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WestConnex

New M5
State Significant Infrastructure Application Report

November 2014

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WestConnex Delivery Authority

The New M5

State significant infrastructure application report

November 2014

Prepared for

WestConnex Delivery Authority

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Document controls

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Approval and authorisation	
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Executive summary

The NSW Government is proposing the construction and operation of the New M5 (the project); which would comprise a new, tolled multi-lane road link between the M5 East Motorway east of King Georges Road and St Peters. The project would also include an interchange at St Peters and connection to the existing road network.

The project is one component of the WestConnex program of works. WestConnex is a 33 kilometre motorway that is intended to link Sydney's west with the airport and the Port Botany precinct. The WestConnex program of works is proposed to be delivered as a series of projects, each of which would be subject to a stand-alone planning assessment and approvals process in accordance with the requirements of the Environmental Planning and Assessment Act 1979 (EP&A Act) and other relevant legislation. The project forms part of WestConnex Stage 2, which also includes the King Georges Road interchange upgrade project.

The WestConnex Delivery Authority (WDA) was established by the NSW Government to deliver the WestConnex program of works for Roads and Maritime Services on behalf of the NSW Government. The WDA is a public subsidiary corporation of the (NSW) Roads and Maritime Services (Roads and Maritime). Its role and functions are set out in Part 4A of the (NSW) *Transport Administration (General) Regulation 2013*. WDA is the proponent for this project.

Key components of the project include:

- Twin motorway tunnels between the M5 East Motorway (between King Georges Road and Bexley Road) and St Peters. Each tunnel would be around nine kilometres in length and would be built to accommodate up to three lanes of traffic each. The location of the western portals along the M5 East Motorway would be between King Georges Road and Bexley Road with the actual location to be determined during the design phase. The location of the eastern portals at St Peters would be in the vicinity of land generally bounded by the Princes Highway, Campbell Road, Burrows Road and Canal Road with the actual location also to be determined during the design phase.
- Tunnel stubs to allow for a potential future connection to Stage 3 of the WestConnex program of works and a potential future connection to southern Sydney.
- Surface road widening works along the M5 East Motorway between east of King Georges Road and the new tunnel portals.
- A new road interchange at St Peters, which would initially provide road connections from the new tunnels to Campbell Road and Euston Road, St Peters and Gardeners Road, Mascot.
- Ancillary infrastructure and operational facilities for electronic tolling, signage (including electronic signage), ventilation structures and systems, fire and life safety systems, and emergency evacuation and smoke extraction infrastructure.
- A motorway control centre that would include operation and maintenance facilities.
- New service utilities and modifications to existing service utilities.
- Works to enhance and upgrade local roads near the St Peters interchange.
- Temporary construction facilities and temporary works to facilitate the construction of the project.

The project would be delivered through a design and construct contract aimed at delivering an innovative, cost effective and environmentally responsive design for the project. The design and construct tender process is being undertaken concurrently with the environmental impact assessment process for the project. The alignment of the project would be located within the project corridor, which forms the basis for the assessment within this document.

WDA, as the proponent, has formed the view that the impact of the project is likely to significantly affect the environment. On this basis, the project is declared to be State significant infrastructure under section 115U (2) of the *Environmental Planning and Assessment Act 1979* by reason of the operation of clause 14 and clause 1 of Schedule 3 of the *State Environmental Planning Policy (State and Regional Development) 2011*. Accordingly, the project is subject to Part 5.1 of the *Environmental Planning and Assessment Act 1979* and requires the approval of the Minister for Planning and Infrastructure.

A preliminary environmental risk analysis and investigations indicate that the following environmental issues would require further detailed assessment and may require project-specific safeguards and management measures:

- Traffic and transport.
- Air quality and human health.
- Noise and vibration.
- Biodiversity.
- Visual impacts and urban design.
- Social and economic.
- Land use and property.
- Hydrology and flooding.
- Geology, soils and water quality.
- Non-Aboriginal heritage.
- Resource management and waste minimisation.

A number of other environmental issues have also been identified. These issues are outlined in this report and are considered to be of lesser consequence taking into consideration the project scope, the existing environment and the implementation of standard safeguard and management measures.

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Glossary of terms and abbreviations

Term	Meaning
AHD	Australian height datum.
AHIMS	Aboriginal Heritage Information Management System.
Alluvial material	Relatively recent deposits of sedimentary material within river / creek beds, floodplains, lakes or at the base of mountain slopes.
Aquifer	Underground layer of water-bearing permeable rock or unconsolidated materials (such as gravel, sand and silt) from which groundwater can be usefully extracted.
Carriageway	Section of a roadway used for vehicular traffic. Generally delineated by kerbs, a verge or a median.
CBD	Central business district.
Community severance	Reduced access to local amenities and disruption of local social networks caused by the introduction of a physical barrier, such as a major road, or through significant increases in traffic volumes on a road that was not originally regarded as a barrier.
EP&A Act	*Environmental Planning and Assessment Act 1979.*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999.*
Environmental assessment process	A part of the decision-making process where the environmental impact of a development, proposal or activity is considered in detail, in conjunction with other aspects of the development, proposal or activity.
GDEs	Groundwater dependent ecosystems.
Interchange	A grade separated junction or overpass to separate road, rail or other traffic that cross each other, so that crossing movements do not conflict.
LGA	Local government area.
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation.
Roads and Maritime	NSW Roads and Maritime.
SEPP	State Environment Planning Policy.
SMPO	Sydney Motorways Project Office.
Threatened	As defined under the *Threatened Species Conservation Act 1995*. A species, population or ecological community that is likely to become extinct or is in immediate danger of extinction.
Tunnel portal	The entry / exit structures at each end of a tunnel.
WDA	WestConnex Delivery Authority.

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1 Introduction

1.1 Overview of WestConnex

The WestConnex program of works is the largest integrated transport and revitalisation project in Australia. It is intended to link the M4 Motorway to the central business district (CBD), Sydney Airport and the M5 East Motorway in south-west Sydney via a 33 kilometre tolled motorway completely free of traffic signals. The WestConnex program of works as shown on **Figure 1-1** is intended to be delivered in three stages. Within each stage, a number of projects are proposed and will be assessed as separate projects as follows:

- **Stage 1**, which consists of two projects:
  - The M4 Motorway Widening.
  - The M4 East Motorway (Homebush Bay Drive to Haberfield).
- **Stage 2**, which consists of three components:
  - The King Georges Road interchange.
  - This project (the subject of this State significant infrastructure application report).
  - The Sydney Gateway (linking the St Peters Interchange with Sydney Airport).
- **Stage 3:**
  - The M4 South Motorway (Haberfield to St Peters via Camperdown).

Each project is subject to approval.

1.2 The Proponent

The WestConnex Delivery Authority (WDA) was established by the NSW Government to deliver the WestConnex series of projects for (NSW) Roads and Maritime Services (Roads and Maritime) on behalf of the State. The WDA is a public subsidiary corporation of the Roads and Maritime. Its role and functions are set out in Part 4A of the (NSW) *Transport Administration (General) Regulation 2013*. WDA is the proponent for this project.

1.3 Overview of the project

The NSW Government is proposing the construction and operation of the New M5 (the project); which would comprise a new, tolled multi-lane road link between the M5 East Motorway east of King Georges Road and St Peters. The project would also include an interchange at St Peters and connection to the existing road network.

The project would span six local government areas including: Canterbury, Hurstville, Rockdale, Marrickville, Botany Bay and Sydney. It would include widening of the existing M5 Motorway between King Georges Road and the new tunnel portals, twin motorway tunnels, both around nine kilometres in length and local road connections in St Peters.

The project would be delivered through a design and construct contract aimed at delivering an innovative, cost effective and environmentally responsive design for the project. The design and construct tender process is being undertaken concurrently with the environmental impact assessment process for the project. The alignment of the project would be located within the project corridor, which forms the basis for the assessment within this document. A description of the project is provided in **Section 3**. The local context of the project is shown in **Figure 1-2**.

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Figure 1-1: Overview of the WestConnex scheme

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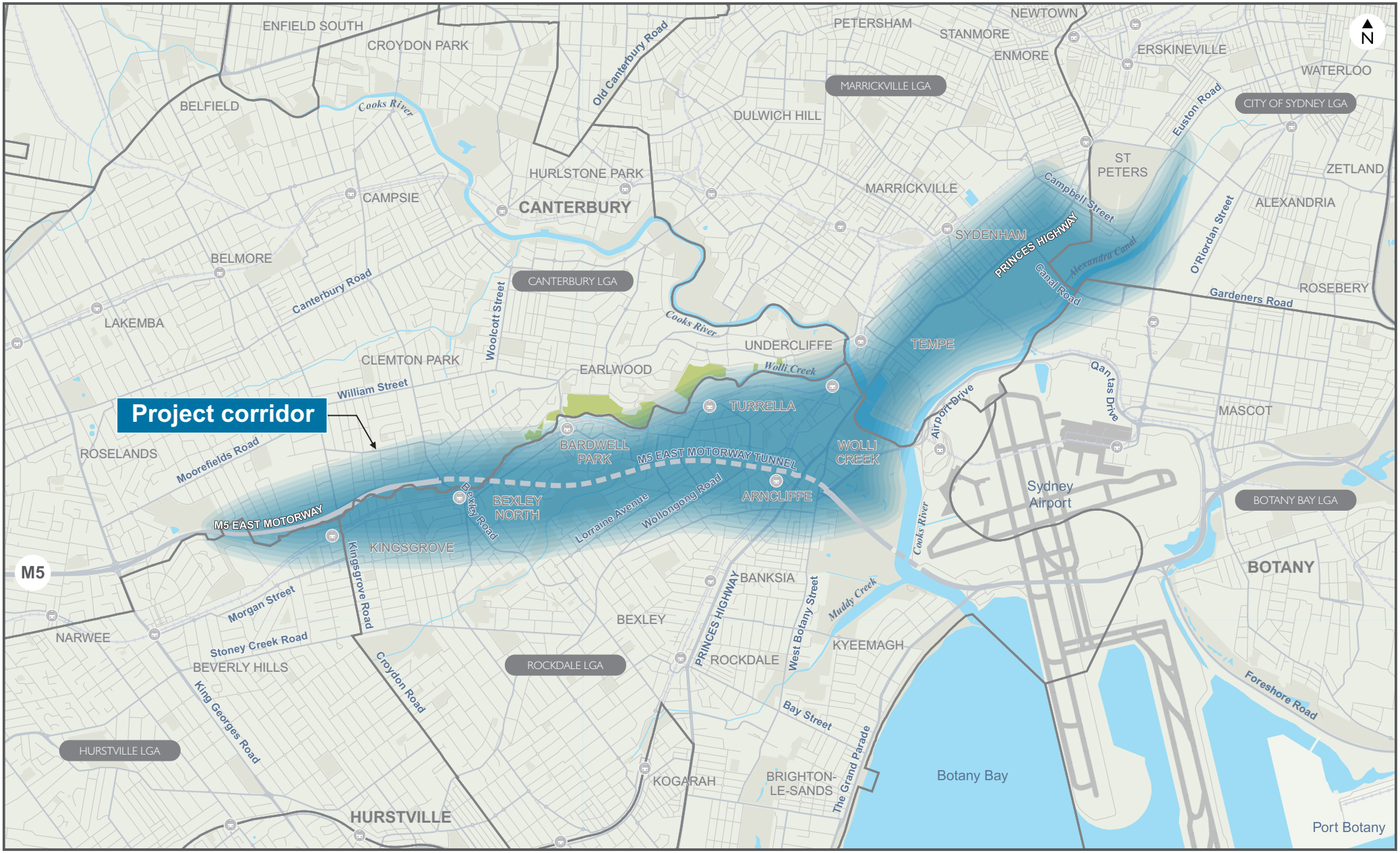

KEY

- Wolli Creek Regional Park
- Parks, reserves and private recreation
- Road
- Rail
- Watercourse
- Local government area boundary

Figure 1-2: Local context of the project

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1.4 Purpose of this document

This report has been prepared to support a State significant infrastructure application under section 115X of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

WDA has formed the opinion that the project is likely to significantly affect the environment and requires the preparation of an environmental impact statement under the EP&A Act. The project does not require development consent under Part 4 of the EP&A Act. Accordingly, as per clause 14 and Schedule 3 of *State Environmental Planning Policy (State and Regional Development) 2011*, the project is declared to be State significant infrastructure under Part 5.1 of the EP&A Act and requires the approval of the Minister for Planning.

The requirements of clause 192 of the *Environmental Planning and Assessment Regulation 2000* for applications seeking approval of the Minister for Planning to carry out State significant infrastructure are addressed in Attachment A to this report.

The purpose of this application report is to assist the formulation of environmental assessment requirements by the Secretary of the Department of Planning and Environment under section 115Y of the EP&A Act.

This application report:

- Describes the project.
- Considers the potential environmental issues for the project.
- Identifies key environmental issues for the project.

The application report and Secretary's environmental assessment requirements would inform the preparation of an environmental impact statement for the project. The form and content of the environmental impact statement would be in accordance with clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*.

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2 Background

2.1 Strategic context and project need

Sydney's strategic road network, which includes Sydney's motorway network, supports economic growth across the Sydney metropolitan area by connecting people to jobs, and allowing businesses to trade with one another (Infrastructure NSW, 2012). It carries the bulk of the State's container freight and acts as a feeder and distributor for other modes of transport, including rail, sea and air transport (Infrastructure NSW, 2012).

The Sydney transport network currently services a population of 4.2 million people with about 15.5 million trips on a normal weekday. The complex transport network needs to meet increasingly complex travel demands. This is the result of the diversification of places of employment, urban infill, higher density residential development within existing areas, as well as the ongoing spatial expansion of Sydney's fringe (Sydney Motorways Project Office, 2013).

Sydney's road network serves 93 per cent of passenger journeys and 86 per cent of road freight movements. Traffic on key corridors has grown by 50 per cent in the last 20 years, and investment in new roads has struggled to keep up with demand. Travel by road is the dominant transport mode in Sydney, and is predicted to continue to be the most dominant over the next 20 years (Infrastructure NSW, 2013). New road capacity is urgently required to meet the challenge of population growth and substantial increases in freight volumes.

Congestion on the road network has an impact on the NSW economy, which has been estimated at around $5.1 billion each year (Sydney Motorways Project Office, 2013). Around half of these costs are associated with light commercial and heavy vehicles due to losses in productivity due to travel delays and increased vehicle operating costs. Congestion also has societal implications due to longer commuter times and associated environmental impacts.

The need for additional capacity on the strategic road network becomes increasingly apparent with the projected growth at Sydney Airport and Port Botany. The Sydney Airport and Port Botany precinct is also the largest employment centre in Sydney after the Sydney Business District (Ernst and Young, 2011). Together, Sydney Airport and Port Botany currently generate around $10.5 billion of economic activity and handle close to $100 billion worth of freight each year.

