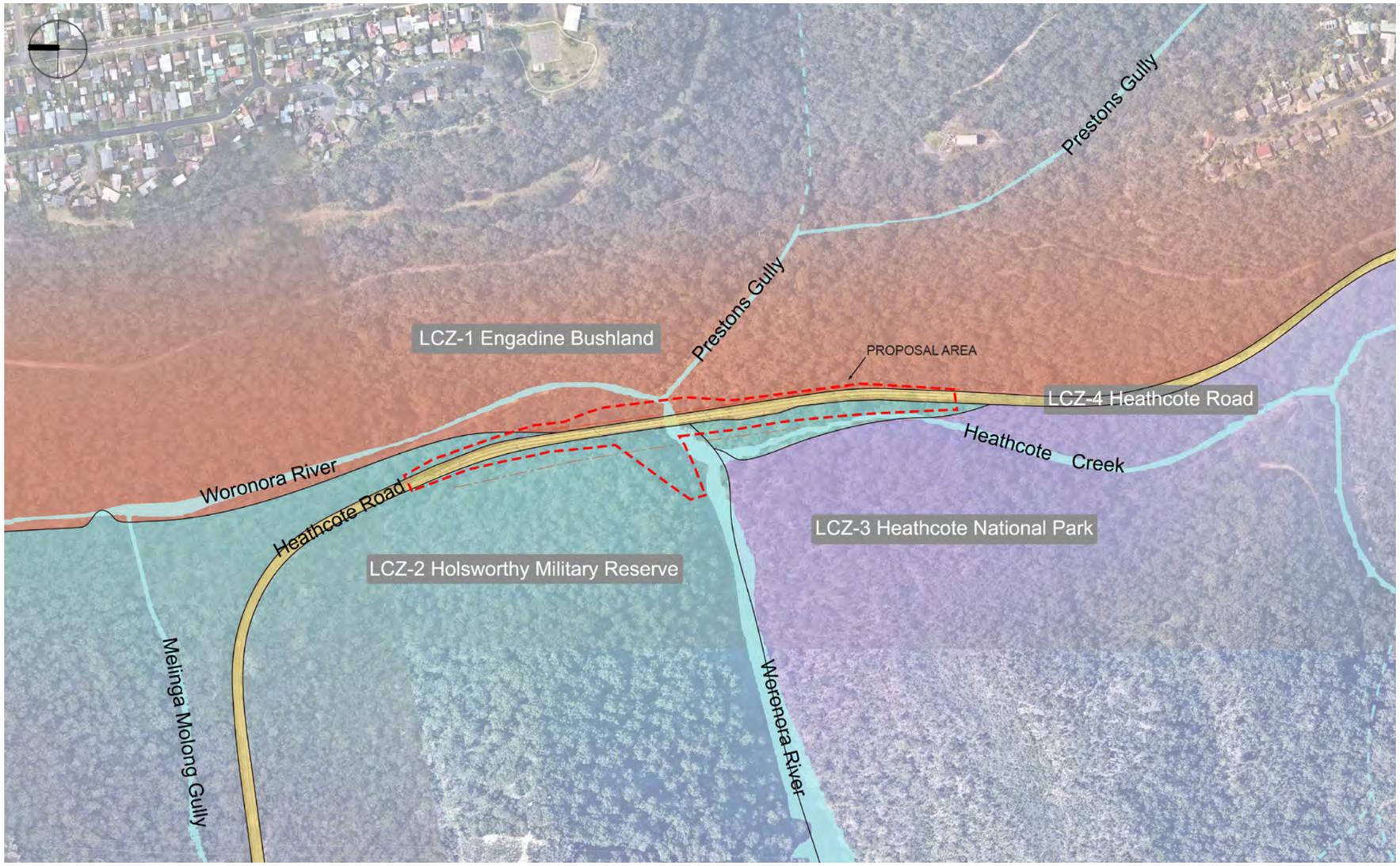


Figure 2.8 Landscape character zone map.

2.3.1 Engadine Bushland (LCZ-1)

East of Heathcote Road is a pocket of bushland wedged between the road and the suburb of Engadine. Pristine bushland with a rugged topography and steep valleys define the setting.

This zone also includes remnants of an abandoned historic road alignment that winds its way down into the gully. It includes remnants of an historic bridge across the Woronora River and dry sandstone retaining walls where the old road used to be.

Other interventions include an historic concrete causeway used by the military.

The waterway includes sand banks and swimming holes that contribute to the idyllic character of the area.

Figure 2.9 Even though this zone has been interfered with in the past, it still displays a pristine character.

Figure 2.10 The old road alignment down to the river is still recognizable today.

Figure 2.11 Remnants of the old piers of the original river crossing.

2.3.2 Holsworthy Military Reserve (LCZ-2)

The Holsworthy Military Reserve is situated directly to the west of the Woronora River and includes a vast expanse of bushland, with an area of 22,000 hectares. The reserve is a training area which includes an artillery range for the Australian Army.

Within the study area, the setting is characterised by dense bushland with dramatic sandstone outcrops overlooking the Woronora River.

As mentioned in the Aboriginal cultural heritage section, the site's cultural and biodiversity values of the site are recognised by the Commonwealth heritage listing- "Cubbitch Barta National Estate."

Figure 2.12 This zone is in a pristine state near the proposal site providing a highly scenic setting.

Figure 2.13 Along the waterway, sandbanks and wetlands define the foreshore.

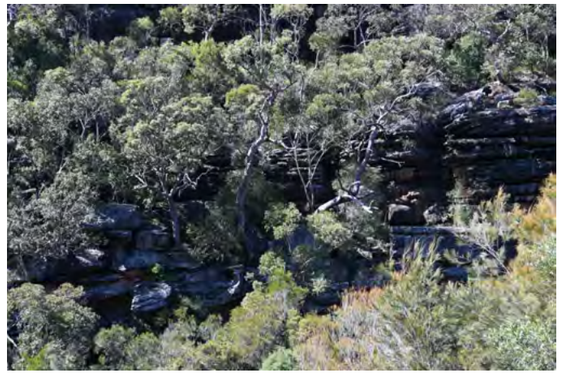


Figure 2.14 Sandstone outcrops define the eastern riverbank displaying the geology of the area and contributing to the rugged character of the setting.

2.3.3 Heathcote National Park (LCZ-3)

Situated to the south of Heathcote Road and east of the Woronora River, this zone is characterised by pristine dense bushland and sandstone woodland.

Heathcote National Park comprises an area of 2,679 hectares and includes a series of walking tracks, picnic and camping facilities.

The park displays the rugged beauty of the Australian bush characterised by magnificent native vegetation and wildlife, rocky outcrops and hidden freshwater pools.

Figure 2.15 This zone is heavily vegetated with dense bushland in a pristine condition.

Figure 2.16 The river sits in a gully with the landform steeply rising to the west.

Figure 2.17 The waterway is of a high scenic quality with wetlands and a dense understorey defining the foreshore.

2.3.4 Heathcote Road (LCZ-4)

Heathcote Road is a two lane arterial road that winds along the landscape dropping in elevation from Heathcote to a low point defined by the bridge and rising again to a high point at Lucas Heights to the west.

The road has a picturesque character and displays dramatic sandstone cuttings, exposing the local sandstone geology of the area.

At the bridge, panoramic vistas to the gully below display the rugged topography and pristine bushland of the area. The journey experience is highly scenic and the limited width of the bridge detracts from the journey experience.

Figure 2.18 The northern approach road has a winding nature and interfaces rock cuttings giving it a dramatic character.

Figure 2.19 The bridge crossing offers panoramic vistas over the gully below, marking the journey sequence.

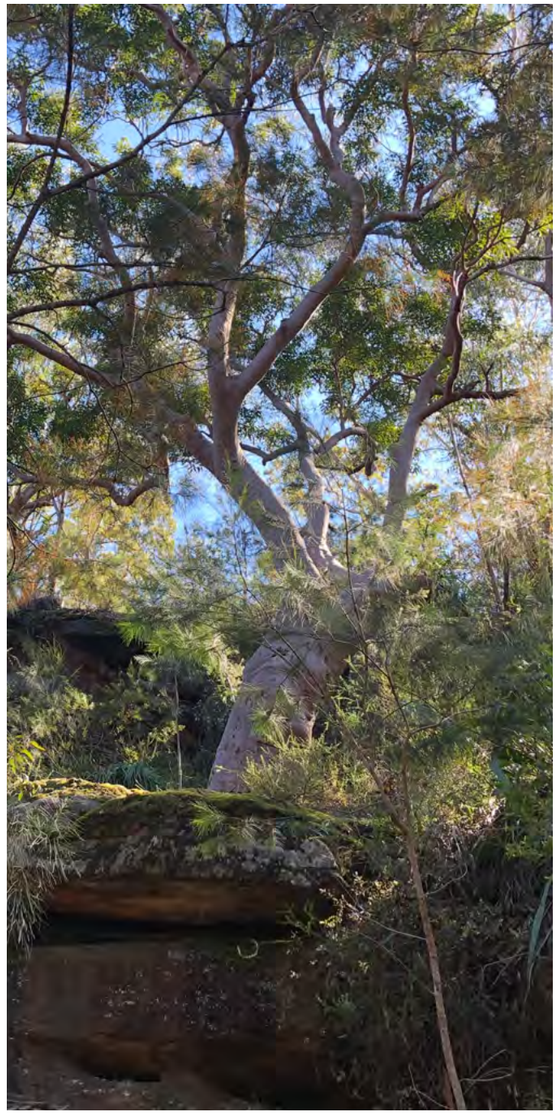
Figure 2.20 The southern approach is defined by large sandstone cuttings contributing to the scenic quality of the road.

3 URBAN DESIGN OBJECTIVES & PRINCIPLES

3.1 URBAN DESIGN OBJECTIVES

The following urban design objectives have been identified for the proposal, in line with the principles of Beyond the Pavement.

- Develop a design that minimises impacts to the surrounding bushland environment to demonstrate a sensitive construction methodology
- Retain the integrity of the existing structure to contribute to the heritage and identity of the area
- Enhance journey experience by improving the bridge width and create a safer and more pleasant journey experience
- Provide a design that limits visual impacts and allows the structure to recede/integrate with the surrounding setting
- Develop a design that minimises maintenance and provides ease of access to key components
- Fit sensitively within the natural bushland setting
- Design built form elements that fit sensitively in the natural bushland setting and steep topography
- Identify Aboriginal cultural heritage themes as part of the urban design process and develop into detailed design.



3.2 URBAN DESIGN PRINCIPLES

The following urban design principles have been identified in regards to the architectural treatment of the structure:

3.2.1 Landscape Design

- Minimise vegetation clearing and consider construction methodologies that minimise the construction footprint
- Consolidate design of construction access tracks to minimise the impact of temporary works- Utilise previously cleared tracks (i.e. old bridge road alignment) for access for construction vehicles etc to minimise clearing requirement
- Minimise disturbance to drainage lines and creeks
- Touch the earth lightly, minimise fills and cuts in this sensitive environment
- Minimise imported topsoil and develop revegetation procedures that do not need imported topsoil
- Reinforce the three existing indigenous vegetation community types in revegetation works
- Introduce water sensitive design principles to minimise impacts upon the environment
- Utilise site materials- trees, leaf litter/mulch, rocks, soil in any restoration/remediation works
- Introduce pinned logs (recycled from site) and rock boulders to retain slopes to assist bank stabilisation and revegetation processes
- Maximise retention of key mature Eucalypts (majority are Eucalyptus sieberi and Angophora costata
- Investigate opportunity for interpretation of the old river crossing- with remaining Heathcote bridge piers
- Investigate opportunities to utilise felled vegetation for fauna connectivity furniture, such as Koala crossings or stream bank stabilisation/ waterway snags
- Minimise impacts to the existing optic fibre asset to avoid environmental impacts caused by utility adjustments
- Ensure retention of the habitat trees
- Minimise fragmentation of the bushland setting
- Integrate landscaped zones in front of retaining walls to reduce the dominance of these elements
- Consider utilising natural materials and/ or dark materials that help recede structures in the landscape
- Ensure operational water quality treatment structures are designed integrally with the bushland setting and/or landscape context and that they have adequately considered maintenance requirements
- Utilise previously cleared road tracks as maintenance access to access the site where feasible
- Consider alternative WSUD approaches to drainage design and for scour protection to disturb less bushland and integrate with landscape revegetation practices.

