NSW GOVERNMENT

Roads and Maritime Services

F6 Extension Stage 1

New M5 Motorway at Arncliffe to President Avenue at Kogarah

Environmental Impact Statement

Appendix C1
Place Making and Urban Design Strategy

Volume 3

C1

CONTENTS


CLEARANCE
4.6m

Introduction

1.0

1.0 Introduction

The project would comprise a new multi-lane motorway between the New M5 Motorway at Arncliffe and President Avenue at Kogarah. The project would connect underground with the New M5 Motorway tunnel and to a new surface level intersection at President Avenue, Kogarah.

1.1 Overview of the project

Key components of the project would include:

- An underground connection to the existing stub tunnels at the New M5 at Arncliffe
- Twin motorway tunnels (around four kilometres in length) between the New M5 at Arncliffe and President Avenue, Kogarah
- An intersection at President Avenue, including:
  - Entry and exit ramps, including sections of tunnel to provide connections to the mainline tunnel
  - A tunnel portal at Brighton-le-Sands within Rockdale Bicentennial Park East, to provide connections to President Avenue
- A widened President Avenue at the location of the intersection, including slip lanes to provide a connection to the project
- Intersection improvements at the President Avenue / Princes Highway intersection
- Mainline tunnel stubs to allow for connections to future stages of the F6 Extension
- A shared cycle and pedestrian pathways connecting Bestic Street, Rockdale to Civic Avenue, Kogarah via Rockdale Bicentennial Park
- Operational motorway Control Centre to be located off West Botany Street, Rockdale
- Ancillary infrastructure and operational facilities for signage (including electronic signage), ventilation structures and systems at Rockdale, fire and safety systems, and emergency evacuation and smoke extraction infrastructure
- Temporary construction ancillary facilities and temporary works to facilitate the construction of the project.
- New service utilities, and modifications and connections to existing service utilities.
- A permanent power supply connection from the Ausgrid Canterbury sub-transmission substation.

The configuration and design of the project will be further developed to take into consideration the outcomes of community and stakeholder engagement. Figure 1-1 shows an overview of the project.

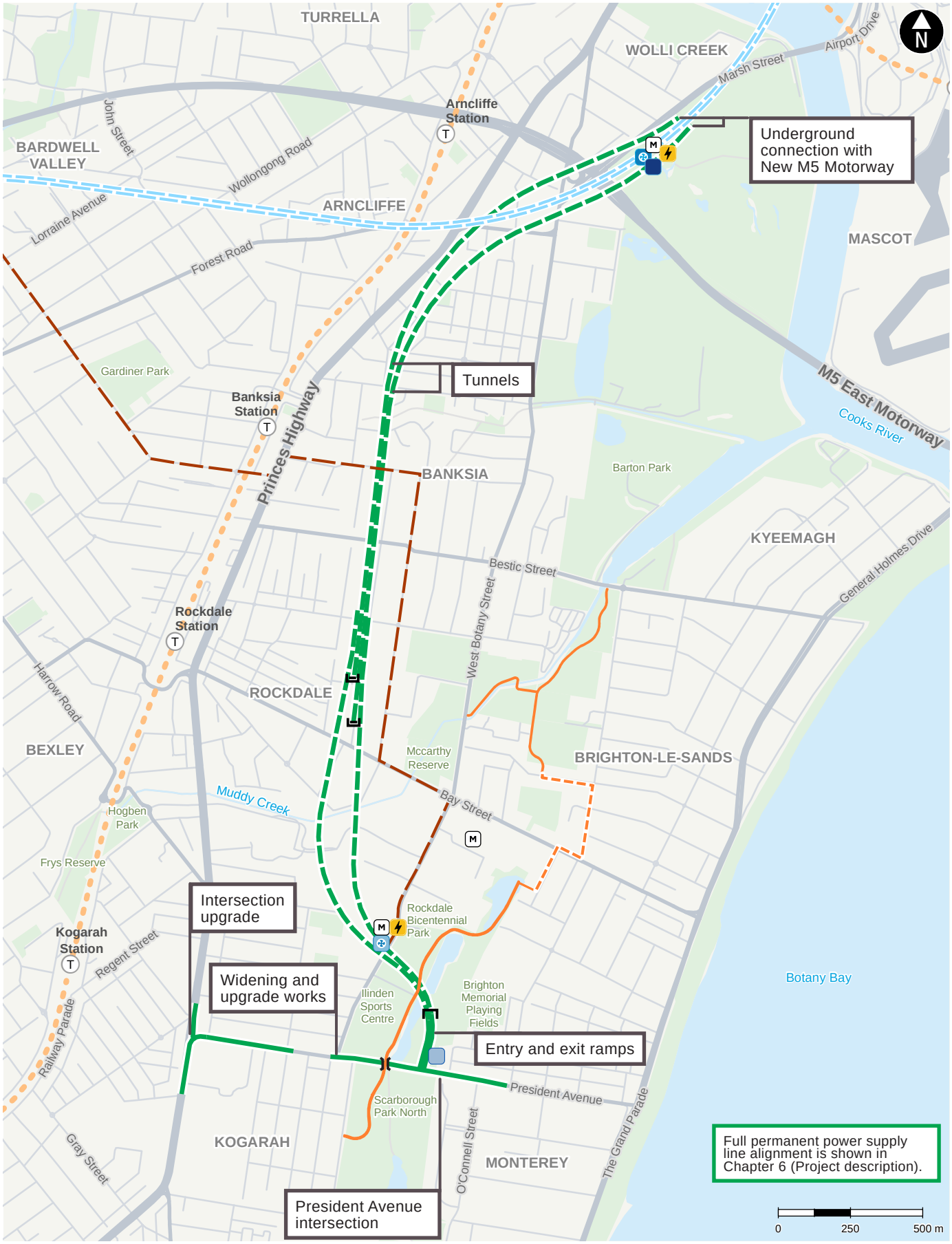


Figure 1-1: Overview of the project

1.2 Project location

This project would be generally located within the Bayside local government area. The project commences about 8 kilometres south west of the Sydney central business district (CBD). The proposed President Avenue intersection would be located about 11 kilometres south east of the Sydney CBD.

1.3 Purpose of this report

The purpose of this report is to inform the Environmental Impact Statement (EIS) for the project, including:

- Addressing the Secretary's Environmental Assessment Requirements
- Outline of key issues and opportunities to inform the concept design
- Provision of an urban design strategy and landscape concept to inform the landscape and visual impact assessment process and the detailed design of the project.

1.4 SEARs and Agency comments

In preparing this Urban Design Strategy, the relevant Secretary's Environmental Assessment Requirements (SEARs) issued for the project are addressed by this report. Item 7 (Place Making and Urban Design) of the SEARs, identifies the key project design components and visual amenity, character and quality outcomes to be addressed. Table 1-1 provides the SEARs relevant to Place Making and urban design, and where they are addressed in this report.

Table 1-1 SEARs – Place Making and urban design strategy

SEARs	Where addressed
The Proponent must identify how functional 'place' outcomes of public benefit would be achieved, including design principles and strategies that:	
a. give consideration to adjacent areas identified for future urban renewal	**Section 6.2**
b. capitalise on reduced traffic volumes and reduced through traffic, particularly in and around commercial and community facilities	**Section 6.2**
c. avoid locating infrastructure, including ancillary facilities adjoining residential areas and other sensitive receivers, and justify where this cannot be achieved	**Section 2**
d. achieve high quality landscaping, streetscapes, architecture and design	**Section 5**
e. identify urban design strategies and opportunities that would enhance healthy, cohesive and inclusive communities, including in relation to accessibility and connectivity	**Section 5 and 6**
f. identify opportunities to enhance the visual, recreational and biodiversity values of the Rockdale Wetlands	**Section 5.5.3 and 6.1**
g. consider resulting residual land treatments, and demonstrate how the proposed hard and soft urban design elements of the proposal would be consistent with the existing and desired future character of the area (wetlands and green corridor) traversed or affected by the project, particularly at President Avenue	**Section 5.5**
h. identify opportunities to utilise surplus or residual land, particularly for the provision of community space (passive and active recreational opportunities and facilities) and utilise key structures (such as ventilation outlets) for multiple uses i.e. integration with other structures	**Section 3.4**
i. explore the use of Crime Prevention Through Environmental Design (CPTED) principles including natural surveillance during the design development process for elements including lighting, walkways, signage and landscaping.	**Annexure B of this report**
The Proponent must describe the accessibility elements of the proposal including relevant accessibility legislation and guidelines, including:	
a. impacts on public transport infrastructure and services	**Chapter 8 of the EIS and Appendix D (Traffic and Transport Technical Report)**
b. impacts on pedestrian and cyclist access and safety across and adjoining the proposal	**Chapter 8 of the EIS and Appendix D (Traffic and Transport Technical Report)**
c. opportunities to integrate and enhance accessibility including the provisions public and active transport infrastructure as a result of the proposal	**Section 5.4 and 6.1**
The Proponent must assess the visual and landscape impacts of the proposal, including ancillary infrastructure on:	**Appendix B and Appendix C2 (Landscape and Visual Technical Report)**
a. views and vistas	
b. streetscapes, key sites and buildings	
c. landscaping, green spaces, wetlands and existing trees and tree canopy and need for removal to be undertaken by an arborist, including the provision of measures to minimise and offset impacts	
d. heritage items including Aboriginal places, environmental heritage, and areas of heritage sensitivity	
e. the local community	
The Proponent must provide artist impressions and perspective drawings of the proposal from key receiver locations to illustrate the proposal and its visual impacts.	**Appendix B and Appendix C2 (Landscape and Visual Technical Report)**

1.5 Structure of this report

This report is divided into seven (7) sections as follows:

1. **Introduction** – provides an overview of the project, including key components of the project and SEARs requirements related to Place Making and urban design to be addressed as part of the project.
1. **Project Development** – describes the project components and how they will impact the urban design and landscape outcome. This section also identifies the urban design and landscape issues to be addressed, along with identifying opportunities that would benefit the local community.
2. **Design Objectives and Principles** – describes the urban design objectives and principles to be applied to the project.
3. **Site Analysis** – provides a contextual analysis summary of the project corridor, from a regional context through to a local context. A detailed site analysis is provided in Annexure A.
4. **Urban Design Strategy** – describes the urban design proposal for the project. This section provides an overview of the urban design strategy which aims to mitigate the impacts of the project. The landscape design outcome is also outlined in this section in the form of a landscape concept plan addressing the immediate construction impacts of the project. Indicative design guidelines for furniture and planting are provided in Annexure B.
5. **Place Making Opportunities** – identifies the potential opportunities and benefits the project would provide for the local, regional and wider community. This section outlines the steps required to return these benefits back to the community.
6. **Landscape and Visual Impact Assessment (LVIA)** - provides a summary of the LVIA prepared for the project and describes the likely impacts the project will have on the urban design outcome.

1.6 Key reference documents

The preparation of this report has been made with reference to the following RMS Design Guidelines:

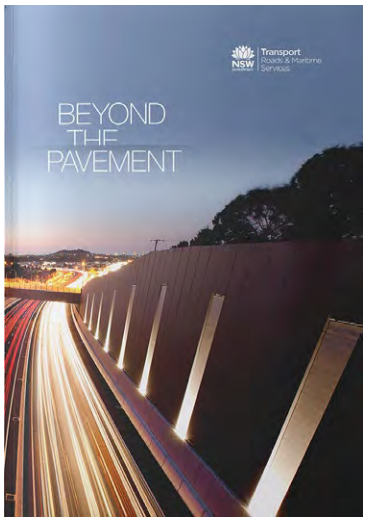
- *'Beyond the Pavement – Urban design policy, procedures and design principles'*, Roads and Maritime, updated February 2014
- *'Tunnel urban design guideline – Design guideline to improve the customer and community experience of road tunnels',* Roads and Maritime, May 2017
- *'Bridge Aesthetics – Design guideline to improve the appearance of bridges in NSW'*, Roads and Maritime, July 2012
- *'Noise Wall Design Guideline – Design guidelines to improve the appearance of noise walls in NSW'*, Roads and Maritime, February 2007
- *'Landscape Guideline – Landscape design and maintenance guidelines to improve the quality, safety and cost effectiveness of road corridor planting and seeding'*, Roads and Maritime, February 2007
- *'Shotcrete Design Guidelines – Design guidelines to avoid, minimise and improve the appearance of shotcrete'*, Roads and Maritime, June 2005.

The following government agency guidelines and policy documents have also been referenced:

- *'Better Placed – An integrated design policy for the built environment in New South Wales*', Government Architect New South Wales, 2017
- *'Greener Places – Establishing an urban Green Infrastructure policy for New South Wales'*, Government Architect New South Wales, 2017
- *'Cyclist Aspects of Austroads Guidelines'*, Austroads, 2017
- *'Sydney Green Grid'*, Government Architect New South Wales and Tyrrell Studios, 2017
- *'Revised Draft Eastern City District Plan'*, Greater Sydney Commission, 2017
- *'Draft Metropolitan Strategy for Sydney to 2031'*, Department of Planning and Environment, 2013.

These documents further strengthen the urban design proposal and ensure consistency with future environmental and growth plans for Sydney's Metropolitan areas.

All of the above documents shall inform and guide all future design iterations of the urban design proposal.


Transport
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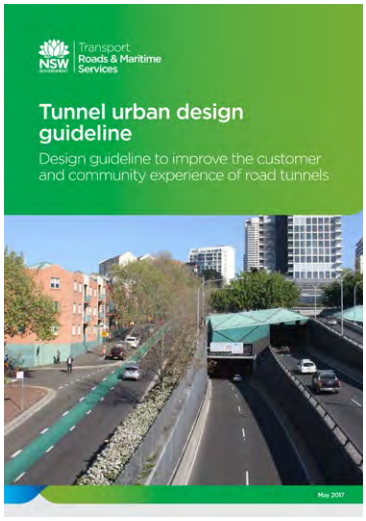
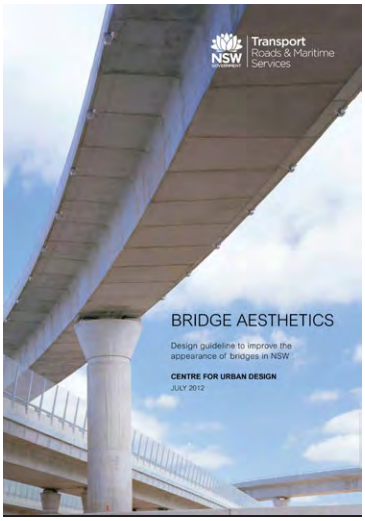
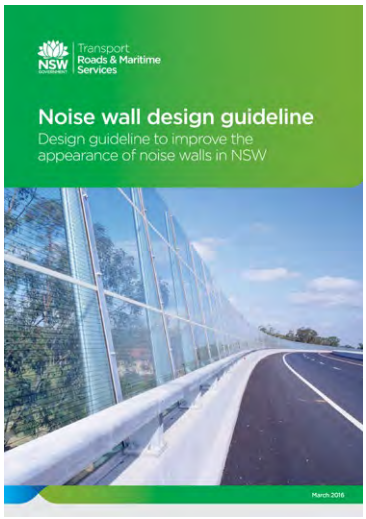
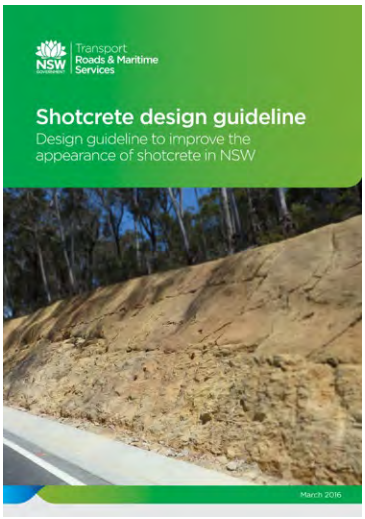

Transport
Roads & Maritime
Services
Tunnel urban design guideline
Design guideline to improve the customer and community experience of road tunnels
May 2017


Transport
Roads & Maritime
Services
BRIDGE AESTHETICS
Design guideline to improve the appearance of bridges in NSW
CENTRE FOR URBAN DESIGN
JULY 2012


Transport
Roads & Maritime
Services
Noise wall design guideline
Design guideline to improve the appearance of noise walls in NSW
March 2016

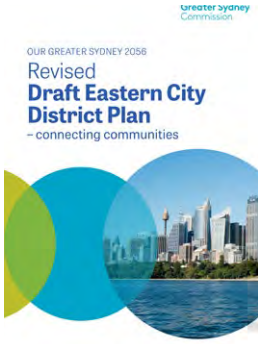

Landscape guideline
Landscape design and maintenance guidelines to improve the quality, safety and cost effectiveness of road corridor planting and seeding
RTA


Transport
Roads & Maritime
Services
Shotcrete design guideline
Design guideline to improve the appearance of shotcrete in NSW
March 2016


BETTER
PLACED
GOVERNMENT ARCHITECT NEW SOUTH WALES


GREENER
PLACES
GOVERNMENT ARCHITECT NEW SOUTH WALES


Cycling Aspects of Austroads Guides
Austroads


Greater Sydney Commission
OUR GREATER SYDNEY 2056
Revised
Draft Eastern City District Plan
– connecting communities


THE GREEN GRID
CREATING SYDNEY'S OPEN SPACE NETWORK
THE NSW GOVERNMENT ARCHITECT'S OFFICE


DRAFT METROPOLITAN STRATEGY FOR SYDNEY TO 2031
March 2013
A strong global city, a liveable local city

Project Development

2.0

2.0 Project Development

The project has been developed to avoid infrastructure, including ancillary facilities, adjoining residential areas and other sensitive receivers, where possible. Justification for the location of some infrastructure in close proximity to sensitive receivers is provided in this section. The project has also been developed with place making and urban design considerations. The following sections describe the key project components that relate to the desired place making and urban design outcomes for the project.

2.1 Motorway elements

The main surface motorway infrastructure for the project would be located within Rockdale Bicentennial Park, within the existing F6 reserved corridor. This section provides justification for the location of the entry and exit ramp tunnels, tunnel portal, and President Avenue intersection.

2.1.1 President Avenue intersection

The location of the President Avenue intersection was determined by the following:

- Within the existing F6 reserved corridor
- Provided a connection with President Avenue
- Ensured minimal impacts on surrounding residents.

Section 5.1.1 provides the urban design strategy for the President Avenue intersection.

2.1.2 Entry and exit ramps

A slot structure, with a transition to surface road, between President Avenue and the tunnel portal was chosen as it allowed the tunnel portal to be located in close proximity to President Avenue.

The slot structure would require retaining walls. Provision for safety fencing and balustrades have been allowed for in the design of the project. Careful consideration has been given to the alignment of the retaining walls to ensure they provide a consistent and smooth visual entry that leads the motorist into and out of the tunnel portal.

The design of the intersection has taken into consideration the opportunity to maximise open space for the reinstated playing fields to ensure the community can continue to access this amenity.

Section 5.1.2 provides the urban design strategy for the entry and exit ramps.

2.1.3 Tunnel portal

The location of the tunnel portal was chosen to minimise permanent impacts to Bicentennial park through the following considerations:

- Locating the tunnel portal in close proximity to President Avenue while still allowing a reasonable grade for the entry and exit ramps
- Locating the tunnel portal in close proximity to the Rockdale Wetlands to minimise fragmentation of Bicentennial Park
- Avoiding impacts on Ilinden Sports Field by locating the tunnel on the eastern side of Rockdale Wetlands.

Section 5.1.3 provides the urban design strategy for the tunnel portal.

2.1.4 Mainline tunnels

A cut and cover construction method through Rockdale Bicentennial Park was chosen over other alternative construction methods for the following reasons:

- The underlying geology would not allow for a driven tunnel
- A surface road would not be within the existing F6 reserved corridor
- A surface road through Bicentennial Park would result in a loss of recreation facilities, Rockdale Wetlands and playing fields.

A cut and cover construction method would allow the majority of Bicentennial Park to be reinstated following construction of the project.

Section 5.1.4 provides the urban design strategy for the mainline tunnels.

2.2 Surface road works

2.2.1 President Avenue widening

During project development the need to widen and raise President Avenue was considered against the desired urban design outcomes for the project. A widened President Avenue includes:

- Sloped batters on either side of President Avenue to allow for planting to provide a buffer between President Avenue and Rockdale Bicentennial Park and Scarborough Park North
- Provision for street trees on either side of President Avenue
- Continuous pedestrian path along the south side of President Avenue.

Section 5.2.1 provides the urban design strategy for the widening of President Avenue.

2.2.2 President Avenue / Princes Highway intersection

The design of the President Avenue / Princes Highway intersection has included provision for reinstated pedestrian paths and replacement street trees.

Section 5.2.2 provides the urban design strategy for the President Avenue / Princes Highway intersection.

2.3 Motorway operational elements

The project would require motorway operational elements to be constructed at three locations. Urban design and visual amenity considerations were taken into account during project development. These considerations are summarised in the table below.

Table 2-1 Motorway operational elements

Location	Operational elements	Urban design and visual amenity considerations
MOC 1	Substation Water treatment plant	MOC1 is located within and next to the New M5 Motorway Operations Complex, which is currently under construction as part of the New M5. By utilising New M5 infrastructure and locating the substation and water treatment plant nearby, the urban design and visual impacts from the project as this location are considered negligible.
MOC 2	Motorway control centre Deluge tanks Office and workshop	MOC2 would be located within an existing Roads and Maritime depot. The current character and land uses within this site are consistent with the uses proposed as part of this project.
MOC 3	Ventilation facility Two substations Disaster recovery site	MOC3 would be located within an existing industrial area, opposite Rockdale Bicentennial Park. This location was chosen it allowed the motorway operational infrastructure to blend with the character of the surrounding industrial area.

Section 5.3 provides the urban design strategy for the Rockdale ventilation facility.

Figure 2-1: Artist's impression of ventilation shaft from West Botany Street. looking north (design is indicative only)

2.4 Shared cycle and pedestrian pathways

The design of the shared cycle and pedestrian pathways has been informed by the following objectives:

- Improve north to south connectivity between the existing cycleways north of Bestic Street and President Avenue
- Provide opportunity for east to west pedestrian and cycleway linkages between Rockdale and Kogarah train stations, and the Botany Bay foreshore
- Improve the amenity and accessibility of the existing wetlands and recreation corridor between Bestic Street and President Avenue
- Provide a safe and direct connection across President Avenue.

Section 5.4 provides the urban design strategy for the shared cycle and pedestrian pathways.

2.5 Rockdale Bicentennial Park

The design of the project has sought to minimise impacts to Rockdale Bicentennial Park, both within and outside of the existing F6 reserved corridor. In particular, the decision to use a cut and cover construction method for the entry and exit ramp tunnels through Rockdale Bicentennial Park, and to locate the tunnel portal as close to President Avenue as possible, allows residual land to be reinstated and used for recreation purposes.

Section 5.5 provides the urban design strategy for the reinstatement of Rockdale Bicentennial Park.

Design Objectives and Principles

3.0

3.0 Design Objectives and Principles

3.1 Introduction

It is important to establish design criteria for all elements of the project's design, not only to minimise the potential for poor visual impacts, but also as a measure of the project's success as a piece of transport infrastructure in an urban and regional environment. The SEARs for the project provide the following desired performance outcomes for the project in relation to place making and urban design:

- The project design complements the visual amenity, character and quality of the surrounding environment
- The project contributes to the accessibility and connectivity of communities.

There is currently no urban design framework for the proposed F6 Extension, from Arncliffe to Loftus, to guide the project towards meeting these desired performance outcomes. The project commences at the New M5, Arncliffe, which is subject to the '*WestConnex Urban Design Framework'* (prepared by Roads and Maritime and WestConnex Delivery Authority, September 2013). This framework has been adopted as a starting point to deliver the urban design outcomes for the project.

To define the urban design aspirations and to guide the design of the project, the urban design vision and objectives are described below. The urban design vision has been tailored to reflect the aspirational outline envisaged for the project. The urban design objectives have been adopted from the '*WestConnex Urban Design Framework'* and modified to suit the contextual environment of the proposed F6 Extension. To further strengthen this, '*Beyond the Pavement – Urban design policy, procedures and design principles*' (Roads and Maritime, 2014) underpin the urban design objectives for the F6 Extension and is integral to the urban design outcome.

Table 3-1 below demonstrates the link between the urban design objectives, '*Beyond the Pavement*' drivers and '*Better Placed*' principles:

Table 3-1 '***Better Placed***', '***Beyond the Pavement***' and F6 Extension motorway principles

'Better Placed' objectives (State-wide and project generic)	'Beyond the Pavement' drivers (State-wide and Roads and Maritime infrastructure project specific)	F6 Extension urban design objectives
Better Fit (contextual local and of its place).	Outcome 1 (fits sensitively into the built, natural and community environment), Principle 2, 4, 5 & 6 (fit with built fabric, landform, natural pattern and heritage).	1. Leading-edge environmental responsiveness.
Better Performance (sustainable, adaptable and durable).	Performance requirements 2 & 3 (cost effectiveness & sustainability), Principle 9 (integrated and minimal maintenance).	1. Leading-edge environmental responsiveness, and 6. A new quality benchmark.
Better for Community (inclusive, connected and diverse).	Outcome 1 and 2 (fits sensitively into the built, natural and community environment & contributes to accessibility and connectivity), Principle 3 (connecting modes and communities).	3. Place Making, and 2. Connectivity, accessibility and legibility.
Better for People (safe, comfortable and liveable).	Performance requirement 1 (safety and security) Principle 7 & 8 (experience in movement & self-explaining roads).	3. Place Making, and 5. Memorable identity and a safe, enjoyable experience.
Better Working (functional, efficient and fit for purpose).	Outcome 2 (contributes to accessibility and connectivity), Performance requirements 2 & 3 (cost effectiveness & sustainability), Principle 9 (integrated and minimal maintenance).	2. Connectivity, accessibility and legibility, and 4. Urban amenity improvements and liveability.
Better Value (creating and adding value).	Performance requirements 2 & 3 (cost effectiveness & sustainability), Principle 1 & 6 (contributing to urban structure & revitalisation and incorporating heritage).	4. Urban amenity improvements and liveability.
Better Look and Feel (engaging, inviting and attractive).	Outcome 3 (high quality public domain), Principle 9 (integrated and minimal maintenance).	6. A new quality benchmark.

3.2 Urban Design Vision

The urban design vision for the F6 Extension, is defined as:

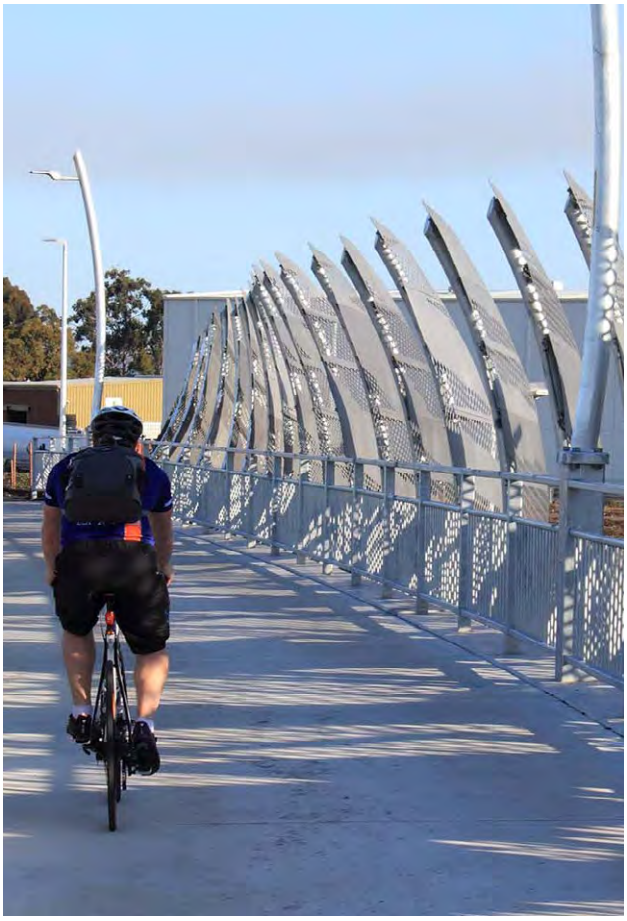
‘To produce a high quality tunnel and surface road outcome that fits into the area, provides a visual experience in movement, and through its form, alignment and influence contributes positively to the urban quality of the streets and centres, the green infrastructure asset and the active transport connections for the local and wider community.’

3.3 Urban Design Objectives

To ensure an integrated ‘whole of corridor’ response with the surrounding environment the following urban design objectives have been developed to govern the project outcomes:

- Leading edge environmental responsiveness
- Connectivity, accessibility and legibility
- Place Making
- Urban amenity improvements and liveability
- Memorable identity and a safe, enjoyable experience
- A new quality benchmark.

The urban design objectives are further described in the following sections.



OBJECTIVE 1

Leading-edge environmental responsiveness

The following design criteria have been applied to ensure environmental responsiveness based on a natural systems approach and leading-edge sustainability practices for the project

Principles

Existing vegetation – protect and retain as much existing vegetation along the corridor, supplementing with new canopy vegetation to provide screening and reinforce green links.

Green infrastructure – incorporate the concept of 'green infrastructure' and its application in the project, including water sensitive urban design principles, aquatic planting to improve water quality and tree planting for shade and amenity.

Landscape restoration – restore and re-establish fragmented vegetation and ecological plant communities along the corridor. Preserve and enhance existing open space along the corridor along the corridor using the existing plant communities for the establishment of an 'urban forest'.