By 2033, passenger growth at Sydney Airport is projected to increase from around 37 million to around 74 million passengers per year, and will handle over one million tonnes of freight by 2033 (SACL, 2014). Only a small proportion of travel to/from the airport is completed by public transport, with the majority of travel completed via the road network.

Freight demands over the next 20 years will more than triple for port container freight in Sydney, and double for bulk freight. The greater demand for imported goods would drive significant growth in port container traffic and result in increased land transport needs, particularly around Port Botany and along major arterial routes. Sydney Ports forecasts container trade through Port Botany to nearly quadruple by 2031, reaching seven million containers per year by 2031 (Infrastructure NSW, 2013).

Most of the freight leaving Port Botany travels by heavy vehicles along the M5 East Motorway and the M5 South West Motorway (M5 corridor), towards Sydney's employment centres in Sydney's west and south-west (Ernst and Young, 2011). Shifting freight from road onto rail remains a priority for the NSW Government. However, assuming the modal share of rail freight doubles by 2020, more than 70 per cent of Port Botany's trade would still be transported by the road network (Sydney Motorways Project Office, 2013).

The Sydney Airport and Port Botany area also forms part of the Economic Global Corridor, an arc that extends northwards through the CBD to Macquarie Park. Around 50 per cent of the NSW Gross State Product is concentrated within the corridor, and the strengthening of this corridor will influence the expansion of Sydney's economy (NSW Government, 2013). The NSW Government's priority is to create at least 173,000 additional jobs within the corridor (NSW Government, 2013). To facilitate this, the draft Metropolitan Strategy recognises the need to implement works to relieve major congestion around Sydney Airport and Port Botany, as well as improve public transport access to the airport.

Increased residential and employment growth in the suburbs neighbouring the M5 Motorway corridor or further afield (such as the Western Sydney Employment Hub and the South West Growth Centre) will place further pressure on the road network.

The M5 Motorway corridor (the M5 East Motorway and the M5 South West Motorway) is the main passenger, commercial and freight corridor between Port Botany, Sydney Airport and south-west Sydney. Traffic demand on the M5 East Motorway is currently exceeding the design capacity of the roadway, and as a result, presents a significant bottleneck to the M5 Motorway corridor.

Each day, the M5 East Motorway carries over 100,000 vehicles, of which 16 per cent are heavy vehicles. An analysis of the destinations of eastbound AM peak traffic using the main-line tunnels of the M5 East Motorway indicates that almost half of all traffic that exits at Marsh Street and the Princes Highway is bound for south Sydney and the airport, with 56 per cent of traffic continuing towards the Eastern Distributor. The significant demand for the M5 East Motorway has resulted in the following outcomes:

- Peak spreading on the M5 Motorway corridor as motorists change travel behaviours to avoid traditional peak hours to improve travel times.
- Increased demand on the surrounding road network. Travel demand within the M5 East Motorway and immediately surrounding surface road network is around 209,000 vehicles. Given that the M5 East Motorway is exceeding its design capacity, significant traffic flows occur on the surrounding road has resulted in congestion along alternative routes. As some sections of the surrounding road network have poor alignments, narrow lanes and uncontrolled access, the alternative routes are prone to disruption due to traffic incidents.
- Unreliable journey times, given the increased congestion during peak periods.

Freight productivity is further constrained on the M5 Motorway corridor and the surrounding road network due to height or mass restrictions which require heavy vehicles to take longer, less direct routes. A steep gradient within the M5 East Motorway also contributes to reductions in travel speeds (and therefore road capacity) within the tunnel.

WestConnex is one of the NSW Government's major infrastructure priorities. The project is one component of the WestConnex program of works and according to the current schedule for works it would be the fourth project to be delivered. WestConnex seeks to respond to the challenges of M5 Motorway corridor and the surrounding road network by:

- Providing quicker, more reliable trips between Western Sydney and the Sydney Airport / Port Botany precinct to support Sydney's urban freight movements by providing additional motorway capacity within the M5 Motorway corridor.
- Reducing demand and congestion on alternative routes on the surface road network, which in turn will improve connectivity and amenity for communities along these routes.
- Providing better connections between employment and population centres along the M5 Motorway corridor and beyond to cater for existing and future demand. This includes a direct connection to employment zones near Sydney Airport and Port Botany via the St Peters interchange.

If the total WestConnex program of works is completed, it would provide the missing link in the Sydney motorway network, linking the M4 and M5 corridors. This would improve access to the wider Sydney road network for vehicles with either origins or destinations in the Sydney CBD, Sydney Airport, Port Botany, south Sydney, inner west and eastern suburbs as well as the north-western and south-western suburbs. It would also provide enhanced connectivity to Sydney Airport and Port Botany through the delivery of the Sydney Gateway.

Opportunities to incorporate a southern connection to WestConnex would also have the potential to relieve congestion along existing arterial roads in the southern Sydney suburbs, and to cater for growth in key centres include Kogarah and Sutherland.

2.2 Strategic planning and policy context

There are a number of key strategic planning documents and policies which align with the need for the project, as discussed below.

2.2.1 NSW 2021 – A plan to make NSW number one

NSW 2021: A plan to make NSW number one (NSW 2021) (NSW Department of Premier and Cabinet, 2011) is the NSW Government's 10-year strategic business plan, which sets priorities for action and guides resource allocation to deliver economic growth and critical infrastructure throughout NSW.

The plan emphasises the investment and delivery of an efficient and effective transport system, including road infrastructure that will relieve congestion, improve travel times, improve road safety and enhance and expand capacity on key road corridors.

The project would involve the delivery of key road infrastructure identified by the NSW Government that would enhance and expand capacity on the M5 corridor, which would help to achieve priority actions outlined in NSW 2021, including goal 7 (reduce travel times), goal 10 (improve road safety) and goal 19 (invest in critical infrastructure).

2.2.2 NSW Long Term Transport Master Plan

The NSW Long Tern Transport Master Plan (LTTMP) (Transport for NSW, 2012) provides a framework for the delivery of an integrated, modern transport system by identifying NSW's transport actions and investment priorities over the next 20 years. WestConnex is identified in the LTTMP as an immediate priority for the NSW Government.

The LTTMP recognises that WestConnex will support Sydney's long term economic growth through improved motorway access and connections linking Sydney's international gateways including Sydney Airport, Port Botany, Western Sydney and employment areas across Sydney. It also notes that WestConnex would relieve road congestion, and thereby improve the speed, reliability and safety of travel, including in the M5 corridor.

The LTTMP identifies the need to progressively deliver WestConnex and recognises that upgrading the M5 corridor is a key component of the WestConnex program of works, as it would increase the capacity of the Motorway to accommodate commercial vehicles and freight demand.

The project would comprise a multi-lane road link between the M5 East Motorway east of King Georges Road, and St Peters. The project would help deliver the benefits of WestConnex by improving traffic efficiency and level of service for freight and public transport on the road network through the relief of road congestion to improve the speed, reliability and safety of travel along the M5 corridor and parallel arterial roads.

2.2.3 NSW State Infrastructure Strategy

The NSW State Infrastructure Strategy 2012-2032 (SIS) is a 20 year strategy developed by Infrastructure NSW. It identifies and prioritises the delivery of critical public infrastructure to enhance productivity and economic growth, Infrastructure NSW's assessment of the State's existing infrastructure has highlighted critical deficiencies in urban road capacity and provides strategic options for delivery, required to meet the challenges of population growth and substantial increases in freight volumes.

The SIS identifies that the most pressing investment needs to occur on the M4 and M5 corridors, due to their importance to freight and business transport, as well as their connections to 'global Sydney' and the international gateways of Sydney Airport and Port Botany. WestConnex is identified in the SIS as a critical program of work that would provide a range of benefits, including reducing congestion, improving access to the major international gateways of Sydney Airport and Port Botany and improved industrial access and business efficiency along the M5 corridor.

The project would duplicate the existing capacity of the M5 East Motorway through the provision of a multi-lane road link between the M5 East Motorway east of King Georges Road, and St Peters and would also include an interchange at St Peters which would eventually provide access to Sydney Airport and Port Botany, thereby contributing to the delivery of critical public infrastructure to enhance productivity and economic growth, as outlined in the SIS.

2.2.4 Draft Metropolitan Strategy for Sydney to 2031

The *Draft Metropolitan Strategy for Sydney to 2031* (Draft Metropolitan Strategy) (NSW Government 2013) was released for public comment in March 2013 and sets the framework and strategic planning foundation for Sydney's housing and job growth to 2031 to inform the final Metropolitan Strategy.

The Draft Metropolitan Strategy is being delivered in conjunction with the LTTMP and SIS to fully integrate planning for housing and employment with the delivery of extensive transport and infrastructure. The draft Metropolitan Strategy envisions Sydney as being highly networked, with more frequent connections into and through the 'global economic corridor'. It also recognises that the transport network between Port Botany, industrial land in Western Sydney and destinations beyond the Sydney metropolitan area will see a likely increase in freight movements, requiring upgrades to transport infrastructure including road networks.

The project is consistent with the draft Metropolitan Strategy as it would improve freight performance along the M5 corridor and provide connections between Port Botany and industrial land in Western Sydney.

2.2.5 NSW Freight and Ports Strategy 2013

The NSW Freight and Ports Strategy 2013 (Freight and Ports Strategy) (Transport for NSW, 2013) is a core component of NSW's overall strategic planning framework and supports the goals identified in NSW 2021.One objective of the draft Freight and Ports Strategy is the delivery of an efficient freight network that supports the projected growth of the NSW economy.

One of the actions identified in the Freight and Ports Strategy is to connect and complete Sydney's motorway network, including priority freight movements. It recognises that WestConnex is a key component in expanding capacity on NSW roads, which would provide benefits for freight movement, including around major freight activity centres including Port Botany and Sydney Airport, which are concentrated along the M4 and M5 corridors.

The project is consistent with the Freight and Ports Strategy as it would enhance freight movements along the M5 corridor and would contribute to improving access from the M5 corridor to Sydney Airport and Port Botany in the longer term.

2.3 Project objectives

The WestConnex program of works is a key recommendation of the State Infrastructure Strategy 2012-2032 (Infrastructure NSW 2012) (State Infrastructure Strategy) and was the subject of a Business Case approved by the NSW Government in September 2013. The Business Case outlines the need for action and identifies the process for delivering this major infrastructure initiative, with a Benefit Cost Ratio of 2.55 for the WestConnex program of works, which is strong for an infrastructure program of this scale. WestConnex is also identified as a key element of Sydney's road future in the LTTMP.

The core objectives of WestConnex are to:

- Support Sydney's long-term economic growth through improved motorway access and connections linking Sydney's international gateways and Western Sydney and places of business across the city.
- Relieve road congestion so as to improve the speed, reliability and safety of travel in the M4 and M5 corridor, including parallel arterial roads.
- Cater for the diverse travel demands along these corridors that are best met by road infrastructure.
- Create opportunities for urban revitalisation, improved liveability, and public and active transport improvements along and around Parramatta Road.
- Enhance the productivity of commercial and freight generating land uses strategically located near transport infrastructure.
- Fit within the financial capacity of the State and Federal Governments, in partnership with the private sector.
- Optimise user pays contributions to support funding in an affordable and equitable way.

An additional specific objective of the project is to provide for integration with other WestConnex projects while not significantly impacting on the surrounding environment in the interim period.

Additionally, the project, consistent with the WestConnex program of works, includes an objective to protect natural and cultural resources and enhance the environment through the following key approaches:

- Manage in-tunnel air quality so as to meet community visibility expectations.
- Manage tunnel ventilation emissions to ensure local air quality meets Environmental Protection Authority (EPA) standards.
- Maintain regional air quality.
- Minimise adverse impacts at a local level on air/noise quality.
- Minimise construction and operational energy use.
- Manage noise in accordance with the *NSW Road Noise Policy* and realise opportunities to reduce or mitigate noise impacts.
- Provide for improvement of social and visual amenity.
- Minimise impacts on natural systems including biodiversity.
- Minimise impact on Aboriginal and non-Aboriginal cultural heritage.

2.4 Consultation

Stakeholder consultation to date has been focused at raising community awareness of the WestConnex program of works, including the project through the website, a project information phone line, emails to registered stakeholders. A range of consultation methods have been utilised to seek input and identify issues from the community including:

- A website www.westconnex.com.au with background information, maps, videos, customer surveys and details for how to provide feedback.
- A centralised feedback telephone line 1300 660 248.
- A project email address info@westconnex.com.au to notify registered stakeholders, solicit comments and respond to community feedback.
- A postal address WestConnex Delivery Authority Locked Bag 928 North Sydney 2059 to contact key stakeholders and receive input.
- Broad advertising in major metropolitan publications such as the Sydney Morning Herald, the Daily Telegraph, local suburban publications and non-English speaking community papers as well as advertising targeting public transport users in mX magazine and online advertising targeting road users.
- Media announcements which have been widely covered in metropolitan television, radio, print and digital news outlets along with trade and advocacy publications such as National Roads and Motorists Associations' Open Road magazine.
- A brochure to explain the project which has been distributed widely along the corridor.
- Customer research groups involving residents, professional road users and business operators.
- Targeted stakeholder discussions with advocacy groups, local councils, elected representatives and peak bodies.
- Roundtable discussions with stakeholders such as councils, the freight industry and business groups.
- Meetings with Government agencies.
- Individual meetings with representatives and community members.

Consultation with a number of local councils, State Government agencies and elected representatives has also been undertaken. This consultation was focused around identifying key issues of potential concern to stakeholders, as well as identifying issues that these stakeholders are anticipating would be of concern to the local community based on previous motorway proposals in the area.

Issues identified during community consultation associated with the WestConnex program of works include:

- Air quality issues associated with ventilation facilities and tunnel portals.
- Implications associated with changes in air quality as a result of the project.
- Access and traffic impacts on local areas, particularly in the vicinity of tunnel portal locations.
- Safe accessibility to homes, schools and services.
- Construction impacts, including noise and vibration, dust, surface water, heritage and groundwater.
- Impacts on properties and perceived impacts on property values in the vicinity of tunnel portals and ventilation facilities.
- The need to consider alternative modes of transport, particularly public transport and cyclists.

2.4.1 Animations and website

A website has been set up at www.westconnex.com.au. Animations explaining the key concepts of the WestConnex program of works are including on the website and have been translated into eight community languages. The Strategic Environmental Review which provides an overview of the environmental impacts of the whole WestConnex program of works is also included on the website.

2.4.2 Stakeholder letter

A letter introducing the WestConnex concepts and encouraging stakeholders to view the animation and participate in the forum was sent to approximately 100 stakeholders (local government, councils, transport associations, emergency services) on Monday 27 August 2012.