3.2.2 Built Form

Abutment Retaining Walls

- Introduce concrete retaining walls with a dark grey oxide to visually recede these elements
- Consider a strong horizontal ribbing that echoes the sandstone block course of the existing abutment wall
- Consider a timber finish to provide a more rugged finish that is in line with the setting and history of the bridge as a military facility.

Headstock

- Locate tension member/cable interfaces as close to the pier as possible
- Minimise bulk of headstock at termination
- Relate the architectural language of headstock extension to the existing structure. Octagonal shapes are appropriate
- Paint headstock extension in a dark grey colour to express new components with an understated character.

Parapet

- Minimise depth of parapet to achieve an elegant proportion between girder and parapet
- Tilt face of parapet away from centreline of bridge to maximise overshadowing of the girder
- Ensure that parapet barriers are the double rail type to maximise visual permeability from the bridge to the adjacent setting.

Girder

- Relate to the form of the existing girders to provide continuity of form language.
- Paint steel girder a dark grey colour to visually recede this member and retain consistency with other components of the bridge extension. This will also allow the structure to appear lighter and visually reinforce the presence of the parapet.

Piers

- Avoid the introduction of new piers as it would deter from the existing structure
- Retain the visual integrity of the piers by allowing new added components to be clearly legible whilst retaining the overall legibility of the original structure
- Where appropriate relate form language of new components to the architectural language of the pier.

Construction

- Minimise the required footprint of the plant and equipment required during construction
- Evaluate the type of plant and equipment to mitigate hard stand areas and required clearing.

3.2.3 Cultural Interpretation

- Consider the potential for Aboriginal artworks such as murals along abutment walls, which would also serve to deter graffiti vandalism. In this regard, military themes may also be considered to express the military heritage of the structure.
- Existing bridge elements: carefully record all aspects of the existing bridge, including retaining walls as a way to preserve and display the original structure. This would include photographic, video documentation 3D scanning and expert assessment
- Existing abutment walls: consider recycling the sandstone cladding in the form of gabion baskets to clad the new abutment walls
- Alternatively consider removing the existing sandstone and recycling it for use in a nearby area as a picnic facility/meeting place or interpretation device.

Beyond the project footprint are a few points of interest, especially on the south west abutment area that could be interpreted should a future trail be considered feasible:

- a section of old retaining wall from the old bridge road alignment
- old weir remains
- old pump station down near creek but on rise
- confluence of the two rivers-Woronora Creek and Heathcote Creek. Clean water beautiful scenery
- Aboriginal land with meanings (to be confirmed with community as part of detailed design workshops with cultural knowledge holders - eg river confluence, bush tucker foods)

4 LANDSCAPE CONCEPT DESIGN

4.1 RESPONSES TO THE SITE

SE abutment

- dominance of Casuarinas, Eucalypts
- this side receives more sun , has gentle & steep slopes to the creek.
- upper slopes have more flowering shrubs such as pink flowering Grevilleas
- Gymea lilies dominant
- 2 white Eucalypts (E. sieberi) where construction access track is proposed
- rock boulders abundant
- bird life noticeable

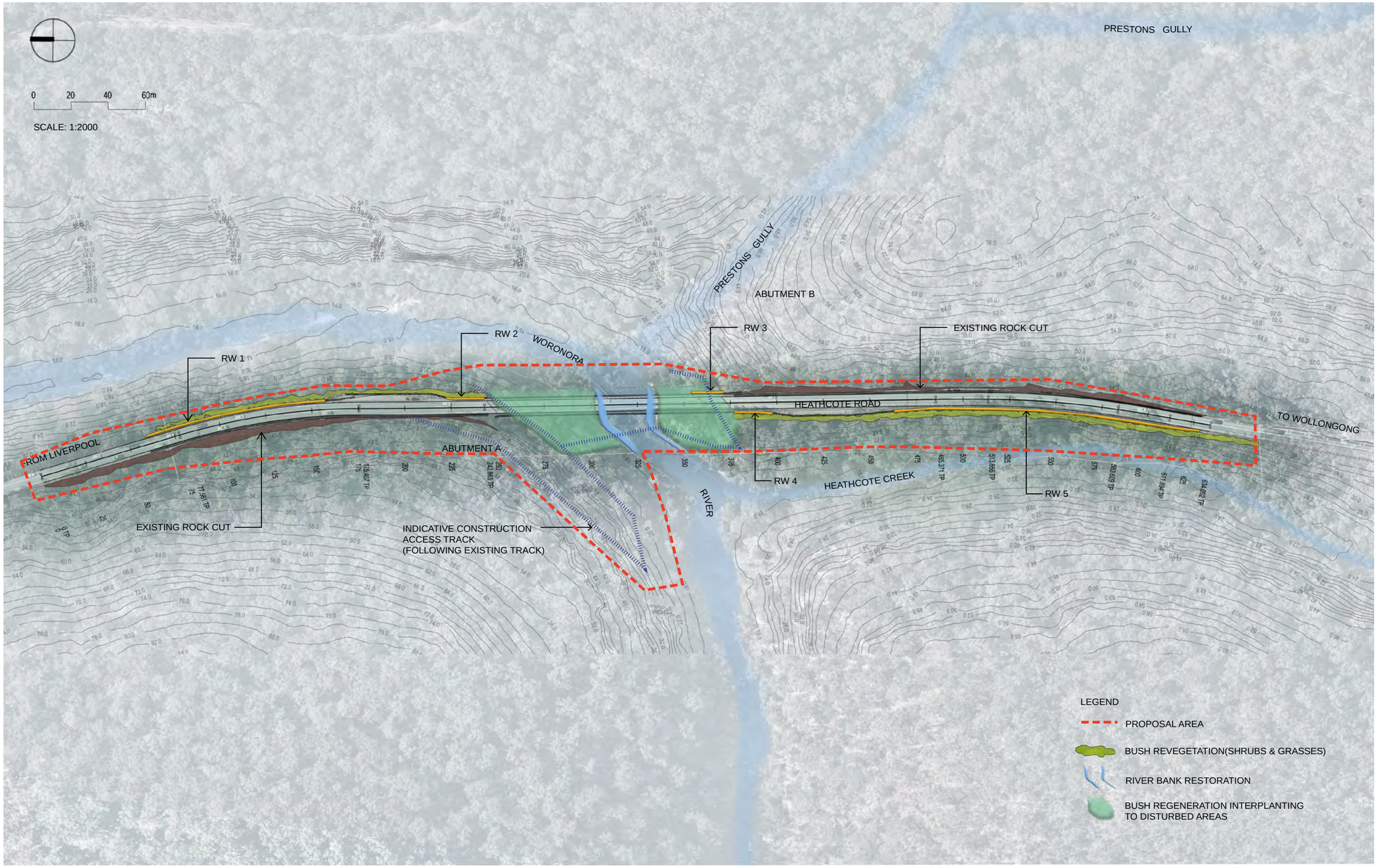


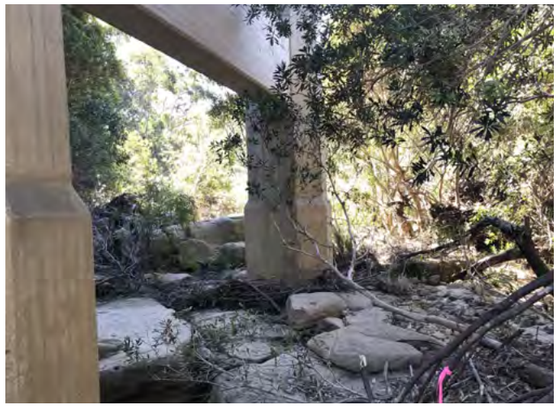
Figure 4.1 Landscape plan. Scale 1: 2000

SW abutment

- massive rock boulders with steep slopes to creek
- vegetation is diverse with Casuarinas, Eucs, Pittosporum, Acacias – Acacia longifolia, ferns- bracken, Epacris, Lomandra longifolia, Casuarinas, Eucalypts, Angophoras, native grasses dominant in upper sunny areas.
- above the rock cut, there Banksias, Hakeas, Gymea lilies dominant.
- on opposite creek bank the dominant character is of Eucalypts with Gymea lilies on steep slopes to creek.
- Angophoras frequent near the bridge.

NE abutment

- this area has very steep inclines to the creek below, a shady environment with less sun than other side. Plants are different with dominance of Casuarinas, Eucalypts, Pittosporum and native pine species.



NW abutment

- in the flood plain area adjacent the water and within the creek banks there was a red flowering Grevillea species.

4.2 REVEGETATION PRINCIPLES:

- Using bushland revegetation practices, spread any topsoil/leaf litter/sand salvaged from each zone for replacing on the following zones:
- Upper slopes: Sydney Peppermint-Smooth-barked Apple-Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin
- Lower slopes: Water Gum-Coachwood Riparian Scrub Along Sandstone Streams, Sydney Basin
- River bank edges:Coastal Freshwater Lagoons of the Sydney Basin and South East Corner
- Consult Aboriginal groups for advice on inclusion of plants with Aboriginal importance in revegetation scheme during the detail design phase.

4.3 RIVERBANK RESTORATION

For restoration to disturbed gently sloped river bank sections, concepts that are minimalistic are appropriate. Utilising a wire mesh to prevent erosion and allowing plants/ seeds to regenerate over time is appropriate.

4.4 BUSH REGENERATION PRACTICES

Intent is to undertake weed removal practices (without using herbicides)and to interplant tubestock into gaps within adjacent bushland areas.
As all areas are also beyond the clear zone, and the intent is to be using recycled site materials for mulching(leaf litter from site) and topsoil requirements (to planting holes only) etc.

The construction methodology would include:

- scarifying the surface 50mm (only to areas where planting and mulching is proposed)
- supplying and placing 100mm depth recycled bush litter from site
- interplanting tubestock trees, shrubs and groundcovers/grasses(no imported topsoil)
- removing existing deciduous trees and weeds(minimal)

4.5 REVEGETATION

For the bushland revegetation areas the following plants have been selected from the Native Vegetation of the Sydney Metropolitan Area NSW Plant Community Type classification.

Plants for interplanting and bushland revegetation works on suitable slopes are listed and illustrated on the following pages.