Protect and enhance waterways – protect and re-establish existing waterways along the corridor. Improve the existing waterway function and quality through appropriate restoration and enhancement of aquatic ecosystem.

Earthworks – optimise planting opportunities by ensuring appropriate slope gradients (4H:1V) that allow successful plant establishment, safe access and appropriate long term maintenance.

Appropriate built form – consider a coordinated 'whole-of corridor' response for the location, mass and overall architectural expression of all motorway infrastructure, that is integrated within the landscape setting.

Sustainability and carbon sequestration – maximise planting to optimise opportunities for carbon sequestration.

OBJECTIVE 2

Connectivity, accessibility and legibility

The project shall promote connectivity and place making beyond the boundaries of the motorway corridor

Principles

Connectivity – create an shared cycle and pedestrian pathways route that promotes safe and seamless journeys for pedestrians and cyclists, while enhancing connectivity to broader community facilities, amenities and public open space networks.

Accessibility - improve the accessibility of streets, community facilities, amenities, public parks and open spaces for the communities surrounding the project.

Visual stimuli and architectural articulation – provide visual stimuli within the tunnel to create a progressive sequence of events for the motorist and to aid driver navigation.

Design consistency – provide an integrated design typology for all motorway elements including bridges, retaining walls and noise walls, that set the standard for the proposed F6 Extension corridor.

Wayfinding – provide self-explanatory roads to aid wayfinding and carefully rationalise roadside elements and signage to reduce visual clutter.

OBJECTIVE 3

Place Making

Places, streets, structures and landscapes shall draw their form, character and materiality from local context

Principles

Public places and place making – provide improved landscape amenity and accessibility along the corridor, including focal points that take advantage of contextual features, including views and remnant vegetation communities. Enhance the experience by using high quality, robust and functional materials.

Existing natural and cultural features – identify landscape and cultural character zones along the corridor that add value and support place making opportunities.

Solar access and views – access to sunlight, daylight, shade, breezes and views shall be considered in supporting and creating place making opportunities, roadside elements and signage to reduce visual clutter.

OBJECTIVE 4

Urban renewal and liveability

Create **opportunities** that promote improved **urban amenity**

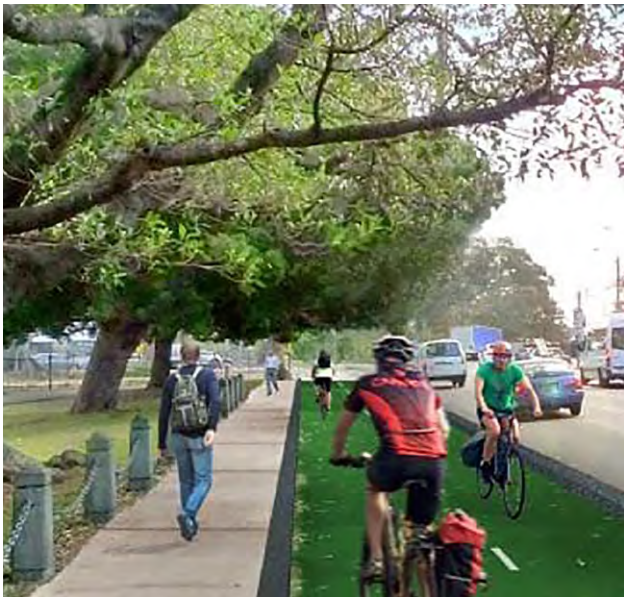
Principles

Promote urban amenity – incorporate extensive tree planting of endemic species into the design to achieve continuous tree canopy cover for shade, shelter and habitat creation.

Improved street connectivity – provide improved access to local streets, pedestrian and bus connectivity to create a well-connected urban environment.

Shared cycle and pedestrian pathways – create a new shared cycle and pedestrian pathways to improve connectivity to the surrounding local environment and key attractions.

Improved streetscapes – provide improvements to local streets by means of street tree planting for shade and amenity, and improved accessibility by providing compliant paths of travel for the elderly, young families and the physically impaired.



OBJECTIVE 5

Memorable identity and a safe, enjoyable experience

Provide a safe, memorable journey experience for road users

Principles

Whole of project design philosophy – develop a 'whole of project' design response to deliver a unified approach to the form, detailing, fabrication and construction of the motorway elements, with appropriate reference to the local site context.

Consistency – provide a simple and consistent suite of built elements along the motorway.

Experience – create a tunnel portal at President Avenue that is integrated with the surrounding context of the Rockdale Wetlands.

Tunnel identity – provide a tunnel experience that transitions from WestConnex and the New M5 into a distinctive driver experience for the F6 Extension, ensuring an awareness of geographical location through the use of lighting, signage and art elements.

Landscape character and identity – establish different landscape character zones that respond to the varying existing landscape character along the corridor, from broad landscape restoration through to detailed landscape precincts, to create a varied corridor identity.

OBJECTIVE 6

A new quality benchmark

Establish a benchmark for integrated infrastructure design and sustainability

Principles

High quality integrated design – landscape and built elements for the proposed F6 Extension should be of the highest quality, ensuring project elements are fully integrated and sharing a common design language.

Durability and 'whole of life' considerations – ensure all construction elements are robust and fit for purpose, with careful consideration given to deterring vandalism.

3.4 Project Enabling Opportunities

The existing F6 reserved corridor is zoned SP2 (Classified Road) in the Local Environment Plan, i.e. a 'special purpose' zone used to provide infrastructure and related uses (hereafter the infrastructure corridor). It includes land that is held privately, by local councils, Roads and Maritime and other Government agencies (refer Figure 3-1).

The infrastructure corridor ranges in width between about 100-200m, and is currently subject to mainly unstructured open space. It adjoins either side with residential areas, providing local residents with a valuable recreational space accessing Bayside suburbs, in addition to significant areas of remnant endangered plant communities and associated fauna. Most of the project will be in-tunnel, with a limited number of surface works falling either within the infrastructure corridor, e.g. the President Avenue Intersection, or within existing industrial settings outside the corridor, e.g. the Ventilation Shaft on West Botany Street.

Given that most of the project will now be in-tunnel, the majority of this extensive tract of land will now no longer be required for a motorway, enabling a wide range of future design opportunities to be considered for the infrastructure corridor.

The future use of those parts of the infrastructure corridor not required for the project will be considered by Transport for NSW. Initially a review of the corridor for possible alternative future public and active transport uses including mass transit, would be undertaken as part of a wider review of transport needs for the area. Following this, the NSW Government may consider removing the SP2 (Classified Road) zoning from properties in Stage 1 that are not directly impacted by the project and are no longer required for future road or other public transport use. The lifting of the existing corridor reservation or rezoning of this corridor, would be separate to the planning approval process for the project.

3.4.1 Opportunities

Subject to the assessment of the infrastructure corridor for integrated, long term transport purposes, potential opportunities include increased investment to improve the recreational values of existing areas of open space, and improving pedestrian and cyclist connectivity both along the corridor (part of this project), and across it, e.g. between Princes Highway and Botany Bay.

Over time, the construction of the project would be expected to present more broad scale opportunities, reaching further into the surrounding communities and suburbs, e.g. arterial roads and local streets that were once heavily used to access major north south arteries would experience less through traffic. This would result in a shift in their function, presenting new opportunities for place making, e.g.: avenue trees with other street plantings in association with water sensitive urban design, (WSUD) functions; off-road active transport corridors (pedestrian and cycling); or community garden areas.

In addition to streetscape amenity and traffic benefits, development of this nature can also have the capability to ameliorate local climatic conditions by means of reduced urban heat island effect, and provide of a connected web of cool, shady outdoor corridors that facilitate active lifestyles through increased walking and cycling.

3.4.2 Eastern City District Plan

The Eastern City District Plan (March, 2018) prepared by the Greater Sydney Council identifies a Green Grid Priority Corridor (Rockdale Wetlands Open Space Corridor) running from Sydney Airport south to the Georges River, in addition to a series of east-west Green Grid opportunities running along both arterial and local roads (Refer Figure 3.2 - Green Grid Priority Corridor 5). The enabling by the project for uses of the infrastructure corridor other than a motorway creates potential to progress the Priority Corridor within the project area.

3.4.3 Greener Places

A Greener Places policy document has been developed by the Government Architect to deliver a strategic approach for the planning, design and management of green infrastructure and to deliver connected urban ecosystems across NSW. Green infrastructure is defined as 'the network of green spaces, natural systems and semi-natural systems including parks, rivers, bushland and private gardens that are strategically planned, designed and managed to support a good quality of life in an urban environment.'

Both the project, and the enabling by the project for uses other than a motorway within the infrastructure corridor, provide opportunities which equate well with the principles of the Greener Places policy for green infrastructure, comprising:

- Integration: combining green infrastructure with urban development and grey infrastructure
- Connectivity: creating an interconnected network of open space
- Multi-functionality: delivering multiple ecosystem services simultaneously, and
- Participation: involving stakeholders in development and implementation.

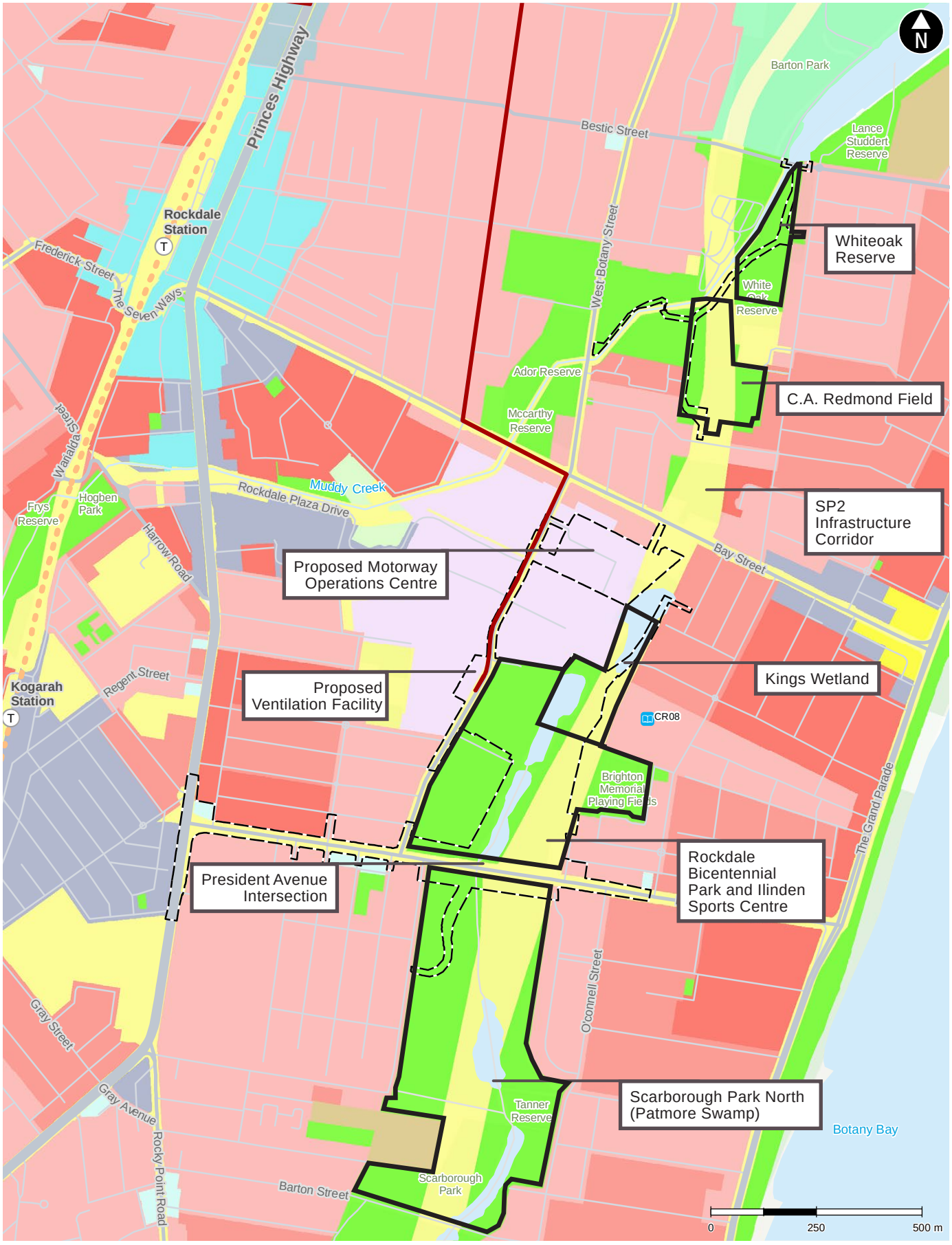
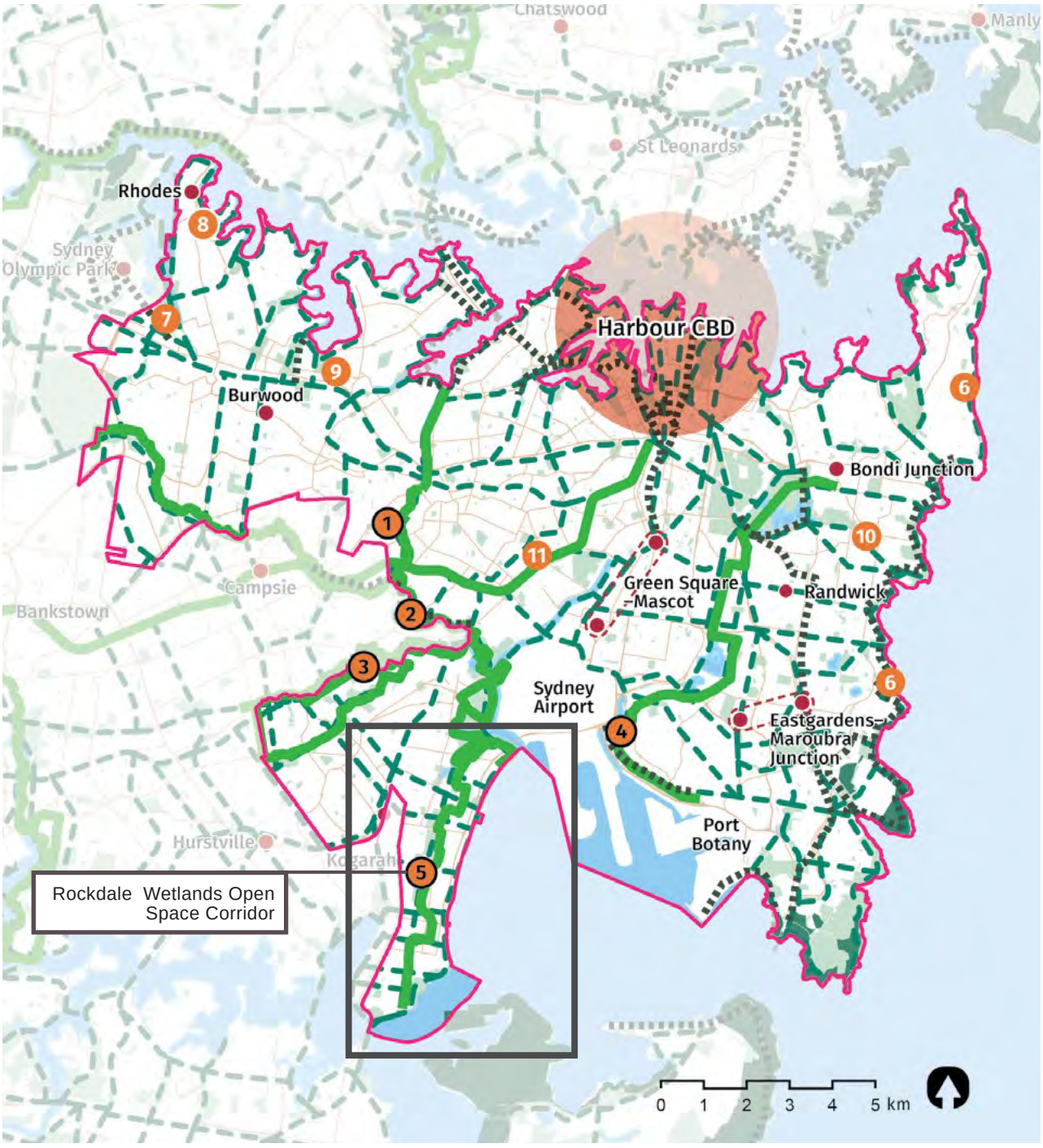


Figure 3-1: Infrastructure corridor/parks and reserves



District Boundary	1 Projects important to the District	National Parks and Reserves
Metropolitan Centre	Other Green Grid Opportunities	Open Space and Reserves
Strategic Centre	Existing Tracks and Trails	Waterways
1 Green Grid Priority Corridor	Road	

Figure 3-2: Excerpt from Greater Sydney Commission Eastern City District Plan showing Green Grid opportunities within and beyond the project area

Site Analysis

4.0

4.0 Site Analysis

4.1 Existing Environment

The following comprises a brief overview of the site analysis process. Refer Annexure A of this report for the detail site analysis reporting.

4.1.1 Natural systems

The existing environment comprises a low-lying Aeolian landscape of low dunes set behind the Botany Bay foreshore, which is subject to high groundwater levels, tidal effects and periodic flooding (refer Figure A-5). Stormwater drains from a high point at the Rockdale Bicentennial Park Wetlands north to the predominantly channelised Muddy Creek then Cooks River, and south to Sans Souci via a low depression set behind the Botany Bay dune system. This north-south, low-lying drainage system is subject to tidal effects and periodic flooding, and comprises a substantial open space system, effectively running from the Cooks River in the north, to the Georges River in the south (refer Figure A-4 and Figure A-6). A series of 'ponds' within this drainage line at Scarborough Park North ('Patmore Swamp') were constructed as part of a depression era program of public works. Remnant vegetation within this corridor comprises water tolerant 'swamp' plant communities comprising moderately sized patches of: Swamp Oak Swamp Forest, Coastal Freshwater Swamp Forest, and Estuarine Reedland, all of which are EECs (refer Figure A-12).

4.1.2 Urban setting

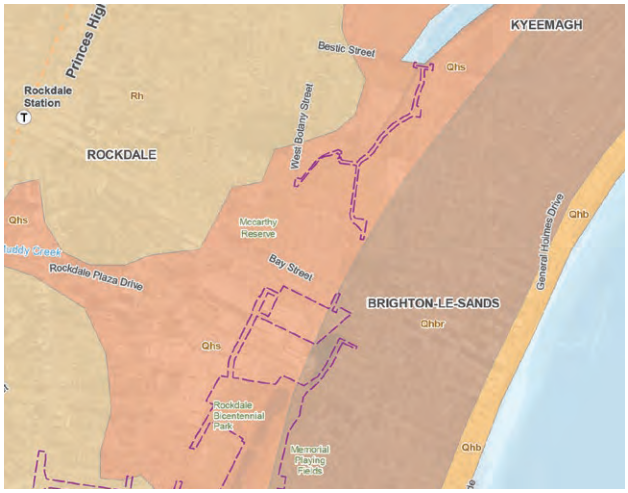
Land use within proximity of the project comprises predominantly of low and medium density residential development. A substantial node of industrial development is located along West Botany Street, adjoining Rockdale Bicentennial Park and Wetlands. Kogarah town centre is located about one kilometre south-west of this location on the south-western rail line, and the town centre of Brighton-Le-Sands located about one kilometre to the east on the Botany Bay foreshore.

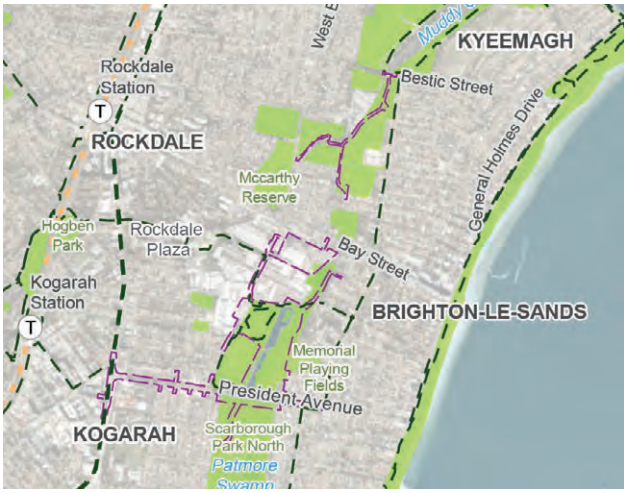
The project area is set between two major north-south roads comprising Princes Highway, and The Grand Parade which runs alongside the Botany Bay foreshore. The number of east-west running streets linking between these two major roads is limited due to the historical difficulty of crossing the above mentioned north-south running corridor of 'swamp' drainage lines.

4.1.3 Corridor parks and reserves

A series of parkland areas are provided within and alongside the project corridor, comprising from north to south (refer Figure 3-1):

Whiteoak Reserve – a generally open park set between the back fences of housing on Francis Avenue, and the straight-lined, concrete channelised form of Muddy Creek which is subject in its lower reaches to tidal inundation. Tree cover within the reserve in conjunction with low mounding seeks to create a series of spaces, often with Swamp Oak plantings atop them or planted alongside Muddy Creek. Other species include Grey Mangrove, Eucalypts and Peppercorn Tree.





CA Redmond Field – the area of the playing fields comprise a low-lying, highly visually exposed area with no significant tree cover. The fields are addressed to the east by the Cairnsfoot Special School, but otherwise much of this space is bordered by the back fences of adjoining residential development. West of the fields is an elevated terrace of well-tended grassed netball courts. These are set between Muddy Creek to the north with a substantial informal planting of trees along its edge, and a brightly coloured themed development of medium density terraces to the south, set around a distinctive old 'grand' home.

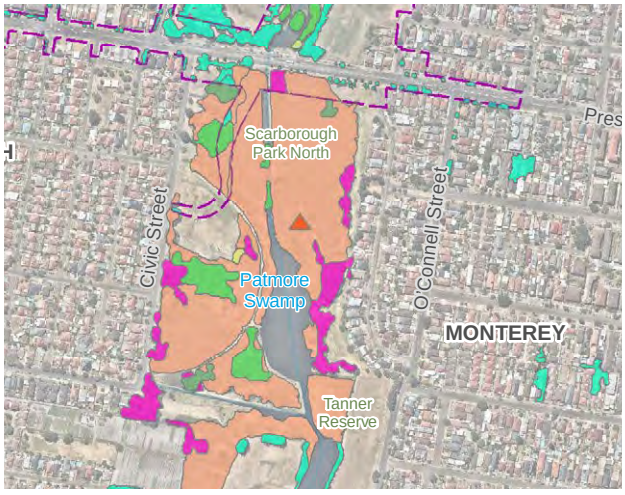
Kings Wetland – This area set within the vicinity of Kings Road comprises a neglected 'bushland' area comprising remnants of Swamp Oak Swamp Forest. The area is subject to heavy weed infestation, with much of it enveloped in smothering weed species.

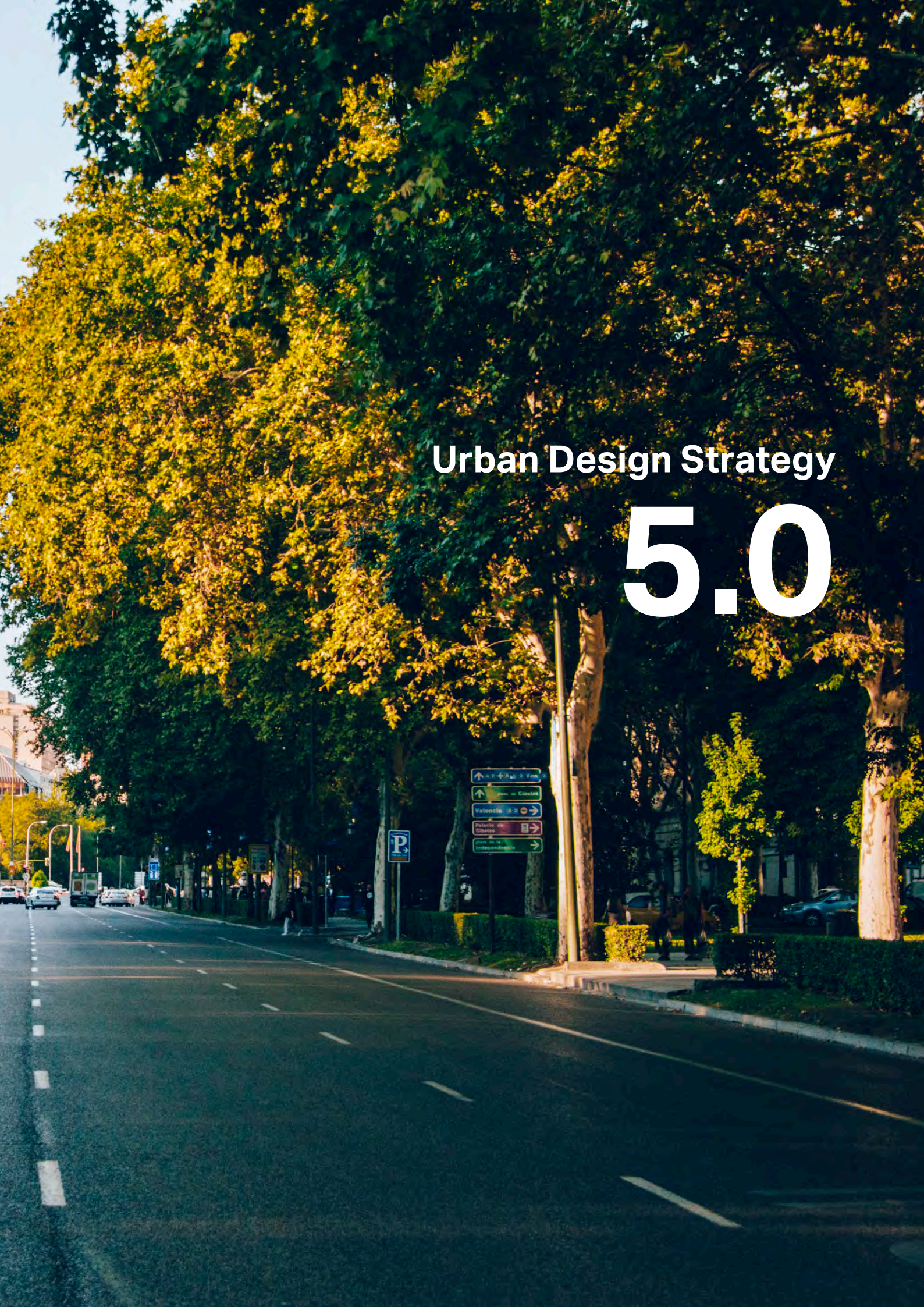
Rockdale Bicentennial Park and Wetlands and Ilinden Sports Centre – This area is centred on the Rockdale Wetlands, a well-managed area of remnant and restored endemic plant communities set arounds a pair of narrow, elongated ponds. East of this feature is a formal playing field with stadium, night lighting and substantial car parking, adjoined by a large informal, well-managed 'kick-about' field within which is set a regional playground and skate park. East of the wetlands comprises the Memorial Playing Fields, a substantial open area bounded to the north by Brighton-Le-Sands Public School including a group of State heritage listed buildings, and perimeter housing which backs onto the space.

Scarborough Park North (Patmore Swamp) – This area has limited areas of publicly accessible space, given much of it is covered with an extensive dense cover of tall reedland punctuated by a series of ponds constructed in the depression era under the direction of Pat Moore. A few small to moderately sized patches of remnant Coastal Freshwater Swamp Forest fringe the reedland. Substantial parts of this area are subject to weed invasion.

4.1.4 Infrastructure corridor

Much of the above described area is subject to a continuous corridor zoned SP2 Infrastructure corridor (hereafter the infrastructure corridor), ranging in width between about 100-200m (refer Figure 3-1). The corridor was reserved to facilitate the F6 Extension project. Given uncertainty over the long-term prospects for this land, much of the open space located within the corridor has historically been subject to minimal landscape design and on-going management, including: CA Redmond Field; Kings Wetland; playing fields; and much of Scarborough Park North. Some of these 'neglected' areas often stand-out in strong visual contrast to immediately adjoining well managed areas, e.g. the new grassed netball courts adjacent to CA Redmond Field, and the carefully managed Rockdale Bicentennial Wetlands where they adjoin Kings Wetland.





Urban Design Strategy

5.0

5.0 Urban Design Strategy

The following section describes the urban design strategy for the project to inform the detailed design development of the project. The urban design strategy builds on the current project design and its urban design components, as described in section 2. The urban design vision and objectives outlined in section 3 provide the foundation for the urban design strategy. The site analysis summarised in section 4, and detailed in Annexure A, has informed the understanding of the existing conditions.

The aim of the urban design strategy is to develop a project design that is well designed and fits into its built, natural and community context, while mitigating adverse impacts.