2.4.3 Media releases

A comprehensive media campaign has been implemented for the WestConnex program of works. Advertisements in various media outlets, including the Sydney Morning Herald, Daily Telegraph, mX magazine, and local newspapers will be further enhanced by media coverage in newspapers, TV and radio in the Sydney metro area and suburban areas that are within proximity to the project. Media releases to date are available on the WestConnex project website.

2.4.4 Community consultation and Stakeholder Engagement Strategy

A community consultation and stakeholder engagement strategy will be adopted to guide consultation on the project. This would be implemented throughout the development of the project, including but not limited to the environmental assessment process. The strategy would detail the methods by which affected communities would be engaged regarding the project, and the proposed future stakeholder consultation.

2.5 Options considered

Strategic alternatives to the project have been considered against the WestConnex objectives, including:

- Base case ('do nothing').
- Construction and operation of public transport options.
- Construction and operation of the new motorway.

The base case or 'do-nothing' option would involve the continued operation of the M5 East Motorway in its current configuration. Traffic demand (passenger and freight) on the existing M5 East Motorway is currently exceeding the design capacity of the roadway and presents a significant bottleneck to the M5 Motorway corridor. The do-nothing option would mean that the motorway would continue to have safety, efficiency and capacity problems, which would have flow on effects to the economy and to users of the motorway with associated adverse amenity and environmental outcomes, The do-nothing option was therefore not considered further as it would not meet the WestConnex objective (refer to **section 2.3**).

Public transport options such as the construction and operation of heavy rail, light rail or bus as an alternative to WestConnex would contribute to relieving congestion along the M5 Motorway corridor by potentially reducing the number of passenger vehicles using the M5 Motorway corridor. However; the transport demands along the M5 corridor cater for a diverse range of needs, including freight movements, which would not be improved nor catered for should this option be implemented.

Although opportunities exist to shift more freight from the road network onto the freight heavy rail network, the need to transport freight by road will continue. The NSW Freight and Ports Strategy notes that dedicated freight rail corridors are being planned to ensure passenger and freight rail demand can be accommodated. However, assuming that the NSW Government's target of doubling the share of container freight moved by rail is achieved by 2020 (Transport for NSW, 2013), more than 70 per cent of Port Botany's trade would still be moved by road, requiring investment in an efficient road network to support the Port Botany and Sydney Airport precincts (Transport for NSW, 2013). The NSW Freight and Ports Strategy notes that road corridors, including WestConnex would be designed to reflect heavy vehicle access requirements as a key component.

The option to construct and operate a new motorway would respond to the diverse travel demands along the M5 corridor, and would relieve congestion on the M5 East Motorway by providing additional road capacity. This option could be achieved through the construction and operation of a new motorway that reflects the existing M5 East Motorway (in effect, duplicating that motorway), or the construction and operation of a new motorway that responds to other strategic road network projects under development (the Marrickville Tunnel and extension of the M4 Motorway).

Adherence to the current M5 East Motorway alignment, which was investigated by Roads and Maritime in 2009, would not provide the opportunity to have a direct connection between the M4 and M5 motorways. As such, the duplication of the M5 East Motorway would not fully achieve the broader economic and road network project objectives for the project, specifically the objective of improving motorway access and connections to link Sydney's international gateways, Western Sydney and places of business across the city. It was also considered to have potential impacts on land such as Tempe Reserve.

It is considered that a motorway following a new corridor would better provide and enhance connections to the M5 motorway corridor, Sydney Airport and Port Botany while also providing for future broader network connections. This corridor, as identified in **Figure 1-2**, is considered to best meet the WestConnex objectives and is the preferred option as it would:

- Support Sydney's long-term economic growth through improved motorway access and connections, linking Sydney' s international gateways and Western Sydney and places of business across the city.
- Relieve road congestion so as to improve the speed, reliability and safety of travel along the M5 corridor.
- Cater for diverse travel demands along the M5 corridor that are best met by road infrastructure.
- Contribute to enhancing the productivity of commercial and freight generating land uses strategically located near transport infrastructure.

2.6 Preferred route option

The preferred route option has evolved through a concept development process and evaluation of options which have been ongoing since 2009, following the public exhibition of the RTA program of works for the duplication of the M5 East Motorway in 2009.

Since the exhibition of the M5 East Motorway duplication, the program of works underwent further development including consideration of options to reduce impacts on some land, such as Tempe Reserve (Sydney Motorways Project Office, 2013).

In 2013, the work undertaken for the M5 East Motorway duplication was incorporated with two other projects under development (the Marrickville Tunnel and extension of the M4 Motorway) to form the WestConnex program of works (refer to **Figure 1-1**). To optimise the design and to reduce cost, two industry partners were appointed to review the existing design and earlier investigations for the southern corridor of the WestConnex program of works and to develop innovative solutions for different forms of alignment options.

As a result of these investigations, a broad corridor has been identified that would provide a connection from the M5 East Motorway east of King Georges Road to St Peters.

WestConnex Delivery Authority will be running a competitive design and construct tender process to identify an innovative, cost effective and environmentally-responsive design within the broad project corridor. Further design and refinement would be undertaken throughout this process to ensure that the final configuration of the project best meets both the WestConnex objectives and meets the environmental outcomes identified for the project. The refinement of the project would consider the outcomes and recommendations from previous investigations within the project corridor, particularly the M5 East Motorway duplication study. The Environmental Impact Statement would be presented on the preferred design.

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3 Description of the project

3.1 Overview

The NSW Government is proposing the construction and operation of the New M5 (the project); which would comprise a new, tolled multi-lane road link between the M5 East Motorway, east of King Georges Road, and St Peters. The project would also include an interchange at St Peters and connections to the existing road network.. The design of the project will be developed through a competitive design and construct tender process.

Key components of the project would include

- Twin motorway tunnels between the M5 East Motorway (between King Georges Road and Bexley Road) and St Peters. Each tunnel would be around nine kilometres in length and would be built to accommodate up to three lanes of traffic each. The location of the western portals along the M5 East Motorway would be between King Georges Road and Bexley Road with the actual location to be determined during the design phase. The location of the eastern portals at St Peters would be in the vicinity of land generally bounded by the Princes Highway, Campbell Road, Burrows Road and Canal Road with the actual location also to be determined during the design phase.
- Tunnel stubs to allow for a potential future connection to Stage 3 of the WestConnex program of works and a potential future connection to southern Sydney.
- Surface road widening works along the M5 East Motorway between east of King Georges Road and the new tunnel portals.
- A new road interchange at St Peters, which would initially provide road connections from the new tunnels to Campbell Road and Euston Road, St Peters and Gardeners Road, Mascot.
- Ancillary infrastructure and operational facilities for electronic tolling, signage (including electronic signage), ventilation structures and systems, fire and life safety systems, and emergency evacuation and smoke extraction infrastructure.
- A motorway control centre that would include operation and maintenance facilities.
- New service utilities and modifications to existing service utilities.
- Works to enhance and upgrade local roads near the St Peters interchange.
- Temporary construction facilities and temporary works to facilitate the construction of the project.

The project corridor is shown on **Figure 3-1**.

The final configuration of the twin main alignment tunnels, surface road connections and ancillary surface facilities would be determined as part of the design development process.

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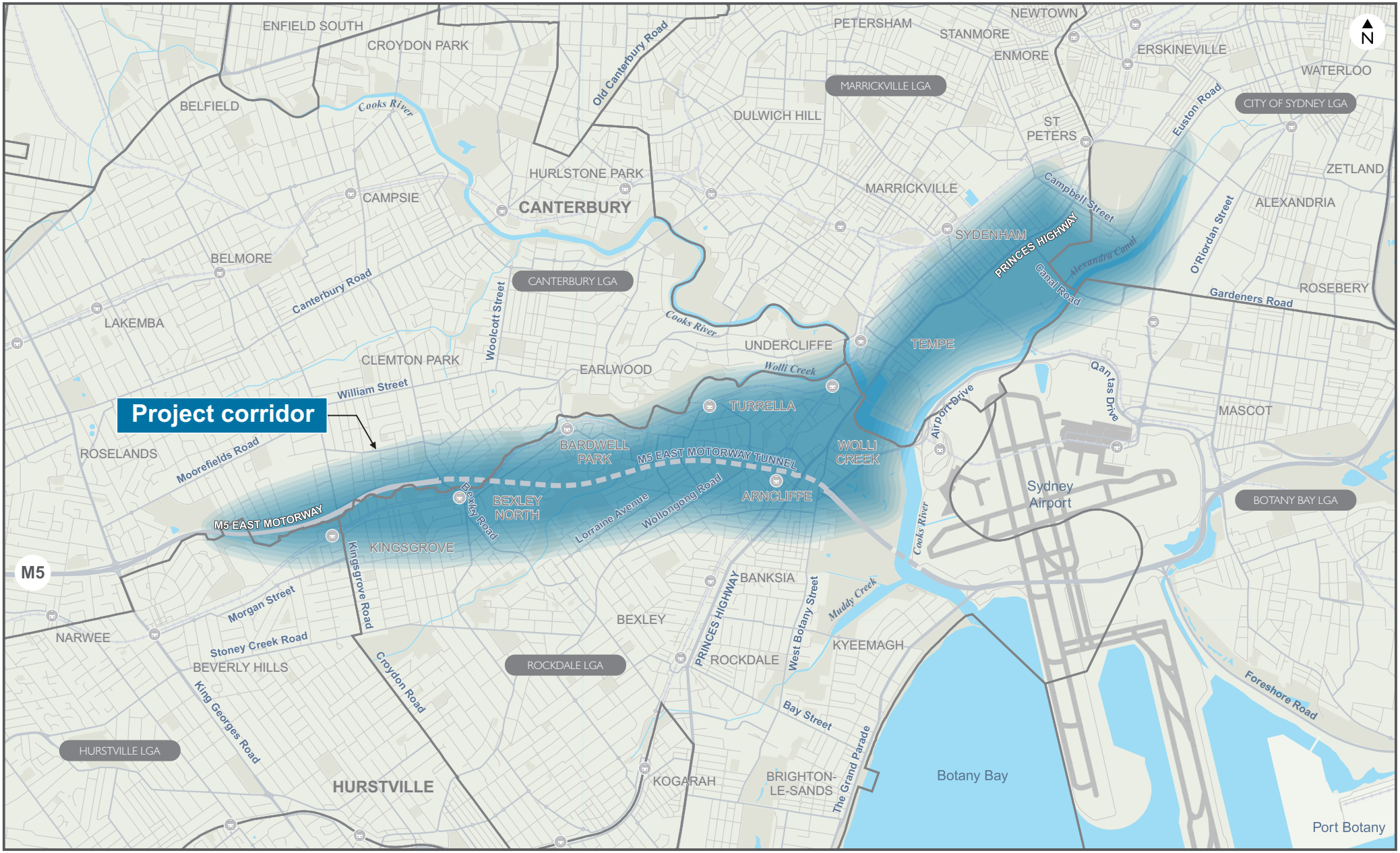

KEY

- Parks, reserves and private recreation
- Road
- Rail
- Watercourse
- Local government area boundary

Figure 3-1: The project corridor

0 1 2
Km

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3.2 Connection to M5 East Motorway

The western portals of the project would be located to the east of King Georges Road and west of Bexley Road to provide a direct connection to and from the M5 East Motorway. To connect the project with the M5 East Motorway, surface works would be required between the King Georges Road interchange and the western portals. This would require widening works along the motorway to provide four lanes in each direction from the King Georges Road interchange to the new western portals. The final layout of the surface road connections would be determined as part of the design development process.

3.3 The motorway tunnel

The proposed twin motorway tunnels would both be around nine kilometres long and would be built to accommodate up to three lanes of traffic. Each tunnel would have a minimum posted speed limit of 80 kilometres per hour.

On and off ramps at each end of the project would include sections of tunnel to provide direct connections from the main motorway tunnels to the M5 East Motorway and the proposed St Peters interchange.

The depth of the tunnel would vary depending on geological constraints and operational design requirements (such as road grade). The shallowest sections of the project are likely to be near the tunnel portals at the eastern and western ends of the project.

Tunnel stubs would be provided for possible future connections to the M4 South Motorway and a possible future connection to southern Sydney. The final tunnel alignment would be determined as part of the design development process.

3.4 St Peters interchange

The St Peters interchange would initially connect the New M5 to Campbell Road and Euston Road, St Peters and through to Gardeners Road, Mascot, to enable traffic to travel to and from the inner western suburbs of Sydney, the airport precinct and Port Botany via the existing surface road network.

Modifications to other local roads in the immediate vicinity of St Peters interchange may be required to cater for altered traffic conditions. Possible changes to pedestrian footpaths along the surface road network and bus stops along Canal Road as a result of the St Peters interchange would be reviewed as part of the preparation of the Environmental Impact Statement.

The WestConnex Stage 3 – M4 South Project and the Sydney Gateway, which do not form part of this project, are under consideration to connect to the St Peters interchange at a later date. Works required at the interchange to provide these possible additional future connections would be subject to a separate environmental assessment and approvals process.

3.5 Ancillary facilities

The project would require ancillary facilities during construction, including but not limited to: construction compounds, sedimentation basins, concrete batching plant, pre-cast yards and stockpiles. In determining the size and location of the ancillary construction facilities, existing land use activities, potential environmental impacts and amenity impacts on the surrounding community would be taken into account. At a minimum, ancillary construction facilities would be required close to the portals to provide tunnelling support. The location and size of the ancillary construction facilities would be developed as part of determining the preferred project design and would be assessed in the Environmental Impact Statement for the project.

3.6 Construction

Construction of the project would occur over a period of around four years and would include (but not be limited to) the following:

- Enabling and temporary works, including construction power, construction water supply, site establishment, demolition works, property and public transport modifications (if required).
- Construction of the road tunnels, interchanges, intersections and roadside infrastructure.
- Haulage of spoil generated during tunnelling and excavation activities.
- Fit-out of the road tunnels and support infrastructure, including ventilation and emergency response systems.
- Construction and fit-out of the tunnel control centre.
- Realignment, modification or replacement of surface roads, bridges, intersections and/or underpasses.
- Environmental management and pollution control facilities for the project.

Temporary works may be required during construction, such as temporary diversions for road traffic or pedestrians near work areas, or alternative arrangements where property accesses may be temporarily disrupted.

Road headers and/or tunnel boring machines may be used for the deeper parts of the alignment, while cut and cover construction methods may be required at shallower sections, such as near the tunnel portals. Other excavation activities likely to be undertaken include the creation of cross passages and caverns or shafts for other support infrastructure. If investigations into a southerly connection conclude that this infrastructure is feasible, stub tunnels would be constructed for connection to the project in the future.