Riparian areas
I.e. lower slopes to river edge

Information taken from :

PCT 1292- Water Gum-Coachwood Riparian Scrub along Sandstone Streams, Sydney Basin

Trees

Ceratopetalum apetalum	*Coachwood*
Callicoma serratifolia	*Black Wattle*
Eucalyptus piperita	*Sydney Peppermint*
Syncarpia glomulifera	*Turpentine*
Tristaniopsis laurina	*Water Gum*

Shrubs

Acacia parramattensis	*Parramatta Wattle*
Acacia longifolia	*Golden Wattle*
Acmena smithii	*Common Lilly Pilly*
Grevillea species	*(on site, red flowers)*
Leptospermum polygalifolium	*Lemon Scented Tea Tree*
Pittosporum undulatum	*Sweet Pittosporum*
Melaleuca linariifolia	*Flax-leaved Paperbark*

Grasses & groundcovers

Doodia caudata	*Smnall Raspfern*
Lomandra longifolia	*Spiny- headed Mat-rush*
Juncus usitatus	*Common Rush*
Viola hederacea	*Native Violets*

Vines & Climbers

Cassytha pubescens	*Devils Twine*
Morinda jasminoides	*Sweet Morinda*

Moist Slopes& Gullies
PCT 1250- Sydney Peppermint-Smooth-barked Apple-Red Bloodwood Shrubby Open Forest on Slopes of Moist Sandstone Gullies, Eastern Sydney Basin

Trees

Angophora costata	*Smooth barked Apple*
Corymbia gummifera	*Red bloodwood*
Eucalyptus piperita	*Sydney Peppermint*
Eucalyptus sieberi	*Sydney Top Ash*

Small Trees

Banksia serrata	*Old Man Banksia*
Ceratopetalum gummiferum	*Christmas Bush*
Acacia suaveolens	*Sweet Wattle*
Acacia terminalis	*Sunshine Wattle*
Banksia ericifolia	*Heath Banksia*
Bossiaea heterophylla	*Variable Bossiaea*
Dillwynia retorta	*Eggs and Bacon*
Epacris longiflora	*Fuchsia Heath*
Lambertia formosa	*Mountain Devil*
Leptospermum trinervium	*Slender Tea Tree*
Persoonia levis	*Broad-leaved Geebung*
Persoonia pinifolia	*Fine Leaf Geebung*
Petrophile pulchella	*Conesticks*
Pimelea linifolia	*Slender Rice Flower*
Platysace linearifolia	*Narrow-leaved Platysace*
Pultenaea stipularis	*Fine-leaf Bush-pea*
Woollsia pungens	*Snow Heath*

Grasses & groundcovers

Dianella caerulea	*Blue Flax Lilly*
Doryanthes excelsa	*Gymea Lilly*
Entolasia stricta	*Wiry Panic*
Lepidosperma laterale	*Variable Swordedge*
Lomandra longifolia	*Spiny-headed Mat-rush*
Lomandra obliqua	*Twisted Mat-rush*
Lomatia silaifolia	*Crinkle Bush*
Pteridium esculentum	*Bracken Fern*
Xanthosia pilosa	*Woolly Xanthosia*
Xanthosia tridentata	*Rock Xanthosia*

Edges of the waterways

PCT 781- Coastal Freshwater Lagoons of the Sydney Basin and South East Corner

Shrubs

Casuarina glauca	River She-Oak
Melaleuca ericifolia	Swamp Paperbark

Groundcovers

Baumea juncea	*Bare Twig-rush*
Baumea articulata	*Jointed Twig-rush*
Blechnum indicum	*Swamp Waterfern*
Bolboschoenus fluviatilis	*River Bulrush*
Carex appressa	*Tall Sedge*
Eleocharis sphacelata	*Tall Spike-rush*
Grevillea species	*(on site, red flowers)*
Hypolepis muelleri	*Ground Fern*
Persicaria strigosa	*Spotted Knotweed*
Phragmites australis	*Common Reed*
Typha orientalis	*Bulrush*

Coastal Freshwater Lagoons - Shrubs and Ground Covers

Baumea juncea 'Bare Twigrush' | *Bolboschoenus fluviatilis* 'River Bulrush' | *Casuarina glauca* *'River She-Oak'* | *Melaleuca ericifolia* 'Swap Paperbark' | *Persicaria strigosa* *'Spotted Knotweed'*

Sydney Peppermint-Smooth-barked Apple-red Bloodwood Shrubby Open Forest - Trees

Angophora costata 'Smooth-barked Apple' | *Banksia serrata* 'Old Man Banksia' | *Corymbia gummifera* *'Red Bloodwood'* | *Eucalyptus piperita* 'Sydney Peppermint' | *Eucalyptus sieberi* *'Sydney Top Ash'*

Sydney Peppermint-Smooth-barked Apple-red Bloodwood Shrubby Open Forest - Grasses and Ground Covers

Dianella caerulea 'Blue Flax Lily' | *Doryanthes excelsa* 'Gymea Lily' | *Lomandra longifolia* *'Spiny-headed Mat-rush'* | *Pteridium esculentum* 'Bracken fern' | *Xanthosia pilosa* *'Woolly Xanthosia'*

Water Gum-Coachwood Riparian Scrub - Shrubs and Native Grasses

Acacia longifolia 'Golden Wattle' | *Acmena smithii* 'Common Lilly Pilly' | *Juncus usitatus* *'Common Rush'* | *Leptospermum poligalifolium subsp. polygalifolium* 'Lemon Scented Tea Tree' | *Lomandra longifolia* *'Spiny-Headed Mat-Rush'*

Sydney Peppermint-Smooth-barked Apple-red Bloodwood Shrubby Open Forest - Shrubs

Acacia terminalis 'Sunshine Wattle' | *Banksia ericafolia* 'Heath Banksia' | *Epacris Longiflora* *'Fuchsia Heath'* | *Lambertia formosa* 'Mountain Devil' | *Leptospermum trinervium* *'Slender Tea-tree'*

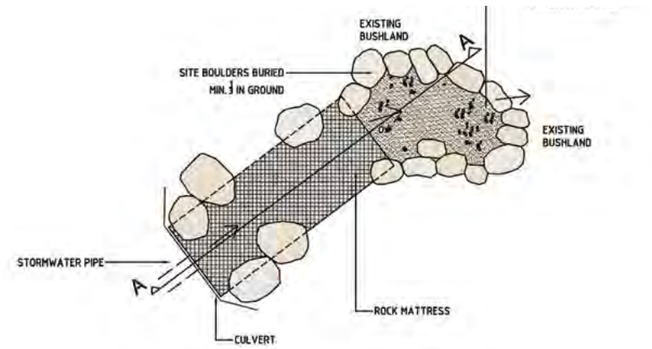
Water Gum Coachwood Riparian Scrub - Trees

Ceratopetalum apetalum Coachwood | *Callicoma serratifolia* 'Black Wattle' | *Eucalyptus piperita* 'Sydney Peppermint' | *Syncarpia glomulifera'* *'Turpentine'* | *Tristaniopsis laurina* 'Water Gum'

Figure 4.2 Vegetation community group species images

4.6 WSUD

Water sensitive design is ideally suited for this sensitive, high quality environmental site. Concepts for reducing flows, velocity, scour protection should include integrated options such as using site boulders, rock mulch, some area of concrete, rocks embedded , bio-retention areas, terraced rock retaining areas.



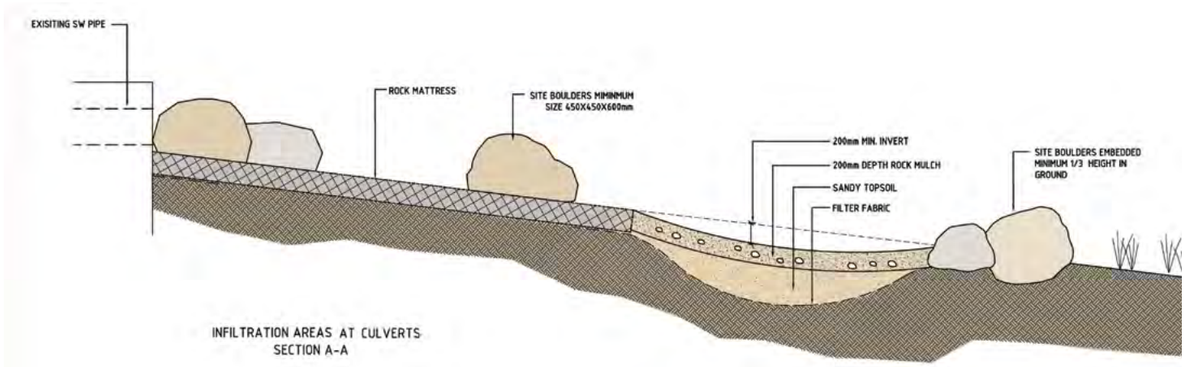


Figure 4.3 Rock infiltration areas proposed for culvert area

4.7 SLOPE STABILISATION

Methods to retain the slopes, prevent scour and erosion of disturbed areas that would deliver appropriate design responses to this sensitive, steep site include pinning site logs and using existing rock boulders to retain slopes. Both methods also promote good plant growth.

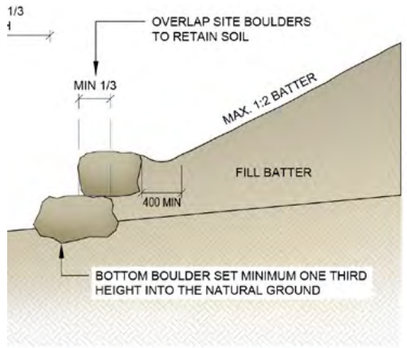


Figure 4.4 Dry rock retaining would reduce impact on trees and minimise extent of fill

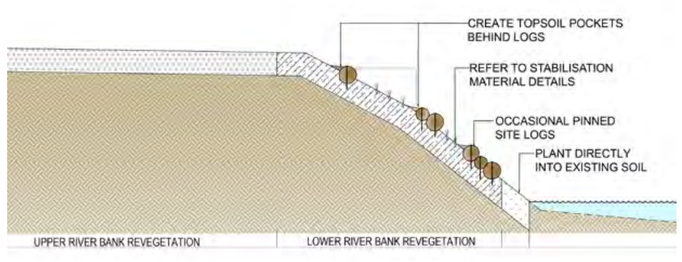


Figure 4.5 Site logs pinned to slopes to minimise erosion

5 BRIDGE WIDENING CONCEPT DESIGN

A number of options have been considered for the widening of the bridge, including:

- Introduction of steel struts
- Headstock widening
- Steel brackets anchored to the existing pier headstock
- Introduction of an independent substructure
- Steel brackets with a post-tensioning system

From these five options, the headstock widening has been identified as the preferred option. Key advantages of this option includes:

- Minimising drilling into the existing pier and compromising its integrity
- Enhancing the capacity of the existing headstock by the application of external post tensioning
- Minimising construction impacts at ground level/water course
- Reducing overall construction footprint
- Introducing a sympathetic solution to the existing structure by retaining its general visual character.

For additional information regarding the assessment of the various options, refer to the "***Heathcote Road Bridge Widening Structural Feasibility Assessment***" prepared by Aurecon.

5.1 HEADSTOCK & PIER

The preferred option, headstock widening, involves the introduction of an additional steel box girder on each side of the bridge. A headstock extension in the form of a steel "knuckle" on each side of the pier would support the additional girder. The extensions are 'clamped' into position to the pier with the use of stainless steel roads. These rods/ tendons would be exposed to minimise any impacts/drilling into the existing structure.

5.2 SUPERSTRUCTURE

The steel box girders on each side would follow the profile of the existing girders, ensuring consistency in form language.

Both the headstock extension and the girder would be painted in a charcoal colour. This approach ensures that a distinction is achieved between old and new components, but the dark colour selection would also help recede the new elements, allowing the old components to dominate.