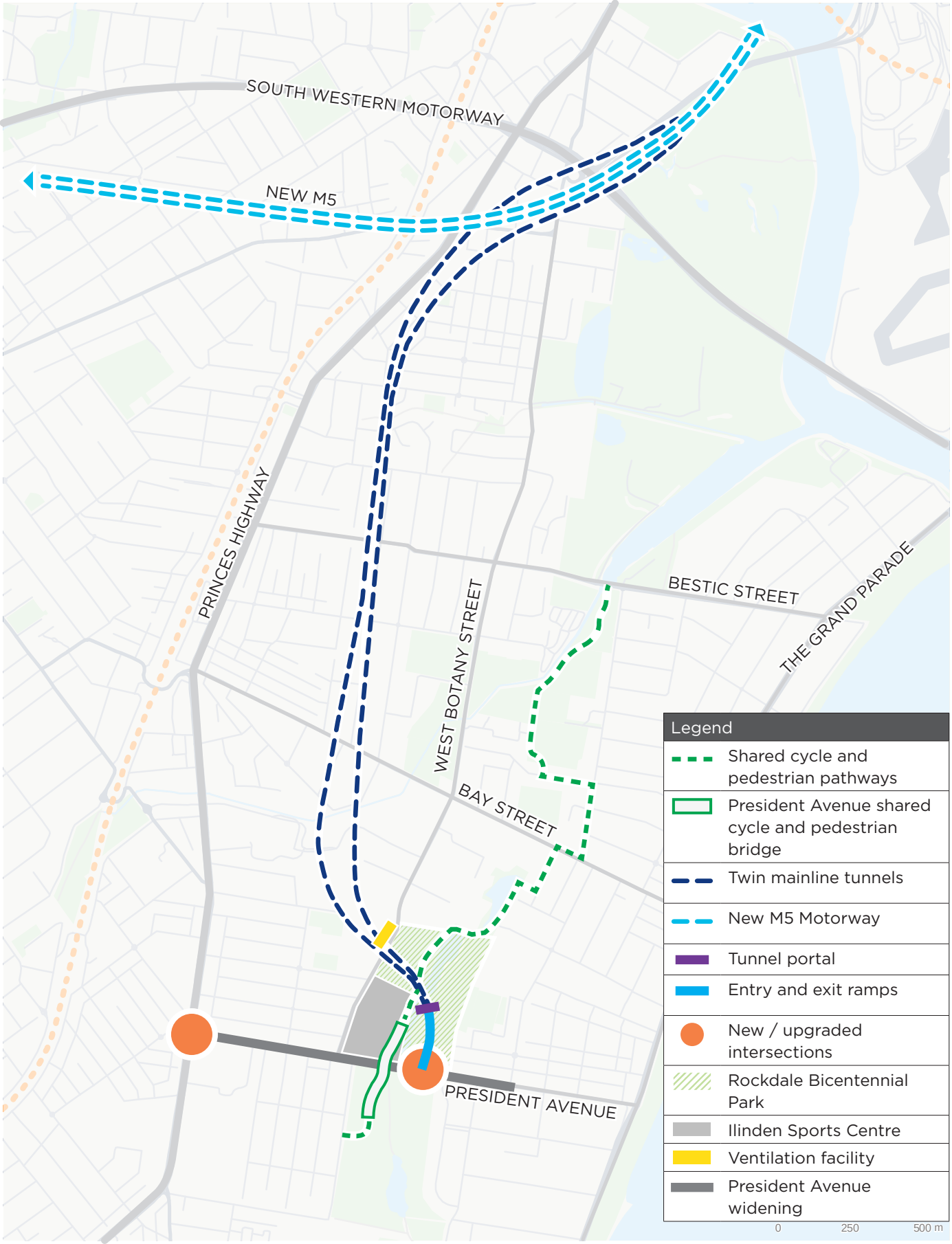


Figure 5-1: Overview of the project urban design elements

5.1 Motorway elements

5.1.1 President Avenue intersection

President Avenue intersection interfaces with open space north and south along the road. The Rockdale Bicentennial Park East playing fields are located to the north side of the intersection and Scarborough Park to the south.

The key urban design measures that would be integrated with the President Avenue intersection include:

- Improved pedestrian connectivity along President Avenue with a continuous path on the south side
- The incorporation of gently sloped batters (4H:1V) on the north side to provide for improved visual integration with Scarborough Park North and allow for a manageable landscape treatment to be applied
- Landscape treatment at the intersection and along President Avenue to integrate with adjacent open space. This would consist of turf verges between road carriageway and footpaths, native grass and ground cover planting to the batters to stabilise and work in with the adjacent interface, and street tree planting to provide shade and amenity along the paths and provide a tree-lined boulevard effect along President Avenue.

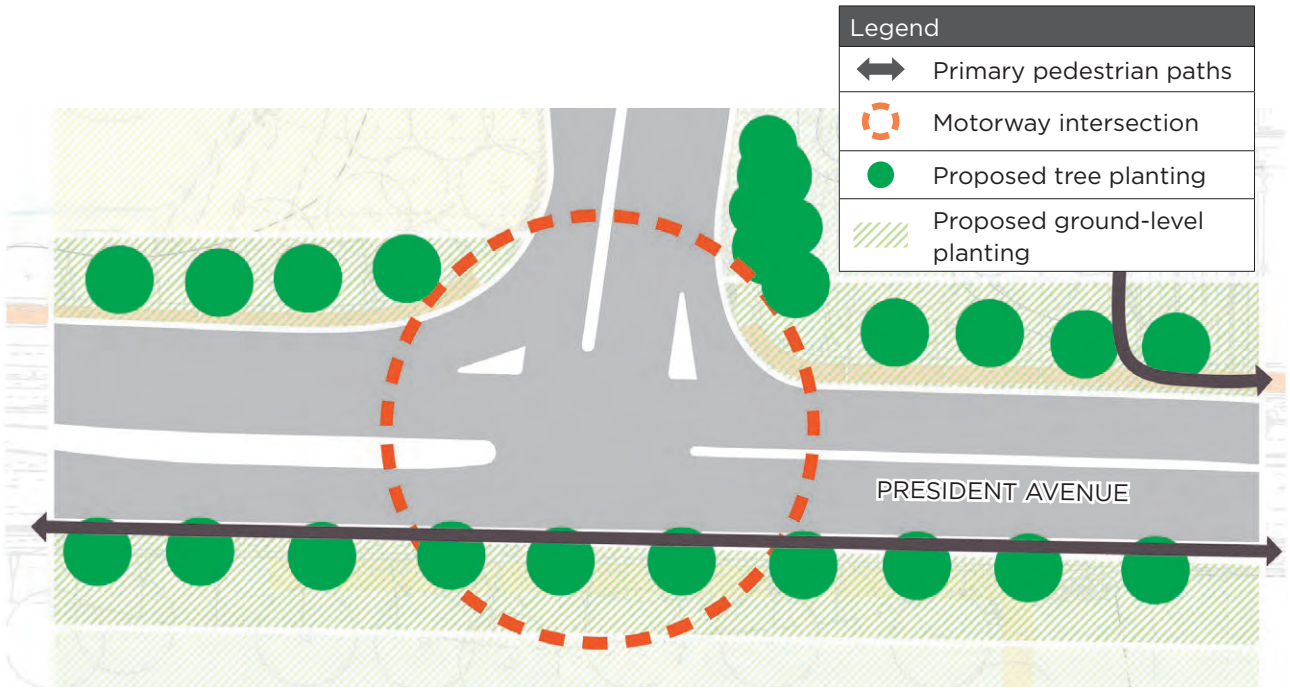


Figure 5-2: Overview of motorway intersection urban design elements at President Avenue

Figure 5-3: Artist's impression of President Avenue intersection from Colson Crescent (design is indicative only)

5.1.2 Entry and exit ramps

The entry and exit ramps would be the first experience of the project when approaching from the south. This design should legibly navigate the driver from President Avenue, the major arterial road access to the motorway, and into the mainline tunnels. The urban design would transition with the driver from a road environment with distinctive landscape character of Rockdale Wetlands Bicentennial Park into the tunnel. Conversely, the experience when exiting onto President Avenue should immediately prompt a sense of place and location to the driver.

To achieve a whole of corridor response that is integrated with the surrounding context, key urban design elements would be considered. The works associated with the entry and exit ramps is a critical link between the surrounding urban fabric and the driven tunnel.

Establishing coordination and consistency with the following elements would ensure the project is integrated and responds positively to the public domain and would be legible for road users entering and exiting the tunnel. These urban design components associated with the entry and exit ramps works include:

- Retaining walls
- Noise walls
- Fencing, safety handrails and safety screens
- Colour treatments
- Lighting
- Road furniture

Figure 5-4: Overview of motorway entry / exit ramp urban design components

Retaining walls

- Retaining walls associated with the entry and exit ramps are to be integrated with the tunnel portal and driven tunnel components, as well as the surround urban context. The structural typology of all walls shall present the same visual appearance when seen in elevation by adopting the following consistent features:
- Retaining structures shall be coordinated with other structural elements, such as barriers, lighting, landscape, drainage, and particularly any noise walls and fencing. For example, cladding systems and / or form work match panel size, proportions and joint set-out of associated wall and fence systems
- Retaining walls and associated noise walls form a coordinated design system at the entry and exit ramps.

Shotcrete

- The use of shotcrete (sprayed concrete) shall be minimised to designated zones not visible to the public (including road users). Where the use of shotcrete in unavoidable, it shall be applied with an aesthetic finish in a highly controlled manner in accordance with Roads and Maritime Guidelines for the use of shotcrete, or covered by panelling.

Retaining wall design principles

Retaining walls should be designed to ensure that the face of all walls associated with the entry and exit ramps are vertically flat.

The tops of walls should generally be consistently horizontal and true along the entry. If they cannot be horizontal, the top of each wall in elevation should be finished to a long, gradual, consistent horizontal curve rather than having sudden steps or changes in level.

The following urban design principles shall be applied to develop the design for all retaining walls within and outside the project corridor:

- Retaining walls and related elements shall be designed as a unified composition and be integrated with other components such as fencing, guard rails and noise walls, and not as an assemblage of separate and uncoordinated parts
- The precautionary principle shall be adopted throughout so that retaining walls are only constructed where there is no other alternative
- Retaining walls would attempt to knit into the adjacent landscape formations or adjacent elements
- The top of wall shall be finished with a solid concrete capping beam with consistent width, finished flush with the face of the wall
- Keystone retaining wall systems must not be used
- Good quality, precast modular concrete fascia or cladding systems may be used to increase the aesthetic appeal of retaining walls, introduce a pattern or rhythm, and reduce their apparent scale and visual impact.

Figure 5-5: Artist's impression of proposed entry and exit ramps and tunnel portal entry arrangement (design is indicative only)

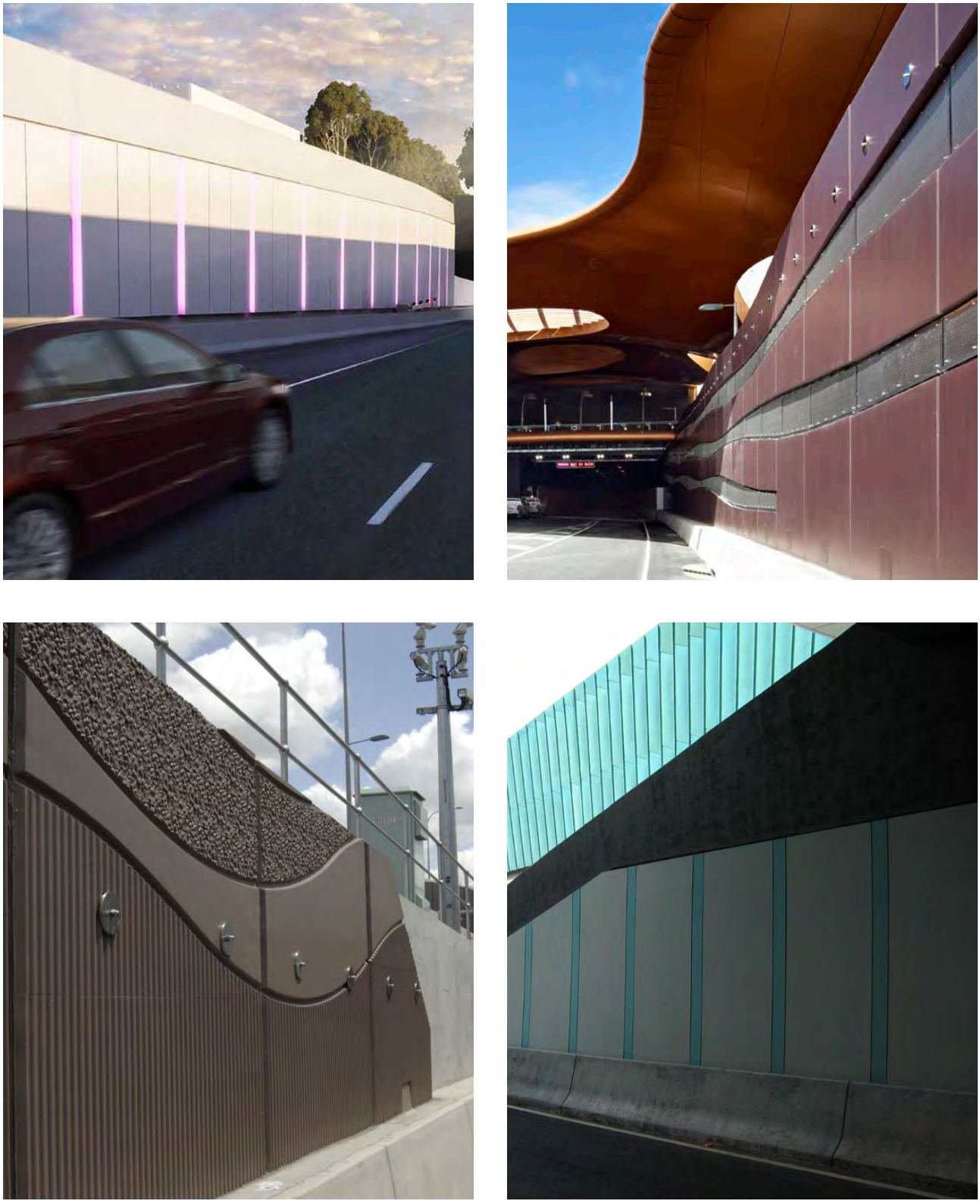


Figure 5-6: Retaining wall examples, both as integrated art elements or integrated with urban design components including road barriers, noise walls or fencing

Noise walls

The noise impact assessment conducted for the EIS determined that noise walls are not required for the project. Should it be determined at a later stage that they would be required, for the project or for future stages of the F6 Extension, noise walls shall be integrated with other urban design components associated with the entry and exit ramps, in particular retaining walls.

Noise wall design principles

If it is determined during the detail design process that noise walls are required, the following urban design principles shall be applied:

- Noise wall panels shall comprise of robust, vandal-resistant materials that are resistant to damage by adjacent planting. The designed noise walls shall be: constructed of modular, precast concrete systems or other approved material: and comprise simple, monochromatic, modular planar panels of consistent height, with a horizontal top edge
- Noise walls shall be designed with the ground level even, horizontal and as linear as possible, and be installed with a top line as consistent and parallel with the adjacent ground-line as possible, ideally horizontal
- All noise walls shall be designed as part of a coordinated hierarchy of walls that include retaining walls, abutments and portal walls, All joints, fixings and panels shall be carefully coordinated as an integrated, three-dimensional design. All vertical joints in supporting structures below
- Coating systems and applied colours must be durable, readily available, and easily and exactly matched throughout the life of the wall
- The scale of noise walls shall be matched with appropriate screen planting where possible to minimise their visual impact

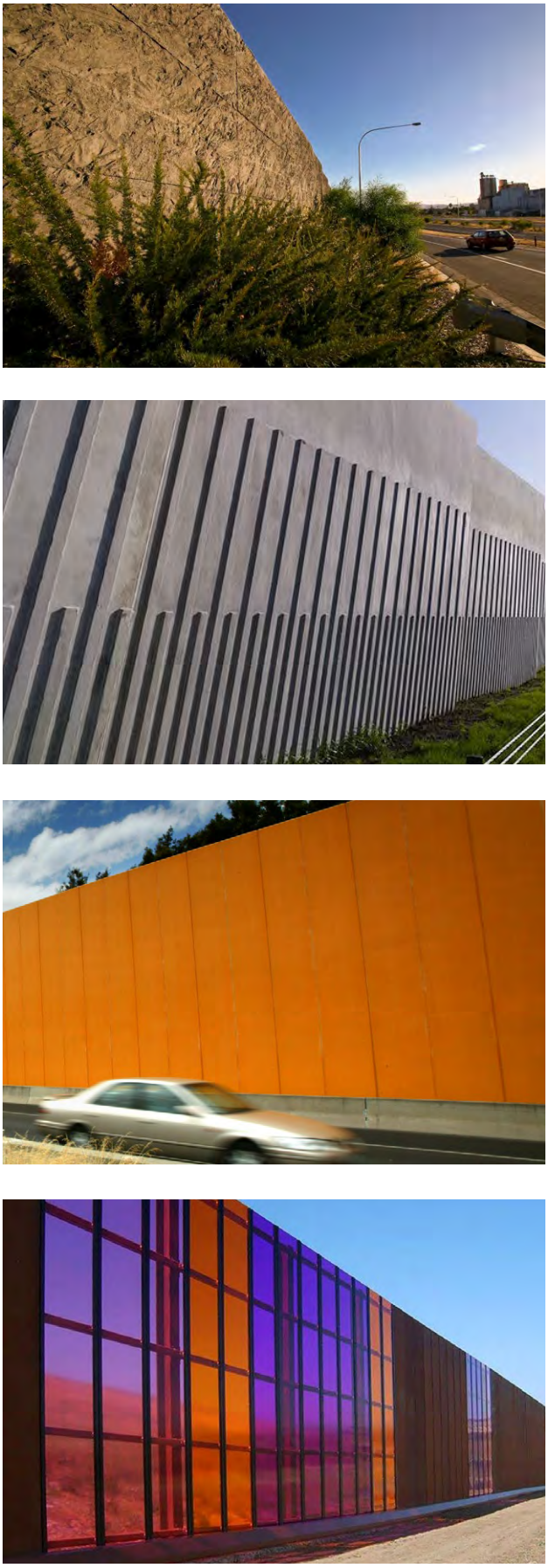


Figure 5-7: Typical noise wall examples

Fencing, safety handrails and safety screens

Fencing, safety handrails and safety screens may be required at the entry and exit ramps as a safety requirement for maintenance purposes. Fencing may also be required as a deterrent measure to prevent equipment (balls, etc.) from entering the road corridor from adjacent sporting fields. The height of this security element would present a visually dominant element in the landscape and would need to be integrated with the overall design.

Fencing, safety handrails and safety screen design principles

The following urban design principles shall be applied to develop the design for all fencing, safety handrails and safety screens within and project corridor, where required:

- The design, detailing and materials including joints, junctions, fixings, and placement of support posts, for all security, safety and other project fencing shall be fully integrated with all other urban elements, including with retaining walls, noise walls and tunnel portals
- Fencing and safety handrail systems shall be designed to be as consistent as possible, they should be minimal and contemporary in design, with a common modularity, materiality and appearance through the choice of readily available materials, considering whole-of-life and replacement costs
- All fencing and safety handrails shall meet operation and Work Health & Safety requirements
- Fencing design must deter climbing, and provide no footholds
- Fencing throughout the entry and exit ramps and public domain areas must avoid creating dead ends or sightline conflicts
- Choice of materials must be coordinated with other structures and the broader materials palette
- Vandalism and graffiti must be considered in the design of fencing and safety handrail finishes and maintenance.

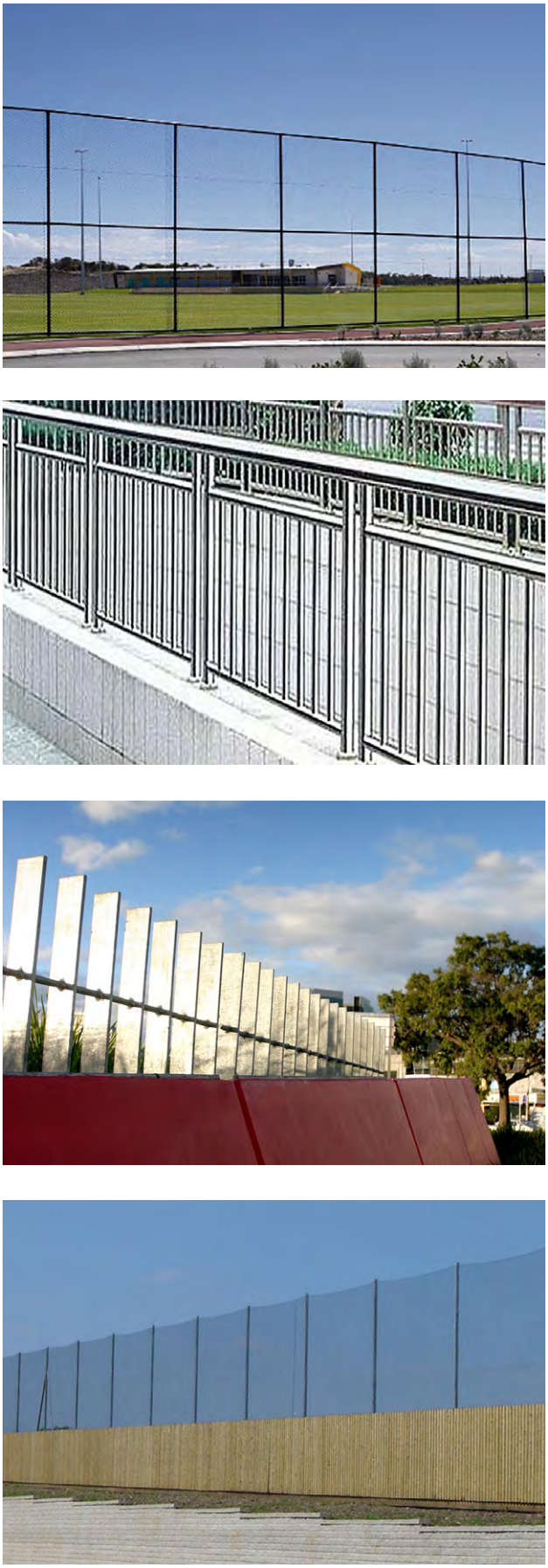


Figure 5-8: Typical fencing, safety handrails and safety screen examples

Colour treatments to urban design elements

Key urban design elements (retaining walls, noise walls and tunnel portals) may be applied with a painted colour treatment system. This would ensure a consistent treatment at the entry and exit ramps location, tunnel portal and through the driven tunnel. It would also facilitate maintenance and removal of graffiti.

The application of a colour treatment shall consist of an application (i.e. painting) of key urban design elements with a colour complementary to natural concrete, with minimal highlighting or embellishment at the entry and exit ramps. This colour treatment would be applied to retaining walls, noise walls and the tunnel portal.

This would identify the tunnel portal structure and determine whether to emphasise the tunnel portal as a feature or to make it recessive to integrate with other urban design components.

Lighting

Locations of lighting columns at the entry and exit ramps in relation to other proposed infrastructure shall be coordinated to ensure a desirable urban design outcome. Luminaires would need to be positioned to ensure that light spillage to adjacent residential properties is minimised, e.g. using deflectors around the light source, or using screen planting as appropriate.

A consistent approach to lighting columns and luminaires would need to be applied to fixtures along the shared cycle and pedestrian pathways.

Lighting would address airport navigation considerations, and CPTED issues arising from restricting lighting to pedestrian pathways only.

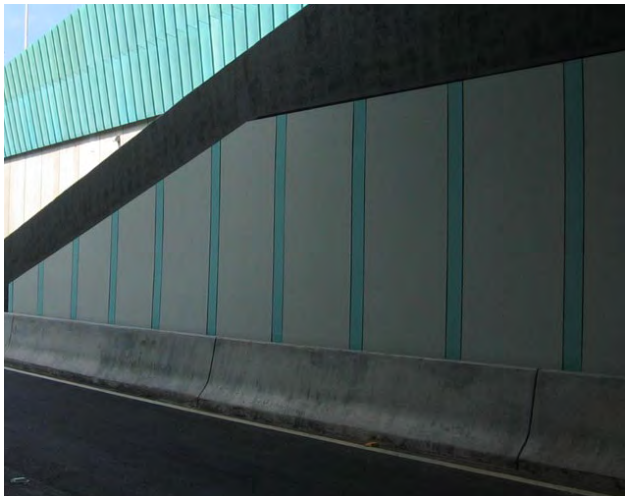


Figure 5-9: Colour treatment examples - colours complementary to natural concrete and integrated with other structural elements.

Figure 5-10: Street lighting examples - lighting elements should be integrated with other urban design elements and spaced to ensure a safe user environment, but also rhythm and consistency along the road corridor and shared cycle and pedestrian path

Road furniture

A coordinated approach would be required for various road furniture elements along the road corridor, in particular at the entry and exit ramps entering / exiting the driven tunnel. This would ensure consistency with the tunnel / motorway requirements, while minimising visual clutter.

Road furniture refers to all the physical elements beyond the road pavement that are required for motorway operations. This includes:

- Signage (regulatory, directional)
- Gantries
- Security cameras
- Lighting
- Crash barriers and fencing
- Emergency phones
- Reflective bollards
- Telecommunications towers
- Hydrants
- Services boxes.

Road furniture, particularly signage and active messaging, would be the most visible element along the motorway. It is important that these elements are visually uncomplicated and well considered.

Design involvement is critical to ensure a holistic, coherent response and the prevention of road furniture becoming uncoordinated visual bright littered along the motorway. This would involve:

- Designing road furniture as a suite of architectural elements
- Ensuring a coordinated approach to the location of the various elements in the context of the overall road experience
- Lane management act active messaging signage must comply with the relevant RMS design guidelines, in particular Technical Direction: Guidelines for the Location and Placement of Variable Message Signs, RMS / RTA TDT 2005/02b, 2008.

Figure 5-11: Examples of key motorway elements to be coordinated including; from top - signage; middle - concrete crash barriers; and bottom - gantries

5.1.3 Tunnel portal

The tunnel portal is the only external entry and exit to the project. It would also form the interface with the Rockdale Wetlands for the driver, with the wetland's associated landscape as a backdrop. The urban design intent for the tunnel portal would be to provide a simple portal element that is integrated with the entry and exit ramps components. Located within the surrounding open space, the tunnel portal needs to sit within the surrounding landscape context and provide an impression that is visually discrete from the surrounding recreational areas.

To offset some of the vegetation to be removed at Rockdale Wetlands, the area surrounding the tunnel portal and entry and exit ramps would be planted with a variety of low, mid and canopy vegetation reflective of the adjacent wetlands and recreational open space species. The overarching intent is for the landscape, existing and proposed, would be to provide site context and an arrival for the portal.

Tunnel portal design principles

The structure of the tunnel portal would be minimal in form and embellishment and would work in unison with the surrounding landscape setting. Given the landscape context is organic in its nature, the portal structure would also mimic this form as a ribbon extending from the entry and exit ramps components and into the landscape setting beyond, before folding back and returning on the other side.

The key urban design principles for the tunnel portal include:

- Organic in form that is integrated with the entry and exit ramps components and surrounding landscape setting
- Use minimal embellishment to allow the landscape to be the dominant feature, with use of natural materiality to integrate with the landscape backdrop
- Use of lighting to highlight and enhance the tunnel portal entry experience, identify key landscape features and transition lighting for driver safety
- Keep colour and overhead signage gantries to a minimum so as not to detract from the driver experience. Information and safety signage should be integrated or displayed as a single variable message sign (VMS) to minimise clutter. Overhead toll gantries should be located inside the mainline tunnels.

5.1.4 Mainline tunnels

The majority of the project would be in tunnel connecting from the New M5 in the north and President Avenue in the south. The tunnel length would be 3.2 kilometres and would require wayfinding elements to provide drivers with an indication of where they are along their journey.

Roads and Maritime's Tunnel urban design guideline – Design guideline to improve the customer and community experience of road tunnels (RMS, May 2017) outlines the key objectives and principles to be considered in the tunnel design. This would ensure the key tunnel components – entry and exit ramps, tunnel portal and tunnels – come together as a seamless and well-thought experience that is integrated with the public domain.

The following urban design components of the mainline tunnel elements would include:

- Tunnel lining
- Roof lining
- Lighting
- Signage
- Breakdown bays

Figure 5-12: Tunnel portal design example - Airport Link M7 tunnel portal entry in Brisbane provides a distinctive tunnel entry experience with minimal road furniture and clutter to distract the driver experience

Figure 5-13: Tunnel portal design example - the tunnel portal entry experience should include organic forms to integrate with the surrounding landscape setting of the Rockdale Wetlands

Mainline tunnels design principles

The aim of the urban design outcome is to create a safe, legible and memorable driver experience for the project. Its identity should be a transition from the WestConnex tunnel identity and consistent in its application to ensure there are no harsh, or sudden transitions that distract the driver, yet ensures to driver always recognises where they are in their journey through visual cues. This should be undertaken with clear signage that does not confuse or clutter the driving experience and through the use of lighting and colour to enhance the journey and wayfinding experience.

The key urban design principles for the mainline tunnel include:

- The transition between WestConnex and the project should be seamless, yet identifiable through bold signage, colour variation and lighting
- Provide contrasting tunnel 'markers' at regular intervals to indicate to the driver where they are in their journey
- Coloured feature lighting at the tunnel entry and exit , including coloured lining panels identifying breakdown bays
- A 'tunnel event' at the approach to the southern entry and exit at President Avenue
- All safety and emergency exit signage requirements.