The project would not include some early works such as some surveys, test drilling and excavations, test excavations, geotechnical, contamination and environmental investigations, modifications and adjustments to utilities including facilities including power, water supply, drainage and wastewater, site access ways and associated traffic management measures; or other tests, surveys, sampling or investigation for the purposes of the design or assessment of the project which are intended to be undertaken prior to the grant of SSI approval. It would also not include some waste facility closure works and/or some remediation of land at the former Alexandria Landfill at St Peters. These activities would be subject to any necessary, separate environmental assessment process.

4 Key environmental issues

4.1 Overview

Key environmental issues are those which may have high or moderate impacts (actual or perceived) and assessment is necessary to determine the level of potential impact and to develop appropriate measures to avoid, manage and mitigate those impacts.

The outcomes of a preliminary risk assessment and investigations indicate that the following key environmental issues will require further detailed assessment and may require project specific safeguards and management measures:

- Traffic and transport.
- Air quality and human health.
- Noise and vibration.
- Biodiversity.
- Visual impacts and urban design.
- Social and economic.
- Land use and property.
- Hydrology and flooding.
- Geology, soils and water quality.
- Non-Aboriginal heritage.
- Resource management and waste minimisation.

A number of other environmental issues have also been identified. These issues are outlined in **Chapter 6** and are considered to be of lesser consequence taking into consideration the Project scope, the existing environment and the implementation of standard management and safeguard measures. It is expected these other environmental issues would not likely be key issues; however, the potential impact of these other environmental issues would be assessed further in any future Environmental Impact Statement for the project.

Preliminary consideration has been given to the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A search of the EPBC Act online Protected Matters Search Tool has been conducted, which identified two Commonwealth listed threatened ecological communities which are likely to, or may occur within the project corridor. A further two Commonwealth listed threatened ecological communities have been previously mapped as occurring within the project corridor (refer **to Section 4.5.1** and **Figure 4-2**).

4.2 Traffic and transport

4.2.1 Overview

The western and central parts of the project corridor generally follow the alignment of the M5 East Motorway, with the northern part of the corridor generally following the alignment of the Princes Highway. The surrounding road network is shown in **Figure 4-1**.

The M5 East Motorway combined with the M5 South West Motorway (the M5 Motorway corridor) provides a key east-west road corridor between greater western Sydney and the Sydney central business district (CBD) as part of Sydney's strategic road network. The M5 Motorway corridor connects Sydney Airport and Port Botany to other key links within the wider road network including:

- The Westlink M7 Motorway which provides links to the employment areas of Western Sydney, and links to the broader Sydney Orbital Network.
- The Hume Motorway (M31), which provides links to Canberra and Melbourne.
- King Georges Road (A3), which provides links to northern, south western and southern suburbs of Sydney.
- The Princes Highway (A36), which provides links to the inner western and south-western suburbs of Sydney.
- Southern Cross Drive (M1), which provides links to the CBD, eastern suburbs and areas north of the CBD via the Pacific Highway.

Route A34 along Milperra Road and Canterbury Road (located to the north of the project corridor) provides an alternative east-west route to the M5 corridor. An additional route (comprising of Forest Road/Stoney Creek Road/Henry Lawson Drive), located to the south of the project corridor, also provides an alternative east-west route to the M5 Motorway corridor.

The WestConnex Strategic Environmental Review identified the following key operational constraints associated with the M5 Motorway corridor:

- Key arterial roads on the surrounding network are operating at or near capacity with limited opportunity for widening. This includes General Holmes Drive and Airport Drive.
- Other arterial roads, such as route A34, are also congested for substantial periods of the day, with little capacity to cater for diverted traffic during incidents on the M5 Motorway corridor.
- The steep grade leading to the exit of the westbound M5 East Motorway tunnel impacts on travel speeds, particularly heavy vehicles, which limits traffic capacity. Vehicles exiting to Kingsgrove Road generally travel in the right hand lane, further impacting on capacity.
- Traffic entering and merging onto the M5 Motorway corridor at major interchanges results in slow traffic and congestion, particularly at Marsh Street, Kingsgrove Road and King Georges Road.

The demand on the network is forecast to grow significantly as a result of population and employment growth in Sydney. This includes growth at Sydney Airport, Port Botany, the Sydney Global Economic Corridor, employment lands in the M5 Motorway corridor, the South-West Growth Centre, and the Western Sydney Employment Area. Combined with increased tourist visitation, congestion on the existing road network is expected to further worsen on the M5 Motorway corridor and alternative arterial routes.

The Princes Highway is the key arterial route within the northern part of the corridor, which provides connections to:

- The M5 East Motorway and surrounding suburbs to the south and south-west.
- Canal Road / Ricketty Street / Gardeners Road to the east, providing access to the Sydney Airport, Port Botany, industrial areas, the M1 and the eastern suburbs.
- Railway Road/Sydenham Road, Enmore Road and King Street, providing access to suburbs to the west and north.

The Princes Highway at this location caters for regional (or through movements) as well as local movements associated with residents and businesses accessing the surrounding suburbs.

Campbell Road, Burrows Road and Euston Road provide access to recreational, residential, commercial and industrial areas in St Peters, Alexandria and Mascot. They also provide connections between major roads, namely the Princes Highway, Canal Road, Gardeners Road and Botany Road.

Public transport network

Bus routes

The bus routes within the project corridor provide east-west and north-south connectivity. Routes follow major roads in the area, including the Princes highway, Canterbury Road and Bexley Road. No bus routes currently use the existing M5 East Motorway.

Cycling and pedestrian facilities

Within the project corridor there is currently a continuous cycle path from King Georges Road in the west to St Peters in the east. The cycleway comprises a mixture of separate dedicated bicycle paths and dedicated bicycle-friendly roads. Cycling is currently permitted on the shoulders of the M5 East Motorway until Bexley Road, where cyclists are diverted to use local and arterial roads. From the commencement of construction of the King Georges Road upgrade, cyclists will no longer be able to use the M5 East Motorway as a cycling route. There are also off road shared paths on either side of the motorway from west of King Georges Road to Bexley Road, as well as through recreational spaces along Cooks River.

Pedestrian footpaths are provided on all major roads within the project corridor, with the exception of the M5 East Motorway. Pedestrian crossings along major roads are, in the majority, restricted to signalised pedestrian crossings.

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KEY

- National Park/Regional Park
- Road
- Rail
- Watercourse
- M Route
- A Route

Figure 4-1: The road network

0 2 4
Km

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4.2.2 Summary of issues

Construction

Construction of the project would require the use of heavy vehicles to deliver construction plant, equipment and materials as well as for the removal of waste, including general construction waste, office waste and spoil from tunnelling activities. Additional discussion on construction waste is provided in **Section 4.12** (Resource management and waste minimisation). Heavy vehicle movements during the tunnelling stage are expected to occur on a 24 hour basis.

It is anticipated that there would be an increase in the number of light vehicles on the surrounding road network during the construction of the project, associated with the construction workforce.

Surface construction works, including ancillary infrastructure, portal works and tie-ins to the surrounding road network, as well as the establishment of construction sites and associated entry / exit points may result in changes or modifications to:

- Existing property access.
- Exiting pedestrian and cyclist access and movements.
- Speed limits on the motorway and surrounding roads.

Additional heavy and light vehicle movements and surface construction works associated with the project have the potential to generate the following traffic and transport related impacts during construction:

- Deterioration in intersection and traffic performance along the local road network due to heavy vehicle movements associated with construction and spoil removal, narrowing of lanes, speed restrictions and temporary road closures.
- Changes in local traffic conditions as a result of traffic shifting from the motorway onto alternative routes while construction work is underway, such as during the surface integration works along the M5 East Motorway. These roads are currently congested and at capacity during peak periods.
- Potential safety risks for road users, including buses, pedestrians and cyclists during construction due to temporary road arrangements or the close proximity of construction activities to normal traffic.
- Temporary disruptions and delays to traffic and public transport services, including buses as a result of speed restrictions and / or potential temporary road closures.
- Temporary impacts on pedestrian and cyclist access on adjacent roads where modifications are required to accommodate access to construction areas.
- Impacts to local parking as a result of construction workforce.
- Temporary impacts to property access.

Operation

The operation of the project would alter traffic movements on the surrounding road network. In particular, the project would result in an increase in traffic movements immediately surrounding the St Peters Interchange which may have operational traffic impacts. These may include:

- Deterioration of individual intersection performance at existing intersections due to the introduction of new movements.
- Improved traffic efficiency and level of service for freight and public transport on the road network through the relief of road congestion to improve the speed, reliability and safety of the travel along the M5 corridor and parallel arterial roads.
- Enhanced productivity of commercial and freight generating land uses, including employment areas in the Sydney Airport and Port Botany area.
- Improved motorway access and connections linking Sydney Airport and Port Botany to greater western Sydney and places of business across the city in order to support Sydney's long-term economic growth.
- Improved road safety.
- A reduction in traffic volumes along existing road corridors, particularly heavy vehicles.
- Improved public transport options along surface roads that have the potential to experience reduced congestion.
- Modified pedestrian movements at existing intersections.
- Alterations to existing property accesses.

It is anticipated that the possible future completion of WestConnex Stage 3 and the complete WestConnex program of works would again alter traffic movements and traffic conditions around interchanges and along the local road network. Tolling would be introduced on each stage of WestConnex as it is developed (SMPO, 2012). There is the potential that introducing a tolling system as part of the WestConnex program of works would change the use of the existing and proposed M5 East Motorway as a result of some traffic switching off the motorway and onto alternate routes along local roads.

4.2.3 Proposed further assessments

The Environmental Impact Statement would include a construction and operational traffic and transport assessment to identify and assess potential impacts and management measures.

The construction traffic study would include identification and assessment of:

- Potential traffic and transport impacts on the road network, including consideration of public transport impacts, as well as pedestrian and cyclist access throughout construction of the project.
- Potential cumulative impacts with other stages of the WestConnex project.

The operational traffic study would identify and assess traffic impacts associated with the project, including an assessment of existing local and regional traffic volumes and traffic patterns against forecast volumes and potential changes to traffic patterns associated with the project. Traffic modelling to be undertaken as part of the operational traffic assessment would be undertaken for the opening year, being the year of completion of the project, and 10 years from the opening date, which would include the completion of WestConnex program of works. The operational traffic assessment for the project would also include:

- A description of intersection functionality.
- Quantification of
  - Anticipated benefits of improved intersection performance.
  - Travel times along the M5 East Motorway and M5 South West Motorway.
- Direct and indirect operational traffic implications on the local and regional road network, including freight movements.
- Identification and assessment of potential operational traffic impacts around interchanges and required modifications to the existing local road network.
- Identification and analysis of the performance of key intersections and interchanges during AM and PM peak periods.
- Traffic time analysis.
- An assessment of the impact of tolling on motorways and the surrounding road network based on the tolling strategy for the program of works.
- An assessment of impact of the project on road users, including motorists, public transport, pedestrians and cyclists.
- Road safety analysis.

4.3 Air quality and human health

4.3.1 Overview

The NSW State of the Environment 2012 (EPA, 2012) provides a report on the status and condition of the major environmental resources in New South Wales (including the atmosphere) and examines the associated environmental trends. The report identifies that air quality within the Sydney metropolitan area consistently meets national air quality standards for four of the six major air pollutants (lead, CO, sulfur dioxide and nitrogen dioxide).

With regard to emissions from vehicles, the key air pollutants are:

- Carbon monoxide (CO).
- Oxides of nitrogen (NO_x), including nitrogen dioxide (NO_2).
- Particulate matter, including fine and ultra-fine particles (PM_{10} and $PM_{2.5}$).
- Air toxics, including benzene, toluene, xylenes, formaldehyde and polycyclic aromatic hydrocarbons (PAHs) which are predominately adsorbed to particulates.

These pollutants are potentially harmful to human health.

The NSW State of the Environment 2012 report states that transport emissions are the most important human-related source of air pollution in Sydney. In 2008, motor vehicles were the largest source of emissions of oxides of nitrogen (63 per cent of total emissions) and the second largest source of volatile organic compounds emissions (24 per cent of total emissions) in the Sydney Report.

The air quality in NSW is generally good when compared with international standards (EPA, 2012). Ambient concentrations of carbon monoxide, nitrogen dioxide and volatile organic compounds are all consistently below the respective national standards in most areas, and emission of these pollutants have decreased by 20 to 40 per cent since the early 1990's (EPA, 2012). These decreases have been attributed to initiatives to reduce air pollution associated with industry, businesses, motor vehicles and residential premises.

Exceedances of ozone and particulate matter (PM_{10}) standards have occurred between 1994 and 2011. However, recorded exceedances of particulate matter standards in Sydney are attributed to natural events such as bushfires and dust storms.

In NSW, measured $PM_{2.5}$ concentrations have generally been at or below the *National Environmental Protection Measure (NEPM) for Ambient Air Quality* 24-hour average advisory reporting standard but above the annual average advisory reporting standard (EPA, 2012). Measured $PM_{2.5}$ concentrations in the years 2000 to 2003 were above the reporting standard and in subsequent years were close to the standard, except for 2009 which had the highest peaks ever recorded due to dust storms (EPA, 2012).

The EPA undertook ambient monitoring of a number of air toxics between 1996 and 2001 at 25 sites (DEC, 2004). Of the 81 measured pollutants, only three required further investigation to ensure that they remained at acceptable levels in the future: benzene, 1,3-butadiene and benzo(a)pyrene. Additional testing conducted between 2008 and 2009 measured concentrations of a number of pollutants include benzene, toluene and xylenes at Turrella and Rozelle. Concentrations of all measured pollutants were recorded to be well below the monitoring investigation levels. As such, current concentrations of air toxics in the Sydney region are not an issue of concern.

The closest OEH air quality monitoring stations to the project are at Earlwood, Randwick and Chullora.

The OEH Air Quality Statement for 2013 noted that in 2013, air quality in NSW was poorer than previous years, which was mainly attributed to warmer and drier climatic conditions and severe bushfires. The OEH Air Quality Index (AQI) values, which standardises measurements of Ozone, CO, sulfur dioxide (SO_2), NO_2, air particles and visibility into one index were in the hazardous category (an AQI greater than 200) on a number of days in 2013. This reflected periods of bushfire activity. The recorded exceedances of ozone, PM_{10} and $PM_{2.5}$ at the Chullora and Earlwood OEH monitoring stations were similarly recorded during periods of high bushfire activity and during calm, hot weather conditions in 2013.

The M5 East Motorway ventilation facility is located in Turrella. As part of the approval of the M5 East Motorway, five monitoring stations have been installed to provide 24 hour air quality data to the Roads and Maritime to measure compliance with the air quality goals specified in the planning approval. Four of these stations monitor concentrations of carbon monoxide, nitrogen dioxide and PM_{10}, while one station monitors volatile organic compounds such as benzene and formaldehyde (which is aromatic). As part of the M5 East Motorway approval, exceedances of the conditions of approval need to be reported. Exceedances of the PM_{10} ambient goal, and one exceedance of the NO_2 ambient air quality goal, have been detected as a result of the monitoring. These exceedances were not attributable to emissions from the ventilation facility; rather they were associated with extreme weather events, bushfires, nearby construction activity or equipment failure.