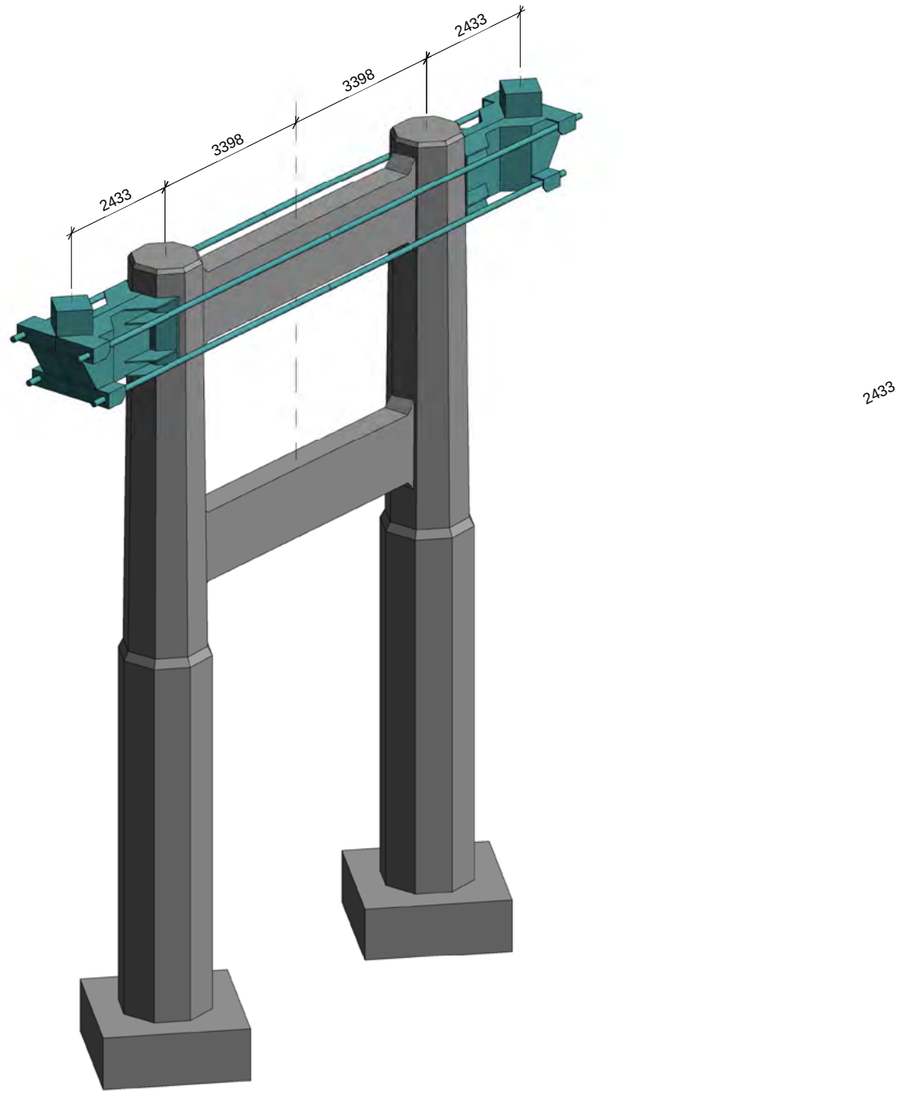


Figure 5.1 Indicative 3D study of the pier and new headstock extension in teal colour.

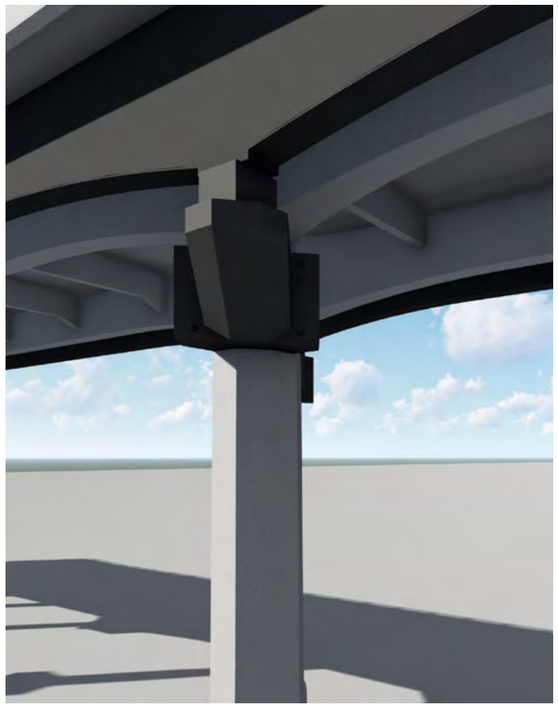


Figure 5.2 Indicative 3D study of the pier and new headstock extension. The form language of the headstock reflects the octagonal shape of the pier.

Figure 5.3 Indicative 3D study of the pier and new headstock extension. Steel rods would be used to clamp the two knuckles to the existing pier.

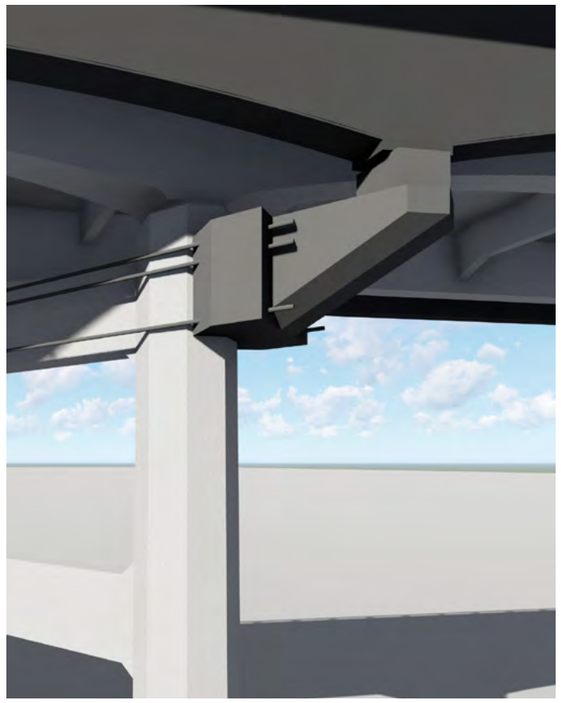


Figure 5.4 Indicative 3D detail study of the bolt connections. The steel rods avoid the existing structure to ensure its integrity.

Figure 5.5 Indicative 3D study of the girder, illustrating the haunched form language at the pier.

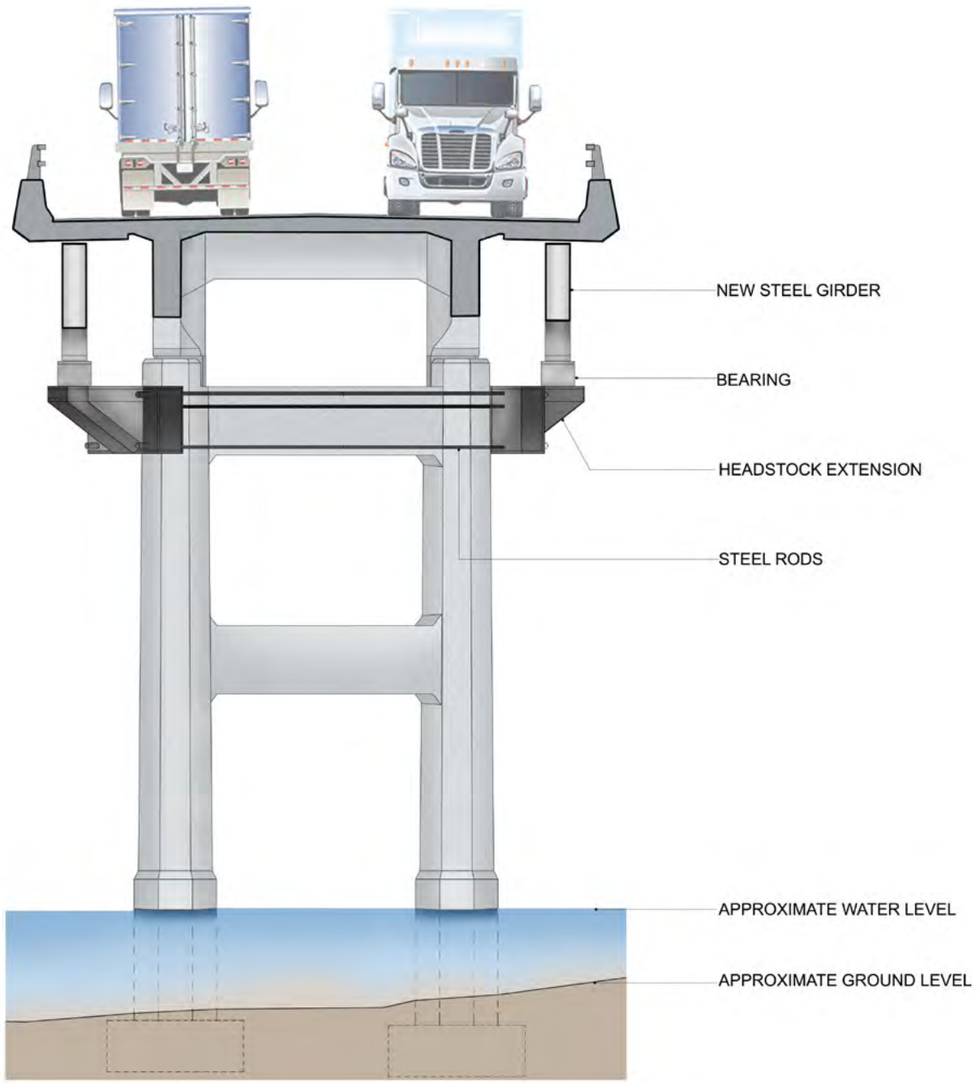


Figure 5.6 Cross section of the bridge illustrating the widened deck and headstock configuration.

5.3 PARAPET

The parapet is designed to have a minimum depth to create a slender element and reflect the existing structure.

There would be no drainage pipes or utilities, eliminating the need to extend the parapet below the soffit of the deck.

The outer face of the parapet is slanted outwards to maximise overshadowing and catch the sunlight.

This is considered particularly important due to the limited deck overhang and the girder depth.

A chamfer is introduced at the bottom of the parapet to make it look more slender, in line with the existing structure.

This approach will assist in receding the overall structure and settle it in its setting, whilst respecting its original appearance.

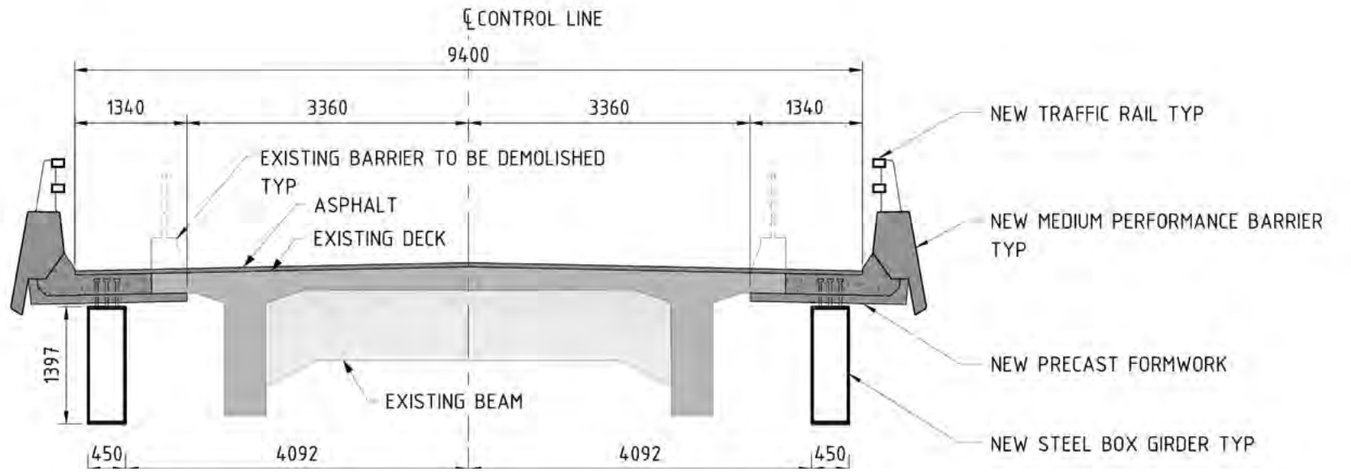


Figure 5.7 Detailed cross section illustrating the various elements of the deck widening.