Figure 5-14: Tunnel design example - Visualisation of tunnel lining effect for WestConnex, with bold wayfinding and signage to identify location along journey

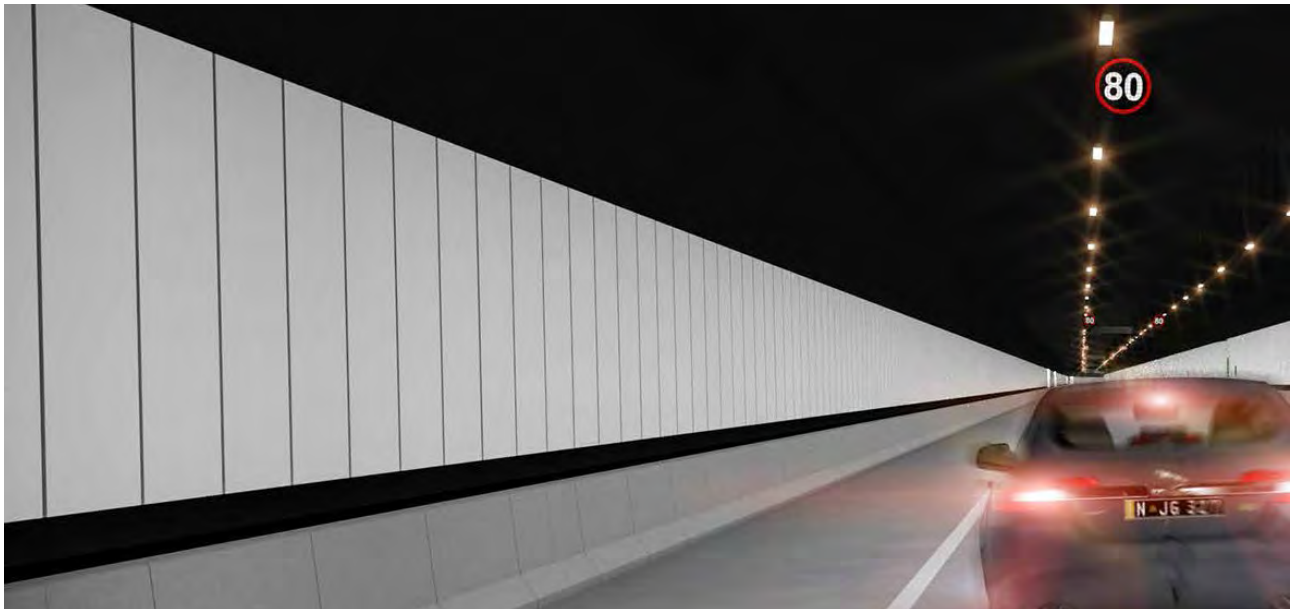


Figure 5-15: Tunnel design example - Visualisation illustrating similar tunnel lining effect for NorthConnex

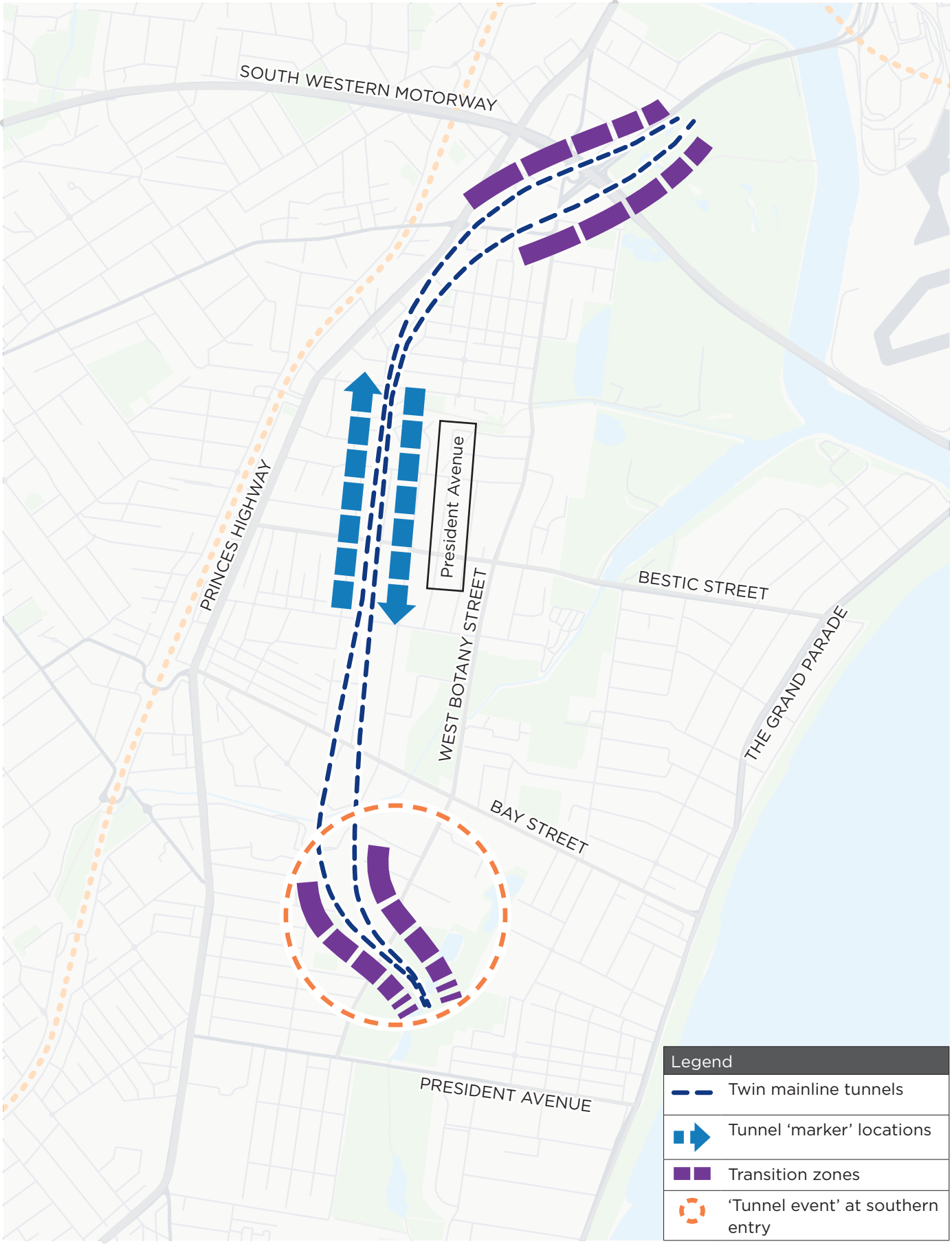


Figure 5-16: Overview of mainline tunnel urban design elements

5.2 Surface road works

5.2.1 President Avenue widening

President Avenue is the primary access to the project from the south. It runs in an east-west direction between the Princes Highway and The Grand Parade. While President Avenue is classified as an arterial road, it consists primarily of low to medium density residential, with some commercial and retail businesses. A pedestrian path is located on both sides of President Avenue, however becomes disjointed at the interface with the Rockdale Wetlands. Tree planting of varying species and quality line both sides of the street.

The key landscape and urban design principles that should be applied to President Avenue include:

- Re-establishment of a strong landscape character to provide an entry 'gateway' and visual hierarchy to the motorway entrance
- Improve pedestrian and cyclist connectivity, including micro-climatic conditions
- Consideration of access points, in particular driveway locations and local roads
- Respond to the existing residential character along the street.

Earthworks and embankments

President Avenue would also need to be raised for flood protection between West Botany Street and O'Connell Street. The following design principles shall be applied to guide approach to earthworks and engineered embankments:

- Visually integrate earthworks into their landscape setting as much as possible to keep engineered structures to a minimum
- Visually, all earthworks shall sit lightly in their context, exhibiting a 'natural fit' within their landscape setting wherever possible
- Landscaped earthworks shall not be steeper than 4H:1V to ensure visual integration with the surrounding landscape context and to allow for a manageable landscape outcome. If this is not practicable then the incorporation of low-height retaining walls (up to 1.0 metre high) is preferred to create terraced landscape opportunities to minimise the earthworks footprint.
- All formations should be gently rounded out at both top and bottom of slopes, and at the end of each formation, in order to achieve a 'natural' transition into adjacent landforms. Where these requirements cannot be met due to limited space, the use of retaining walls is preferred
- A coordinated design by the civil engineer and landscape architect should ensure an embankment design which is sympathetic to the existing topography.

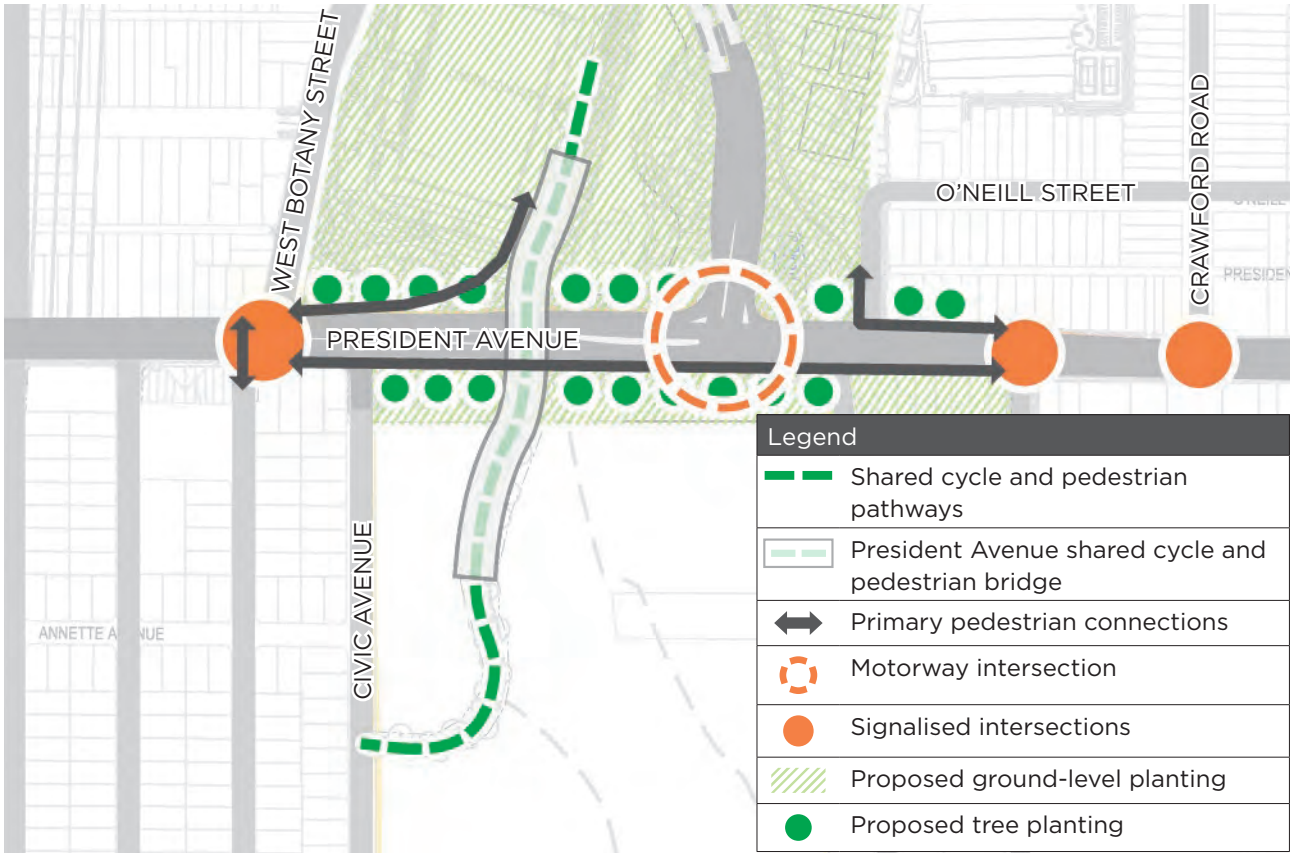


Figure 5-17: Overview of President Avenue urban design elements

Figure 5-18: Top and above - typical examples of boulevard streets that provides the user with a strong linear, rhythmic and landscape experience

5.2.2 Princes Highway / President Avenue intersection

To facilitate increased traffic volumes onto President Avenue from Princes Highway, this intersection would require widening. This would consist of an additional right-turn lane northbound on the Princes Highway as well as widening of President Avenue at this intersection. These works would require partial acquisition of property as well as removal of existing vegetation along President Avenue.

These impacts would need to be mitigated and adequately addressed, in particular the removal of existing vegetation along President Avenue, which currently provides a physical and visual screen to the road. Supplementary tree planting and screening would need to be provided to offset this tree removal and to re-establish a visual screen along President Avenue.

The road widening at President Avenue near Princes Highway intersection would also impact on-street parking amenity and pedestrian connectivity on the north side. Pedestrian connectivity would need to be maintained along President Avenue and improved on the north-side intersection at Princes Highway to facilitate a safe and legible crossing.

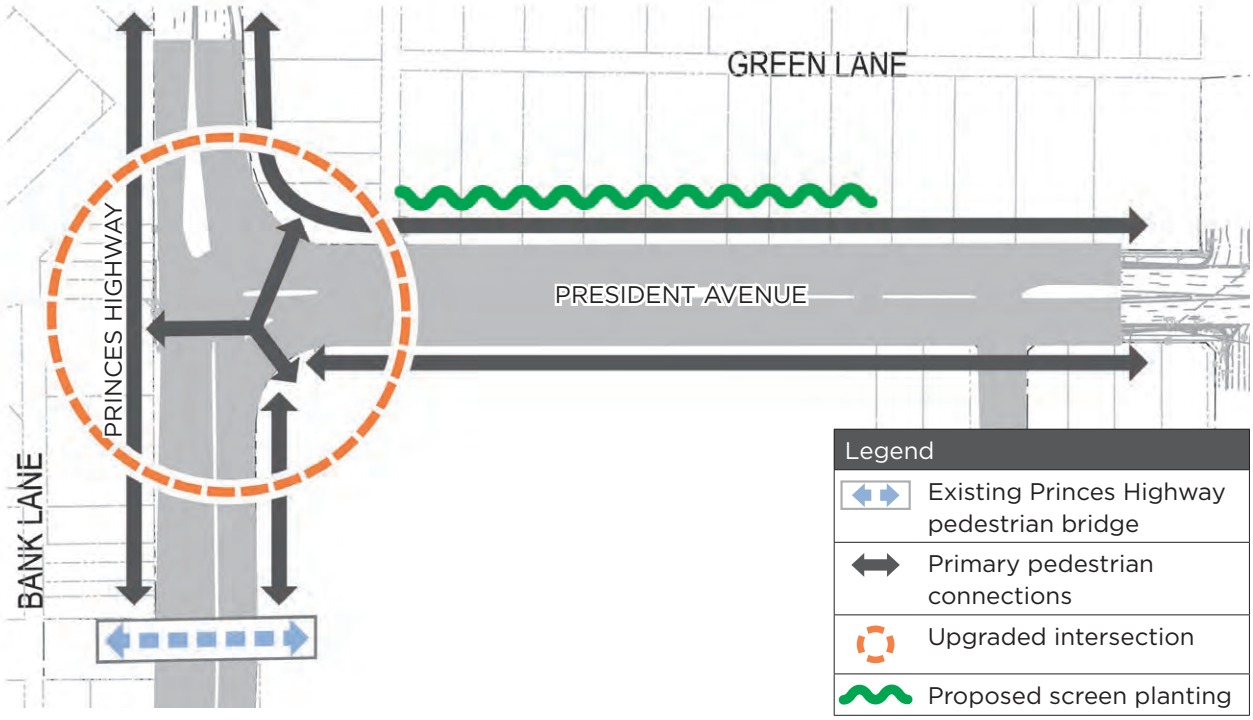


Figure 5-19: Overview of Princes Highway / President Avenue intersection urban design and landscape elements

Figure 5-20: Existing conditions at Princes Highway / President Avenue intersection. Left - the intersection is heavily trafficked and is not welcoming for pedestrians. Right - President Avenue consists of mature trees along the north side of the road, which will require removal to widen the road

Figure 5-21: An example of a legible and safe intersection for pedestrians, including changes of material to identify pedestrian zones at the intersection

5.3 Motorway operational elements

The key operational elements required for the project would include the Rockdale ventilation facility and other infrastructure at West Botany Street, within MOC3. An urban design strategy has been developed for the Rockdale ventilation facility as it would be visible from adjacent residential areas and along West Botany Street. Guiding urban and landscape design principles would need to be prepared to ensure it is integrated with its surrounding context.

The Rockdale ventilation facility would be visually prominent within the landscape, particularly when viewed from Rockdale Bicentennial Park and along West Botany Street. The architectural design of the ventilation shaft and associated facilities must consider the functional requirements to ensure efficient and effective functioning that would dictate the ultimate scale and arrangement for the facilities.

The location of the ventilation outlet and associated facilities in the Rockdale industrial area should drive the materiality, colours and built form to ensure it is integrated with the surrounding context.

The key design principles to consider for the Rockdale ventilation facility include:

- Articulation of the built form along West Botany Street to maximise opportunities for screen and buffer planting, and to break up the building mass
- Consideration of the height and scale of the ventilation outlet in relation to the residential development surrounding it
- Visual appearance and materiality of the ventilation outlet is to reflect built form elements of the surrounding urban character
- Coordination of all motorway operations centre structures including, associated buildings (substations and disaster recovery structures), parking facilities, site landscape works and response to urban setting
- Improved maintenance access into the compound from West Botany Street
- Community perception of the ventilation outlet within visual proximity to residential areas.

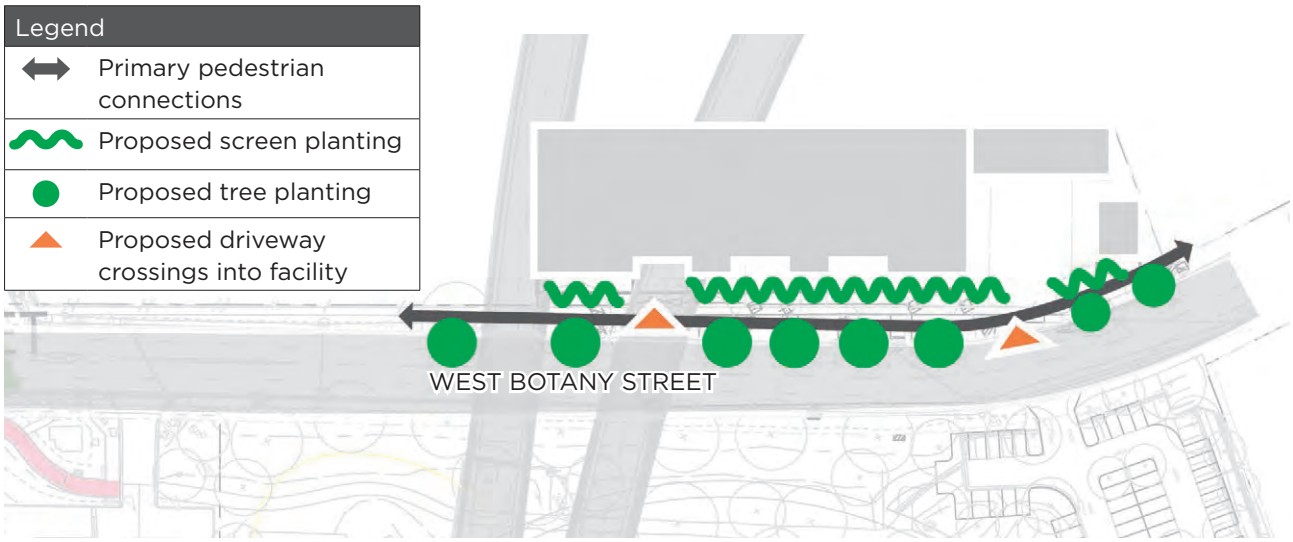


Figure 5-22: Overview of ventilation facility at West Botany Street urban design and landscape elements

Figure 5-23: Artist's impression of ventilation facility from West Botany Street, looking north (design is indicative only)

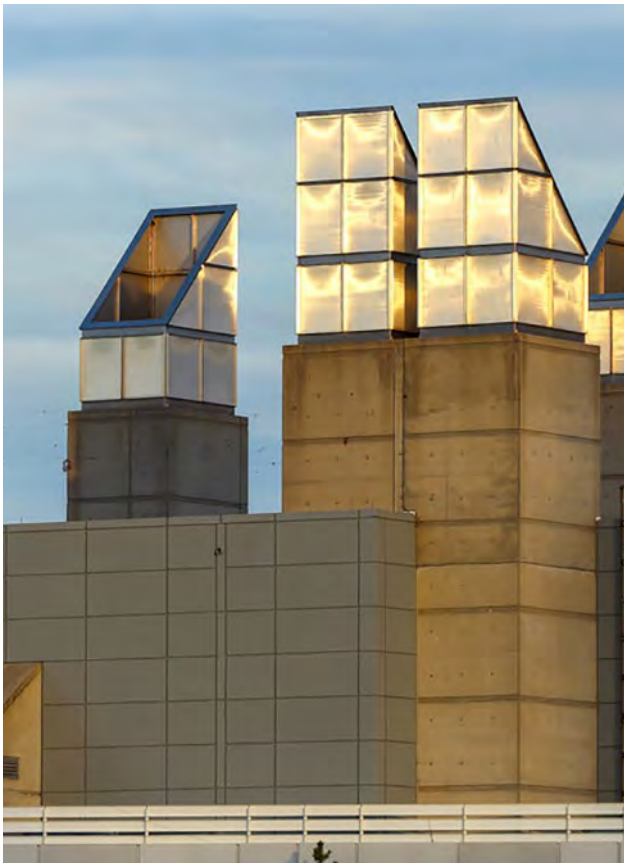


Figure 5-24: Architectural examples of built form and facade details of motorway ventilation facilities

5.4 Shared cycle and pedestrian pathways

The shared cycle and pedestrian pathways would be designed in accordance with Austroads Guidelines Part 6 – Pedestrian and Cyclist Paths. The adjacent landscape treatment should respond to the surrounding context which the shared cycle and pedestrian pathways is running through, without obstructing visibility or creating a safety concern. Figure 5-25 provides a typical cross section of the shared cycle and pedestrian path with associated lighting fixture along whole route.

Figure 5-26 provides a typical cross section of the shared cycle and pedestrian path along Bay Street, where it would become part of an on-road system and be integrated with a shared-path system.

The southern end point of the shared cycle and pedestrian path would need to be designed to ensure that:

- It fits with the redevelopment / reinstatement plans of Rockdale Bicentennial Park following construction of the project
- It is consistent with and / or does not preclude a legible connection with President Avenue shared cycle and pedestrian bridge.

The key design principles of the shared cycle and pedestrian pathways are:

- The average width would be five metres, comprising a three metre two-way cycle lane, 1.5 metre pedestrian path and 0.5 metre painted buffer
- Lighting would be provided along the length of the shared cycle and pedestrian pathways where required (refer to Section 6.11.7 of EIS)

Figure 5-25: Typical section of the shared cycle and pedestrian pathways with 500mm wide painted buffer

Figure 5-26: Typical section of shared cycle and pedestrian pathways at Bay Street, Brighton-le-Sands

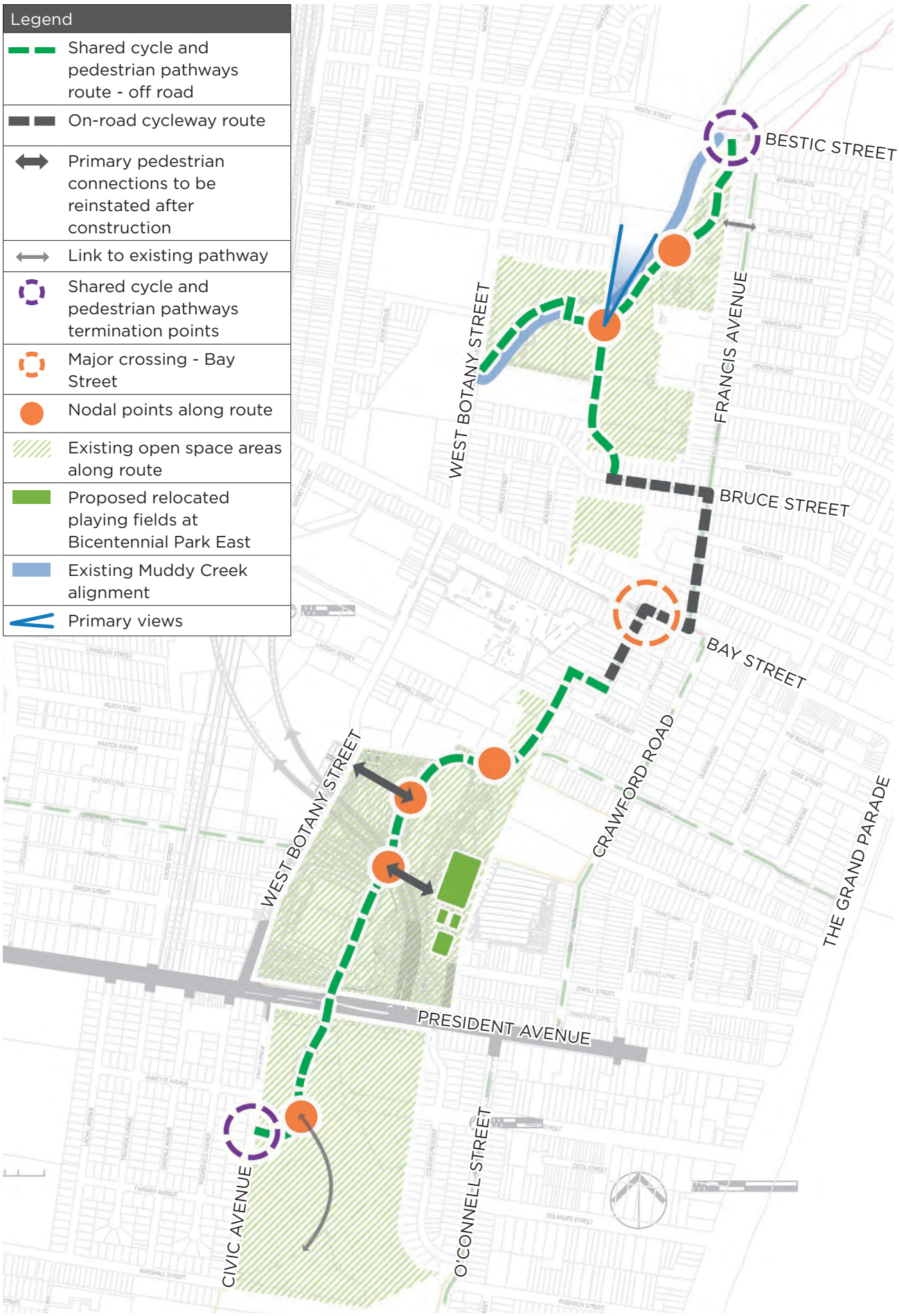


Figure 5-27: Overview of shared cycle and pedestrian pathways urban design and landscape elements

Figure 5-28: Examples of safety screens to shared cycle and pedestrian bridge

President Avenue shared cycle and pedestrian bridge

The President Avenue shared cycle and pedestrian bridge would provide a connection along the shared cycle and pedestrian pathways. Bridges are considered as completely interconnected elements within the shared cycle and pedestrian pathways, safely connecting key community destinations across the road corridor and embedding the bridge into the landscape setting and urban fabric along President Avenue.

The President Avenue shared cycle and pedestrian bridge has been located to maximise connectivity with the broader circulation network and to allow for extension during future stages of the project. The design of the President Avenue shared cycle and pedestrian bridge should be visually unobtrusive, optimises safety for all users, ensures ease of maintainability and contributes positively to the local built form character.

The key design principles for the development of the bridge shall include:

- The design of the bridge shall be developed through a collaboration between the engineer and urban designer from the outset, to ensure a coordinated and visually integrated outcome. The design should present smooth, clean lines with minimum structural depth consistent with their spans
- Urban design elements including throw screens, lighting and fencing shall all be considered as part of the overall composition and form, with a view to developing a slender, symmetrical, visually uncluttered and well-ordered profile. Signage requirements should be kept to a minimum
- Complement the surrounding built-form and natural environment
- Engage with road users as an elegant form and an identifiable visual marker in the landscape from President Avenue
- Provision of generous and smooth radii to ramps to provide safe line of sight and easy transitions for cyclists and pedestrians

The design elements of the bridge must comply with the relevant Roads and Maritime 'Bridge Aesthetics' design guidelines and be designed to achieve relevant access code requirements.