4.3.2 Summary of issues

Construction

The construction of the project has the potential for the following air quality related impacts:

- Temporary increases in dust during earthworks, vegetation clearance, use of the ancillary concrete batching plant and construction activities. The potential impacts on air quality would be dependent on the scale of the activities, quantities of the material handled, and the proximity of sensitive receivers.
- Temporary increases in emissions associated with the use of the ancillary concrete batching plant vehicles, plant and machinery. This includes temporary ventilation systems within the tunnel during construction.

Operation

During the operation of the project, the potential emissions to air are associated with vehicular fuel combustion. As discussed in **section 4.3.1**, the primary air pollutants of concern are CO, NO_2 and PM_{10} and $PM_{2.5}$.

In-tunnel air quality

The level of emissions from the project would be affected by the length of the tunnel(s), its grade and the mix of vehicles travelling through the tunnel. Maintaining a free flow of traffic in the tunnel(s) would also be a significant factor in minimising the emissions generated by vehicles using the project.

The design parameter for ventilation systems and the management of in-tunnel air quality for tunnels within NSW has been historically based on a CO limit. CO has also been used as a proxy for monitoring and management of all traffic related pollutants. In NSW, a 15-minute average CO in-tunnel limit is used, which since the 1990s has been based on the World Health Organisation (WHO) limit of 87 parts per million (ppm). Visibility limits are also adopted in many tunnels for the purposes of road safety.

The NSW Government has appointed an Advisory Committee on Tunnel Air Quality (the Advisory Committee) to review current international best practice and experience from Australian motorway tunnels. The committee will:

- Review and set performance standards for road tunnel emissions.
- Recommend appropriate monitoring, compliance and reporting mechanisms to support public confidence in the operation of road tunnels.
- Provide ongoing advice to the NSW Government on air quality issues.

WDA will consult with the Advisory Committee and other relevant agencies concerning appropriate in-tunnel air quality criteria.

Local air quality – surface roads

At a local level, air quality effects would be influenced by the emissions associated with vehicles on surface roads and in tunnels. The reduction in traffic congestion along surface roads has the potential to deliver air quality improvements to areas along key arterial roads. These local effects would be the subject of further investigation.

Local air quality – ventilation facilities

The project would require ventilation facilities for the tunnel. Well-designed ventilation facilities are very effective at dispersing tunnel emissions and are expected to be an important component of the final ventilation design solution.

The tunnel ventilation system would be designed and operated to meet in-tunnel air quality criteria, as well as to meet local and regional air quality criteria. The tunnel ventilation system would take account of in-tunnel ambient air quality, traffic conditions and external meteorological conditions. The tunnel ventilation design would be optimised to avoid unnecessary capacity and minimise operational energy use, while ensuring air quality outcomes are met.

The locations of ventilation facilities would be subject to further design development. Ventilation facilities would most likely be located close to the tunnel exit portals. Location of ventilation facilities near the tunnel exit portals would be the most cost effective and energy efficient location, given the reduced requirement for pushing tunnel air in the opposite direction to traffic flow. Subject to further design development, management of in-tunnel air quality may require construction of ventilation facilities at intermediate locations along the main alignment tunnels.

Air discharged from tunnel ventilation facilities would be subject to detailed investigations as part of the air quality assessment. The assessment would be based on the location and design characteristics of the facilities, emissions to air (based on in-tunnel emissions inventories), buildings and land use, prevailing meteorological and topographical effects to determine any changes in air pollutant concentrations at sensitive receivers.

Treatment of emissions

Air pollution control technology has been used in a limited number of tunnels in a few countries including Norway, Austria, Germany and Japan as well as the M5 East Motorway tunnel trial in Sydney. This technology includes the use of electrostatic precipitators to remove particles as well as catalytic and biological processes and adsorption technologies to remove nitrogen oxides. Evidence to date suggests that the benefits of such measures when applied to road tunnels are limited to specific situations (Advisory Committee on Tunnel Air Quality, 2014).

A range of solutions to manage in-tunnel air quality would be considered during the design of the project including, but not limited to ventilation (including number, size and position of outlets) and air treatment technologies.

Summary

The operation of the project has the potential for the following air quality impacts, and associated human health implications:

- Potential increase and decrease in near roadside air pollutant concentrations due to changes in traffic volumes on surface roads, or the introduction of new roads (such as the St Peters interchange).
- Potential increase in air pollutant levels near the ventilation facilities.
- Potential exposure to air pollutants for motorist using long tunnels.

4.3.3 Proposed further assessments

An air quality assessment would be undertaken to assess the construction and operation impacts of the project and to assist in developing air quality mitigation measures.

For construction, an assessment would be undertaken which would consider mitigation and management measures to reduce and minimise the emission of dust and other pollutants during construction.

Emissions from concrete batching plants are predominantly particulate matter emissions, although relatively small quantities of combustion pollutants (carbon monoxide, oxides of nitrogen, oxides of sulphur and hydrocarbons) can also be emitted. Should a concrete batching plant be required, a quantitative assessment of particulate matter emissions would be undertaken.

For the assessment of air quality impacts during operation, an assessment of in-tunnel air quality would be undertaken to predict the levels of CO, NO_2 and particulates based on the proposed ventilation design, and to predict the potential exposure to motorists. As identified in **Section 4.3.2**, WDA will continue to consult with the Advisory Committee and other relevant agencies concerning appropriate in-tunnel air quality criteria to inform this assessment.

The operational air quality assessment would be undertaken in accordance with *Approved Methods for the Modelling and Assessment of Air Pollution in NSW* (DEC, 2005) to assess the potential impacts on surrounding sensitive receivers. The operational air quality assessment would apply modelling techniques endorsed in that guideline and relevant air quality criteria. The methodology applied to the assessment would be determined in consultation with Department of Planning and Environment and the Environment Protection Authority.

The assessment would consider local dispersion conditions, existing background levels of pollutants, managed air emissions, and changes in vehicle emissions on surface roads. Background monitoring data from the nearest existing air quality monitoring stations would be used in the assessment, in addition to data collected from project-specific air quality monitoring stations.

A human health risk assessment would also be undertaken to assess the potential human health implications of in-tunnel air quality as well as the implications of changes in air quality external to the project as a result of the project. This would be based on the results of the air quality modelling for the project. The methodology for the assessment would be determined in consultation with NSW Health.

4.4 Noise and vibration

4.4.1 Overview

The noise environment within the project corridor is characterised by noise generated by the major transport infrastructure located in the area, including the M5 East Motorway, the Princes Highway, Sydney Airport, and the suburban Sydney Trains railway network (T2, T3 and T4 rail lines). Industrial and commercial developments located in the project corridor, such as those located at Kingsgrove, Wolli Creek, Tempe, Sydenham, St Peters, Mascot and Alexandria, also contribute to the local noise environment.

A wide range of sensitive receivers are located within the project corridor, which include:

- Residential properties.
- Parks and recreational areas.
- Education facilities, including indoor and outdoor areas.
- Hospitals.
- Places of worship.
- Aged care facilities.

During construction, the project would result in localised noise and vibration impacts, particularly where surface works would occur for interchanges, tunnel portals and ancillary surface infrastructure. Tunnelling could also generate vibration and ground borne noise impacts on sensitive receivers located above the project alignment and in the vicinity of construction compounds.

With the majority of the project being in tunnel, potential operational noise impacts on sensitive receivers would be limited to where project infrastructure is located at the surface or where traffic volumes on surface roads would change. This would include potential reductions in traffic noise at sensitive receivers due to the shift of traffic from surface roads into the project tunnels.

4.4.2 Summary of issues

Construction

The construction of the project would likely result in the following noise and vibration issues:

- Airborne noise from surface works including at the interchange, the integration with the M5 East Motorway, construction ventilation systems, ancillary construction facilities and any open cut sections of the project.
- Ground-borne noise from tunnelling and piling.
- Potential vibration impacts on buildings near to surface works, or buildings above the tunnel alignment.
- Construction traffic noise from the use of heavy vehicles and construction equipment.
- Potential vibration impacts on buildings generated by blasting activities, which may be required depending on the geological conditions encountered.

Construction works during the evening and night time periods would be required, with the potential for tunnelling and associated above-ground support activities (including spoil haulage) to occur 24 hours a day, seven days a week. This is likely to result in impacts to sensitive receivers. There is also likely to be a requirement for some construction activities, such as integration works with the existing M5 East Motorway, to be conducted during the evening and night time periods for safety and operational reasons.

Operation

The project would result in the re-distribution of traffic around the project corridor, which would change the operational noise environment of existing surface roads. The project is likely to result in localised increases in road traffic noise from the following components:

- The widening of the M5 East Motorway to enable the integration of the project.
- The St Peters interchange and associated local road connections.
- Any open cut section(s) of the project
- The tunnel portals
- Other sources of operational noise emissions may include ventilation infrastructure, the tunnel control centre and other surface ancillary infrastructure.

4.4.3 Proposed further assessments

A detailed noise and vibration assessment would be undertaken to assess the construction and the operation impacts of the project and to assist in developing noise and vibration mitigation measures. The assessment would include:

- Identification of potentially affected noise and vibration sensitive receivers.
- Establishment of project specific construction noise management levels.
- Establishment of construction vibration goals.
- Identification of out of hours work required during construction.
- An assessment of noise (airborne and ground-borne) and vibration impacts from the construction of the project on identified residential and other sensitive receivers.
- An assessment of road traffic noise from the use of heavy vehicles during the construction of the project.
- An assessment of noise from the operation of the project on identified residential and other sensitive receivers.
- If required, recommendations for feasible and reasonable noise and vibration mitigation measures to be implemented during construction and operation.

The assessment of noise and vibration impacts for the construction and operation of the project would be undertaken in accordance with the following guidelines as relevant:

- NSW Road Noise Policy (DECCW, 2011).
- Environmental Noise Management Manual (RTA, 2001).
- Interim Construction Noise Guideline (DECC, 2009).
- Assessing Vibration: a Technical Guideline (DEC, 2006).
- German Standard DIN 4150 1999: Structural Vibration – Effects of Vibration on Structures.
- British Standard BS7385 1993: Evaluation and Measurement for Vibration in Buildings: Guide to Damage Levels from Ground-borne Vibration.
- Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC, 1990).

4.5 Biodiversity

4.5.1 Overview

Flora

Threatened flora

Database searches of the NSW BioNet Atlas of Wildlife and the EPBC Protected Matters Search Tool identified previous records of 22 listed threatened flora species or their habitat and one threatened flora population as occurring within 10 kilometres of the project corridor (refer to **Table B-1** in **Appendix B**).

Vegetation communities

Wolli Creek Regional Park

Wolli Creek Regional Park is reserved under the *National Parks and Wildlife Act 1974*. It comprises a linear corridor of bushland along Wolli Creek (identified as key fish habitat under the *Fisheries Management Act 1994* (FM Act)), and is considered a vital recreational and educational source for local and regional users containing important flora and fauna habitat and features of cultural and historical significance. A small portion of Wolli Creek Regional Park is located within the project corridor on the northern side of Wolli Creek (refer to **Figure 4-2**). The section of Wolli Creek Regional Park within the project corridor contains a number of native vegetation communities, including Coastal Sandstone Heath-Mallee, Coastal Sandstone Foreshores Forest, Estuarine Reedland and mapped weeds and exotic species.

Wetlands

Eve Street Marsh

Eve Street Marsh is situated within the project corridor west of the Cooks River at Arncliffe, about two kilometres west of Sydney Airport. The marsh is listed on the directory of important wetlands in Australia and covers an area of about two hectares. The Eve Street Marsh is situated on a low lying coastal floodplain and is subject to brackish tidal flows. It is identified as a marine and coastal wetland comprising intertidal mud, sand or salt flats as well as intertidal marshes.

The listing of the marsh notes that it is a wetland which is important as the habitat for animal taxa at a vulnerable stage on their life cycles, or provides a refuge when adverse conditions such as drought prevail. The wetlands are associated with the Green and Golden Bell Frog Lower Cooks River Key Population. Further, a number of threatened migratory species have been previously recorded in this area. The Eve Street Marsh provides habitat for six species listed on the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA), and is of special importance to four of these due to loss of habitat around Botany Bay. The six listed species for which this habitat is particularly significant includes:

- Great Egret (*Ardea alba*).
- Greenshank (Tringa nebularia).
- Curlew Sandpiper (*Calidris ferruginea*).
- Red-necked Stint (*Calidris ruficollis*).
- Sharp-tailed Sandpiper (*Calidris acuminata*).
- Bar-tailed Godwit (*Limosa lapponica*).

It is also considered to be nationally important as it is of outstanding historical or cultural significance. The Eve Street Marsh is a remnant of a once extensive brackish marsh and is considered to be a significant wetland as it is one of the first Australian examples of a rehabilitated tidal marsh that provides habitat for uncommon saltmarsh communities and for migratory wading birds and resident birds. Rehabilitation works have included major earthworks to establish appropriate gradients for tidal inundation, a mangrove lined channel connecting the wetland with the Cooks River and an enlarged tidal pond area in which water level is controlled by a weir. The weir constructed at the outlet of the wetland only permits some high tides from the Cooks River to enter the wetland.

Towra Point Wetlands

Towra Point Wetlands is a RAMSAR listed site and is an estuarine complex comprising a mixture of spits, bars, mudflats, dunes and beaches. It is the largest wetland of its type in the Sydney Basin bioregion and represents vegetation types that are now rare in the area. The wetland system comprises 60 per cent of the remaining saltmarsh communities and 40 per cent of the remaining mangrove communities in Sydney and is an important area for migratory and native bird species, with records in the area of more than 200 species. The Towra Point Wetlands is located about 6.8 kilometres south of the project corridor.

Threatened ecological communities

Searches of the Protected Matters Search Tool, BioNet Atlas of NSW Wildlife and examination of the DPI estuarine habitat maps identified 23 listed threatened ecological communities with the potential to occur within project corridor, as summarised in **Table 4-1**.

The search of the BioNet Atlas of NSW Wildlife was undertaken within the 10 kilometre minimum allowable search area centred on the Project corridor, the search of the Protected Matters Search Tool database was undertaken with about a one kilometre buffer around the Project corridor and the DPI estuarine habitat maps were examined within the Project corridor only.

The Native Vegetation of the Sydney Metropolitan Area dataset (NSW Office of Environment and Heritage, 2013) was also examined to identify any vegetation communities previously mapped within the Project corridor. A search of this dataset identified six threatened ecological communities which are mapped as occurring within the Project corridor, as summarised in **Table 4-1**. Mapped threatened ecological communities within the Project corridor are shown on **Figure 4-2**. Some areas of Sydney Turpentine Ironbark Forest and Cooks River / Castlereagh Ironbark Forest in the Sydney Basin Bioregion mapped within the project corridor are within Beverly Grove Park, which is a biodiversity offset area which was set aside during the initial construction of the M5 East Motorway.