5.4 ABUTMENTS

The existing abutments consist of reinforced concrete retaining walls founded on rock and the wing walls consist of gravity concrete with mortared sandstone facing.

Due to the bridge widening, it is proposed to remove and recycle the sandstone cladding as a way to retain aspects of the existing heritage structure and showcase this in a creative way.

Two alternative treatments are proposed- gabion walls and concrete finish.

5.4.1 Option 1: Gabion Walls

It is proposed to clad the abutment return wall with gabion baskets filled with recycled sandstone from the original walls. It is expected that in removing the existing sandstone cladding, the facing block would be damaged and hence could be reused for such a purpose. The new appearance would be a reinterpretation of the original wall in an abstract way and would visually integrate well with the natural setting.

The abutment wall itself is proposed to be executed in concrete, using a dark grey oxide to differentiate it with the original structure. Timber form work is proposed to give the structure a sympathetic finish with the setting and also with the existing structure.

5.4.2 Option 2: Concrete Finish

This second option assumes that the sandstone would be recycled in a different way and that the abutment return wall would be fully finished in concrete.

In this case, a timber finish with dark grey oxide is proposed and a horizontal ribbing would further settle the structure in the setting.

Figure 5.8 Existing abutment return wall showing the sandstone cladding.

Figure 5.9 Example of a bridge abutment using gabion baskets, giving the structure a more naturalistic character.

Figure 5.10 This example uses larger size rock. However, this will impact the basket's width.

Figure 5.11 Example of a retaining wall in Leura, Blue Mountains, using oxide and an exposed aggregate finish to create a darker effect.

5.5 RECYCLING OF MATERIALS

In coordination with other authorities, there is the opportunity to recycle the sandstone from the new cuttings as rip-rap below the abutment or utilise it for access maintenance paths at the abutments in the form of crushed sandstone and for water sensitive design and batter stabilisation construction.

There is also the opportunity to recycle the sandstone material from the cuttings and recycle it for the use in the gabion walls in the proposed abutment return walls if the removal of the existing sandstone cladding is not considered appropriate.

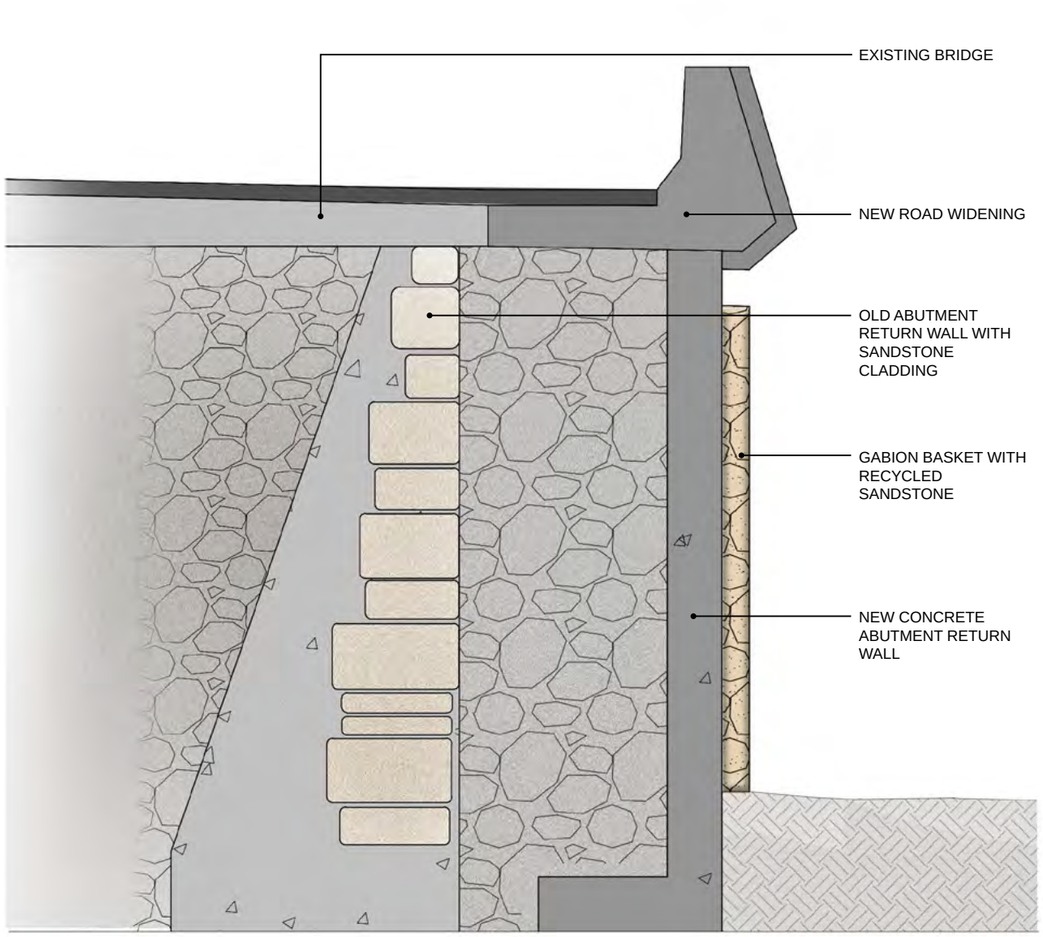


Figure 5.12 Indicative cross section at the abutment return wall.

Figure 5.13 Crushed sandstone could be used for access paths at the abutment.

Figure 5.14 Example of a gabion cladding configuration. A similar approach is proposed for the abutment walls.

5.6 ACCESS STAIR

Access stairs would be required at either abutment for maintenance purposes. The access stairs are proposed as stabilised gravel treads with a weathered steel riser.

The intent is to provide a naturalistic appearance that is sensitive to the setting.

Handrails in the form of Monowills can be provided and painted in a charcoal or black colour.

Figure 5.15 Example of a stair using weathered steel risers and stabilised gravel treads.

5.7 KOALA CONNECTIVITY STRUCTURE

Below the bridge, fauna furniture is proposed to provide for Koalas crossing under the bridge. Revegetation around this area should be low to not screen the structure from view, and to provide some cover for the Koalas when approaching and exiting under the bridge.

Landscape revegetation is to use indigenous species and target koala food tree species. Revegetation near the crossing structure must commence immediately on completion of the construction activity.

Methods for topsoiling,seeding and planting will be in accordance with the Biodiversity Guidelines and managing biodiversity on RTA projects (RTA 2010).

Figure 5.16 Example of a Koala connectivity structure along the Pacific Highway

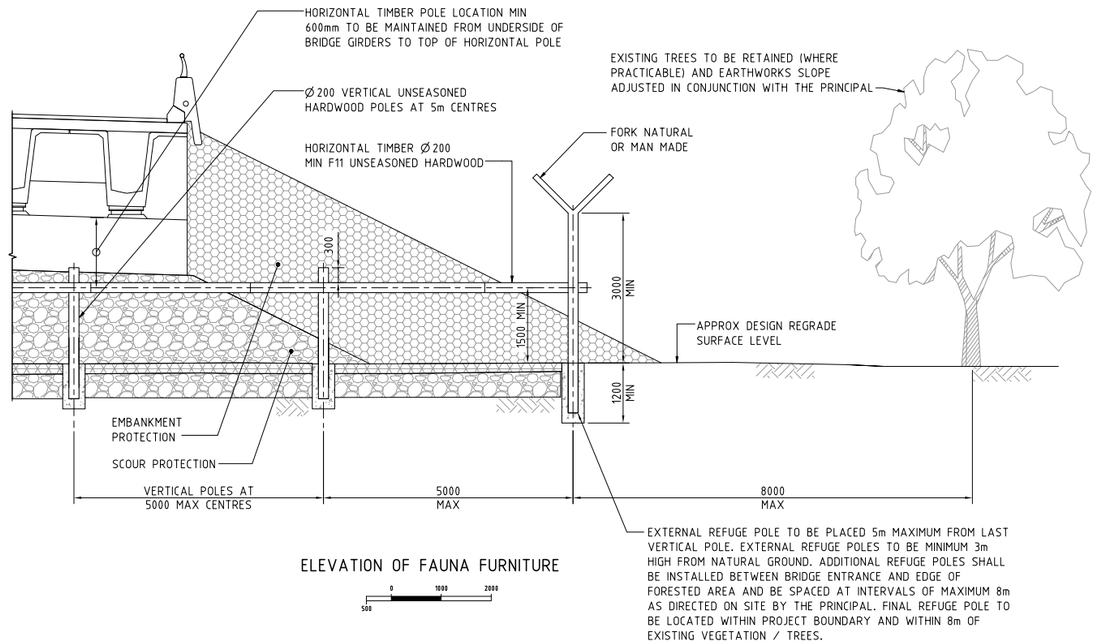


Figure 5.17 Example of a fauna connectivity standard drawing

5.8 SLOPE STABILISATION MEASURES

As part of the proposal, some of the existing rock cut faces along the bridge approaches would be impacted to ensure sightlines.

Key measures may include:

- Removal of vegetation from the existing rock cutting to stabilise the face
- Installation of rock bolts to stabilise potential wedge
- Application of localised shotcrete, to provide face protection and avoid erosion and weathering of cut face materials
- Introduction of a rock fall net for full length of slope in key areas where required.

Figure 5.18 Example of a rock mesh/rockfall barrier.

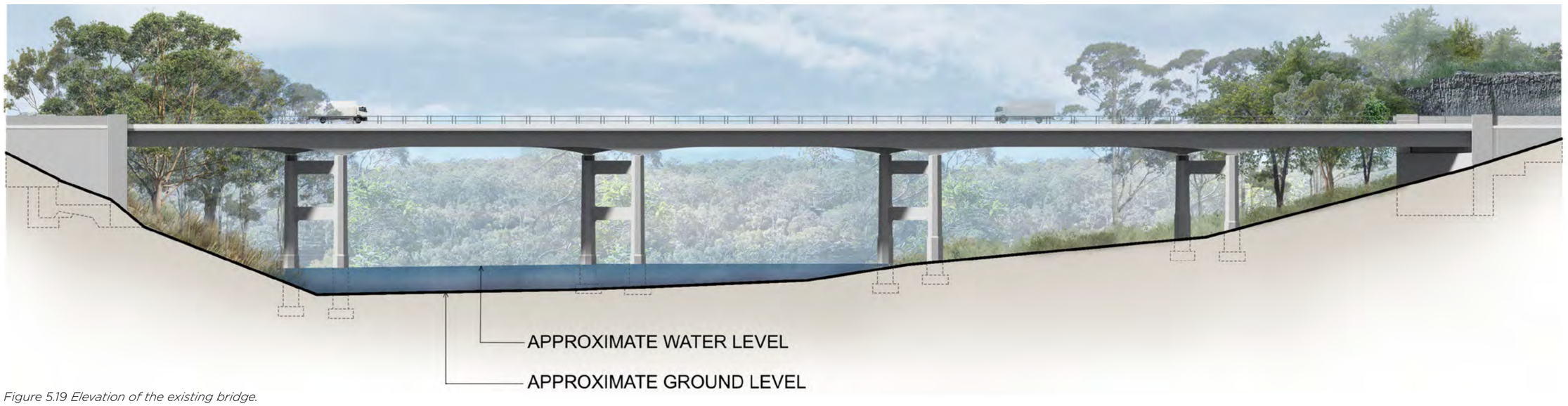


Figure 5.19 Elevation of the existing bridge.