Figure 5-29: Artist's impression of President Avenue shared cycle and pedestrian bridge, looking east (design is indicative only)

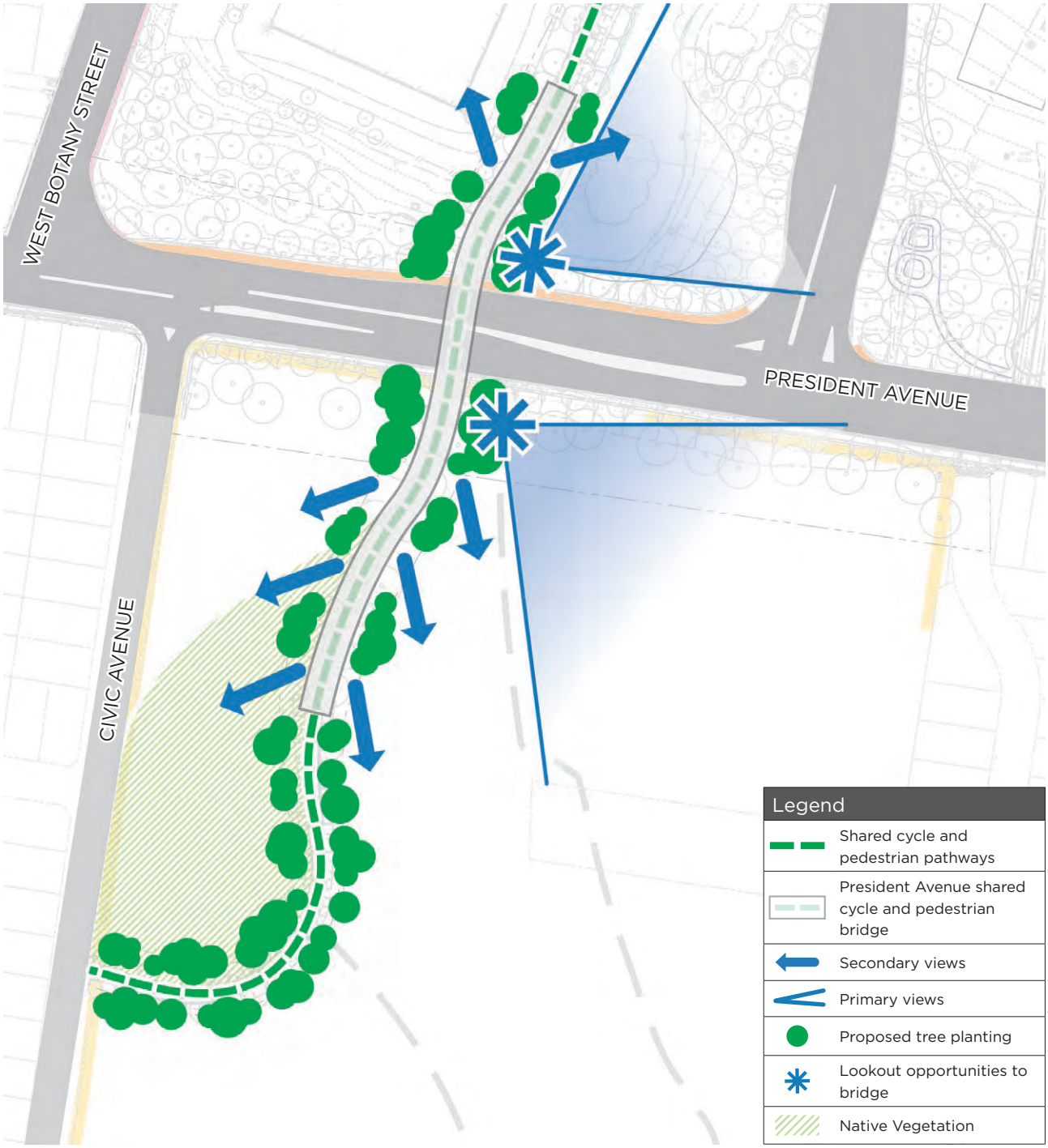


Figure 5-30: Overview of President Avenue shared cycle and pedestrian bridge urban design and landscape elements

Figure 5-31: President Avenue shared cycle and pedestrian bridge design example - The bridge shall fit naturally within the surrounding context. The external components, including bridge deck and underside of deck shall also be considered visually from President Avenue

Figure 5-32: President Avenue shared cycle and pedestrian bridge design example - All bridge components including throw screens, lighting and fencing need to be considered as part of the overall composition of the bridge

5.5 Rockdale Bicentennial Park

A preliminary landscape concept has been developed for the reconfiguration of Rockdale Bicentennial Park (refer to Figure 5-34) in accordance with the urban design objectives and principles.

The preliminary landscape concept has been developed to:

- Enhance the amenity of the adjoining open spaces with canopy tree planting, shrubs and appropriate park furniture
- Highlight the portal intersection and pedestrian bridge as visual landmarks for motorway users along President Avenue
- Reinstate vegetation to disturbed areas impacted by construction works to integrate with the existing character
- Promote cross-corridor connectivity by identifying and reinforcing public open space connections.

Preliminary landscape concepts for Rockdale Bicentennial Park and the shared cycle and pedestrian pathways through Whiteoak Park, Redmond Field and the Rockdale Womens Sports Fields are shown in Figure 5-35 and Figure 5-36. The plans represent a potential outcome for the parks. Roads and Maritime would work with Sydney Water, Bayside Council and other key stakeholders to further develop this design in response to stakeholder feedback.

Figure 5-33: Overview of Rockdale Bicentennial Park urban design and landscape elements

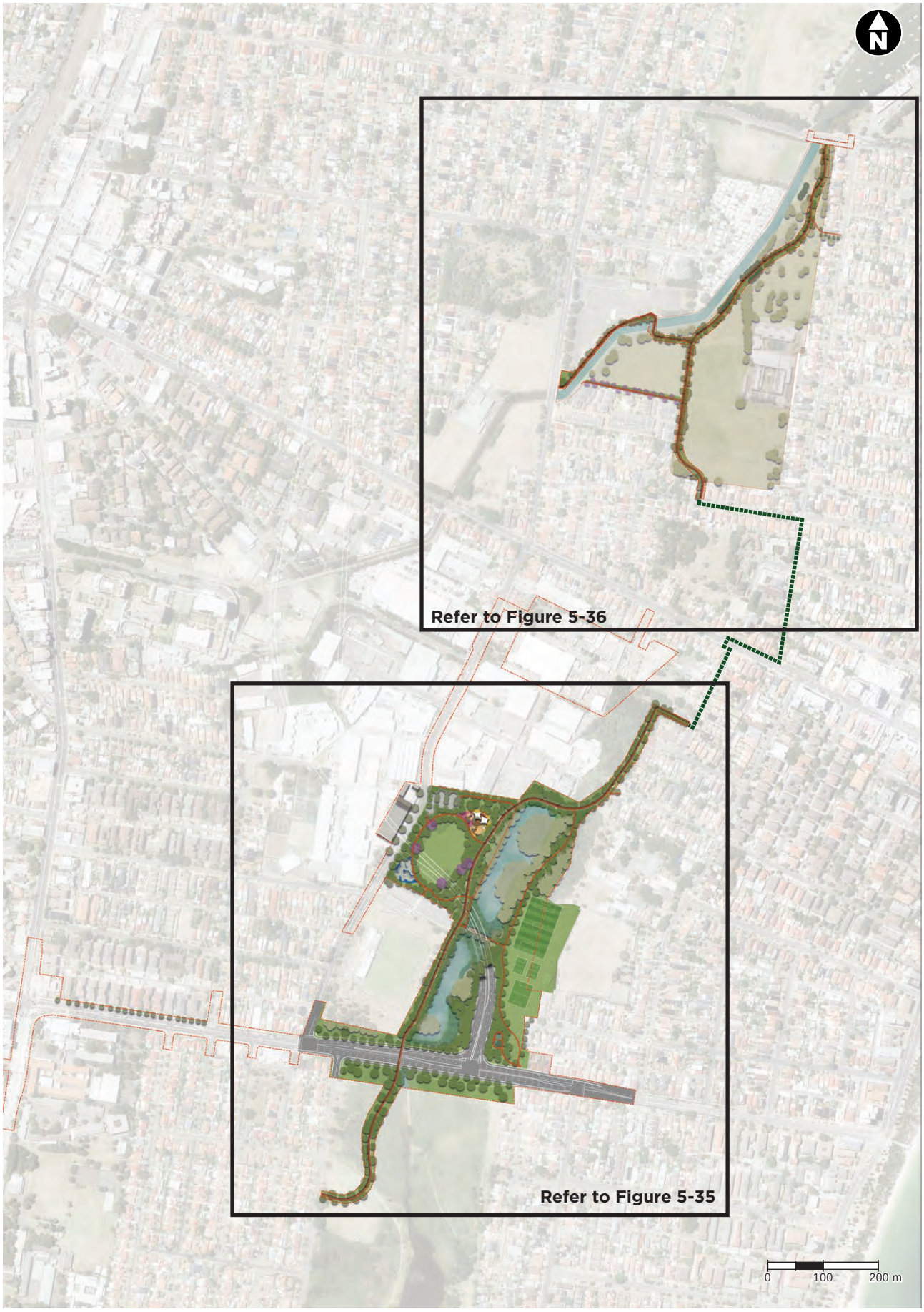


Figure 5-34: Preliminary landscape concept

Figure 5-35: Indicative landscape plan at Rockdale Bicentennial Park

Figure 5-36: Indicative landscape plan of Shared cycle and pedestrian pathways through Whiteoak Reserve, Redmond Field and the Rockdale Womens Sports Fields

5.5.1 Rockdale Bicentennial Park East

The existing landscape character at Rockdale Bicentennial Park East is defined by dense vegetation at the interface of Rockdale Wetlands to the west and cultural planting associated with adjacent residences to the east. The sporting facilities would be relocated to ensure the community can maintain equivalent use of the sporting facilities during construction.

Upon project completion, the sporting facilities would be reinstated to achieve equivalent use of open space and playing fields. To achieve this outcome, one possible arrangement would be to extend into the Memorial Playing Fields as shown in Figure 5 18. This would be subject to further consultation with Bayside Council and key stakeholders.

The other key design features to enhance the sporting fields should include:

- Associated landscape amenity including supplementary tree and shrub planting to screen the motorway entry and to integrate with adjacent interfaces (Refer to Annexure B for indicative plant schedule)
- Provision for overland flow path and water quality basin
- Improved pedestrian circulation, connectivity and lighting associated with the playing fields
- Temporary and permanent bridging structure across Rockdale Wetland from Bicentennial Park
- Provision for additional recreational and furniture amenity including seating, bin enclosures, bicycle racks, shelters and drinking fountains (Refer to Annexure B for indicative furniture elements).

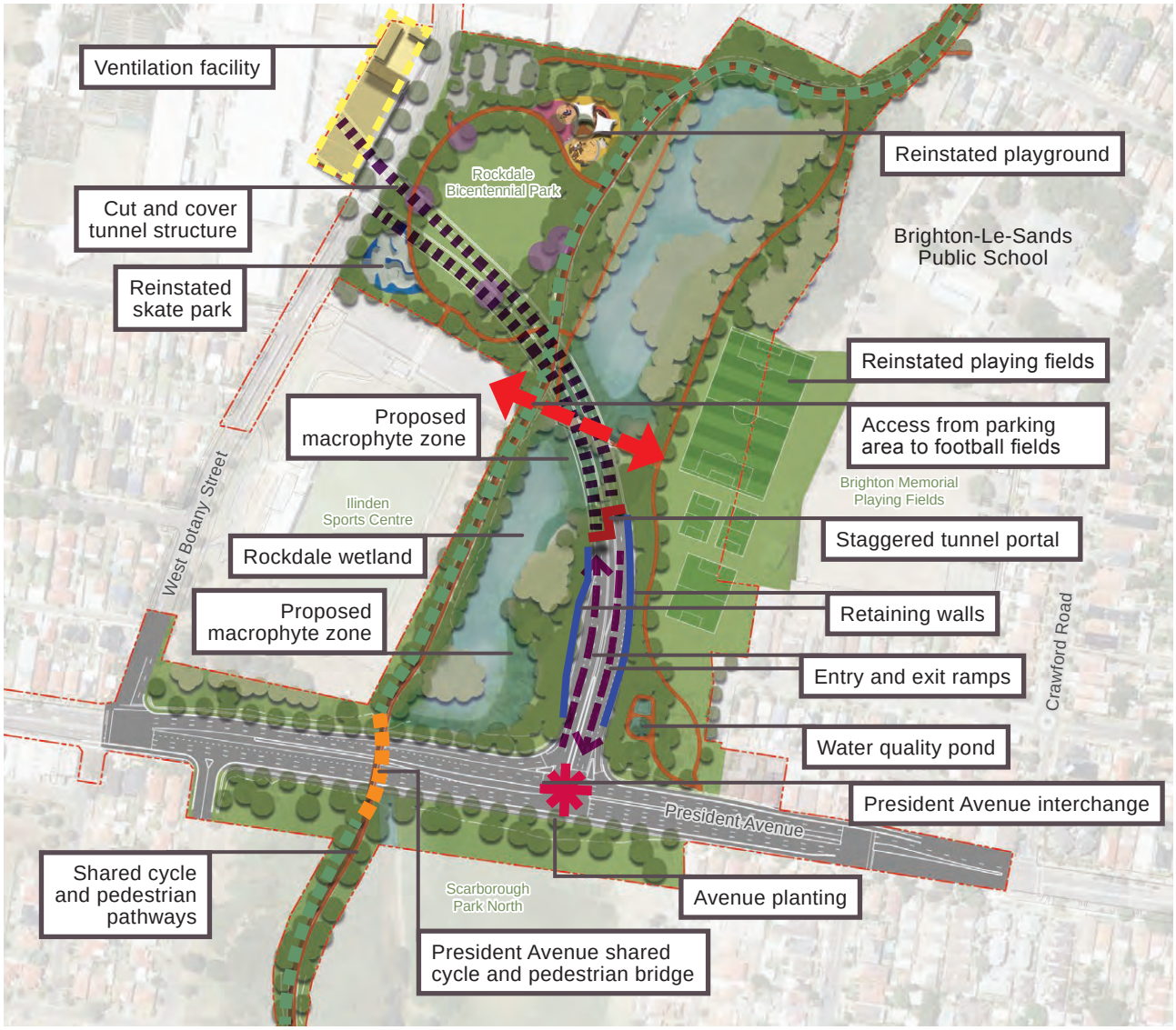


Figure 5-37: Plan of Bicentennial Park East playing fields showing possible end-state arrangement after construction works and consultation with stakeholders

Figure 5-38: Artist's impression looking west towards Bicentennial Park East and Memorial Playing Fields arrangement with silhouette of West Botany Street ventilation outlet in distance. It demonstrates that this should not be visually prominent from Memorial Playing Fields

5.5.2 Rockdale Bicentennial Park North

Rockdale Bicentennial Park North is located west of the Rockdale Wetlands, north of Ilinden Sports Centre. It provides a combination of both passive and active programmes including informal open space area, circular walking track, skate park and playground.

Considerations for the reinstatement of Rockdale Bicentennial Park would include:

- Coordination with Council, community and other key stakeholders for programming of space that supports the vision and role as an accessible recreation and open space facility
- Associated landscape amenity including supplementary tree and shrub planting to screen the motorway entry and to integrate with adjacent interfaces (Refer to Annexure B for indicative plant schedule)
- Improved pedestrian circulation and integration with the shared cycle and pedestrian pathways / existing path network
- Replacement of key active recreational facilities impacted by the works, in particular the playground and skate park, with similar (like for like) facilities
- Provision for additional recreational and furniture amenity including seating, bin enclosures, bicycle racks, shelters and drinking fountains (Refer to Annexure B for indicative furniture elements).

5.5.3 Rockdale Wetlands

The Rockdale Wetlands provides an important habitat for plants and wildlife in the area. As part of the project there is an opportunity to preserve and enhance the ecological systems of the Rockdale Wetlands through the implementation of the following principles:

- Where possible, preserve and enhance the natural system, including vegetation communities and fauna habitats. The management and restoration of these systems is a high priority
- Where possible, investigate opportunities to integrate educational and sustainability objectives
- Consultation with Council, community and other key stakeholders for the ongoing management and maintenance
- Prepare a Vegetation Management Plan that includes provision for weed management and ongoing maintenance, for the wetlands based on the above consultation.

As a section of the existing pond would need to be rebuilt at completion of construction, it would be envisaged that macrophyte benches be incorporated as part of the works where there is currently open water. This would be incorporated into the earthworks within the disturbance zones to create habitat for macrophytes and associated biofilms to improve nutrient cycling and out-compete problematic algae species.

The key benefits of macrophyte benches would include:

- Shallower water depths to allow macrophytes to establish where the water is currently too deep to support macrophytes
- Additional areas of macrophytes would enhance cycling of nutrients through biological uptake and reduce nutrient concentrations in the water column and sediments
- Additional areas of macrophytes would shade and cool water temperatures to inhibit aquatic weed and algal growth
- Habitat for aquatic invertebrates that graze on algae
- Improve water quality compared to existing conditions by reducing nutrients, algae and aquatic weed growth (particularly duck weed).

Place Making Opportunities

6.0

6.0 Place Making Opportunities

This section outlines the place making and community amenity opportunities arising from the project. The opportunities vary in size, scale and complexity, as well as location. The approach taken in identifying potential opportunities is to look at the broader contextual benefits that could flow from road network improvements, and how this relates to the surrounding precincts, town centres and local centres adjacent the road corridor. The opportunities could then be implemented by Roads and Maritime, Transport for NSW, Bayside Council or other infrastructure providers and land owners.

The opportunities noted in this section are not currently committed by the project and would require further consideration and agreement with various stakeholders prior to they being implemented in the future.

Identifying broader precinct opportunities would reveal more site-specific opportunities as an immediate benefit of the project. These include improved pedestrian and cyclist connectivity, accessibility to community facilities, landscape restoration / improvement programmes and urban / community asset development.

Facilitation of improved accessibility requires a number of approaches to achieve an integrated outcome. This includes accessibility of key community amenities and facilities, provision for improved amenity to reinforce these connections and compliance with relevant guidelines and standards to provide equitable accessibility for all users.

The place making opportunities identified as part of this project have been divided into two categories:

- Local place making opportunities
- Strategic place making opportunities.

The place making opportunities have been developed through a detailed site analysis along the project corridor. The following contextual elements were all considered in developing the place making opportunities including; landscape context, geology, land use, public transport corridors, road hierarchy, active travel circulation, existing plant communities, drainage, views and heritage. The findings and outcomes of the site analysis are described in further detail in Annexure A.

The local and strategic place making opportunities identified for the project are outlined in further detail in **Sections 6.1** and **6.2**

6.1 Local place making opportunities

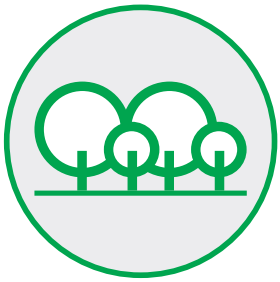
The key benefits and outcomes of local place making opportunities are provided below. Each is represented by a graphic and then applied to the relevant place making opportunity to demonstrate the resulting benefits and outcomes.
The locations that present opportunities for local place making is provided in **Figure 6-1**.

Connectivity

The place making opportunity provides an enhanced level of connectivity for pedestrians and cyclists, as well as improving connectivity between communities and key destinations or amenities.

Environmental / Restoration

The place making opportunity integrates environmental, ecological and landscape restoration measures to enhance the ecological value of the asset for the community.



Landscape Amenity

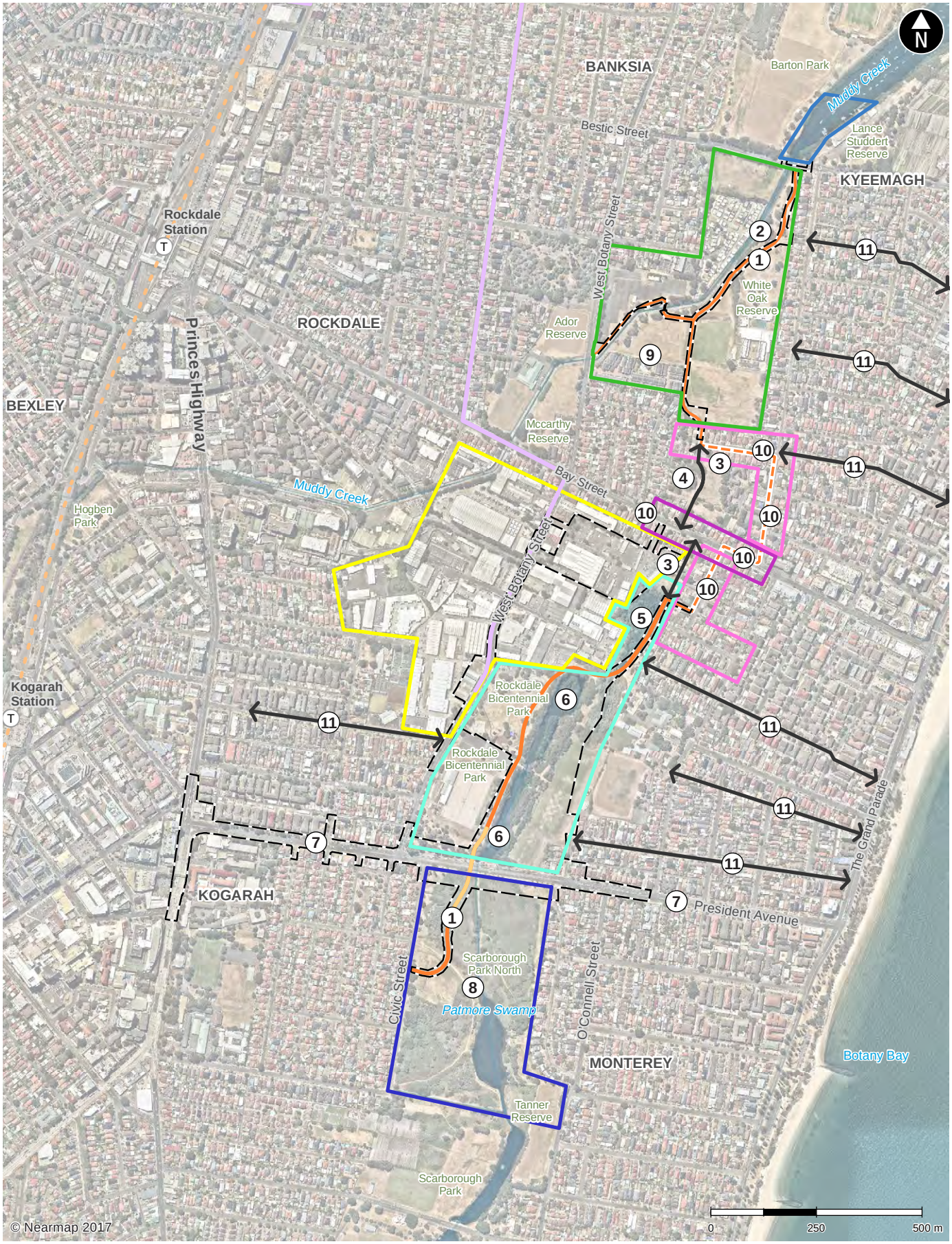
The place making opportunity provides an increased level of landscape amenity as either a functional or recreational benefit for the community.

Recreational Amenity

The place making opportunity provides enhanced levels of recreational amenity for the community through either improving existing recreational facilities or by proposing additional amenities to benefit the community.

Streetscape improvements

The place making opportunity provides streetscape enhancements in the form of additional street tree planting, Water Sensitive Urban Design (WSUD) functionality or improved accessibility for pedestrians and cyclists.



LEGEND

- Construction boundary
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Permanent power supply construction boundary
- Bay Street
- Industrial zone
- Residential streets
- White Oak Reserve
- Estuarine Reedland and Forest
- Muddy Creek Downstream of Bestic Street
- Rockdale Wetlands/Bicentennial Park & Playing Fields
- Waterbody
- Waterway
- Railway station
- Railway line

Figure 6-1: Location of local place making opportunities

Opportunity 1 – To establish a shared cycle and pedestrian pathways system throughout the existing F6 reserved corridor

Description

An opportunity exists to improve access and connectivity along the existing F6 reserved corridor by reinforcing the shared cycle and pedestrian pathways route. The project provides the opportunity to lay the foundations of an integrated and legible shared cycle and pedestrian pathways route by incorporating design principles that entice greater patronage such as:

- Amenity
- Frequent rest stop locations
- Shade, through increased tree planting and shelters
- Furniture and fixtures including lighting

It is envisaged that making the shared cycle and pedestrian pathways more user-friendly would encourage more people to use, providing benefits in:

- Traffic and transport – reduced traffic congestion
- Place Making and urban design – ensuring the shared cycle and pedestrian pathways route connects to key destinations along the corridor, as well as the opportunity to create destinations along the shared cycle and pedestrian pathways
- Climate change risk – reinforcing the shared cycle and pedestrian pathways with tree planting to provide a legible pedestrian and cycleway connection and managing heat-island effect.

Responsibility

Roads and Maritime | Bayside Council | Transport for NSW | Bike Groups.

SEARs Reference

Item 1(d), Item 1 (e), Item 2(b), Item 2 (c).

(Refer to Table 1-1)

Figure 6-2: Section of possible separation of shared cycle and pedestrian pathways functions (cycling and pedestrian) to allow for more amenity and sustainable outcomes to be achieved

Opportunity 2 – Naturalisation of Muddy Creek south of Bestic Street

Description

Sydney Water plans to naturalise the concrete-lined channel at Muddy Creek, interfacing with Whiteoak Reserve. An opportunity exists to work with Sydney Water to ensure a coordinated design approach with the shared cycle and pedestrian pathways. Based upon successful examples of natural colonisation of endemic plant communities within the reserve, a landscape restoration approach could feasibly include elements of: Mangroves, Saltmarsh, Swamp Oak Forest and Common Reed that could be incorporated into this landscape. Refer principles diagram in Figure 6-4.

As demonstrated on site, these elements have the benefit of providing:

- increased levels of ground cover (compared with grassed areas which are failing in some areas) due to the highly porous, sandy soils
- improved plant performance over some of the existing park planting
- improved wildlife habitat and corridor effects
- significantly improved carbon sequestration (mangroves and saltmarsh) within the soil layer
- low maintenance plant communities that provide visually attractive, thriving and 'lush' vegetation (e.g. the existing row of Mangroves which have colonised the intertidal zone of the open stormwater drainage channel emanating from the Cairnsfoot Special School site)

Roads and Maritime to work with Sydney Water, Bayside Council and local community groups to progress Place Making Opportunity no. 2 for naturalisation of Muddy Creek south of Bestic Street.

Responsibility

Roads and Maritime | Sydney Water | Bayside Council | Local Community Groups.

SEARs Reference

Item 1(g).

(Refer to Table 1-1)

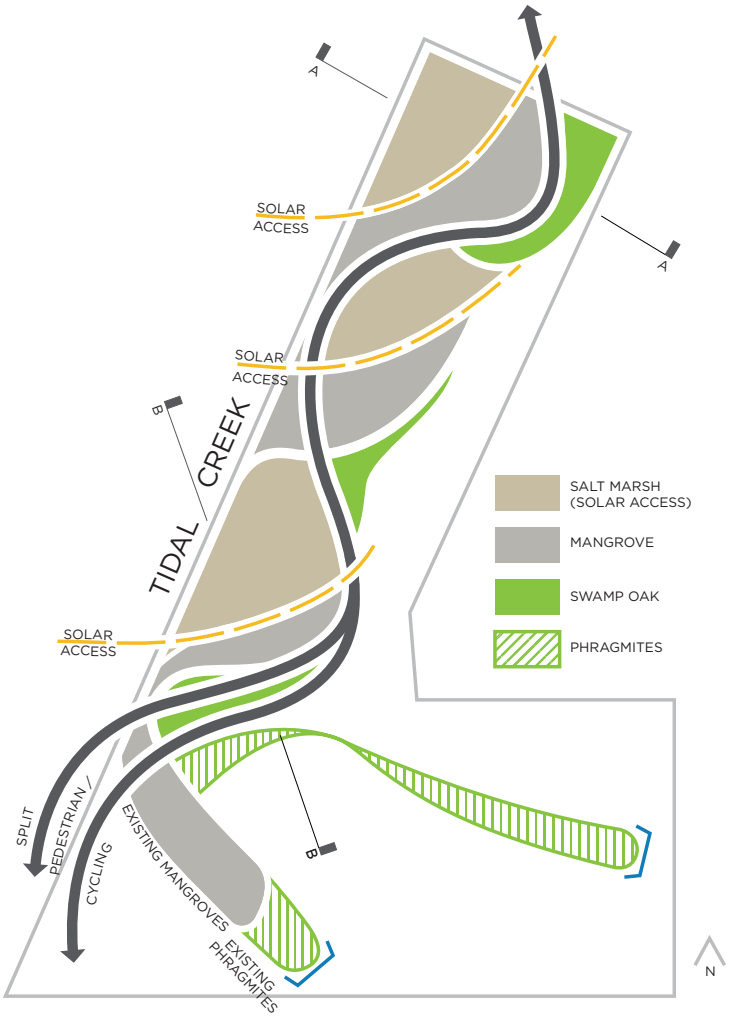
Figure 6-3: Example of creekline landscape restoration

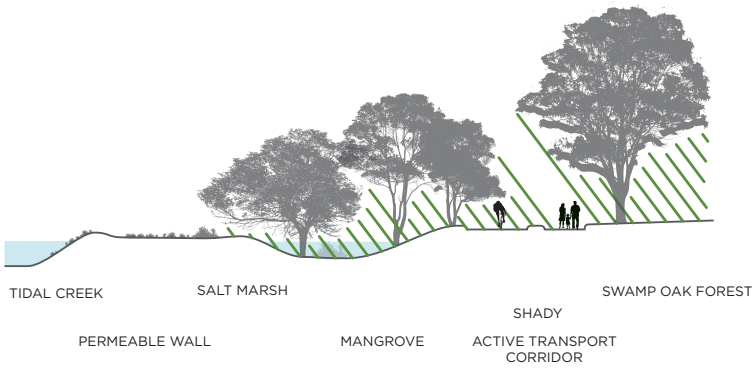
Principles

- 4 x communities present on the site/thriving in limited locations
- All subject to variable levels of marine and freshwater inundation
- Site soils are sandy, highly porous with active groundwater system
- Amenity landscape is struggling with harsh conditions

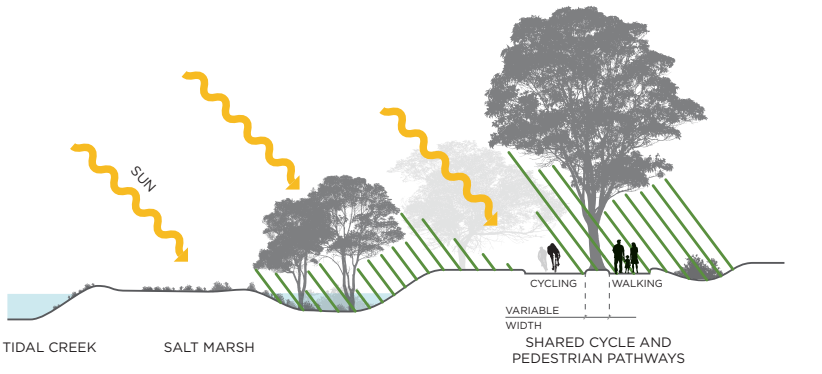
Opportunity

- Incorporate robust, endemic plant communities, meeting:
  - Natural system requirements
  - Park user/ amenity requirements
  - Low maintenance requirements
- Solar access to salt marsh integral
- Shared cycle and pedestrian pathways provide structuring element/ brings the community into close proximity with each plant community
- Provides regular well shaded areas
- Splitting cycling and pedestrian paths provides opportunities for central shading/diversity of user experience.