Other vegetation communities

The following vegetation communities have been mapped as part of the Native Vegetation of the Sydney Metropolitan Area dataset (NSW Office of Environment and Heritage, 2014) as occurring within the project corridor:

- Coastal enriched sandstone moist forest.
- Coastal sandstone foreshores forest.
- Estuarine reedland.
- Urban native and exotic cover.
- Coastal Sandstone Heath-Mallee.
- Weeds and exotic cover.

Noxious weeds

The *Noxious Weeds Act 1993* establishes control mechanisms to reduce the negative impacts of weeds on the economy, community and environment. Noxious and environmental weeds are known to be present across the project corridor. Under Section 13 of the *Noxious Weeds Act 1993*, WDA, as a public authority, is obliged to control noxious weeds on land that it owns and to prevent noxious weeds from spreading to adjoining properties.

Fauna

Threatened fauna and threatened fauna populations

Sixty-one threatened fauna species and three threatened fauna populations listed under the EPBC Act and / or the TSC Act or their potential habitat have been previously recorded within 10 kilometres of the project corridor (refer to **Table B-2** in **Appendix B**). Fauna species included:

- Forty bird species.
- One fish species.
- Four frog species.
- Ten mammal species.
- Six reptile species.

The three threatened fauna populations listed under the EPBC Act or TSC Act which have been previously recorded within 10 kilometres of the project corridor include:

- Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (SE mainland population) (*Dasyurus maculatus maculatus*), endangered under the EPBC Act.
- Long-nosed Bandicoot population in inner western Sydney (*Perameles nasuta*), an endangered population under the TSC Act.
- Koala – combined populations of QLD, NSW and ACT (*Phascolarctos cinerus*), a vulnerable population under the EPBC Act.

Other fauna populations

Green and Golden Bell Frog Lower Cooks River Key Population

The Green and Golden Bell Frog Lower Cooks River Key Population is located in the vicinity of the lower Cooks River delta immediately west of Sydney's Kingsford Smith Airport. The population consists of one main population within the wetlands and recreation corridor at Arncliffe, including the Eve Street Marsh.

The Green and Golden Bell Frog Lower Cooks River Key Population at Arncliffe is one of two key populations that fringe the shores of Botany Bay, and one of four that inhabit south-eastern Sydney. Habitat associated with this key population is largely comprised of modified natural or artificially created waterbodies which require ongoing active management. Green and Golden Bell Frogs inhabit wetlands, waterbodies and ponds throughout the wetlands and recreation corridor that are interspersed amongst green space, including golf courses and playing fields, residential development and along major transport and infrastructure routes.

Wolli Creek Regional Park Grey-headed Flying Fox Camp

There is a known Grey-headed Flying Fox (*Pteropus poliocephalus*) population or 'camp' within Wolli Creek Regional Park. The camp is situated close to Wolli Creek within a canopy of Eucalypts and Casuarina trees which were planted in the early 1980s as part of a revegetation project. The camp is thought to have been established in mid-2007 and can include up to several hundred individual flying foxes during summer. The Grey-headed Flying Fox camp is considered seasonal, with the flying foxes heading north for the winter. However, in recent years the camp has continued to be occupied during the winter months, suggesting that it is possible that the camp has moved from being a seasonal camp to a permanent one (Wolli Creek Preservation Society, 2014).

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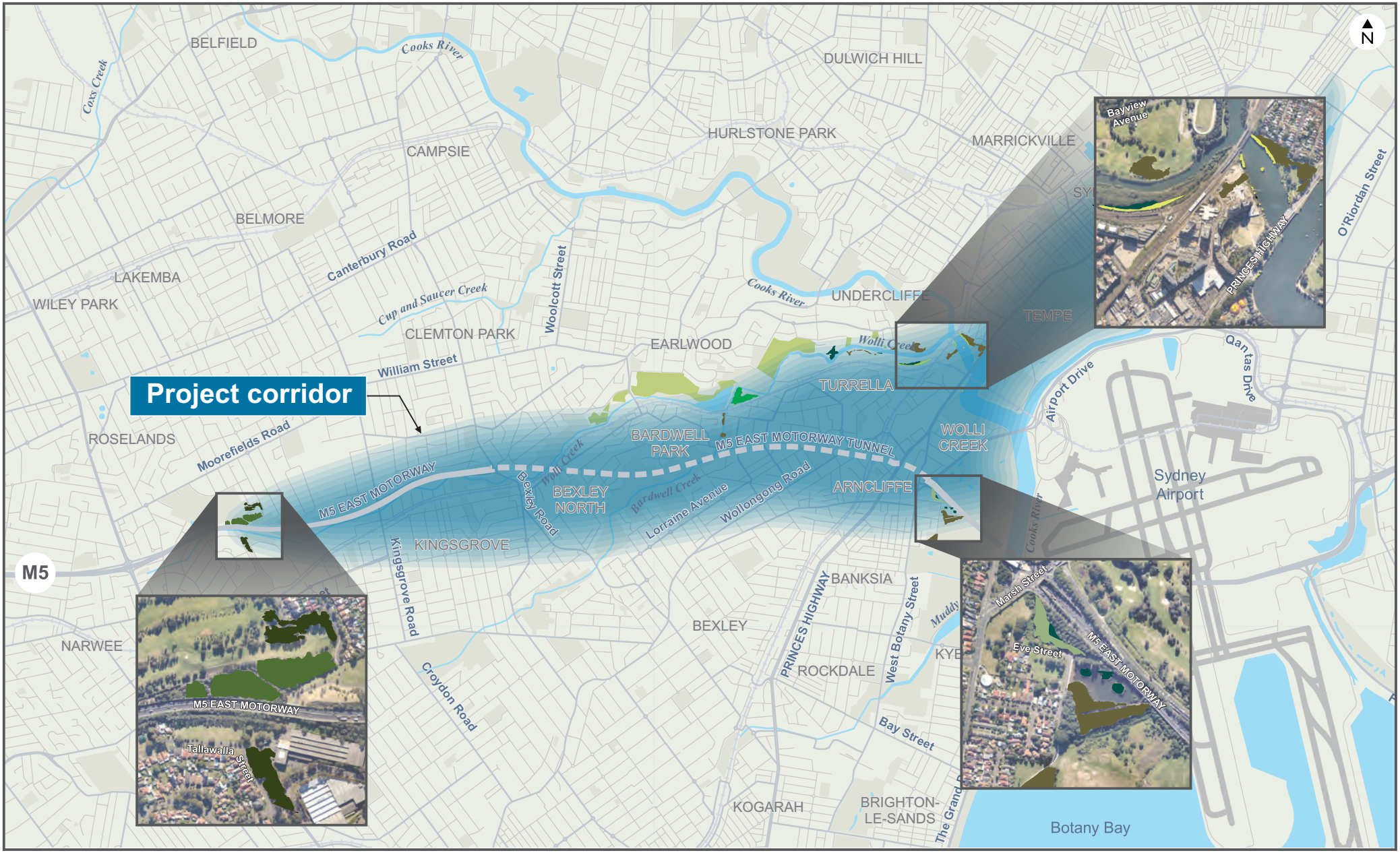
Table 4-1 Threatened ecological communities within 10 kilometres of the project corridor

Ecological community	Commonwealth listing (EPBC Act)		NSW listing (TSC Act/FM Act)		Mapped within Project corridor
	Yes / No	Status	Yes / No	Status	
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions.	No	-	Yes	Endangered	×
Blue Gum High Forest in the Sydney Basin Bioregion.	Yes	Critically Endangered	Yes	Critically Endangered	×
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion.	No	-	Yes	Vulnerable	×
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.	Yes	Vulnerable	Yes	Endangered	✓
Coastal Upland Swamp in the Sydney Basin Bioregion.	Yes	Endangered	Yes	Endangered	×
Cooks River / Castlereagh Ironbark Forest in the Sydney Basin Bioregion.	No	-	Yes	Endangered	✓
Duffys Forest Ecological Community in the Sydney Basin Bioregion.	No	-	Yes	Endangered	×
Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion.	Yes	Endangered	Yes	Endangered	×
Estuarine Mangrove Forest.	No	-	Yes	Protected*	✓
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.	No	-	Yes	Endangered	×
Kurnell Dune Forest in the Sutherland Shire and City of Rockdale.	No	-	Yes	Endangered	×
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.	Yes	Critically Endangered	Yes	Endangered	×
Moist Shale Woodland in the Sydney Basin Bioregion.	Yes	Critically Endangered	Yes	Endangered	×
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.	No	-	Yes	Endangered	✓
Shale gravel Transition Forest in the Sydney Basin Bioregion.	Yes	Critically Endangered	Yes	Endangered	×
Shale / Sandstone Transition Forest.	Yes	Endangered	Yes	Endangered	×
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion.	No	-	Yes	E3	×
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.	No	-	Yes	Endangered	✓
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.	No	-	Yes	Endangered	×
Sydney Freshwater Wetlands in the Sydney Basin Bioregion.	No	-	Yes	Endangered	×
Sydney – Turpentine Ironbark Forest.	Yes	Critically Endangered	Yes	Endangered	✓

Ecological community	Commonwealth listing (EPBC Act)		NSW listing (TSC Act/FM Act)		Mapped within Project corridor
	Yes / No	Status	Yes / No	Status	
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions.	No	-	Yes	Endangered	×
Western Sydney Dry Rainforest in the Sydney Basin Bioregion.	Yes	Critically Endangered	Yes	Endangered	×

*Protected under the Fisheries Management Act 1994



KEY

- Wolli Creek Regional Park
- Road
- Rail
- Watercourse
- Cooks River/Castlereagh ironbark forest
- Sydney turpentine-ironbark forest
- Swamp oak floodplain forest
- River-Flat Eucalypt forest on coastal flood plains
- Coastal saltmarsh
- Estuarine mangrove forest
- Swamp sclerophyll forest

Figure 4-2: Mapped threatened ecological communities within the project corridor

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Km

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Migratory species

Seventeen listed threatened marine migratory bird species listed under the TSC Act and / or EPBC Act have been previously recorded within the project corridor (refer to **Table B-2** in **Appendix B**). There is a large number of records of migratory birds within the Project corridor in the vicinity of the Eve Street Marsh wetlands system, which is recognised for the suitable bird habitat it provides (refer to **Figure 4-2**).

Aquatic habitat

The project corridor encompasses Wolli Creek, Alexandra Canal and the Cooks River. All waterways within the project corridor are declared as key fish habitat by the NSW Department of Primary Industries; being those aquatic habitats that are important to the sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species.

Wildlife corridors

Wildlife corridors are connections across the landscape that link up areas of habitat, while supporting multiple land uses. Wildlife corridors generally comprise native vegetation and connect two or more areas of similar wildlife habitat. Corridors are critical for the maintenance of ecological processes, including allowing for the movement of animals and the continuation of viable processes. Landscape connections between larger areas of habitat through wildlife corridors enable migration, colonisation and breeding of flora and fauna.

Corridors can comprise either discontinuous areas of habitat, such as wetlands and roadside vegetation, continuous lineal strips of vegetation and habitat, such as riparian strips and ridge lines, or parts of a larger habitat area selected for its known or likely importance to local fauna.

Based on their ecological value, the following areas are considered to have potential functionality as wildlife corridors or part of wildlife corridors:

- Vegetation along Wolli Creek, including Wolli Creek Regional Park.
- Vegetation along the F6 reserved road corridor, including the Eve Street Marsh.
- Vegetation along Bardwell Creek, including Kingsgrove Park, Bardwell Valley Parklands, Broadford Street Reserve and Coolibah Reserve.
- Vegetation along the Cooks River north of its confluence with Wolli Creek, including parts of Wentworth Park and Gough Whitlam Park.

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater, such as wetlands and vegetation on coastal sand dunes. The project corridor is located within land that forms part of the Botany Sands Groundwater Source, subject to the provisions of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011*. The Botany Sands Groundwater Source extends to the Botany Wetlands, which includes high priority groundwater dependent ecosystem listed on Schedule 4 of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011.* The mapping of potential high priority groundwater dependent ecosystems in the Botany Sands Groundwater Source notes two potential GDEs about two kilometres south of the project corridor. A search of the National Atlas of Groundwater Dependent Ecosystems (Australian Bureau of Meteorology) did not identify any GDEs within the project corridor.

4.5.2 Summary of issues

The project has the potential to impact on biodiversity, including threatened and protected species, populations and communities. Impacts on biodiversity (direct and indirect) would be mostly associated with areas of surface disturbance. However, potential impacts could potentially occur as a result of surface water discharges, and groundwater drawdown could have impacts on GDEs. The mechanisms by which these impacts could occur include:

- Vegetation clearance at the locations of surface infrastructure and ancillary facilities resulting in habitat loss and edge effects.
- Potential loss of connectivity between habitat areas, resulting in habitat fragmentation.
- Mortality of individuals during both the construction and operation of the project.
- Introduction and / or spread of noxious weeds and other invasive species.
- Impacts to groundwater levels due to groundwater inflows during construction and operation.
- Mobilisation of sediments into waterways and potential pollution from materials used in the process of construction and operation, including discharges from water treatment plants.
- Potential changes to hydrology and geomorphology as a result of the project, including discharges from the water treatment plants.
- Loss of migratory species habitat.

While located within the project corridor, direct impacts to Wolli Creek Regional Park would be avoided through project design.

Further, there is potential for the project to result in alterations to natural surface water flows, loss of hollow bearing trees, and the removal of dead wood and dead trees which are considered to be key threatening processes under Schedule 3 of the *Threatened Species Conservation Act 1995*.

4.5.3 Proposed further assessments

Throughout the environmental assessment process, opportunities to avoid and / or minimise impacts to areas of ecological value would be investigated, where reasonable. A flora and fauna assessment would be prepared as part of the Environmental Impact Statement for the project. The flora and fauna assessment would include:

- Field surveys within the project corridor to determine the presence of endangered ecological communities and other vegetation communities.
- An assessment of impacts of the project on fauna habitat, including native vegetation loss, habitat fragmentation, wildlife corridors, loss of ecological connectivity and weed infestation.
- An assessment of the impacts on biodiversity, including impacts of the project on threatened species populations and ecological communities.
- Identification and management of key threatening processes associated with the construction and operation of the project.
- Recommended safeguards and management measures to minimise the impacts of the project on flora and fauna, in particular, threatened species, populations and communities and critical habitat.
- Assessment of matters of national environmental significance under the EPBC Act and preparation of a referral, if required, in accordance with the requirements of the EPBC Act.