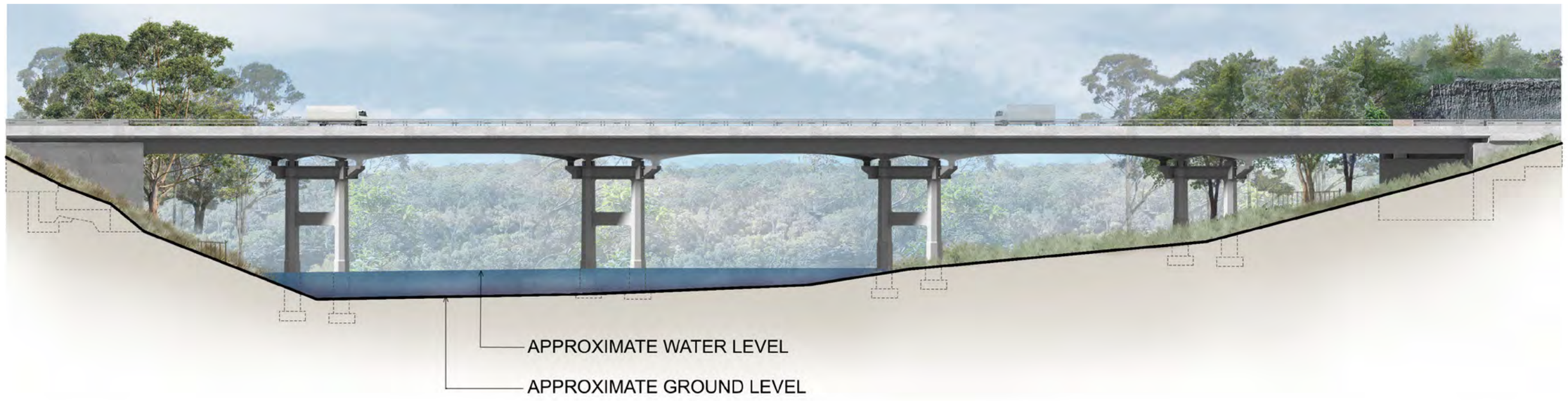


Figure 5.20 Elevation of the bridge widening. The overall character of the structure would greatly be retained

Key mitigation measures that have been incorporated into the design include:

- Remote location for site compound to limit any impacts on site for such functions
- Closure of Heathcote Road for six months during construction. This will speed up construction and allow for ease of access
- Utilisation of the existing road as lay-down areas to minimise the overall construction footprint
- Re-use of the historic road formation as part of the construction access track. This will minimise impacts to the existing topography and environment
- Minimisation of hardstand areas to limit impacts in and adjacent to the waterway
- Simple construction methodology to mitigate issues during construction.

Figure 5.21 View of the existing bridge looking east.

Figure 5.22 Indicative photomontage of the bridge with the widened deck.

6 LANDSCAPE CHARACTER AND VISUAL IMPACT ASSESSMENT

6.1 LANDSCAPE CHARACTER IMPACT ASSESSMENT

Based on the concept design, the following impact has been assessed. The landscape character impact is based on the aggregate of an area's built, natural and cultural character and sense of place. In this regard, it is measured by the combination of the area's sensitivity and the magnitude (scale, character and distance).

The adjacent table illustrates how the level of sensitivity and magnitude are combined to achieve an overall level of impact for both the landscape character impact and the visual impact. It should be noted that the ratings are measured relative to each other rather then assigned through an absolute scale. Hence the resulting landscape character impact rating is project specific and identifies those areas with the highest and lowest impacts.

Sensitivity	Magnitude: high	moderate	low	negligible
high	high impact	high- moderate	moderate	negligible
moderate	high- moderate	moderate	moderate-low	negligible
low	moderate	moderate-low	low	negligible
negligible	negligible	negligible	negligible	negligible

Table 6.1 Landscape character and visual impacts rating table - TfNSW EIA Guidance Note EIA-N04.

Figure 6.1 Pristine and scenic bushland dominates the landscape.

LANDSCAPE CHARACTER ZONE	SENSITIVITY LEVEL	MAGNITUDE OF IMPACT (OPERATIONAL)	LANDSCAPE CHARACTER IMPACT (OPERATIONAL)
ZONE 01 - ENGADINE BUSHLAND	High: although not a national park, this relatively pristine bushland is considered of high sensitivity. It includes waterways, mature endemic vegetation and scenic qualities. It should be noted, that this zone includes past human interventions which makes this zone slightly less sensitive compared to others included in this assessment.	Moderate: The proposed works would have some impact to the setting, requiring the removal of vegetation and introducing an access track for construction. Although, this works are of a temporary nature, they would impact the setting for some time after construction. The identity and sense of place of this zone would largely be retained. The loss of some established vegetation would strongly contribute to this rating, with visual impacts expected.	Moderate to high: the scenic qualities of the setting contribute to the overall sense of place and identity. Although these impacts are of a visual nature, they contribute to the perceived values of this area. It should be noted that only a small portion of this character zone is impacted and that the general recreational and scenic values would be greatly retained. The high sensitivity results in the moderate to high landscape character impact.
ZONE 02 - HOLSWORTHY MILITARY RESERVE	High: even though this zone has a restricted access, its natural beauty and pristine environment make it sensitive to change.	Negligible: this area would retain its overall character and identity. The general setting and beauty of the area would be retained.	Negligible: minor impacts near the watercourse whilst the site re-establishes after construction. The overall sense of place and beauty would not be compromised and its current use and function would not change.
ZONE 03 - HEATHCOTE NATIONAL PARK	High: highly sensitive setting that provides for important wild life habitat, endemic vegetation and geological formations and has been classified as a national park. In addition, the park provides an important recreational function for the community.	Negligible: the general sense of place and identity of the national park would not be impacted. The scenic qualities, integrity and recreational values would not be compromised.	Negligible: the impact to the landscape character of this zone is negligible. This area would retain its scenic and habitat value and continue to provide a recreational function to the community. No impacts as a consequence of the proposal have been identified.
ZONE 04 - HEATHCOTE ROAD	Moderate: the roadway has a scenic quality that engages the traveller with the bushland setting and reinforces the identity and sense of place. The transient nature of the road contributes to a lower rating compared to the other landscape character zones.	Moderate: although the scenic quality of the journey would not greatly change, the driver's experience would be enhanced, contributing to the desired effect on this scenic drive. The wider roadway would make the bridge crossing safer and enjoyable for travellers. At the approaches to the bridge, the existing rock cuttings would be partly impacted, with the introduction of the occasional rock bolts and the introduction of rock mesh. Although these areas are considered minor, they would contribute to a more built form character and detract from the natural setting.	Moderate: the proposal is considered to have a positive impact to the traveller's experience crossing the bridge whilst a negative experience at either side of the bridge approach.

Table 6.2 Landscape Character Impacts Table - Operational Phase.

LANDSCAPE CHARACTER ZONE	SENSITIVITY LEVEL	MAGNITUDE OF IMPACT (CONSTRUCTION)	LANDSCAPE CHARACTER IMPACT (CONSTRUCTION)
ZONE 01 - ENGADINE BUSHLAND	High	High: The proposed works would impact the setting during construction, requiring the removal of vegetation and introducing an access track for construction. Hard stand areas near the waterway would further impact the setting by creating a construction site. It is expected that the identity of the immediate area and sense of place of this zone would be transformed to some extent. The construction access track would likely be exposed and the loss of established vegetation would contribute to this rating.	High: this zone would have the most impact during construction. This is largely due to the vegetation clearing, construction access tracks and hard stand areas tend to be confined to this zone.
ZONE 02 - HOLSWORTHY MILITARY RESERVE	High	Low: there would be minor impacts of a temporary nature during construction.	Moderate: only minor portions of this zone would be impacted during construction, predominantly near the watercourse.
ZONE 03 - HEATHCOTE NATIONAL PARK	High	Negligible: this zone would not be impacted during construction. Its sense of place and natural integrity would be retained.	Negligible: the impact to the landscape character of this zone during construction is negligible.
ZONE 04 - HEATHCOTE ROAD	Moderate	High: during construction, the road would become part of the construction site, including lay-down areas, plant and equipment. Hence, the construction site would highly contrast with the desired character of the area and this zone.	Moderate to high: although a moderate to high rating has been identified, there would be limited access to Heathcote Road during construction.

Table 6.3 - Landscape Character Impacts Table - Construction Phase.

6.1.1 Summary of landscape character impacts

Overall, the proposal has a variety of impacts, driven by two key factors; the high sensitivity of the area and the resulting enhancement in road safety.

Landscape character zone 1 is the most impacted with a moderate to high rating. This is because the main construction access and footprint during construction occurs within this zone. Key mitigation measures include:

- Minimise vegetation clearing to provide for the construction access path
- Limit width of access track
- Carefully consider plant and equipment required.

Landscape Character Zone 2, Holsworthy Military Reserve, would experience a negligible impact. Yet, during construction, this zone would experience a moderate impact.
This is due to the higher interface with the construction footprint. It should be noted though, that the impact is predominantly of a temporary nature and once the site is re-established, these impacts would be minor in the long term.

For Landscape Character Zone 3, the Heathcote National Park, the impact is minimal, resulting in a negligible rating.

A moderate landscape character impact rating is identified for Landscape Character Zone 4, Heathcote Road. In this case, the proposal is providing a positive outcome and contributing to the identity and functioning of this zone. Key mitigation measures include:

- Minimal verge widening
- Minimimal use of shotcrete and rock mesh

From all the three zones surrounding the bridge, Landscape Character Zone 1 is considered to have the highest absorption capacity besides Heathcote Road itself.

This is because this zone has been interfered with in the past slightly reducing its pristine value. In this particular case, re-using the historic road alignment seems a sensible approach to achieve construction access.

It will be important in the next phases of the design to further refine the concept design to mitigate the identified impacts. In particular the construction methodology, in conjunction with the type of equipment required for the construction process.

6.2 VISUAL IMPACT ASSESSMENT

6.2.1 Visual Envelope

In order to assess the visual impact, a Visual Envelope Map of the project's visual catchment from the surrounding area has been prepared. The visual catchment is defined either by topographical features, built form elements or screening vegetation.

Due to the confined road corridor and the heavily vegetated character of the area, combined with the rugged topography, the visual exposure of the overall proposal is limited.

There is effective vegetative screening limiting any visual exposure of the proposal to the residential areas of Engadine. This is further underpinned by the distance to the proposal and the steep drop in the topography.

The proposal would be most noticeable along the road corridor and at the waterway near the bridge, whilst glimpses from various other locations outside the road corridor are attainable. Refer visual envelope map - figure 6.2.