Section A-A



Section B-B

Figure 6-4: Principles diagram illustrating landscape opportunities at Reserve and integration with Tidal Creek naturalisation

Opportunity 3 – Extension of off-road shared cycle and pedestrian pathways

Description

The current proposal for the shared cycle and pedestrian pathways is for it to go on-road through Bruce Street, Francis Avenue, Bay Street and England Street, before reconnecting with the open space system at Bicentennial Park. Opportunities should be explored to provide a continuous off-road system (with safe road crossing points) between CA Redmond Field to Bicentennial Park, e.g. through Tony Baker Reserve. This would improve legibility of the shared cycle and pedestrian pathways route by providing a consistent and more direct connection throughout. Benefits in safety would also be apparent through not requiring users of the shared cycle and pedestrian pathways to travel on-road. Continuing the shared cycle and pedestrian pathways off-road could also facilitate increased levels of landscape restoration and connectivity, enhancing the ecological values of the open space corridor.

Continuing the shared cycle and pedestrian pathways directly across Bay Street is important from usability, safety and legibility perspectives. There are a number of options available to facilitate this connection including utilising the existing Roads and Maritime-owned compound opposite Tony Baker Reserve. This would enable the shared cycle and pedestrian pathways with associated open space and landscape restoration to continue through to Kings Wetland and then Bicentennial Park.

However, provision of above opportunity would require:

- the displacing of current RMS tenants living on Bruce Street to facilitate access to Tony Baker Reserve;
- potential safety / nuisance concerns for residents either side of a new access way from Bruce Street, and between Bay Street and Tony Baker Reserve resulting from increased usage, and
- acquisitions of private land north of Kings Wetland to achieve a direct link from Bay Street to Rockdale Wetlands.

Roads and Maritime would consider this option and other alternatives, work with Council and consult with any affected landowner to determine the preferred design for this section of the shared cycle and pedestrian pathways.

Responsibility

Roads and Maritime | Bayside Council.

SEARs Reference

Item 1(e), Item 1(h), Item 1 (i), Item 2(b), Item 2(c).

(Refer to Table 1-1)

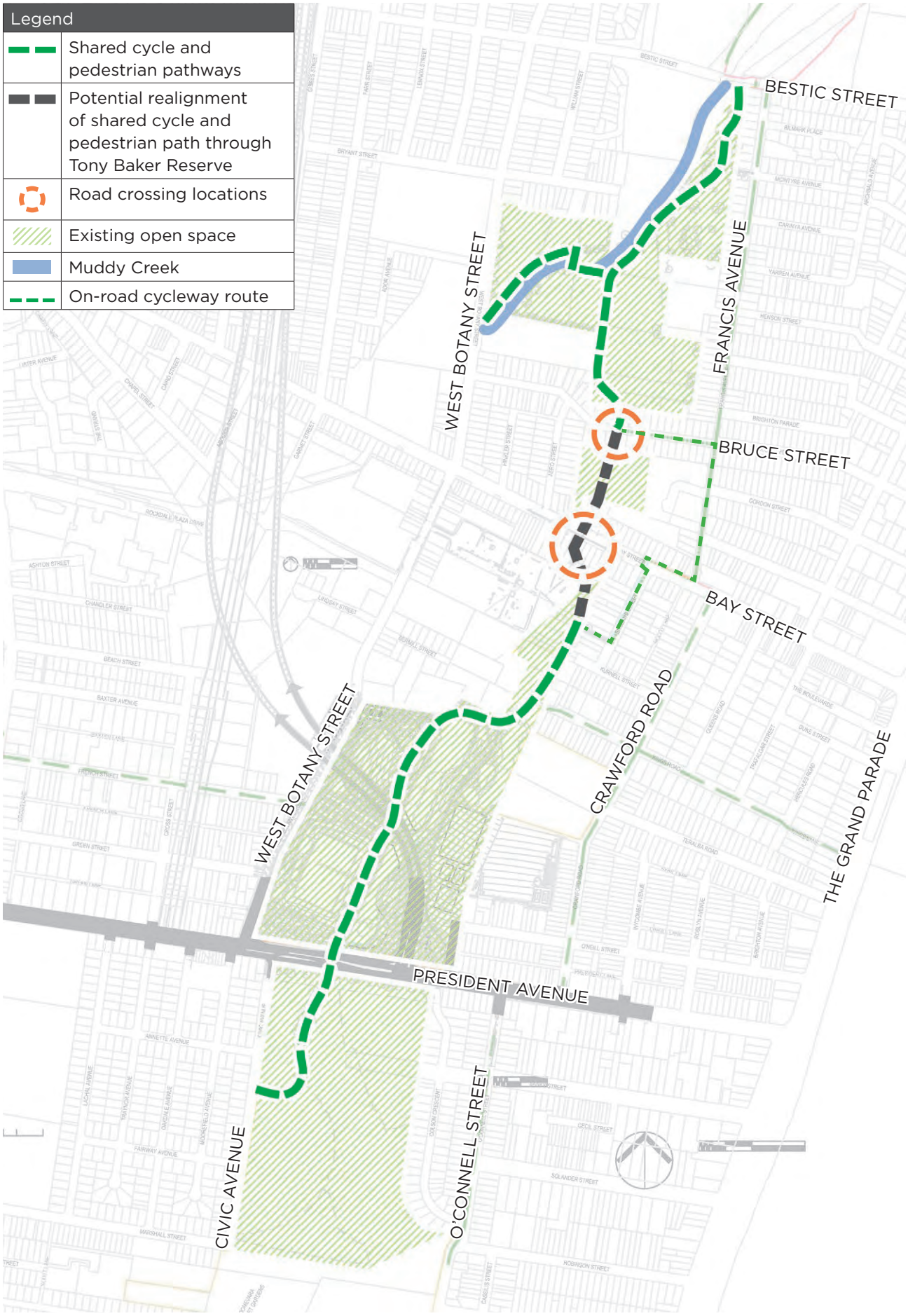


Figure 6-5: Possible realignment of shared cycle and pedestrian path through Tony Baker Reserve

Opportunity 4 – Upgrade options to Tony Baker Reserve

Description

Tony Baker Reserve is currently open space which is predominantly enclosed by low and medium density residential development. The current zoning for most of the reserve is for Infrastructure as part of the existing F6 reserved corridor, with a strip of Public Recreation along the western edge of the reserve. With the project being constructed underground, this provides an opportunity to reconsider the use of this space, potentially including the carrying through of shared cycle and pedestrian pathways and open space corridor in conjunction with attractive parkland development. In addition to providing a new and valued recreational area, activation of the space in these ways could also assist in alleviating inherent risks and issues pertaining to use of the highly enclosed site including accessibility, surveillance, and application of other Crime Prevention through Environmental Design (CPTED) and safety initiatives.

Responsibility

Bayside Council | Local Community Groups.

SEARs Reference

Item 1(d), Item 1(e), Item 1(f).

(Refer to Table 1-1)

Figure 6-6: Existing ecologically endangered plant community at Tony Baker Reserve

Opportunity 5 – To address weed infestation associated with Kings Wetland

Description

The area north of Bicentennial Park is identified as a local heritage item – Kings Wetland (I169) due to it being one of the last remaining areas of Swamp Oak Swamp Forest left within the area, this being a once commonly observed plant community. The undertaking of a landscape restoration process for this area would increase both the ecological value of the Rockdale Wetlands, and the corridor values of the existing north-south running open space spine . The proximity of Brighton-le-Sands Public School could also benefit by having students participate in educational and planting day programs.

However, the Kings Wetland area is currently heavily weed infested, with much of the tree canopy enveloped with smothering weed species such as Morning Glory. Consider undertaking a bushland restoration project within this area that includes areas of Swamp Oak Swamp Forest.

A key issue with regard to the success of an initiative of this type would be agreement on who would undertake the long-term management and maintenance of the area once re-established. Restoration of the wetland would also need to consider the need for a bushfire asset protection zone (APZ) around the forest component of the wetland, and if required, which authority would be responsible for the ongoing management of this.

Responsibility

Department of Planning & Environment | Roads and Maritime | Bayside Council.

SEARs Reference

Item 1(a), Item 1(d), Item 1(e), Item 1(h), Item 1 (i), Item 2(b), Item 2(c).

(Refer to Table 1-1)

Figure 6-7: Rockdale Wetlands looking south from existing shared path

Opportunity 6 – Improvements to Rockdale Wetlands

Description

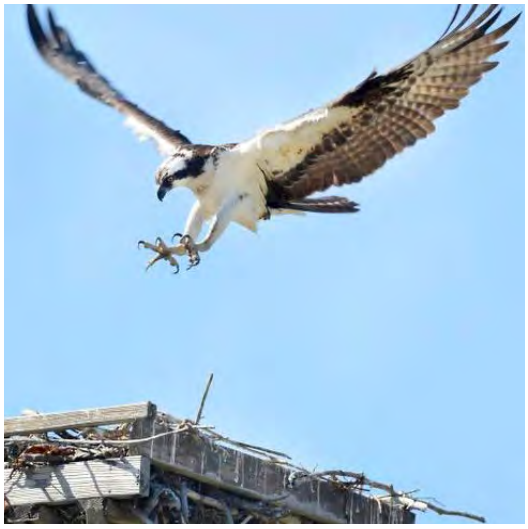
The Rockdale Wetlands are currently subject to water quality problems. A potential significant contributor to this issue could be the large number of waterfowl and ibis that inhabit the wetlands, and associated high levels of nutrient rich bird excrement causing reductions in water quality. Bird numbers may be exacerbated due to feeding by recreational users. Refer Figure 5-35.

The southern area of Kings Wetland which adjoins the Rockdale Wetlands appears subject to a substantial patch of colonising Silver Poplar trees (*Populus alba*), most of which are covered with smothering weed species. Extending of the Rockdale wetlands into part of this area could provide a substantial increase in the area of the waterbody, with high solar access. In conjunction with macrophyte planting and other mechanisms such as water circulation, this would have the potential to provide significant water quality improvements.

Further, an opportunity exists to engage with a suitably experienced ecologist to explore opportunities to reduce waterbird numbers within the wetlands through the use of adaptive management techniques that aim to change the currently hospitable habitat conditions for these birds.

For example, given the ongoing improvements to water quality within Botany Bay, predator species such as Osprey or other raptors could be encouraged to nest close to the wetlands within Bicentennial Park, e.g. on a nest platform or wire frame basket located atop a 'telegraph' pole. The constant coming and going of the birds from the nest could sufficiently unsettle the local waterbird population to reduce population levels. This in conjunction with an interpretation program that dissuaded feeding of the birds could result in reduced nutrient inputs into the waterbody. The ability of recreational users to also view the coming and going of these impressive birds and their fledglings would be a notable attraction for the park.

In the given example, it is of course possible that osprey would choose not to use the nesting platform. However, given the relatively small cost of implementing a proposal such as this, and assuming ideas put forward by the ecologist comprised sound adaptive management measures with similarly manageable costs, implementation of an adaptive management program may be possible within the context of the Project. Further, in the case of this example, the project could be designed to have a dual purpose, e.g. the pole and nesting frame could be designed as a permanent art / sculpture installation such as a 'totem pole'.



Elements of this nature could be developed in conjunction with the local Aboriginal community, potentially reflecting themes or actual totems of the traditional land owners.

Opportunities also exist to engage with a suitably experienced ecologist to explore opportunities for species specific habitat creation as outlined below.

Southern Myotis

The Southern Myotis (*Myotis macrocarpus*) is a large bat with a wing span of about 30cm. It is listed as a threatened species and has previously been sighted at Patmore Swamp. It generally roosts in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. It forages over streams and pools catching insects and small fish by raking their feet across the water surface. http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10549

The following opportunities could be explored:

- Pedestrian overbridge: The President Avenue pedestrian overbridge will cross over a substantial area of Estuarine Reedland. There may be potential to provide roosting habitat on the underside of the bridge where it comes in close contact with the reedland. Run-off from scuppers on the bridge could beneficially be directed towards the roosting area.
- Purpose made structure: A purpose made structure/s could be deployed within the reedland or over a protected area of open water.

Guiding principles for the success of this work include:

- The more time the ecologist has to plan measures such as those suggested below, the more options and flexibility they are able to build into a project
- Consideration needs to be given to maintenance of infrastructure, e.g. the underside of bridges. Multiple habitat creation sites may provide alternative habitats during these periods
- Projects of this nature should be monitored with results published in the literature to provide information to inform future habitat creation measures, e.g. in conjunction with a PhD student. All measures therefore need to facilitate this process either with direct access to the habitat, or indirectly through the use of monitoring equipment such as cameras.

Other species

A number of other bat species could occur within proximity of the Project. Consideration could be given to the potential for building a bat roosting site into proposed infrastructure such as the ventilation tower. An elevated location such as this may also be able to provide suitable roosting or nesting habitat for other types of threatened or locally rare flying species.

Responsibility

Bayside Council | Local Community Groups.

SEARs Reference

Item 1(d), Item 1(e), Item 1(f).

(Refer to Table 1-1)

Opportunity 7 – Urban design and amenity upgrades along President Avenue

Description

- Opportunity to reduce visual scale of street cross section
- Opportunity to provide amenity
- Need to challenge lane widths and kerb to kerb footprint
- Continuity of street furniture, amenity and lighting
- Opportunity to provide totem structures or similar that mark the boundaries of the open space corridor and celebrate the corridor, including the extensive 'untamed' estuarine reedland and associated dense patches of 'swamp' forest.

Responsibility

Roads and Maritime | Bayside Council.

SEARs Reference

Item 1(d), Item 1(e), Item 1(f), Item 1(i), Item2(b), Item 2(c).

(Refer to Table 1-1)

Opportunity 8 – Opportunities for Scarborough Park North

Description

The pedestrian bridge crossing of President Avenue would provide extensive district views to the east, south and west, including across the Scarborough Park open space corridor and beyond to the south. Opportunities for the park include:

- Improved amenity: The park currently has little in the way of formal recreational opportunities to engage with it. A key opportunity would be to prepare a master plan for this area in conjunction with Council and the community
- Provide totem structures or similar along President Avenue at both edges of the open space corridor that highlight and celebrate the corridor, including the extensive 'untamed' estuarine reedland and associated dense patches of 'swamp' forest
- Incorporate additional landscape and habitat opportunities within Scarborough Park North in proximity to the President Avenue pedestrian bridge, associated with the likely need for a construction pad through Estuarine Reedland, e.g.
  - augmentation to an existing small nearby patch of Coastal Flats Swamp Mahogany Forest (EEC) through raising levels to match those of the existing remnant, or
  - adjust water depth to reedland areas subject to weed invasion, e.g. increasing water depths such that they are optimal for colonisation by reedland species, and naturally exclude weed species due to water depth
- Push a construction pad out from the embankment raising works for southern edge of President Avenue into the currently weed infested corridor running alongside the Rockdale Wetlands channel outlet into 'Patmore Swamp'. This would allow for removal of sediment from upstream and reinstating water depths optimal for re-colonisation by reedland species, or further increasing water depth to preclude colonisation of reedland species and provide an area of open water instead. Open water would also provide additional bat foraging habitat. This approach would further provide a significant amenity improvement for people crossing the pedestrian bridge, who would otherwise have highly detailed views of the weed plume

- The existing semi-circular track provides a well-considered design approach that facilitates substantial views across the existing large pond. An opportunity exists to undertake bush restoration along the western edge of the existing semi-circular track including a low native grassland community, and the provision of viewing windows along the track through to Civic Avenue to address potential CPTED issues.
- Existing patches of Coastal Freshwater Swamp Forest and Coastal Flats Swamp Mahogany Forest (both EECs) within Scarborough Park North exhibit substantial to very high levels of resilience to weed invasion and park maintenance activities (refer to Figure A-35) and add significantly to the landscape character qualities of the park.
  Explore opportunities for the area of these communities to be increased by means of simple adaptive management measures such as localised increasing or reducing of levels to adjoining areas such that they more closely match those of the existing robust parts of these communities.
- Design the access path between the pedestrian bridge and the park such that it could in the future comfortably link with the existing semi-circular track, the ends of which connect to Annette Avenue and Marshall Street

Responsibility

Roads and Maritime | Bayside Council.

SEARs Reference

Item 1(d), Item 1(e), Item 1(f), Item 1(i), Item2(b), Item 2(c).

(Refer to Table 1-1)

Opportunity 9 – Alternative shared cycle and pedestrian pathways route

Description

Opportunities to provide alternative transport corridor routes to that currently proposed are outlined below:

- Whiteoak Reserve: The proposed shared cycle and pedestrian path route commences from the north at the Bestic Street entry to Whiteoak Reserve (refer Figure 6-8). The current layout of the active transport route broadly mirrors a proposed path layout for an ecological restoration project proposed by Sydney Water along the edge of Muddy Creek. A key feature of the project is the creation of substantial areas of Saltmarsh (EEC). Given the 5m width of the share path system, Sydney Water may choose to adjust its concept to better integrate this new substantial element with the restoration design.

  In conjunction with this process, an opportunity exists to augment the representation of the plant communities currently present in other parts of the reserve, including: Mangroves, Swamp Oak Swamp Forest and Phragmites (Common Rush) Reedland, in addition to the currently proposed Saltmarsh community. A principles diagram of how this might be achieved is provided in Figure 6-4.

- Rockdale Women's Sports Fields: The currently proposed shared cycle and pedestrian pathways branches off at CA Redmond Field, crossing an existing footbridge over Muddy Creek and running along a relatively steep and narrow batter between the creek and hard surface netball courts upslope. This would result in a substantial narrowing of the active transport route along this edge and difficult landscape design and management issues. An alternative would be to run the facility along a wider and less steep batter between the elevated terrace of grassed netball courts and the Brighton Terraces, using a cultural avenue planting that draws upon the garden landscape of Brighton Terraces.

  Further, rather than the running through a narrow access way between the residential development and Muddy Creek to reach West Botany Street, the facility could continue straight through to bridge Muddy Creek and exit onto West Botany Street at a location central to Ador Avenue Reserve opposite, incorporating a new pedestrian crossing.

  However:
  - The current arrangement has the benefit of utilising section of existing pathway and an existing pedestrian bridge crossing of Muddy Creek;
  - The above opportunity would benefit from consultation with adjacent residents in the Brighton Terraces development, to understand and manage potential concerns with issues such as privacy, noise or increased lighting;
  - The opportunity would ideally incorporate the new bridge crossing of Muddy Creek, and associated new pedestrian crossing point to Ador Reserve, with these elements comprising a significant additional cost for the Project.

- Scarborough Park North: The pedestrian over pass could exit onto the existing semi-circular track system opposite the 'dog park', rather than crossing the open grassed area to exit onto Civic Avenue. Refer to opportunity item 8 above. While providing the benefits of logical access to Marshall Street and the opportunity to view and engage with the existing large pond, this option would need to resolve a number of issues including:
  - the existing track currently comprises a roughly slashed trail that would not meet basic pathway requirements;
  - the bushland in this area is predominantly highly weed infested, requiring of bush restoration and regeneration measures;
  - edge conditions of the pond are currently unknown, and therefore potentially unsafe without proper consideration for how this would be managed; and
  - visibility of the track from the street is currently limited, potentially giving rise to safety and nuisance concerns.

Responsibility

Roads and Maritime | Bayside Council.

SEARs Reference

Item 1(d), Item 1(e), Item 1(f), Item 1(i), Item2(b), Item 2(c).

(Refer to Table 1-1)

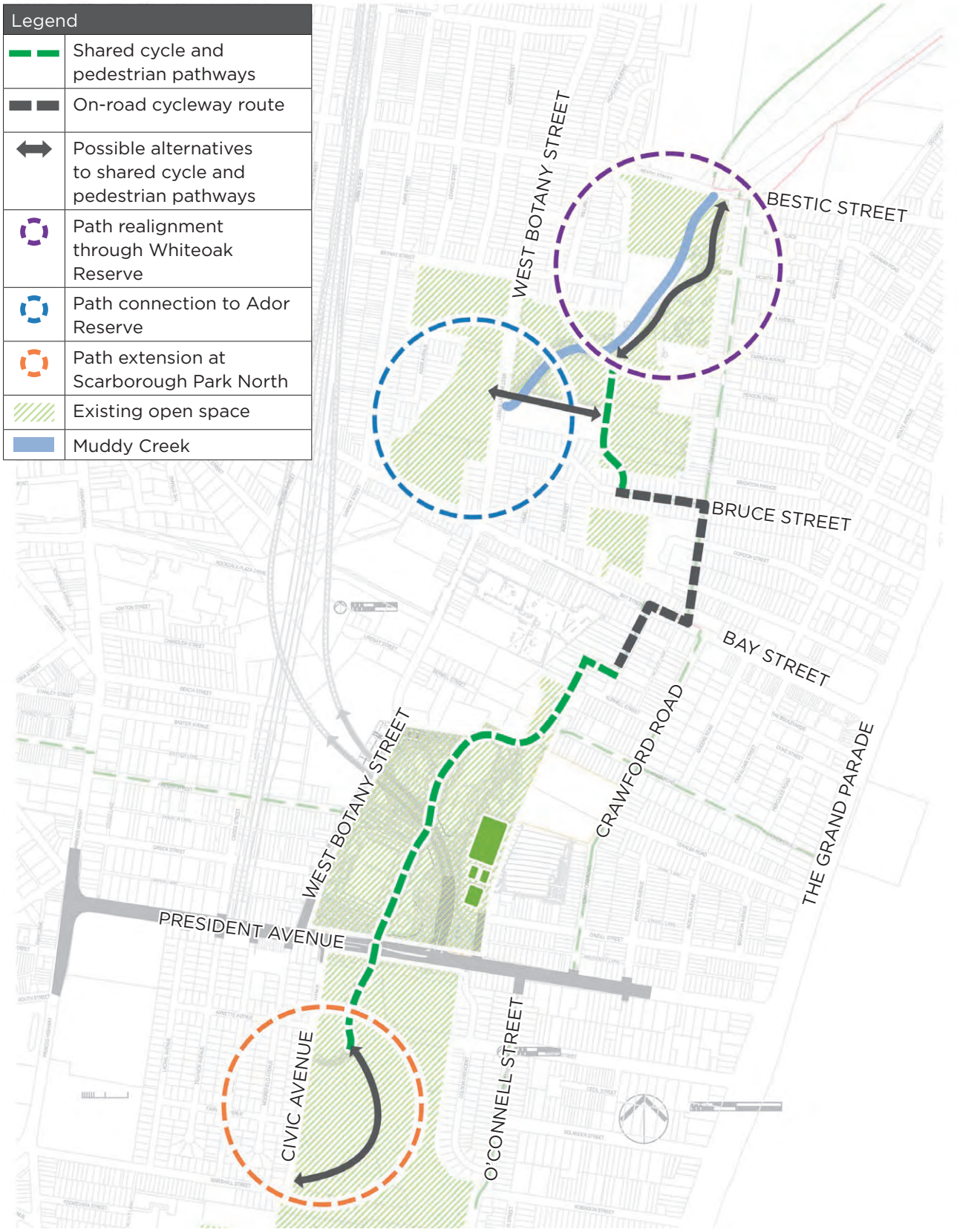


Figure 6-8: Possible alternative shared cycle and pedestrian pathway routes

Opportunity 10 – Improvement of on-road cycleway route

Description

An opportunity exists to improve the amenity and safety of on-road sections of cycleways as follows:

- Bruce Street - Overhead powerlines run down north side of street. There is an opportunity to include a substantial shade tree planting avenue along south side of street, either in the parking lane (preferred) or in the verge, and to include a small shade tree planting under the powerlines along north side of street in verge. Refer to Figure 6-9.
- Francis Avenue – There is an opportunity to:
  - remove the 'parking lane' and extend the footpath by 2m to provide a ~3m wide share path

    or
  - extend the footpath by 4m and provide a compliant shared cycle and pedestrian pathways with single lane one-way traffic only to this section of Francis Avenue. Refer to Figure 6-10.
- Bay Street - Overhead powerlines run down north side of this street. There is an opportunity to:
  - include a substantial shade tree planting avenue within the verge along the south side of the street using the same or similar species to the two eucalypts currently doing very well in this situation, located about 50m and 100m west of England Street. There is potential to carry this planting from Crawford Road, west through to Princes Highway. The width of the residential lots suggests planting intervals in the order of 8-10m may be possible for most of this length.
  - provide a marked 'slow zone' along the northern footpath between Francis Avenue and England Street, with a pedestrian crossing at England Street.
- England Street - Overhead powerlines run down west side of this street. There is an opportunity to include substantial shade tree planting in the parking lane along east side of street, and small shade tree planting in the verge along the west side of this street. Refer to Figure 6-11.
- Bruce Street - overhead powerlines run down north side of street. Opportunity to include substantial shade tree planting in the parking lane along the south side of street, and small shade tree planting along north side of street in verge.

Responsibility

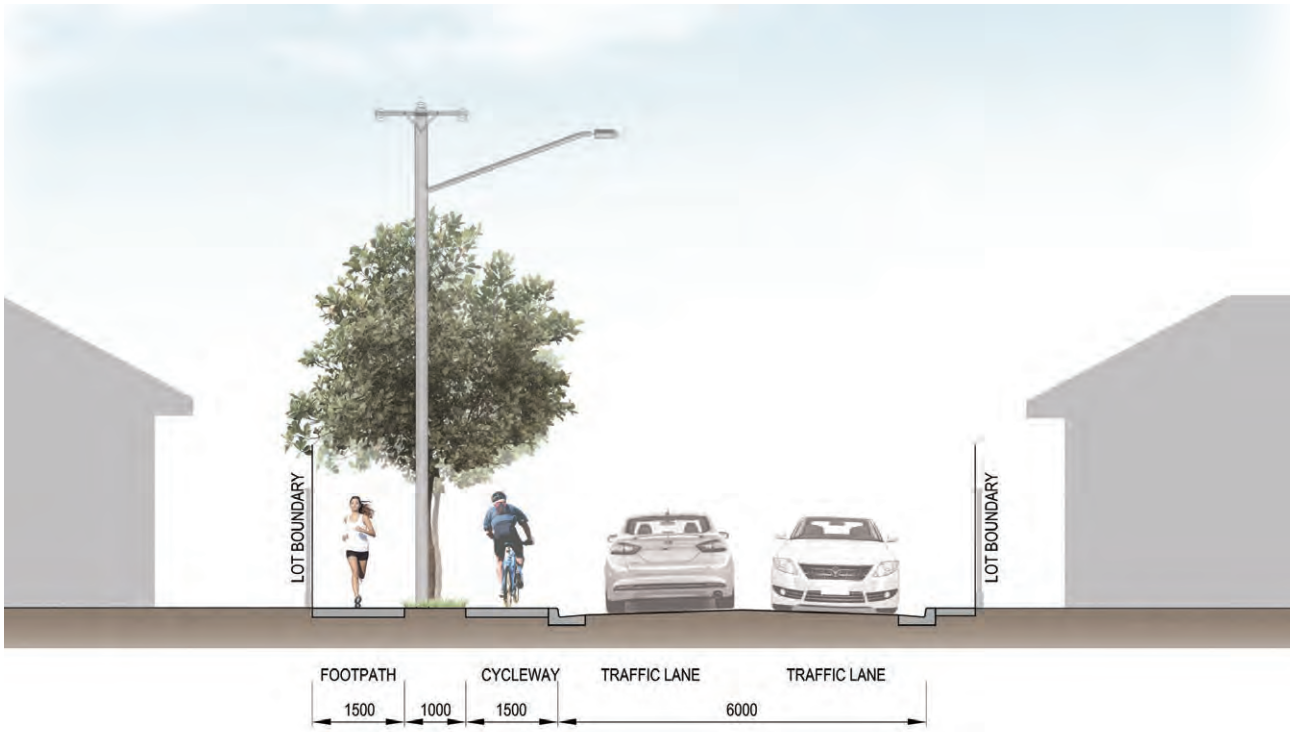
Roads and Maritime | Bayside Council.

SEARs Reference

Item 1(d), Item 1(e), Item 1(i), Item2(b).

(Refer to Table 1-1)

Figure 6-9: Section of possible options for incorporation of street tree planting on Bruce Street for shade and amenity.