4.6 Visual impacts and urban design

4.6.1 Overview

The project corridor covers a varied urban environment, comprising several distinct landscape character zones and visual catchments.

Kingsgrove to the Cooks River

To the west of the Cooks River, areas predominately consist of established low density residential development located along ridgelines with open spaces forming green corridors along the Wolli Creek and Bardwell Creek valleys. Increased residential densities, with commercial buildings, are located along major roads and within town centres focused around train stations. Pockets of light industrial areas, mostly consisting of large warehouse style buildings, are located at Kingsgrove, Arncliffe and Turrella. Older industrial areas, such as those at Arncliffe, are transitioning from an industrial to residential character. Major transport corridors intersect the area, including the M5 East Motorway and the Sydney Trains suburban rail lines.

The Cooks River

Along the Cooks River, open spaces dominate the low lying areas adjacent to the river, with significant landscape character changes occurring as part of the Wolli Creek redevelopment. Partially completed, this area has been transformed from industrial to a mixed use high rise development with associations with the historic Tempe House (a State Heritage item). Areas along the Cooks River have been re-shaped through reclamation associated with historic land uses and the development of Sydney Airport.

Tempe to St Peters

Moving north-east, the topography gently rises to the north. The urban landscape transitions from low-density and terrace-style residential areas located to the north-west of the Princes Highway, to large warehouse style commercial and industrial developments interspersed with container storage facilities, intermodal facilities and the Alexandria landfill to the south-east of the Princes Highway. Major transport corridors intersect the area, including the Princes Highway, the suburban railway and freight rail lines. Alexandra Canal, an item of State heritage significance under the *Heritage Act 1977* (refer to **Section 4.11.1** for additional information) also passes through the project corridor. The canal has been substantially modified and contains little to no natural features. The banks of the canal are inaccessible for most of its length within the project corridor, with industrial buildings backing onto the canal. Tempe Recreational Reserve, Tempe Wetlands and the Tempe Golf Driving Range are located north of the Cooks River on the eastern side of the Princes Highway, adjacent to the waterway.

Sydney Park

Sydney Park, located on a former industrial area and landfill at the northern extent of the project corridor, represents a large area of public open space. Smaller parks and pocket parks are interspersed within the residential areas to the north-west of the Princes Highway.

4.6.2 Summary of issues

Construction

Construction of the project has the potential for the following urban design and visual assessment related impacts:

- Visual impacts from active construction areas and the introduction of associated construction ancillary facilities. This includes lighting.
- Vegetation clearing within the project corridor.
- Construction traffic management measures such as road barriers and associated construction lighting.
- Construction management measures such as fencing and noise hoarding.

At the St Peters interchange, views of construction activities would be apparent from Sydney Park, to motorists on immediately surrounding roads, and from surrounding industrial and residential areas. Commercial buildings, located along the Princes Highway, would provide some screening for sensitive receivers to the north-west of the highway.

Where the project would be integrated with the M5 East Motorway, the corridor would be widened. Construction activities could be visible from open spaces along the motorway, as well as from residential and industrial areas where changes to motorway overbridges, embankments, noise walls or mounds, and vegetation are directly impacted or require modification.

Operation

Key visual aspects of the project to be addressed in the Environmental Impact Statement include:

- Visual impact of new infrastructure on existing views from residences and surrounding development including:
  - The interchanges and tunnel portals.
  - Surface infrastructure such as ventilation facilities.
  - Gantries and signs.
  - Noise mitigation measures, such as noise barriers and noise mounds, if required. The height and location of any new or modified noise walls (or mounds) would be informed by the future noise impact assessment and would be subject to consideration of the reasonableness and feasibility of such a noise mitigation approach. This would include the consideration of visual impacts.
- Impact to the motorist experience due to visual quality of new motorway infrastructure, structures and elements, and changes to the existing landscape, views and visual characteristics of existing roads.
- Impact on the landscape characteristics of existing open spaces adjacent to the project, and views from these spaces. The integration works associated with the M5 East Motorway may require additional land take within areas currently used for open space. The visual character of these spaces is already defined by the presence of the motorway. However, additional land take (if required) would need to consider any potential impacts on visual character and functionality of these spaces.

- The removal of mature trees and vegetation, if unavoidable through design.
- Overshadowing caused by surface infrastructure.
- Changes in light spill at St Peters interchange or at surface infrastructure.
- Impacts to existing pedestrian and cycle pathways adjacent to, along and across the corridor.
- Landscape character and visual impact associated with the possible creation of residual land areas adjacent to the project.

The visual impacts of the project would be dependent on the design features of the interchanges and other surface infrastructure, landscape treatments and the exploration of opportunities to integrate the surface infrastructure elements with the surrounding features of the area. Design of the portals, the interchange and surface infrastructure would take into consideration their visibility and presence within their context to ensure an appropriate design response. Integration works with the M5 East Motorway would also take into account visual integration with the design of the existing motorway to ensure an appropriate visual transition to and from the project. The design of the project would also be guided by the Urban Design Corridor Framework that is under development for the broader WestConnex program of works. This framework will ensure a consistent high quality design approach and outcome across all three stages.

4.6.3 Proposed further assessments

Further assessment of the potential for visual impacts and landscape character impacts along the project corridor would be conducted as part of the Environmental Impact Statement, which would include:

- Identification of the visual qualities present, including the existing landscape character of the region, sensitive locations, catchments and key viewpoints.
- An assessment of visual impacts from the construction and operational stages of the project on existing views and landscapes.
- An assessment of the urban design elements of the project.
- Identification of urban design mitigation measures, where required.

The design of the project would be in keeping with urban design principles for the project, the WestConnex Urban Design Corridor Framework and the Roads and Maritime guideline Beyond the Pavement: RTA urban design policy, procedures and design principles (RTA, 2009), which identifies the following urban design principles regarding road infrastructure:

- Contributing to urban structure and revitalisation.
- Fitting with the built fabric.
- Connecting modes and communities.
- Fitting with the landform.
- Responding to the natural pattern.
- Incorporating heritage and cultural contexts.
- Designing roads as an experience in movement.
- Creating self-explaining road environments.
- Achieving integrated and minimal maintenance design.

Additional guidelines would be considered, where applicable, during the design development process and the preparation of the Environmental Impact Statement:

- Bridge Aesthetics: Design guidelines to improve the appearance of bridges in NSW (RTA, 2012).
- Noise wall design guideline: Design guidelines to improve the appearance of noise walls in NSW (RTA, 2007).
- Landscape guideline: Landscape design and maintenance guidelines to improve the quality, safety and cost effectiveness of road corridor planting and seed (RTA, 2008).
- Shotcrete Design Guidelines: Design guidelines to avoid, minimise and improve the appearance of shotcrete (RTA, 2005).

4.7 Social and economic

4.7.1 Overview

Demographics

The project is located within the Canterbury, Hurstville, Rockdale, Marrickville, Botany Bay and Sydney Local Government Areas (LGAs). Key statistics of these combined LGAs are summarised in **Table 4-2** below.

Table 4-2 Key population statistics (Australian Bureau of Statistics, 2011)

Statistic	Description
Population	599,010
Median age	35 years
Main occupations	Professionals. Clerical and administrative workers. Technicians and trade workers. Managers.
Average motor vehicles per dwelling	1.3
Total in labour force	309,451
Main mode of travel to work	Marrickville LGA: Car (as driver or passenger) (35.8%), Train (20.5%) Canterbury LGA: Car (as driver or passenger) (58.7%), Train (15.1%) Hurstville LGA: Car (as driver or passenger) (55%), Train (20.8) Rockdale LGA: Car (as driver or passenger) (55.3%), train (18.2%) Botany LGA: Car (as driver or passenger) (56.9%), Bus (13.4%) Sydney LGA: Walk (25.3%), Car (22.8%)

Land use of high social value

Land uses of high social value within the project corridor comprises a mixture of facilities, including areas of for passive and active recreation, including parks, nature reserves, bushland, golf courses and sporting facilities, as well as churches, community halls, child care facilities, schools, medical centres and aged care facilities. A list of land uses of high social value are provided in **Appendix C**. Open spaces and recreational areas within the project corridor are shown on **Figure 4-3**.

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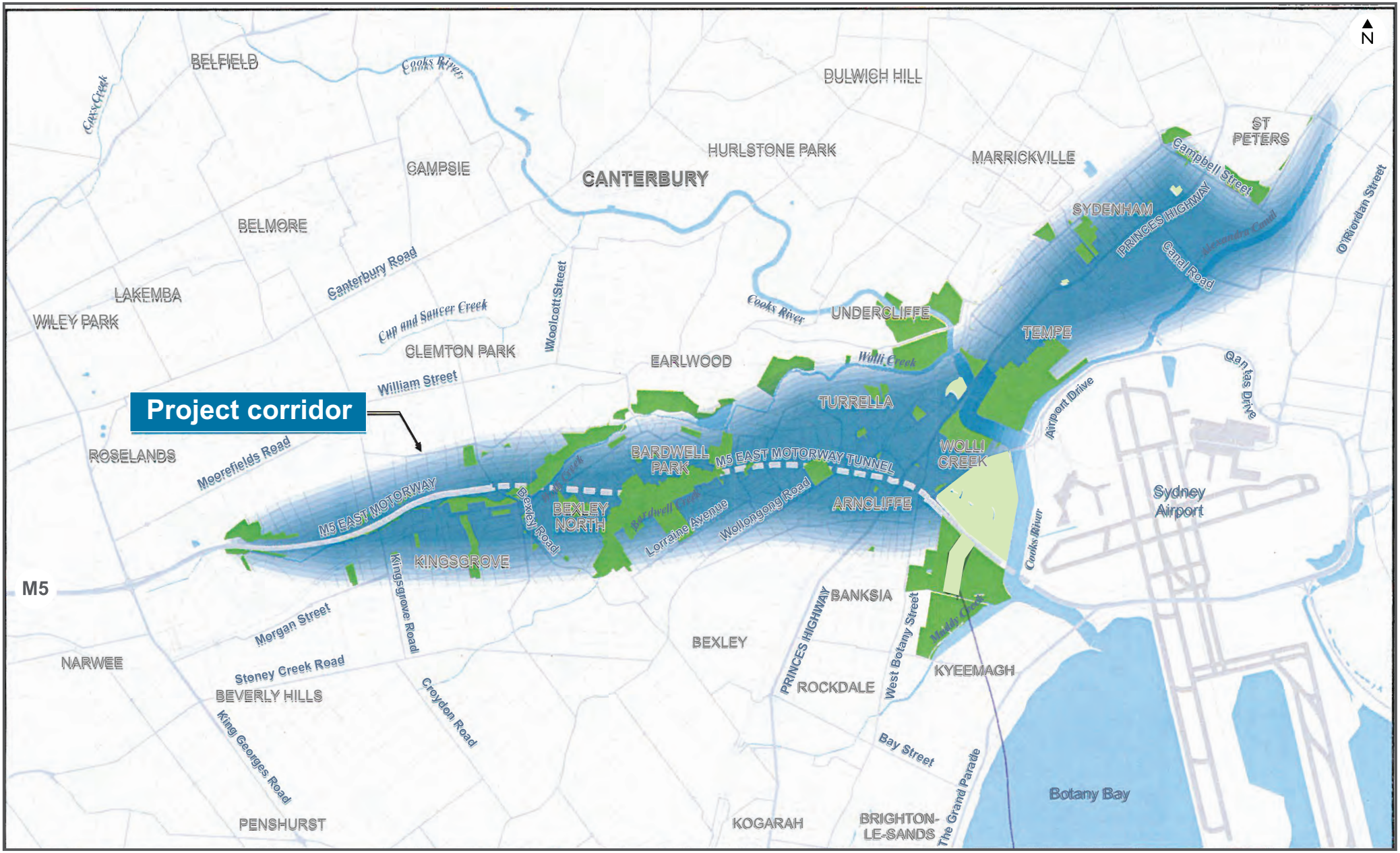

KEY

- Road
- Rail
- Watercourse
- Public Recreation
- Private Recreation

0 1 2 Km

Figure 4-3: Open space and recreational uses within the project corridor

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Economic context

Employment lands

The NSW Government defines employment lands as those lands which are zoned for industrial or similar purposes in planning instruments. The State Government established the Employment Lands Development Program for managing the supply of Employment Lands for the Sydney Region and assisting infrastructure coordination (refer to **Section 6.4** for additional information related to land use).

The draft *Metropolitan Plan for Sydney 2036* sets out employment capacity targets for key strategic employment centres. A summary of these targets for centres relevant to the Project corridor is provided in **Table 4-3**.

Table 4-3 Employment capacity targets of strategic centres relevant to the project

Strategic centre	2006 base employment	2036 long term employment capacity target	2006-2036 employment growth	2006-2036 employment growth (%)
Port Botany	12,000	16,000	+4,000	+33%
Sydney Airport	34,000	56,000	+12,000	+65%
Sydney	358,000	454,000	+96,000	+27%
Hurstville	10,000	17,000	+7,000	+70%
Kogarah	10,000	12,000	+2,000	+20%

Source: Metropolitan Plan for Sydney 2036

Areas of commercial and industrial land use

The M5 East Motorway is the main road freight, commercial and passenger route between Port Botany, the Sydney Airport, and south west Sydney. The motorway also provides access to the wider Sydney arterial and orbital network, including the M4 Motorway and Parramatta Road. The M5 East Motorway is also a key corridor for transport to and from freight intermodal terminals located at Cooks River, Enfield and Clyde.

Interchanges along the M5 East Motorway within the project corridor include intersections of the M5 East Motorway with King Georges Road, Bexley Road and the Princes Highway, as well as the intersection of West Botany Street with Marsh Street. These intersections provide access to areas of commercial and industrial land use within and surrounding the project corridor, including:

- King Georges Road provides a major link between the northern and southern parts of the Sydney orbital Motorway, and provides access to Roselands to the north and Beverly Hills to the south.
- Bexley Road provides access to commercial and retail precincts on Canterbury Road to the north and a number of public recreational spaces in Bardwell Valley to the south.
- Princess Highway provides access to the Sydney CBD to the north, Rockdale town centre to the south and industrial areas at St Peters, Alexandria, Marrickville and Tempe.
- West Botany/Marsh Street provides access to recreational facilities such as Arncliffe Base fields to the south and access to the Airport in the north.