Eight viewpoints have been assessed with photos showing the existing environment.

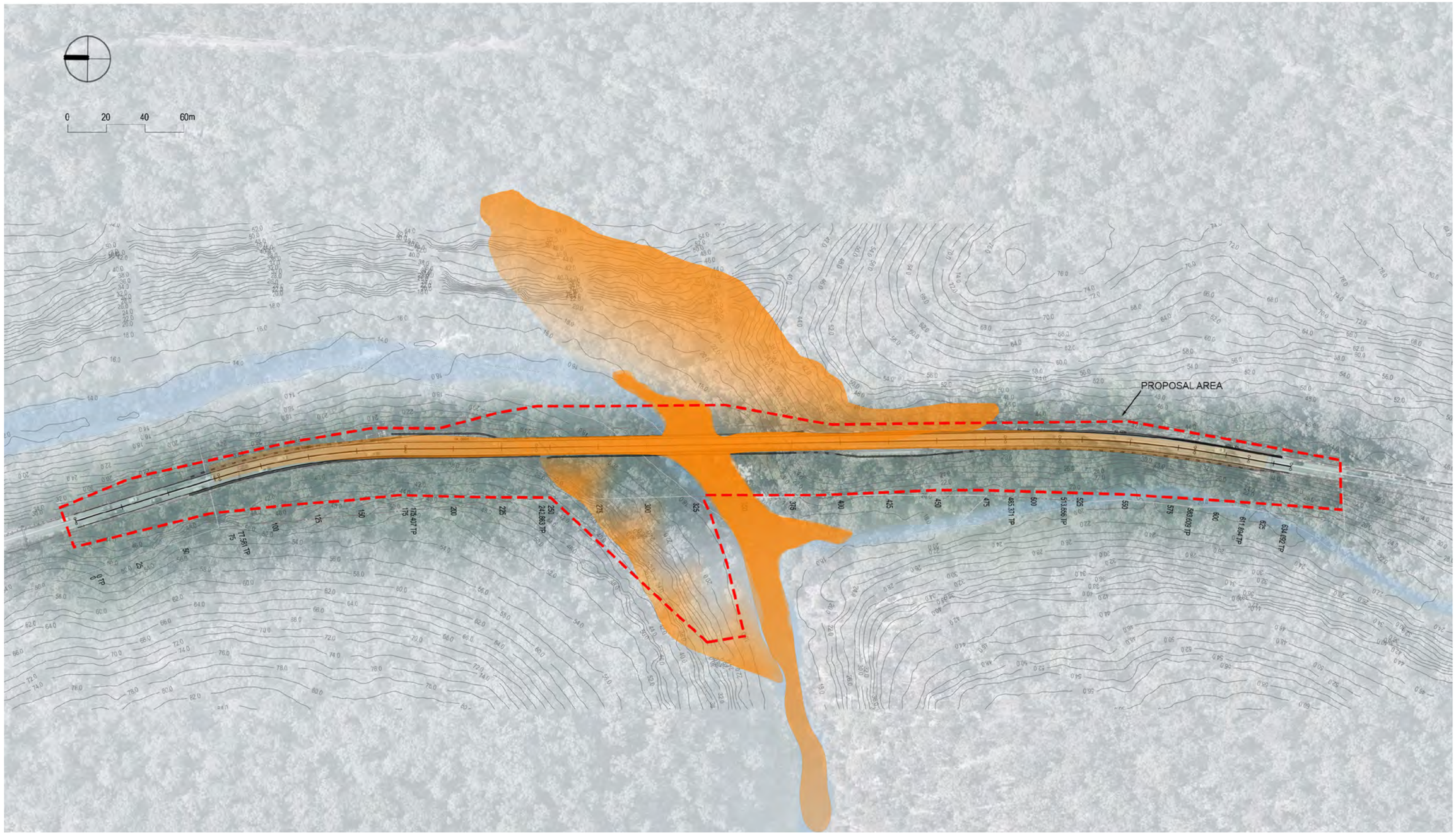
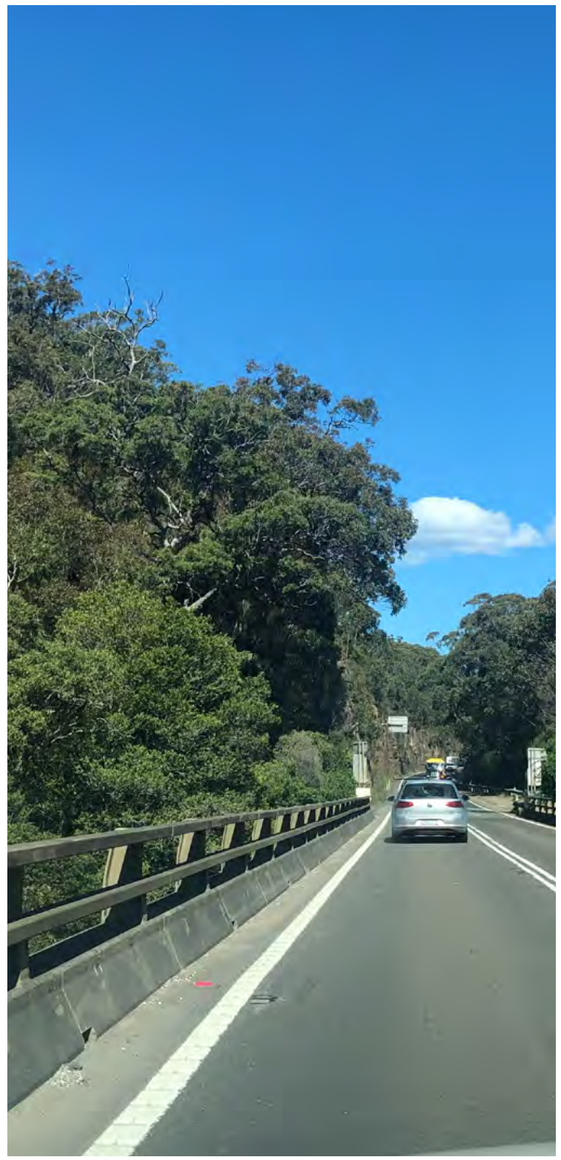


Figure 6.2 Plan illustrating the visual impact assessment of new bridge



6.2.2 Selected Viewpoints

The visual impact assessment has been based by selecting representative viewpoints from various locations. A number of representative viewpoints have been identified within the general project area. Refer figure 6.3 illustrating the location of the selected viewpoints used for the visual impact assessment.

In order to determine the visual impact, sensitivity values have been assigned to the various viewpoints. The sensitivity rating combined with the visual magnitude of impact rating determines the visual impact for each viewpoint and is based on the same matrix as shown in section 6.1 of this chapter.

The assessment is based on TfNSW's Environmental Impact Assessment Practice Note - Guidelines for Landscape Character and Visual Impact Assessment No. EIA-N04,"Version 2.2 Issue Date August 2020.

The visual impact assessment has focussed on key aspects of the proposal visible from various locations. These include rock cuttings, road vistas, the approach to the bridge, panoramic vistas from the waterway towards the bridge and views from under and nearby the structure.

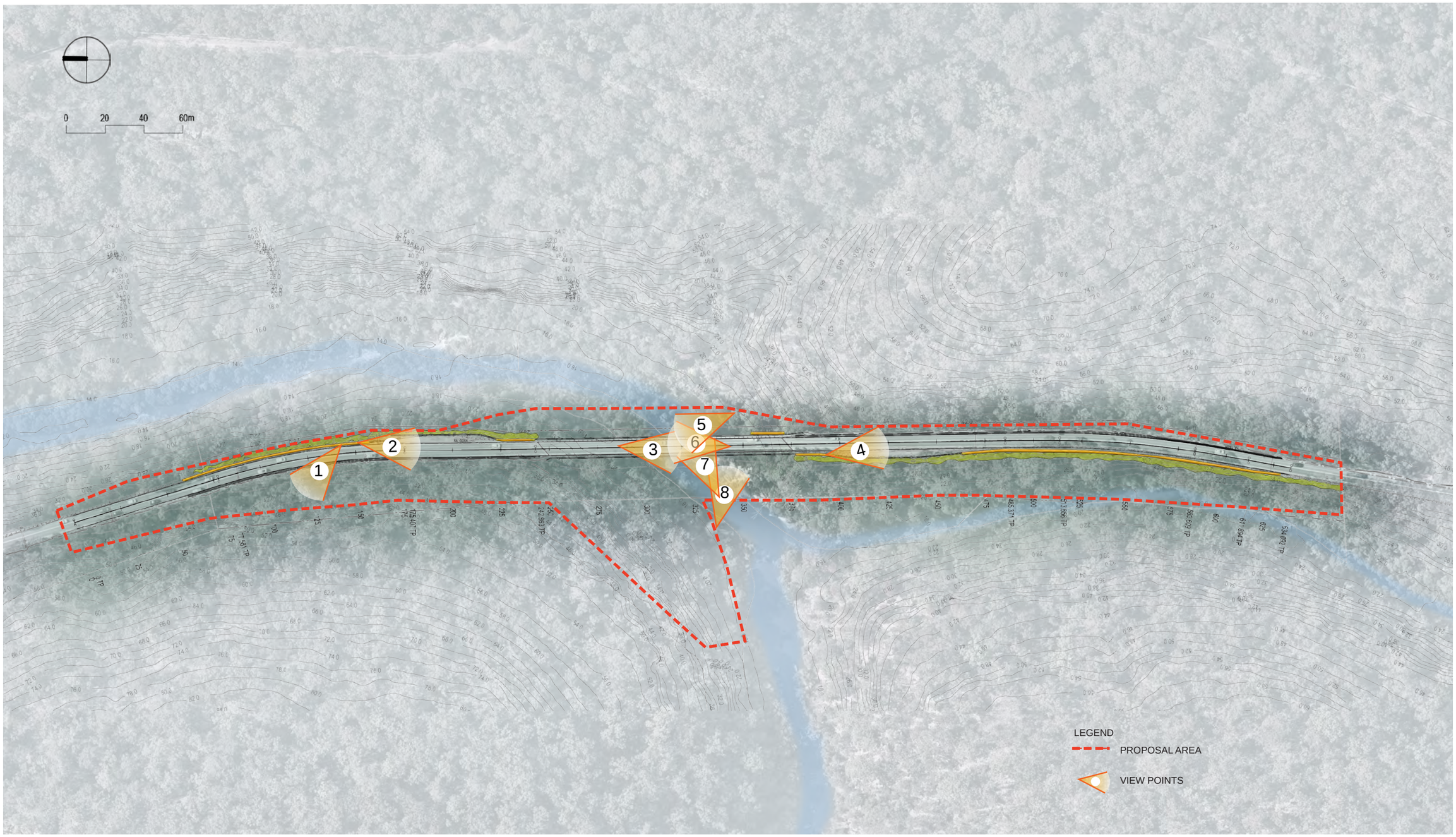


Figure 6.3 Plan illustrating the various viewpoints selected for the visual impact assessment.

Figure 6.4 V01: View looking north near the northern approach to the bridge.

Figure 6.5 V02: View looking south from the northern approach to the bridge. To the right side of the picture, sandstone cuttings expose the geology of the area.

Figure 6.6 V03: Crossing over the Woronora River with panoramic vistas of the pristine bushland.

Figure 6.7 V04: Sandstone cutting at the southern approach creates a visually dramatic setting and displays the rugged topography.