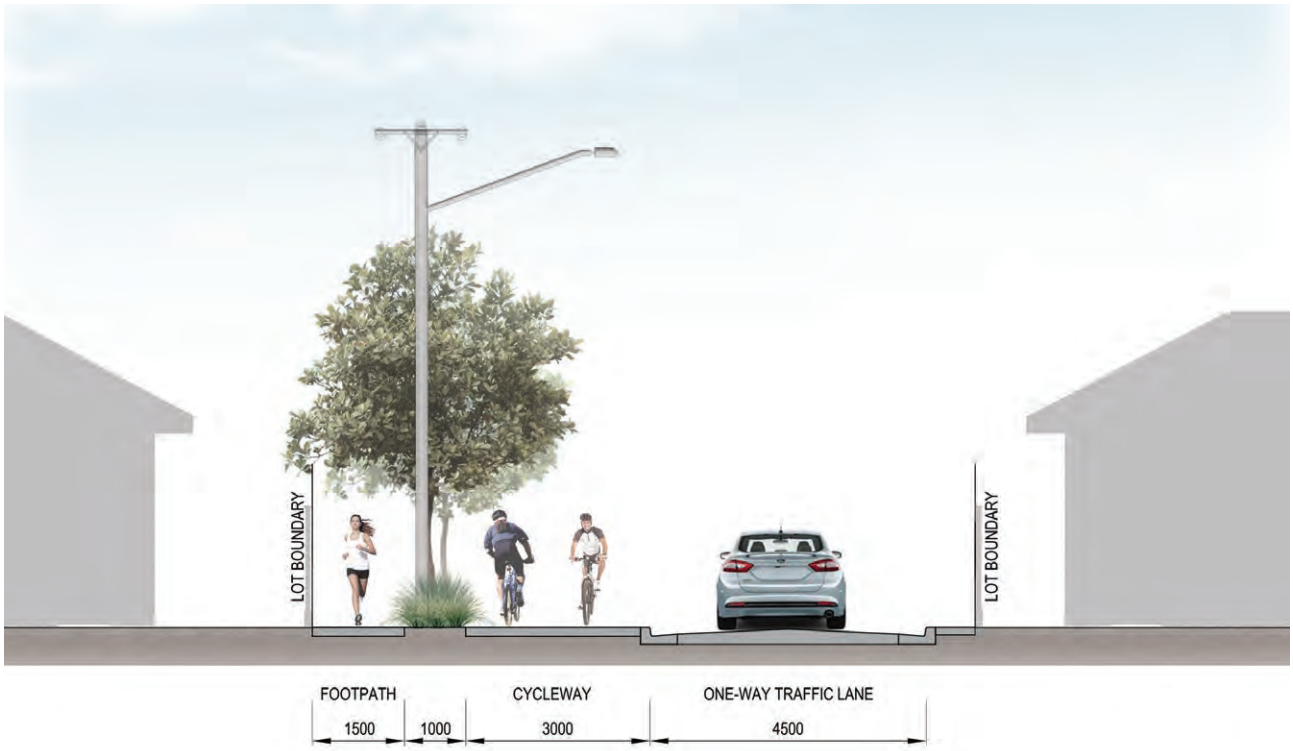
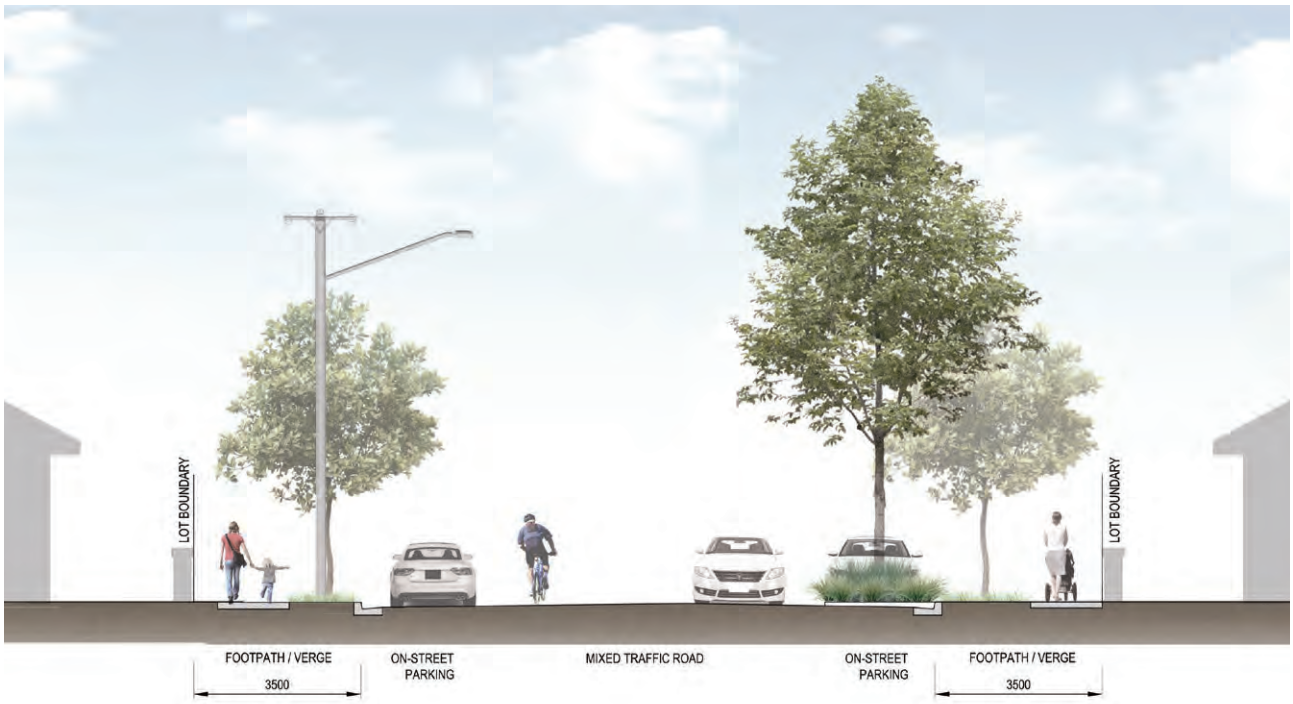


Figure 6-10: Section of possible options to extend the western footpath along Francis Avenue and incorporate separated pedestrian footpath and cycleway as part of the Shared cycle and pedestrian pathways.



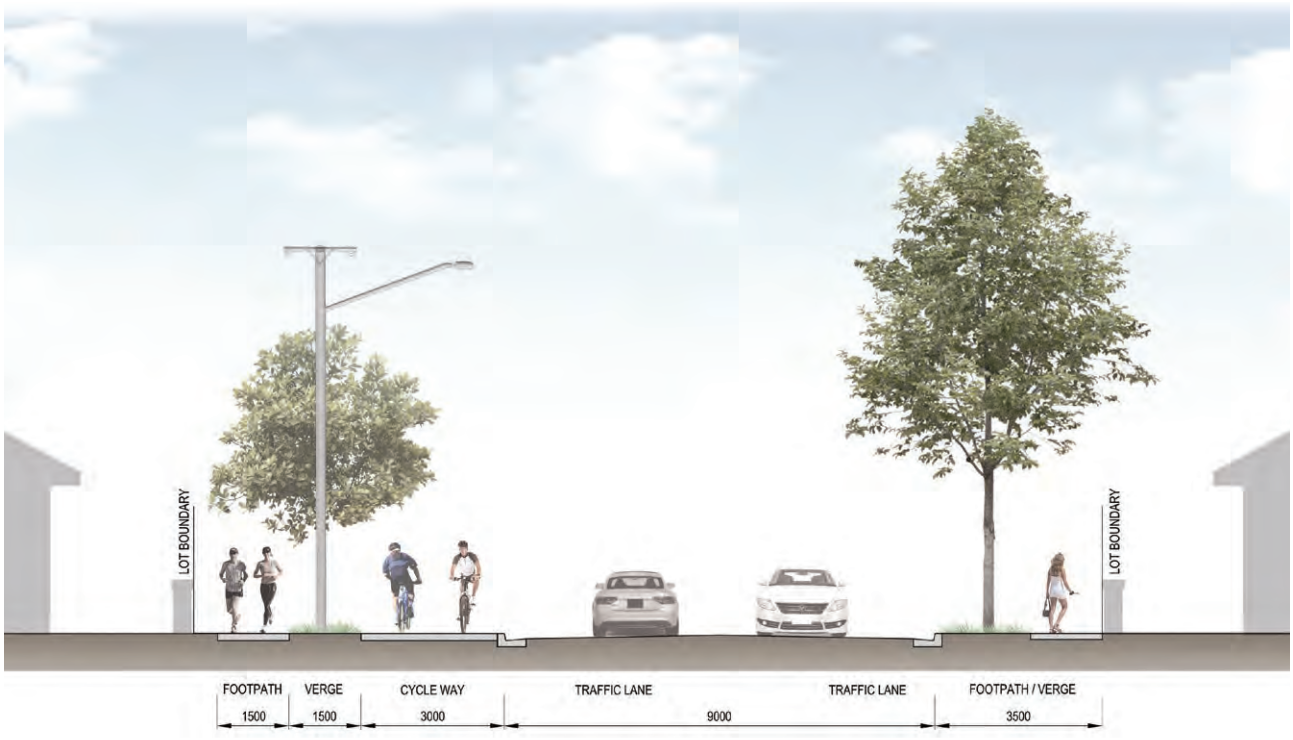


Figure 6-11: Section of possible options to provide separated pedestrian and cyclist facilities along England Street, including provision for street tree planting for shade and amenity.

Opportunity 11 – Opportunity for amenity improvements for East-West streets

Description

There is an opportunity to facilitate a comfortable shaded environment for bicycle and pedestrian links from the project to Botany Bay and Princes Highway, and associated connections with the urban centres of Rockdale, Banksia and Kogarah. Small shade trees could be provided to the powerlines side of the street, and substantial shade trees to the other side of the street, planted either within the parking lane (preferred) to facilitate passive watering from street run-off and increased area for soil air / water exchange in comparison to planting atop the kerb within the existing verge.

The implementation of the WSUD component of this opportunity would comprise a significant cost to the project, followed by Council commitment to upskill if/as required and undertake the long term management of the system.

Responsibility

Roads and Maritime | Bayside Council.

SEARs Ref.

Item 1(d), Item 1(e), Item 1(i), Item2(b).

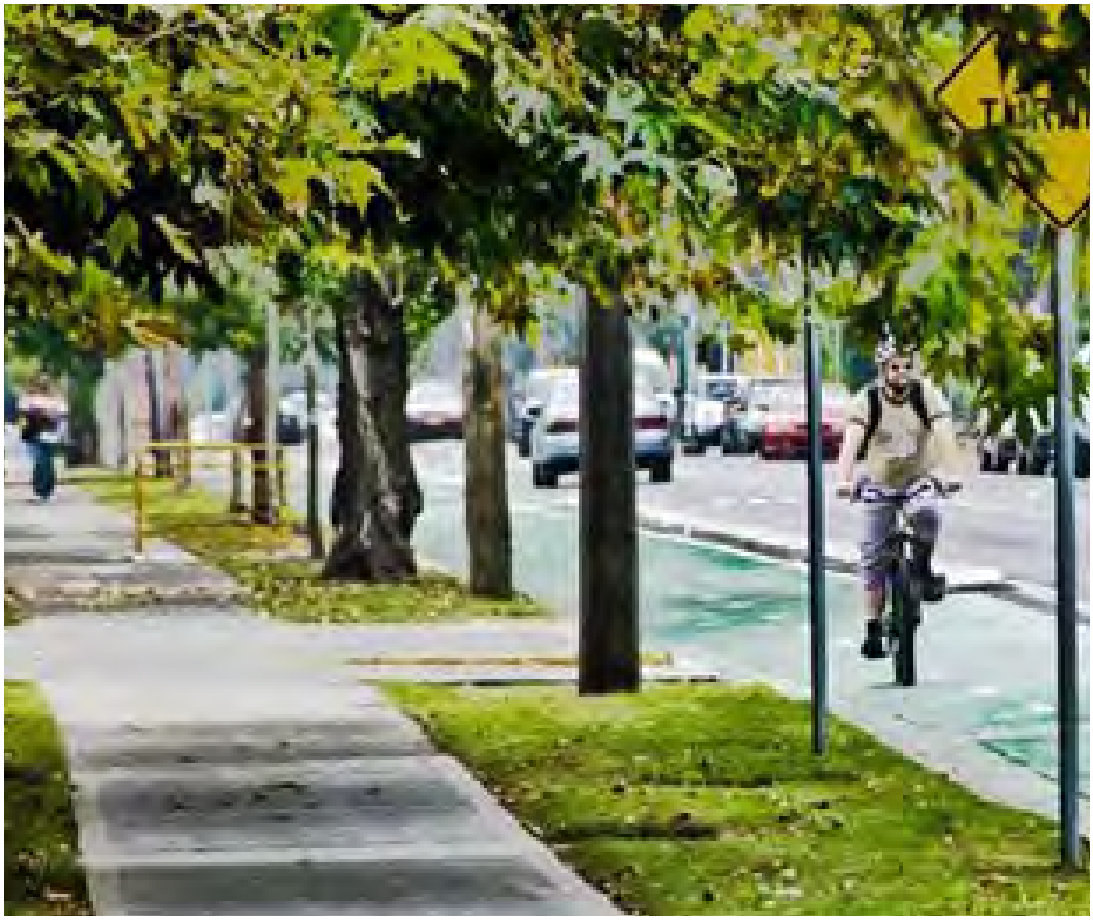


Figure 6-12: Proposed improvement of east-west street connections

6.2 Strategic place making opportunities

Strategic place making opportunities have been defined as those opportunities that would provide a wider community benefit through reduced traffic as a result of the project. It is envisaged that traffic movements between Sydney's southern suburbs and the Sydney CBD would utilise the project. This provides the opportunity re-imagine the functionality of roads, local streets, precincts and local centres. These opportunities relate to:

- Supporting the strategic planning initiatives of adjacent areas identified for future urban renewal
- Capitalising on reduced traffic volumes and reduced through traffic, particularly in and around commercial and community facilities.

A good example of how these opportunities can be driven and realised is demonstrated by the Eastern Distributor project. The development of the Eastern Distributor led to significant amenity and safety improvements through traffic reduction along Crown Street in Surry Hills, with positive flow on effects felt in the surrounding local streets.

This section describes opportunities in the context of parallel roads such as The Grand Parade and the Princes Highway. Likewise, opportunities are presented within the town centres of Banksia, Arncliffe, Rockdale and Brighton-le-Sands.

6.2.1 The Grand Parade

The Grand Parade currently provides a connection for traffic traveling between southern Sydney and the Sydney CBD. As a result, this key corridor along the shores of Botany Bay is often congested, and the associated noise, air quality and visual impacts reduce the amenity of the foreshore precinct. The project, through reducing through traffic at this location, would reduce these amenity impacts for the users of the Botany Bay foreshore presenting opportunities for revitalisation and activation.

The Grand Parade has the opportunity to become a significant visitor economy and vibrant activated strip. The project would provide such opportunities for place making along The Grand Parade.

6.2.2 Princes Highway

The Princes Highway corridor between Wolli Creek and Kogarah is an attractive location for people wishing to live, work and locate business in proximity of the CBD (which is only about 10k kilometres away).

Although presented with a number of constraints including lack of coherency of character, wide ranging land uses and height limitations, the Princes Highway corridor has significant potential for revitalisation. The highway frontage offers great exposure for business uses, supported by its proximity to rail services which provides opportunities for accessible residential development in the area.

The *Princes Highway Corridor Strategy* (2013) was developed to identify and *understand the existing conditions of the Corridor and present a* vision based on this analysis. The vision the strategy sets out is to revitalise the corridor along the highway for employment uses and to grow Arncliffe as a residential precinct.

This is aligned with the *Bayside West Precincts 2036 Plan* for the Bayside West Precincts (which include the Arncliffe Precinct and the Banksia Precinct). This strategy aims to create connected town centres for Arncliffe, Banksia and Cooks Cove, better transport connections, more housing choices, a vibrant Princes Highway corridor and new areas of open space.

The project would reduce the traffic flow along the Princes Highway through Arncliffe and Banksia and past Cooks Cove, assisting the facilitation of both of these strategies. By reducing the number of vehicles on surface roads the project allows for future growth and urban changes along the Princes Highway corridor as per the above strategies, and improves the safety of connections for active transport users.

6.2.3 Bayside West Precincts

Banksia and Arncliffe have been identified by the NSW Government as Planned Precincts and are collectively referred to as the Bayside West Precincts. The Planned Precincts program responds to the challenge of providing new housing and jobs in locations with good access to existing or planned transport services. The Bayside West precincts have been identified as Planned Precincts based on the opportunity they each present for urban renewal and the provision of more homes and jobs in accessible locations. The precincts are critically located within close proximity to key transport nodes, including Sydney Airport, the T4 Illawarra Rail Line, WestConnex and the Princes Highway.

The *Bayside West Precincts 2036 Plan* (The Strategy) for the Bayside West Precincts provides an overview of the opportunities for renewal in each of the precincts. It identifies an overarching aim to create connected town centres for the three precincts, better transport connections, more housing choices, a vibrant Princes highway corridor and new areas of open space.

The Princes Highway extends for the length of the Arncliffe and Banksia precincts and serves to separate eastern and western parts of both. It provides the main road access from the Arncliffe and Banksia precincts to the Sydney CBD and also forms the spine of the local road network. As a result, it is subject to high traffic volumes for both private vehicles and freight.

As the project would reduce the traffic flow along the Princes Highway through Arncliffe and Banksia it would support and facilitate future growth and urban changes along the corridor as foreseen by The Strategy and assist in its development as a 'vibrant' place. It would also improve the safety of connections for active transport users within the Precincts.

Relevant land use strategies outlined in The Strategy include:

- Expanding the Arncliffe town centre: Expansion of the existing Arncliffe town centre to include areas either side of the railway line and up to Forest Road. This would allow for a greater area of commercial activity around the railway station including retail, cafes, accommodation and offices. Residential development is to be accommodated in the town centre in the form of shop top housing. The purpose of this change is to encourage the development of Arncliffe as a vibrant and active place with the focus of activity around the station. Allowing residential development in the form of shop top housing adds to the vibrancy of the area whilst increasing the number of dwellings within close proximity to the railway station.
- Expanding the Banksia neighbourhood centre: In Banksia, a smaller neighbourhood centre is located west of the railway station along Railway Street. The Strategy proposes to expand the town centre on the other side of the railway line in the block bound by Hattersley Street. The Strategy proposes allowing mixed use development in this area with retail at ground levels and residential apartments above. The purpose of this change is to provide a focal point with a greater range of local services to the residents of Banksia.
- Princes Highway corridor – mixed use: The Strategy recommends changing the land uses adjoining the Princes Highway, through Arncliffe, to allow for a wider range of commercial uses with residential apartments on upper levels. The purpose of this change is to encourage revitalisation of the corridor, bringing additional business opportunities whilst providing for additional housing. Buildings within this part of the corridor would typically include apartments with ground floor retail or showrooms.

- Areas of medium density, low-rise residential development: The Arncliffe Park neighbourhood, located north of Wollongong Road, and the Gardiner Park neighbourhood, located between the park and Banksia Station, have been identified as areas for future development of medium, low rise dwellings. These areas are considered suitable for a change from low density residential development as they fall within the 800m walking catchment of the railway stations and are located close to community amenities. However, these areas have a defined local character, with a number of houses listed as local heritage items. Medium density development is considered more suitable in these locations to ensure local character can be retained. They are also affected by flooding during major storm events. Future urban design of these areas should respond to local character and heritage values and be based on further analysis of upgrades to drainage infrastructure.
- Princes Highway expansion area: An existing residential area, which backs onto commercial properties location along the Princes Highway close to Banksia Station, has been identified as a future opportunity area. This area should be further assessed to determine if site amalgamations could occur to allow for expanded uses fronting the highway with rear lane access.

The Strategy also identifies the following relevant infrastructure strategy:

- New and improved cycle and pedestrian crossing of the Princes Highway from Cahill Park to Brodie Spark Drive. A pedestrian bridge would assist in improving accessibility.

6.2.4 Rockdale Local Centre / Town Centre

The Rockdale Town Centre is located around the Rockdale railway station and is bisected by the Princes Highway. It is one of the largest commercial centres in the Bayside Council area and historically has played an integral role in the economy and development of the St George region. Over the past few decades, this role has diminished however as the centre has experienced competition from nearby Major Centres at Kogarah and Hurstville. Rockdale Plaza has also contributed to the diminishing of the centre as it generally restricts its users solely to this shopping centre, precluding visitation into the Town Centre.

A number of strategies identify priorities around, and opportunities for, the improvement of the Rockdale Town Centre. This includes:

- *Eastern City District Plan* (Greater Sydney Commission, 2018): This strategy identifies Brighton-le-Sands as a 'local centre'. The vision for local centres is for them to be the focal point of neighbourhoods, where there is a focus on walking and cycling, with a mix of uses and urban spaces creating a vibrant character and places to meet and socialise. The Greater Sydney Commission sees the success of local centres and their high streets, as being supported through specific and flexible measures to improve activation and viability. The strategy identifies the following place-based planning principles for local centres:
  - provide public realm and open space focus
  - deliver transit-oriented development and co-locate facilities and social infrastructure
  - provide, increase or improve local infrastructure and open space
  - improve walking, cycling and public transport connections, including through the Greater Sydney Green Grid
  - protect or expand retail and/or commercial floor space
  - protect and expand employment opportunities
  - integrate and support arts and creative enterprise and expression
  - support the night-time economy
  - augment or provide community facilities and services, arts and cultural facilities
  - conserve and interpret heritage values
  - accommodate local festivals, celebrations, temporary and interim uses.
  - increase residential development in, or within a walkable distance of, the centre
  - provide parking that is adaptable to future uses and takes account of access to public transport, walking and cycling connections.
- *Rockdale Town Centre Master Plan* (Bayside Council, 2012): Based on the recognised diminishing role of the Rockdale Town Centre, Bayside/Rockdale Council identified a need for a new direction to be determined that reflects Council's and the community's aspirations. The *Rockdale Town Centre Master Plan* sets out the future direction for the Rockdale Town Centre and the path to achieving it. The communities identified aspirations for the Town Centre focus on creating a vibrant and liveable inner city town that is a great place to shop, work, visit and live. A Structure Plan sets out the following five broad initiatives for achieving the communities vision for the Town Centre:
  - Town heart and civic precinct: Build on the established traditional civic and community use elements contained within the Town Centre to develop a strong heart for the Centre
  - Pedestrian spine and retail hubs: Formalise and enhance a primary pedestrian spine which connects the Town Centre's retail hubs

- Intersection precinct redevelopment: Redevelop the Transport Intersection Precinct (located on the Princes Highway adjoining the Railway Station, bounded by the Tramway Arcade and Greeves Avenue) into a high quality mixed use precinct with extensive ground and first floor retail forming a podium upon which would sit a number of residential towers.
- Green gateways: improve how the various entry points to the Town Centre present to passing motorists and distinguish Rockdale Town Centre from the rest of the Princes Highway and other nearby centres.
- Residential revitalisation: Allow increased residential densities in key precincts at the centre edges to offer a range of housing choice. Creating an active and attractive public domain in these precincts would be critical to ensuring they become high quality residential areas that contribute positively to the Centre

- *Rockdale City Urban Strategy* (Bayside Council, 2010): This strategy sets out a vision for Rockdale Town Centre to become a vibrant and walkable centre that caters to its diverse community. It also acknowledges that Bay Street links Brighton-le-Sands Town Centre with Rockdale Town Centre, both visually and physically, and has the potential to be utilised to strengthen the relationship between the two centres, and provide additional facilities within close proximity to them.

The project presents improved opportunities for Rockdale Town Centre to become a more vibrant, revitalised area in line with the objectives set out in the above outlined strategies. The reduction in traffic along the Princes Highway that would result from the project would assist in improving amenity and safety along this part of the Town Centre, which would have flow on affects for the other parts of the town centre. This provides increased place making opportunities for the town centre.

6.2.5 Brighton-le-Sands Local Centre / Town Centre

- The Brighton-le-Sands town centre is focussed around The Grand Parade which forms the suburbs 'high street' and serves to separate commercial and retail uses from the Botany Bay foreshore. The Grand Parade provides a connection for traffic traveling between southern Sydney, the Sydney Airport precinct and the Sydney CBD and as a result, this key corridor is often congested, and the associated noise, air quality and visual impacts reduce the amenity of the foreshore precinct.

A number of strategies identify priorities around, and opportunities for, the improvement of the Brighton-le-Sands town centre. This includes:

- *Eastern City District Plan* (Greater Sydney Commission, 2018): This strategy identifies Brighton le Sands as a 'local centre'. The vision for local centres is for them to be the focal point of neighbourhoods, where there is a focus on walking and cycling, with a mix of uses and urban spaces creating a vibrant character and places to meet and socialise. The Greater Sydney Commission sees the success of local centres and their high streets, as being supported through specific and flexible measures to improve activation and viability. The strategy also identifies a number of place-based planning principles for local centres (refer to **section 6.2.4**):
- *Rockdale City Urban Strategy* (Bayside Council, 2010):This strategy sets out a vision for the Brighton Le Sands Town Centre to transform it into a lively destination for locals and visitors, leveraging its unique bay side opportunities. It also acknowledges that Bay Street links Brighton-le-Sands Town Centre with Rockdale Town Centre, both visually and physically, and has the potential to be utilised to strengthen the relationship between the two centres and provide additional facilities within close proximity to them.

As identified in the strategic documents, Brighton-le-Sands has the opportunity to become a significant visitor economy and vibrant town centre. As foreseen by the above strategies, through a reduction in traffic along its high street (The Grand Parade), which would result in improved amenity and safety, the project could provide such opportunities for place making.

6.2.6 Kogarah Local Centre/ Health and Education Precinct

- The *Eastern City District Plan* and *South District Plan* identify Kogarah as an health and education precinct and a nominated Collaboration Area. The *South District Plan* states that collaborative planning will be used to encourage and prioritise land uses that can grow health and ancillary services and provide opportunities for new allied health and education services within the Kogarah health and education precinct. It also identifies that the provision of housing and choice for moderate-income households, students and health visitors are considered important to support the growth of the precinct, as is improving accessibility to the precinct and connections from the public transport network.

The Plan states that the Commission will facilitate the collaboration of key Kogarah health and education precinct stakeholders to identify impediments and opportunities to:

- prioritise land uses to grow existing and new allied health and education services
- increase knowledge-based and population serving employment
- prioritise opportunities for affordable housing for students, moderate income households and health visitors
- investigate opportunities to improve connections within the precinct and east-west transport connections within the District.

The project presents improved opportunities for Kogarah to achieve the strategic goals set out for the health and education precinct. The reduction in traffic along the Princes Highway that could result from the project could assist in improving amenity and safety along this part of the precinct. It would also assist in improving accessibility to the precinct and east-west transport connections.

Landscape and Visual Impact Assessment Overview

7.0

7.0 Landscape and Visual Impact Assessment Overview

This section provides an overview of the landscape and visual impact assessment (LVIA) undertaken for this project. Refer Appendix B and Appendix C2 for the full Landscape and Visual Impact Assessment (LVIA) report (IRIS, May 2018).

The LVIA report addresses both: the northern Arncliffe Site at the underground connection point with New M5, with surface elements comprising motorway operations complex (MOC1), ventilation facility, and water treatment plant (WTP); and southern President Avenue Site, with surface elements comprising motorway operations complexes (MOC2 and MOC3), ventilation facility, tunnel portal and surface road works to President Avenue (refer Figure 1-1). Given that the urban design considerations for the northern Arncliffe site have been addressed as part of the New M5 EIS, this report addresses only the findings for the southern President Avenue Site. Additionally, the LVIA addressed both 'construction' and 'operation' impacts. For the purposes of this report, operation impacts only are addressed.

This overview provides summary tables of landscape character impacts and visual impacts. Key impacts (assessed as being impacts that fall within the range of High to High-moderate) are further briefly discussed. Detail on impacts that fall within the range of Moderate and below can be found within the LVIA report.

7.1 Landscape character impact assessment

Six landscape character zones were identified as follows (refer Figure 7-1):

- LCZ4: Rockdale Bicentennial and Scarborough Parks open space and recreation area
- LCZ5: Brighton-Le-Sands coastal low density residential area
- LCZ6: Kogarah residential and urban local centre
- LCZ7: Kogarah Princes Highway commercial centre
- LCZ8: West Botany Street industrial and commercial area
- LCZ9: Rockdale Muddy Creek open space and recreation area.

Note: LCZ1, 2 and 3 relate to the northern Arncliffe Site and are not addressed as discussed above.

Table 7-1 summarises the impacts on the landscape character zones arising from the southern (President Avenue) surface works area (hereafter the southern surface works).