4.7.2 Summary of issues

Construction

Construction of the project has the potential for the following social and economic related impacts:

- Impacts associated with property acquisition, including uncertainty for residents and business owners about the property acquisition process and potential need to relocate.
- Disruption to access to private properties, businesses and community facilities.
- Some increased trade during construction due to customers from the construction workforce.
- Impacts associated with acquisition (temporary and / or permanent) of areas of high social value.
- Temporary changes to access and potential for traffic delays and disruptions near to construction work, including for motorists, public transport users, pedestrians and cyclists, commercial and freight transport operators, and emergency services.
- Impacts on amenity for local residents, businesses and users of community facilities (including schools) located close to the construction compounds and proposed construction work, as a result of increased dust, noise and traffic from construction activities, including the haulage of spoil material and parking for construction workers.
- Temporary disruption to pedestrian and cycle access near construction work, including potential changes between King Georges Road and Bexley Road.
- Potential impacts on road safety for motorists, cyclists and pedestrians near to construction work and construction compounds, particularly at interchange upgrade locations.
- Potential impacts on the use of sections of Sydney Park, particularly along the edges close to Campbell Road. Barwon Park Road, the Princes Highway, Sydney Park Road and Euston Road.

Operation

There is the potential for operation of the project to have the following economic and amenity-related benefits:

- Improved access, connectivity and reliability for local and regional businesses, freight and communities.
- Improved amenity for residents, pedestrians and other users along major roads related to a reduction in road traffic noise and improved air quality.
- Increased road capacity to service growth in employment lands and residential developments.
- Improved travel times along local surface roads as a result of a reduction in congestion.
- Improved freight travel times for vehicles using the Project.
- Improved access to Sydney Airport and Port Botany.
- Improved accessibility for businesses.
- Community perceptions about increased severance, cohesion and access.
- Bypassing of suburbs, which would impact on businesses that rely on trade from passing vehicles.
- Amenity impacts to properties close to the project, due to changes in traffic noise, visual impacts of surface infrastructure and potential changes in air quality.
- Changes to local access and connectivity near surface roads.

A reduction of heavy vehicle traffic on major arterials would allow traffic to flow more freely, increasing local accessibility and reducing travel times for motorists, pedestrians and cyclists. The project would also provide a continuous motorway-standard service for vehicles travelling to and from western Sydney and the Sydney Orbital Network, facilitating more efficient movement of freight between centres of important economic activity. This would likely generate productivity benefits for the State economy, as well as other less tangible benefits related to potential increases in regional development.

The potential for increased severance, cohesion and access is anticipated to be minor, as the majority of the project would be in tunnel. However, surface components may fragment land and alter accessibility for residents and other users of these areas. Such changes are not expected to result in a significant loss of community cohesion within the area.

In removing a portion of traffic from surface roads, the project may have an impact on some businesses that rely on trade from passing vehicles (for example, service stations and fast food outlets). Alterations to traffic flow throughout the local road network may have similar implications for businesses in other suburbs.

4.7.3 Proposed further assessments

A social and economic impact assessment would be undertaken which would consider the potential impacts of the project (beneficial and adverse, as well as direct and indirect), including:

- A description of the social and economic profile for the communities and businesses surrounding the project.
- An assessment of the potential positive and negative impacts of the project on the social and economic values of the area during construction and operation.
- Identification of appropriate management and safeguard measures.

The assessment would consider the Environmental Planning and Impact Assessment Practice Note – Socio-Economic Impact Assessment (RMS, 2013).

4.8 Land use and property

4.8.1 Overview

The project corridor spans the Hurstville, Canterbury, Rockdale, Marrickville, Botany Bay and City of Sydney local government areas. Land use and existing development within and around the project corridor is predominately urban in nature, containing a mix of residential, commercial, industrial and open space uses. There are several major transport corridors and infrastructure located in or adjacent to the study area, including the M5 East Motorway, the Princes Highway, the Sydney Trains suburban rail network and Sydney Airport.

Land uses within the project corridor comprise a mix of the following:

- Residential land

  Predominately low density residential, with medium and high density residential land uses located in areas close to public transport and along major roads. Land use changes are occurring within the project corridor as older industrial areas are redeveloped for residential purposes. This includes the significant mixed use redevelopment at Wolli Creek within the Rockdale local government area.

- Open space

  Nature reserves, active recreational uses (such as golf courses and sports grounds) and passive recreational uses, are located throughout the project corridor. This includes the Wolli Creek Regional Park, Cahill Park, Barton Park, the Kogarah Golf Course, Tempe Recreation Reserve and Sydney Park. Continuous open space corridors, consisting of smaller open spaces, are located along Bardwell Creek and Wolli Creek.

- Industrial and commercial land

  Concentrated in the suburbs of Kingsgrove, Turrella, Wolli Creek, Arncliffe, Tempe, St Peters, Mascot and Alexandria. Commercial uses are typically concentrated along major roads (such as the Princes Highway) and at train stations, alongside medium and high density residential uses. Community facilities, churches, schools, medical and veterinary centres are located along the length of the project corridor.

Land zoning within the project corridor is set by the following environmental planning instruments:

- *Sydney Regional Environmental Plan No. 33 – Cooks Cove.*
- *Hurstville Local Environmental Plan 2012.*
- *Canterbury Local Environmental Plan 2012.*
- *Rockdale Local Environmental Plan 2011.*
- *Botany Bay Local Environmental Plan 2013.*
- *Marrickville Local Environmental Plan 2011*.
- *Sydney Local Environmental Plan 2012*.

The regional zoning context of the project and the land use zoning within the project corridor are shown on **Figure 4-4** and **Figure 4-5** respectively. The zoning generally reflects actual land uses within project corridor and includes:

- General and light industrial.
- Business (ie commercial) zones, including centres, enterprise corridors along major road and business parks.
- Residential zones, ranging from low to high density.
- Mixed use zones (commercial and residential).
- Special infrastructure zones, which align with major transport infrastructure and corridors, as well as drainage, electricity infrastructure and educational establishments.
- Recreational zones (private and public).
- Conservation and waterways zones, including national parks and nature reserves.

A number of strategic planning initiatives are also underway within the project corridor. This includes:

- The Princes Highway Corridor.
- Cooks Cove Precinct.
- The Mascot Station Town Centre Precinct (City of Botany Bay Council) and the Mascot Station Urban Activation Precinct (Department of Planning and Environment).
- Zoned and proposed employment lands.

The Princes Highway Corridor Strategy, an initiative of Rockdale City Council, was adopted by the Council in late 2013. The strategy focuses on revitalising the corridor within the Rockdale local government area for employment uses and growing the Arncliffe town centre. This strategy recommends the changes to the distribution of residential, mixed use and business zones, as well as increased densities.

The Cooks Cove Growth Centre is a 100 hectare precinct, which is bounded by the Cooks River and Muddy Creek, Marsh Street, West Botany Street and Bestic Street. It is subject to Sydney Regional Environmental Plan No. 33 – Cooks Cove. Preliminary strategies identified an area for employment uses near Marsh Street with the remainder of the site to be set aside for conservation, open space and recreational purposes. Planning for the site is now being handled by the Urban Growth Development Corporation.

The Mascot Station Town Centre Precinct, an initiative of City of Botany Bay Council, is centred on the Mascot railway station and is partially located within the project corridor. The area has been rezoned as part of the *Botany Bay Local Environmental Plan 2013*, and will allow for the intensification of residential and commercial land uses. The Department of Planning and Environment have also announced the Mascot Station Urban Activation Precinct, which also covers the area in the vicinity of the station. This strategic initiative would investigate the feasibility of increased residential and commercial uses in proximity to Mascot Station. These investigations are presently on hold to consider the interaction with WestConnex.

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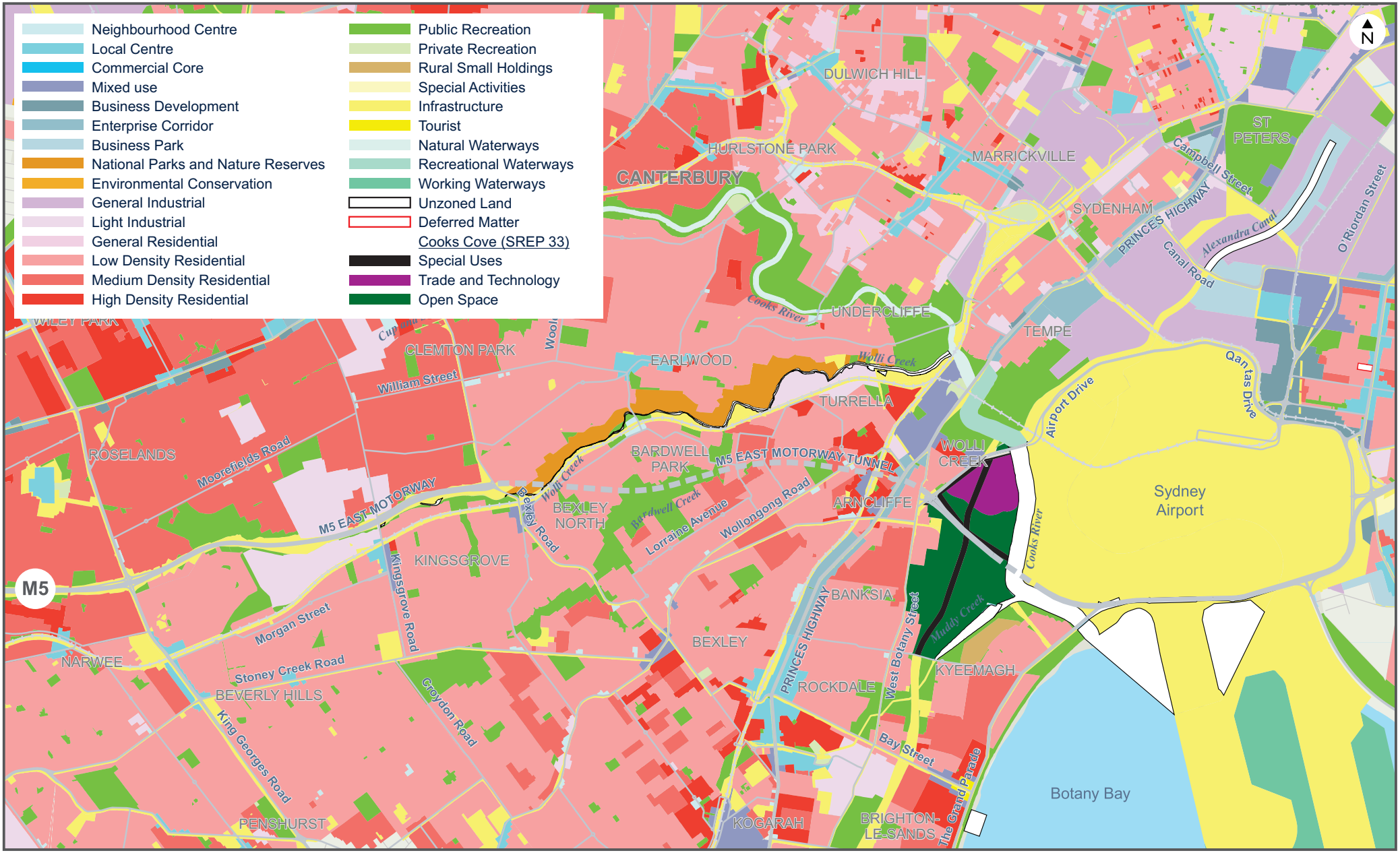

KEY

Road
Rail
Watercourse

Figure 4-4: Regional zoning context

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Km

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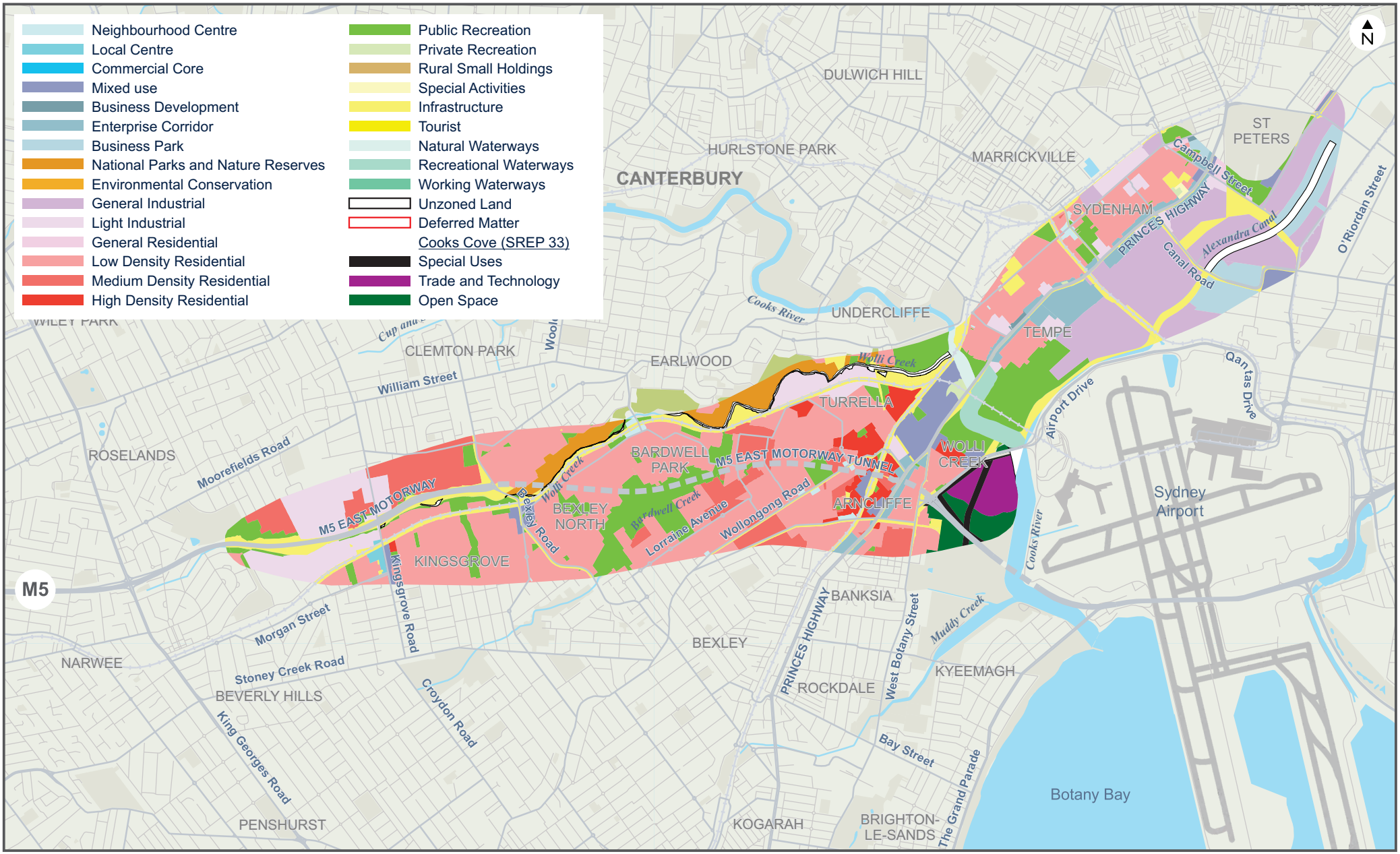

Figure 4-5: Land use zoning within the project corridor

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