View	Description of setting	Sensitivity of view	
V01	Existing sandstone cutting along the northern approach to the bridge, travelling north. The cutting exposes the geology of the area and contributes to the identity of the roadway.	M	Moderate, although the road is of a high scenic quality, the transient nature of the viewer limits the sensitivity compared to other viewpoints assessed.
V02	Northern approach to the bridge travelling south. Highly scenic setting with dense bushland within a rugged terrain.	M	Moderate, although the road is of a high scenic quality, the transient nature of the viewer limits the sensitivity.
V03	Bridge over the Woronora River, travelling south. Open panoramic vistas towards the adjacent bushland with vistas towards a deep gully, exposing sandstone cliffs.	H	High, the bridge crossing visually accentuates the scenic character of the area, providing elevated panoramic views to the adjacent landscape. The crossing is a key visual marker along the journey experience and the scenic setting contributes to the higher rating to an otherwise transient viewpoint.
V04	View of the southern approach looking south towards a dramatic sandstone cutting.	M	Moderate; similar to V01 and V02, the transient nature of the viewer limits the overall sensitivity of the viewpoint.

Table 6.4 Sensitivity ranking for viewpoints 1 to 4

View	Element of project visible	Magnitude of change		Nature of impact
V01	Exposed rock cuttings and new verge treatment. Potentially minor sections of shotcrete visible where required. Other potential treatments may include rock bolts, rock netting and minor removal of existing vegetation along rock cutting face.	M	Moderate. The magnitude of change is considered moderate. The presence of rock mesh, rock bolts and shotcrete would contrast with the current situation. Also the removal of vegetation would contribute to this effect.	Adverse
V02	Widened road with shoulder and paved break-down bay. Minor changes to verge treatments.	H	The formalisation of the break-down bay and the widened road contribute to the road being more dominant within the setting. The presence of rock mesh, rock bolts and shotcrete would contrast with the current situation. Also the removal of vegetation would contribute to this effect, all contributing to a high rating.	Adverse
V03	Widened bridge with new barriers overlooking the Woronora River.	M	The widened bridge with the additional shoulders would make the structure visually more dominant. The enhanced sense of safety through the road widening would contribute to a better visual experience.	Adverse
V04	View of the sandstone cutting, south of the bridge. Potentially minor sections of shotcrete visible where required.	M	Moderate. The magnitude of change is considered moderate. The presence of rock mesh, rock bolts and shotcrete would contrast with the current situation. Also the removal of vegetation would contribute to this effect.	Adverse

Table 6.5 Magnitude rating for viewpoints 1 to 4

View	Sensitivity	Magnitude	Visual impact	Comments
V01	Moderate	Moderate	A moderate visual impact is assessed based on the relative minor interventions to the existing rock cutting and widened road formation.	It is important to ensure any shotcrete works are minimised. If larger areas are required, a set of aesthetic guidelines needs to be considered in the next phases of the design. The use of rock mesh and bolts should be minimised to retain the existing natural character. The overall driving experience would be slightly enhanced by introducing better sight lines.
V02	Moderate	High	The more formal road and break-down bay contributes to a moderate to high visual impact, increasing the presence of the roadway. The intervention of sandstone cutting stabilisation works would reinforce the new roadworks.	Consideration of verge treatments such as barrier typologies is important to retain vistas to the bushland setting. Double rail barriers or tri-beams are preferred over solid type F barriers. It is important to ensure any shotcrete works are minimised. If larger areas are required, a set of aesthetic guidelines needs to be considered in the next phases of the design. The use of rock mesh and bolts should be minimised to retain the existing natural character.
V03	High	Moderate	Although the visual impact is moderate to high, the rating is a result of both a higher visual presence of the bridge but also an improved visual experience.	The enhanced perception of safety through the wider bridge also improves the opportunity to visually absorb the scenery.
V04	Moderate	Moderate	A moderate visual impact is assessed based on the relative minor interventions to the existing rock cutting and widened road formation.	It is important to ensure any shotcrete works are minimised. If larger areas are required, a set of aesthetic guidelines needs to be considered in the next phases of the design. The use of rock mesh and bolts should be minimised to retain the existing natural character. The overall driving experience would be slightly enhanced by introducing better sight lines.

Table 6.6 Overall risk rating (sensitivity x magnitude) for viewpoints 1 to 4

Figure 6.8 View looking north from the river foreshore with the structure clearly visible.

Figure 6.9 View looking north from beneath the structure. .

Figure 6.10 Close up view of the structure looking from the southern foreshore to the northeast. Note the structure being in the shade (dark grey) helping it to visually blend with the backdrop.

Figure 6.11 Distant view from the northern foreshore looking east. The bushland backdrop helps settle the structure in its setting.

View	Description of setting	Sensitivity of view	
V05	River foreshore in a pristine bushland setting with wetland grasses, rock shelves and sand banks. Road bridge clearly visible that is a dominant feature.	M	Moderate, the viewpoint's scenic quality is detracted by the bridge in close proximity, resulting in a moderate rating.
V06	View from under the bridge looking towards the northern abutment. Bushland setting with riverscape in the foreground	L	Low, the dominance of the structure deters the quality of the viewscape, limiting its sensitivity. This viewpoint is considered of a transient nature, contributing to the low rating.
V07	River foreshore looking towards road bridge overhead.	M	Moderate, although the bridge crossing is a dominant feature, the scenic quality of the setting makes this viewpoint more sensitive compared to Viewpoint 06.
V08	Riverscape with rock shelves and dense bushland. Road bridge in the mid-ground.	H	High; the highly scenic setting and the limited dominance of the bridge makes this viewpoint more sensitive.

Table 6.7 Sensitivity rating for viewpoints 5 to 8

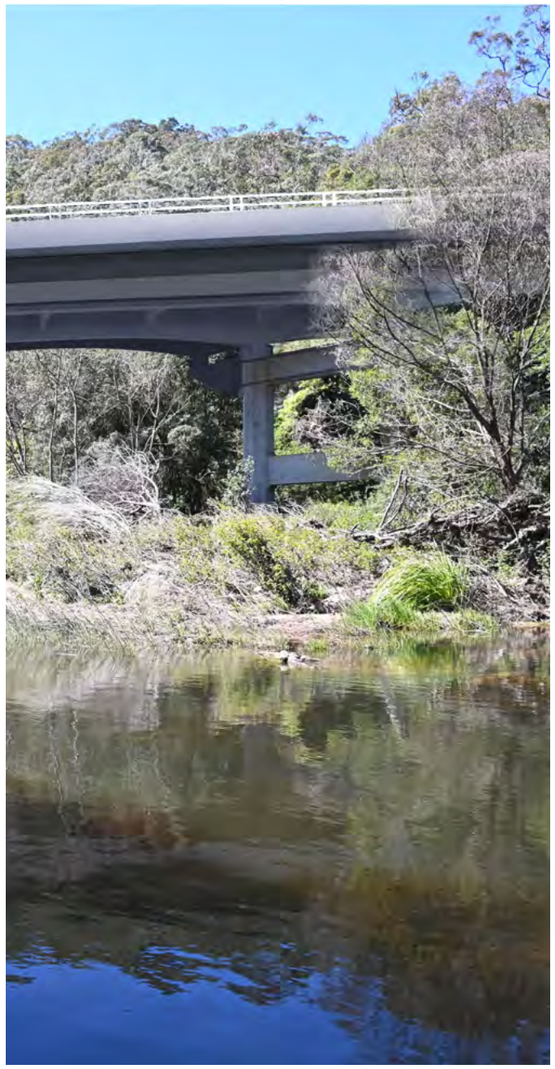
View	Element of project visible	Magnitude of change		Nature of impact
V05	Widened bridge deck and headstock extension clearly visible, including new girders. Northern abutment wall may be partially visible.	L	Low. The overall intervention is considered limited, with the predominant structure remaining in its general form and character.	Adverse
V06	Widened bridge deck and headstock extension clearly visible, including tendons and new girders. Loss of vegetation due to construction access road would be noticeable	H	Moderate, the structure would have a similar visual dominance, although it would be more prominent due to the widened deck. Vegetation clearing would likely expose historic rock cutting in the background.	Adverse
V07	Widened bridge deck and headstock extension clearly visible, including new girders.	L	The widened bridge with the additional girders would make the structure visually slightly more dominant. However, the visual contrast is considered limited, hence the low rating. A contributing factor to the moderate rating is the impact to the foreshore vegetation.	Adverse
V08	Headstock extension and new girders seen in elevation.	L	Low. The visual contrast and general intervention is limited, resulting in a low rating. The magnitude of change in regards to the bridge elevation is considered minor. There would be impacts to the existing vegetation at the river foreshore in front of the bridge. This impact is considered of a temporary nature.	Adverse

Table 6.8 Magnitude rating for viewpoints 5 to 8

View	Sensitivity	Magnitude	Visual impact	Comments
V05	Moderate	Low	A low to moderate visual impact is assessed based on the relative minor interventions to the overall setting. The long term visual impact is considered negligible once the riverscape vegetation recovers post construction.	Rock shelves mould likely be exposed but not necessarily be out of character with the setting.
V06	Low	High	The higher magnitude of impact combined with the lower visual sensitivity result in a moderate visual impact. This is partially a result due to the proximity of the proposal.	Impacts to existing vegetation for the construction access track are considered of a long term duration until the vegetation is fully re-established.
V07	Moderate	Low	The visual impact is low to moderate, the viewscape would not dramatically change. It should be noted, that the impact is higher after construction due to impacts to the foreshore setting.	The long term visual contrast is considered limited and the re-establishment of foreshore vegetation is considered of a temporary nature, resulting in the low to moderate rating.
V08	High	Low	Moderate. The proposal would have a limited visual contrast to the existing situation.	It should be noted, that this rating is based on the temporary nature of the impacts to the foreshore setting as part of hardstand areas for construction.

Table 6.9 Overall risk rating (sensitivity x magnitude) for viewpoints 5 to 8

7 CONCLUSION



The proposal is situated in a highly sensitive environment and requires upmost attention in regards to construction methodologies to minimise impacts to the environment. In this regard, selection of plant and equipment, crane typology and erection methodology are critical. Also material storage, site compounds and lay-down areas are important.

In this regard, the design focuses on three key drivers:

- Development of a built form that is sympathetic to the existing structure
- Expressing new bridge components to differentiate them from the old structure
- Limiting the physical intervention on site and reducing the construction footprint
- Sensitively integrating rock/slope stabilisation works and limiting their extent
- Landscape design measures that re-establish the endemic species of the area and provide slope stabilisation and water sensitive design “soft engineering” approaches
- Establishing a heritage curtilage that protects the various historic river crossing intervention as a unique ensemble.

It is important that construction methodologies be developed in consultation with the urban designer/landscape architect to identify strategies that minimise not only construction footprints but that also provide the best strategies for the site’s re-establishment.

This cooperation together with ecologist and other specialists is fundamental to the overall success of the proposal.

The proposal has a limited visual exposure and the highest visual impact assessed is along the road itself. The identified moderate to high rating is project specific and driven by the visual contrast of the proposed slope stabilisation (rock cutting) works and the wider bridge which is considered a positive development that enhances the journey’s visual experience and functioning of the bridge.

In regards to landscape character impacts, the design has focused in minimising impacts to the most sensitive zones and affects the zone most disturbed in the past.

It should be noted that from a landscape character point of view, the proposal provides a positive contribution to the functioning of Heathcote Road; Zone 4, by creating a safer road and a more enjoyable experience to travellers.

The proposal also safeguards the continuing use of the existing heritage bridge, ensuring its heritage value is conserved into the future.