Landscape character zone	Operation		
	Sensitivity	Magnitude of change	Impact level
LCZ4: Rockdale Bicentennial and Scarborough Parks open space and recreation area	Moderate	High	Moderate - High
LCZ5: Brighton-Le-Sands coastal low density residential area	Low	Low	Low
LCZ6: Kogarah residential and urban local centre	Low	Low	Low
LCZ7: Kogarah Princes Highway commercial centre	Low	Negligible	Negligible
LCZ8: West Botany Street industrial and commercial area	Low	Low	Low
LCZ9: Rockdale Muddy Creek open space and recreation area	Moderate	Low	Low-Moderate

Low | Low-Moderate | Moderate | Moderate - High | High | Negligible

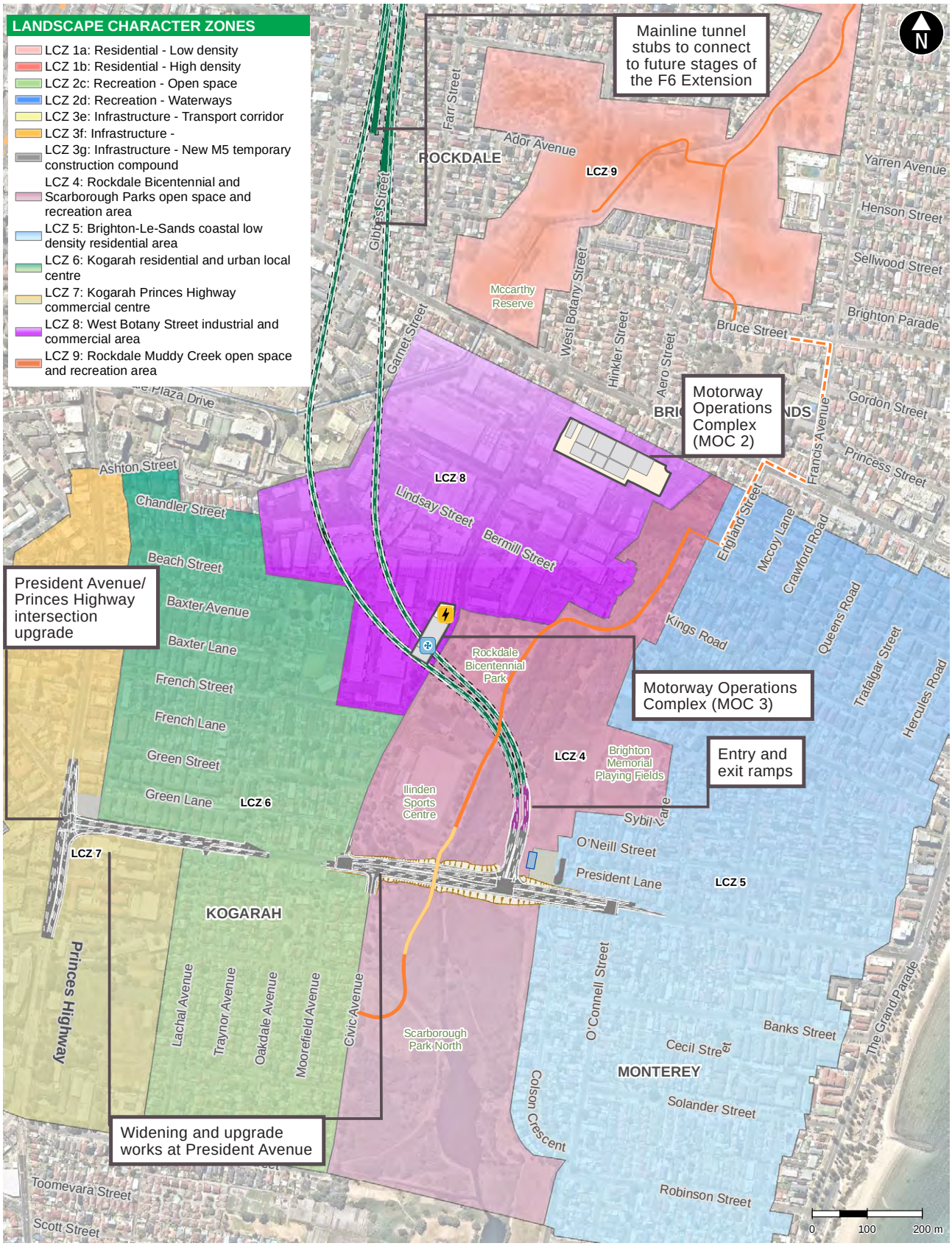


Figure 7-1: Landscape character zones, southern surface works

7.2 Visibility of proposal

7.2.1 Potential visibility of the project

To assess the potential visibility of the southern works area the LVIA report considered the project as three key visual components: the roadworks (which are contained within the streetscape); the ventilation facility (which would be a built structure and rise above the surrounding built form); and the shared pedestrian and cycle pathway bridge (which would also rise above the road corridor)

Road works

The potential visibility of the road works would be reduced by the relatively low profile of these works including the intersection and tunnel entry, and the dense surrounding built form and vegetation of the study area. A Visual Envelope Map (VEM) has been used to establish the theoretical area from which the surface works may be visible. This is based on interpretation of aerial photography (refer Figure 7-2).

It is expected that views to the President Avenue intersection and tunnel entry and exit ramps would be visible from the Brighton-Le-Sands Public School and adjacent residential areas to the east. Views to the upgraded President Avenue would be seen from Scarborough Park, properties facing President Avenue, and along intersecting streets.

The Rockdale Motorway Operations Centre would be largely enclosed by surrounding built form and vegetation, limiting views to adjacent industrial, commercial and residential properties, and providing some glimpses from West Botany and Bay Streets.

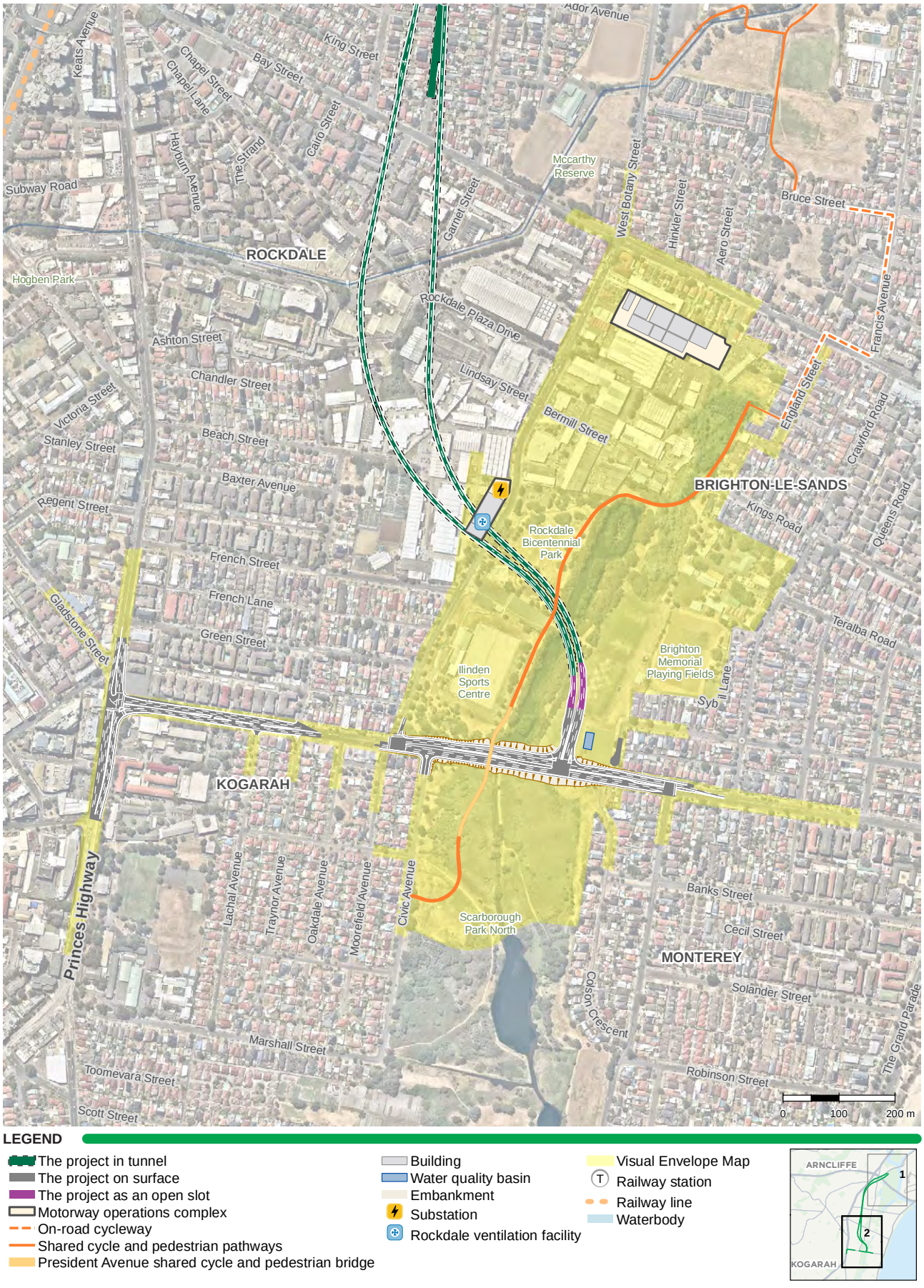


Figure 7-2: Visual Envelope Map – Road works

Rockdale ventilation facility

The LVIA report has used a Visual Envelope Map (VEM) to establish the theoretical area from which the ventilation facility may be visible. This theoretical extent is based on LIDAR data (including built form and vegetation), with an assumed height at the outlet of 35 metres. The analysis uses a 3D model to identify the areas from which views to the site may be possible.

This diagram shows the outlet as being visible from the streets and buildings surrounding the ventilation facility site, north and south along West Botany Street and extending east across Rockdale Bicentennial Park, and beyond the Rockdale Wetlands to the Brighton Memorial Playing Fields. This theoretical area includes the rooftops of buildings in the surrounding industrial, commercial and residential areas to the very top of the outlet. This area formed the basis for field investigations to identify views to the proposed ventilation outlet (refer Figure 7-3).

Figure 7-3: Visual Envelope Map – Rockdale ventilation facility

President Avenue Shared cycle and pedestrian bridge

A Visual Envelope Map (VEM) has also been used to establish the theoretical area from which the shared pedestrian and cycle pathway bridge over Presidents Avenue may be visible. This theoretical extent is based on LIDAR data (including built form and vegetation) and an assumed height of the bridge of 5.5 metres. Figure 7-4 shows the shared pedestrian and cycle pathway bridge as being visible from east and west along President Avenue and extending north into the Ilinden Sports Centre, and south across Scarborough Park North. This theoretical area formed the basis for field investigations to identify relevant viewpoints for this area. (refer Figure 7-4).

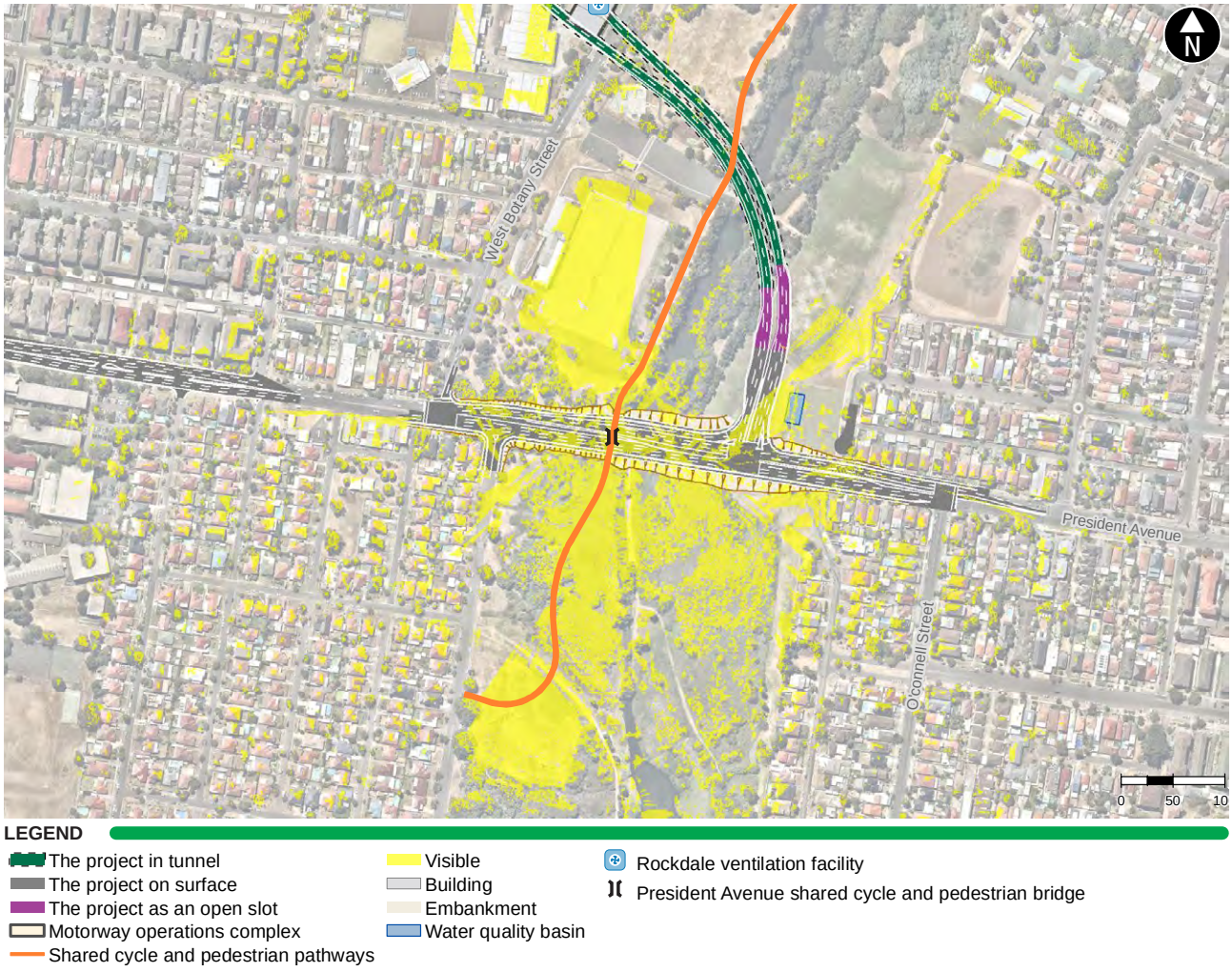


Figure 7-4: Visual Envelope Map – Shared cycle and pedestrian bridge

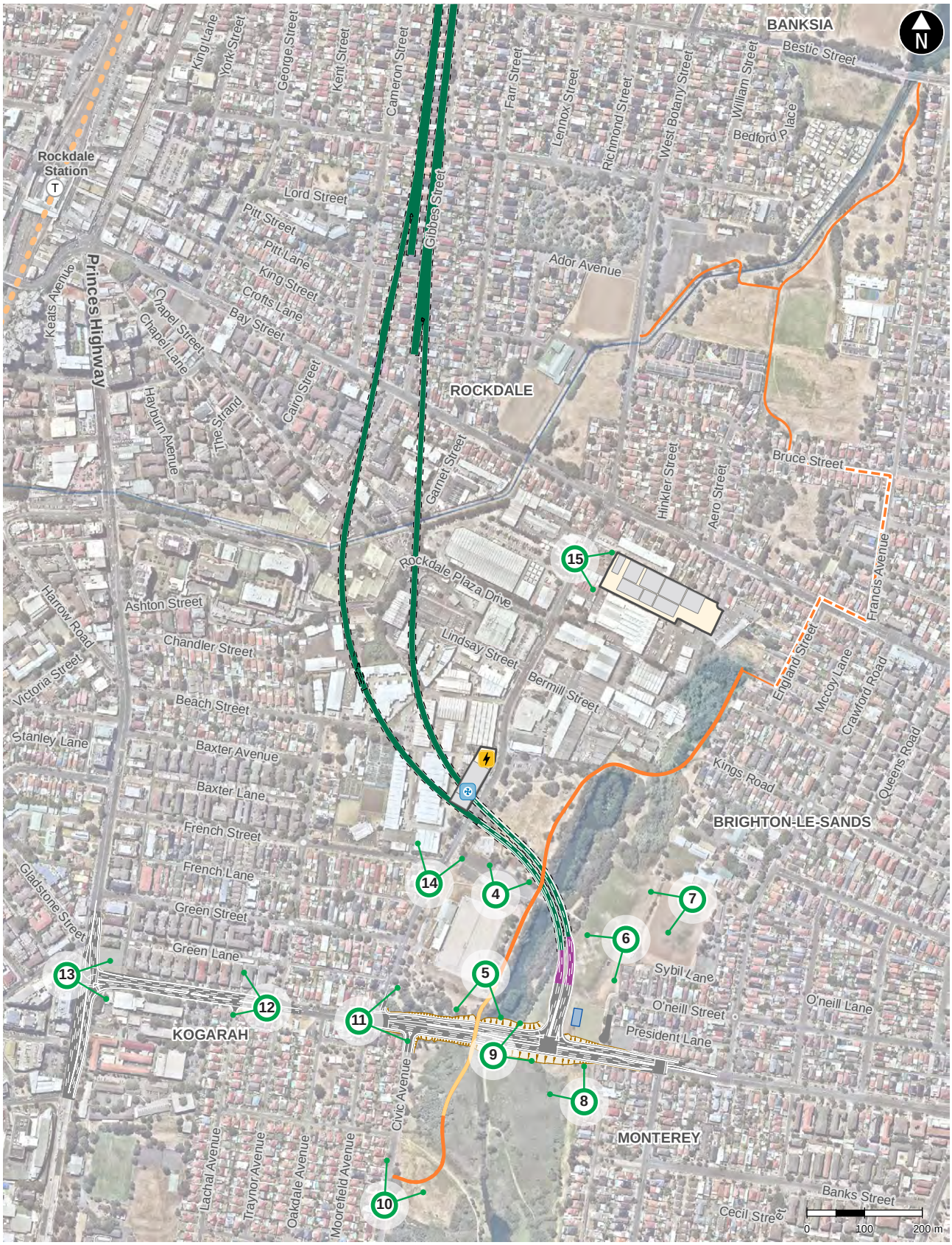


Figure 7-5: Viewpoint locations, Southern surface works

Selection of representative viewpoints

Fifteen viewpoints were selected from within the visual catchment of the project as representative of a broad range of potential views to the project in the southern surface works area. These views include views to the roadworks, Rockdale ventilation facility and shared pedestrian and cycle pathway. These views also include residential areas, schools, public open space, heritage places and local businesses.

The following views have been identified as representative of the views to the Southern surface works area (President Avenue):

- Viewpoint 4: View north from the Ilinden Sports Centre
- Viewpoint 5: View south from the southern part of Rockdale Bicentennial Park
- Viewpoint 6: View south from Memorial Fields
- Viewpoint 7: View south from Brighton-Le-Sands Public School
- Viewpoint 8: View north from Colson Crescent
- Viewpoint 9: View northeast from President Avenue
- Viewpoint 10: View east from Civic Avenue
- Viewpoint 11: View east from President Avenue retail area
- Viewpoint 12: View west along President Avenue at Lachal Avenue
- Viewpoint 13: View east along President Avenue from the Princes Highway
- Viewpoint 14: View south from West Botany Street
- Viewpoint 15: View east from West Botany Street to the Roads and Maritime Services maintenance depot

The location of these Viewpoints is shown in Figure 7-5.

7.3 Visual impact assessment

Table 7-2 summarises the impacts on views within the southern surface works area (President Avenue).

Table 7-2 Southern surface works area (President Avenue) – summary of visual impacts

Viewpoint	Operation		
	Sensitivity	Magnitude of change	Impact level
VP4: View north from the Ilinden Sports Centre	Moderate	Low	Low
VP5: View south from Rockdale Bicentennial Park south	Moderate	Moderate	Moderate
VP6: View south from Memorial Fields	Moderate	Low	Low-Moderate
VP7: View south from open space at Brighton-Le-Sands Public School	Moderate	Low	Low-Moderate
VP8: View north from Colson Crescent	Low	Moderate	Low-Moderate
VP9: View northeast from President Avenue	Moderate	High	Moderate - High
VP10: View east from Civic Avenue	Low	Low	Low
VP11: View east from President Avenue retail area	Low	Low	Low
VP12: View west along President Avenue at Lachal Avenue	Low	Low	Low
VP13: View east along President Avenue from the Princes Highway	Low	Low	Low
VP14: View south from West Botany Street	Low	Low	Low
VP15: View east from West Botany Street to Roads and Maritime maintenance depot	Low	Low	Low
Night views at the President Avenue, President Avenue intersection and tunnel exit and entry ramps	Low	Moderate	Low-Moderate
Night views of the shared cycle and pedestrian pathway	Low	Low	Low
Night views at the Princes Highway intersection	Low	Low	Low
Night views at the Rockdale ventilation facility	Low	Negligible	Negligible

Low Low-Moderate Moderate
Moderate - High High Negligible

7.3.1 Viewpoint assessment

Only one of the 12 representative viewpoints in the southern surface works area (President Avenue) assessed fell within an upper impact range (assessed as High and High-moderate ratings). Key issues associated with this viewpoint are summarised below. Further, no visual impacts arising from night lighting fell within the upper impact rating range.

Viewpoint 9: View northeast from President Avenue

Table 7-3 Viewpoint 9 - Impact assessment table

Sensitivity and Description of setting	**Moderate –** View across four lanes wide road to the Rockdale Wetlands. Views into the parkland are enclosed by dense vegetation. Residential properties with intermittent street trees and overhead powerlines can be seen in the background.
Operation - Magnitude	**High –** The President Avenue intersection would be visible in the centre of the view, including additional lanes, entry and exit ramps, and the tunnel portal. There would be new lighting, traffic signals and gantry signage. New street and parkland plantings would assist to visually integrate the corridor into the open space/recreational landscape setting. The entire view would be altered.
Impact level	**High – moderate** visual impact

Urban Design Response

This urban design of the President Avenue intersection has sought to address this visual impact in the following ways:

- Landscape treatment at the intersection and along President Avenue to visually integrate with existing treatments, including: the creation of shade and amenity with a tree-lined boulevard effect along President Avenue between West Botany Street and Colson Avenue; native grassland and ground cover plantings to batters to facilitate views into the adjoining parklands; and substantial planting alongside the tunnel portal and entry and exit ramps to offset tree cover loss to the project, and reflect the character of the adjacent wetlands, bushland and recreational open spaces.
- Coordination and consistency of built-form entry and exit ramp elements, including: retaining walls; noise walls; fencing, safety handrails and safety screens; colour treatments; lighting and road furniture.
- Tunnel portal that is organic in form, and highly integrated with both the entry and exit ramps components, and the surrounding landscape setting.
- Improved pedestrian connectivity along both sides of President Avenue with a continuous path on the north side, and widened path with signalised crossing on the south side, providing new, extensive views across the Scarborough Park North wetlands and 'swamp' forest remnants, currently not available from President Avenue.
- Incorporation of gently sloped batters (4H:1V) on the south side of the Avenue to improved visual integration with Scarborough Park North and that facilitate regular landscape maintenance and associated landscape amenity for both pedestrian, cyclist and road users.

Refer s.5.0 of this report for a detailed description of the above measures.

7.3.2 Summary of visual impacts

The LVIA report provides the following summary of visual impacts arising from the project, as reflected within the context of each of the above described Landscape Character Zones (refer Figure 7-).

Views from Rockdale Bicentennial and Scarborough Parks open space and recreation area (LCZ4)

The open space landscape of Bicentennial Park would be reinstated to its former use as parkland and wetlands surrounding the new operational road. The President Avenue corridor would be raised and widened to incorporate the intersection, extending into and above the adjacent Rockdale Bicentennial Park and Scarborough Park landscapes. Ancillary infrastructure for electronic tolling and traffic control and signage (including electronic signage) would be a new visible feature at the intersection. Streetscape planting would be reinstated along this section of President Avenue including street trees and landform modifications and planting to visually integrate the embankments. The new shared cycle and pedestrian pathway bridge over President Avenue would be visually prominent.

Located to the west of West Botany Street, the Rockdale ventilation facility would be visible from Rockdale Bicentennial Park. Trees along the park edge and along the street would filter views to the facility. Furthermore, the light industrial character and scale of the facility would be visually absorbed into the surrounding area of mixed light industrial built form. The stack would rise above the surrounding built form, and may be seen rising above the vegetation in views from the western areas of the park.

The report finds that overall, the introduction of a large intersection and road upgrade into views which were formerly open space would alter the character of views to and from the Scarborough Park and particularly Rockdale Bicentennial Park. This would be partly reduced over time by vegetation located to screen and visually integrate the works. Overall, this would range from a low to moderate magnitude of change to views from within the park. These views are of moderate sensitivity, resulting in a moderate and moderate-low visual impact during operation.

Refer Viewpoint 4: View north from the Ilinden Sports Centre, Viewpoint 5: View south from Rockdale Bicentennial Park south, and Viewpoint 6: View south from Memorial Fields.

Views from Brighton-Le-Sands coastal low density residential area (LCZ5)

Views from this flat, low density suburban zone would be restricted to properties and streets in close proximity to the President Avenue intersection. The demolition of nine houses at the corner of O'Neill Street and President Avenue would open up views to the new intersection, particularly from properties at the western end of O'Neill Street and President Lane. The open space surrounding the portal and ramps would be reinstated for recreational use, including sporting fields and parkland. New vegetation would be installed, visually integrating and softening the appearance of the new road structures. The widening of President Avenue and the new shared cycle and pedestrian pathway bridge structure would also be seen in the background of views.

Views from residential properties north of President Avenue, in close proximity to the project, would experience a moderate magnitude of change, to views of low sensitivity, resulting in moderate-low visual impact. This is due to the removal of residential properties and opening up of other properties within the character area to new views of President Avenue and the President Avenue intersection.

Views from residential properties on Colson Crescent, south of President Avenue, would be in close proximity to the President Avenue intersection, and widened President Avenue. The intersection and road would be elevated above the existing landform, and widened, creating a visually dominant feature in these views. The entry and exit ramps leading into the tunnel portal would also be seen in the background. There would be a moderate magnitude of change, to views of low sensitivity, resulting in a moderate-low visual impact.

In views from the Brighton-Le-Sands Public School the tunnel portal would be oriented away from the viewer. Existing and proposed vegetation within the park would screen views towards the portal, the entry and exit tunnels and ramps, and the President Avenue intersection beyond. Mature existing vegetation fringing the wetlands to the west of the school would have been protected and would screen views to the Rockdale ventilation facility on West Botany Street. This would result in a low magnitude of change, to views of moderate sensitivity, and a moderate-low visual impact (Refer Figure 7-6 and Figure 7-7).

Refer Viewpoint 7: View south-west from open space at Brighton-Le-Sands Public School, Viewpoint 8: View north from Colson Crescent, and Viewpoint 9: View northeast from President Avenue.

Figure 7-6: Existing condition – View west from Brighton-Le-Sands Public School

Figure 7-7: Artist's impression – View west from Brighton-Le-Sands Public School during operation illustrating how the tunnel entry ramps and portal, and ventilation facility would be screened by retained vegetation when seen from this location (Design is indicative only)

Views from Kogarah residential and urban local centre (LCZ6)

Views east and west along President Avenue would be transformed by the new intersection, additional lanes and new level of the road, raised above the surrounding parkland. The character of the road would be intensified with the introduction of a wide intersection with signals, lighting and signage. The removal of trees within Rockdale Bicentennial and Scarborough Parks for construction of the intersection and road upgrade would open up views into the parkland. In particular, views south would be more elevated above the surrounding parkland, as the landform drops away. At the intersection the entry and exit ramps would be seen unobstructed in the middle and foreground, set within parkland and screen planting. (Refer to Viewpoint 11: View northeast from President Avenue and Figures 7-8 and 7-9)

The character of the upgraded road and new intersection would contrast with the surrounding open space context. This would result in a high magnitude of change, within a zone of moderate sensitivity, and a high-moderate visual impact.

Views north and east from Civic Avenue would include the upgraded President Avenue, which would be raised and widened, converting the road corridor into three lanes in each direction. The shared cycle and pedestrian pathway bridge would also be visible crossing President Avenue. It would be a visually lightweight structure with viaduct approaches located within Rockdale Bicentennial and Scarborough Parks. The President Avenue intersection would be visible beyond the bridge, including a new intersection on raised embankments.

New planting along the President Avenue streetscape and within Scarborough Park would assist in screening and filtering views to the road corridor and bridge. However, the road corridor would be more visually dominant in these views. This would result in a low magnitude of change to views from Civic Avenue, which are of low sensitivity, creating a low visual impact during operation.

Views from President Avenue, adjacent footpaths and residential properties, would include the widened road corridor with the removal of some trees. This would result in a low magnitude of change to views which are of low sensitivity, creating a low visual impact during operation.

Refer to Viewpoint 10: View east from Civic Avenue, Viewpoint 11: View east from President Avenue retail area, and Viewpoint 12: View west along President Avenue at Lachal Avenue.

Figure 7-8: Existing condition – View west along President Avenue

Figure 7-9: Artist's impression – View west along President Avenue during operation (Design is indicative only)

Views from West Botany Street industrial area (LCZ8)

Views to the Rockdale operational Motorway Operations Centre from West Botany Street and Bay Street would be limited by the surrounding large scale buildings and flat terrain. The character of this complex would be compatible with the surrounding built form and readily absorbed into views. This would result in a low magnitude of change, within a zone of low sensitivity, and a low visual impact.

The Rockdale ventilation facility would be seen from West Botany Street, filtered by new street trees along the western verge (subject to consultation with Council). The built form and massing of the ventilation facility would be compatible and visually absorbed into the surrounding commercial and light industrial precinct (refer to Figure 7-10 and Figure 7-11). The cut-and-cover structures through Rockdale Bicentennial Park would be restored to open space and West Botany Street would also have been reinstated. Overall, views from West Botany Street towards the ventilation facility would experience a low magnitude of change, within a zone of low sensitivity, resulting in low visual impact.

Refer to Viewpoint 14: View north from West Botany Street, and Viewpoint 15: View east from West Botany Street to Roads and Maritime maintenance depot.

Figure 7-10: Existing condition – View north along West Botany Street

Figure 7-11: Artist's impression – View north along West Botany Street during operation (Design is indicative only)

7.4 Assessment of cumulative impacts

7.4.1 Other motorway projects

Southern surface works area (President Avenue)

Operational impacts

There would not be any other motorway projects visible from the visual catchment of the Southern surface works area (President Avenue) during the day or night.

7.4.2 Landscape character and visual impact mitigation strategy

Management of operational impacts

Where feasible and reasonable, the following measures will be undertaken to mitigate operational landscape and visual impacts:

- Cut off and direct light fittings (or similar technologies) would be used to minimise glare and light spill onto private property.
- Semi-mature trees (assume minimum container size of 100 L should be provided where short term screening is required, such as in areas between the President Avenue intersection and tunnel entry, and exit ramps and adjacent residential areas of Brighton-Le-Sands.