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WestConnex – M4 Widening

State Significant Infrastructure Application Report

September 2013

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State significant infrastructure

Application report

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Executive summary

The NSW Government is proposing to widen and upgrade approximately 7.5 kilometres of the M4 Western Motorway between Pitt Street, Parramatta and Homebush Bay Drive, Homebush.

The NSW Government is establishing a WestConnex Delivery Authority (WDA) to deliver the WestConnex scheme. The Authority will be established as an independent subsidiary agency of Roads and Maritime Services (RMS). For the purpose of the project planning for the M4 Widening project, RMS will be the proponent.

The project is a component of the WestConnex scheme. WestConnex is a proposed 33 kilometre motorway to link Sydney's west with the airport and the Port Botany precinct. WestConnex would include widening of the M4 Motorway east of Parramatta, an extension of the M4 Motorway east from Homebush Bay Drive to Parramatta Road and City West Link at Haberfield, a further stage from City West Link to Camperdown and St Peters and a new link from St Peters to the M5 East as well as the M5 East Duplication.

WestConnex aims to accommodate the growing transport needs of greater Sydney and strengthen access for industry to commercial centres, improving growth opportunities for local businesses. It is also designed to stimulate urban renewal along the Parramatta Road corridor.

The M4 Widening project would include the following key features:

- Construction of a new two lane westbound viaduct south of the existing viaduct structure between Church Street, Parramatta and Wentworth Street, Granville.
- Reconfiguration of the traffic lanes on the existing viaduct structure to four lanes eastbound and two lanes westbound.
- Construction of a new bridge / viaduct over Duck River.
- Widening of the at-surface carriageway of the motorway predominantly within the existing motorway corridor, between Junction Street, Auburn and Homebush Bay Drive, Homebush to provide four traffic lanes westbound and four traffic lanes eastbound.
- Upgrades to existing interchanges including provision of additional ramps and widening and/or lengthening of existing ramps.
- Construction of a new westbound G-type entry ramp to the M4 Motorway at Homebush Bay Drive.
- Provision for new connections to the M4 Motorway at Hill Road, Church Street and at Westmead.
- Provision of road infrastructure and services to support the future implementation of the managed motorway including Intelligent Transport Systems (ITS) infrastructure and widening/lengthening of existing ramps.
- Installation of tolling infrastructure such as gantries and control systems.

RMS has formed the opinion that the impacts of the project on the issues listed below would be likely to significantly affect the environment and require the preparation of an environmental impact statement under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). Accordingly, the project is State significant infrastructure under Part 5.1 of the EP&A Act. Approval from the Minister for Planning and Infrastructure is required for the project.

Preliminary environmental assessments carried out for this application report indicate the following key issues will require detailed assessment and may require project specific impact management and safeguard measures:

- Traffic and transport.
- Noise and vibration.
- Socio-economic.
- Land use and property.
- Urban design.

A number of other environmental issues have also been identified. These issues are outlined within this report 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.

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Abbreviations and glossary

Term	Definition
ABS	Australian Bureau of Statistics
Afflux	An increase in water level resulting from obstacles in the flow path
AHD	Australian height datum
AHIMS	Aboriginal Heritage Information Management System
Alluvium	Relatively recent deposits of sedimentary material laid down in river/creek beds, floodplains, lakes, or at the base of mountain slopes
Aquifer	An underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, or silt) from which groundwater can be usefully extracted
Batter	The slope of walls, embankments and cuttings, usually expressed as a ratio of horizontal distance unit to one vertical height unit, eg 2H:1V
Carriageway	The portion of a roadway devoted to vehicular traffic generally delineated by kerbs, a verge or a median
CBD	Central Business District
CEMP	Construction environmental management plan
CHAR	Cultural heritage assessment report
CO	Carbon monoxide
Culvert	An enclosed channel for conveying water below a road
Curtilage	The land immediately surrounding a house or dwelling, including any closely associated buildings and structures
Threatened ecological community	Ecological communities that are listed under the *Threatened Species Conservation Act 1995* as critically endangered, endangered or vulnerable, depending on their risk of extinction.
EIS	Environmental impact statement
EPA	NSW Environmental Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979 (NSW).*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).
EMS	Environmental management system

Term	Definition
Environmental assessment (process)	A specialised part of the decision-making process, where the environmental impact of a development or proposal or activity is considered in detail, together with other aspects of the development
Grade separation	The use of an underpass or overpass to separate road, rail or other traffic that cross each other, so that crossing movements do not conflict.
Greater Sydney Metropolitan Area/Region	A general term to define Sydney and its surrounding metropolitan areas covering all of the Sydney basin, the Lower Hunter and the Illawarra.
Habitat	The place where an organism lives.
Interchange	A grade separated junction between roads where the local road passes above or beneath the highway via bridge or underpass structure with one or more interconnecting roadways
ITS	Intelligent Transport Systems
km/h	Kilometres per hour
LALC	Local Aboriginal Land Council
LEP	*Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act*
LGA	Local government area
Motorway	A tolled highway
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
OEH	Office of Environment and Heritage (formerly Department of Environment, Climate Change and Water)
PACHCI	RMS' *Procedure for Aboriginal Cultural Heritage Consultation and Investigation*
PHALMS	Parramatta Historical Archaeological Landscape Management Study
$PM_{2.5}$	Airborne particulate matter with equivalent aerodynamic diameter of 2.5 microns or less.
PM_{10}	Airborne particulate matter (such as airborne dust or silt) with equivalent aerodynamic diameter of 10 microns or less.
RMS	NSW Roads and Maritime Services
RNP	Road noise policy

Term	Definition
SEPP	State environmental planning policy
SHR	NSW State heritage register
SMPO	Sydney Motorways Project Office
TEU	Twenty-foot equivalent units
Threatened	As defined under the *NSW Threatened Species Conservation Act 1995.* A species, population or ecological community that is likely to become extinct or is in immediate danger of extinction
TSC Act	*Threatened Species Conservation Act 1995 (NSW)*
Tunnel portal	The entrance/exit structures at each end of a tunnel
Viaduct	A long bridge generally composed of a series of spans over land, which carried a road, or railway. The term is used to distinguish an aqueduct, which is a bridge, supporting a pipe, or channel, carrying water
VMS	Variable message sign
WSUD	Water sensitive urban design

1 Introduction

1.1 Overview of the project

The NSW Government is proposing to widen and upgrade approximately 7.5 kilometres of the M4 Western Motorway (the M4 Motorway) between Pitt Street, Parramatta and Homebush Bay Drive, Homebush (hereafter referred to as the project).

The project spans four local government areas including Holroyd City Council, Parramatta City Council, Auburn City Council and Strathfield Council, and includes the widening of the existing motorway to four lanes each way and the upgrade of existing interchange points along the motorway.

The NSW Government is establishing a WestConnex Delivery Authority (WDA) to deliver the WestConnex scheme. The Authority will be established as an independent subsidiary agency of Roads and Maritime Services (RMS). For the purpose of the project planning for the M4 Widening project, RMS will be the proponent.

Other components of WestConnex include:

- Stage 1(b): M4 East – Homebush Bay Drive to Parramatta Road and City West Link.
- Stage 2: M5 East Airport Link – King Georges Road, Beverly Hills to St Peters.
- Stage 3: M4 South – Haberfield to St Peters via Camperdown.

These components will be assessed separately as each stage is developed further.

WestConnex would extend the M4 Motorway east to the Camperdown area and south to Sydney Airport and duplicate the existing M5 East as an integrated scheme. The strategic benefits of WestConnex are outlined in Section 2.1 of this report and the regional context of the scheme is shown in Figure 1-1.

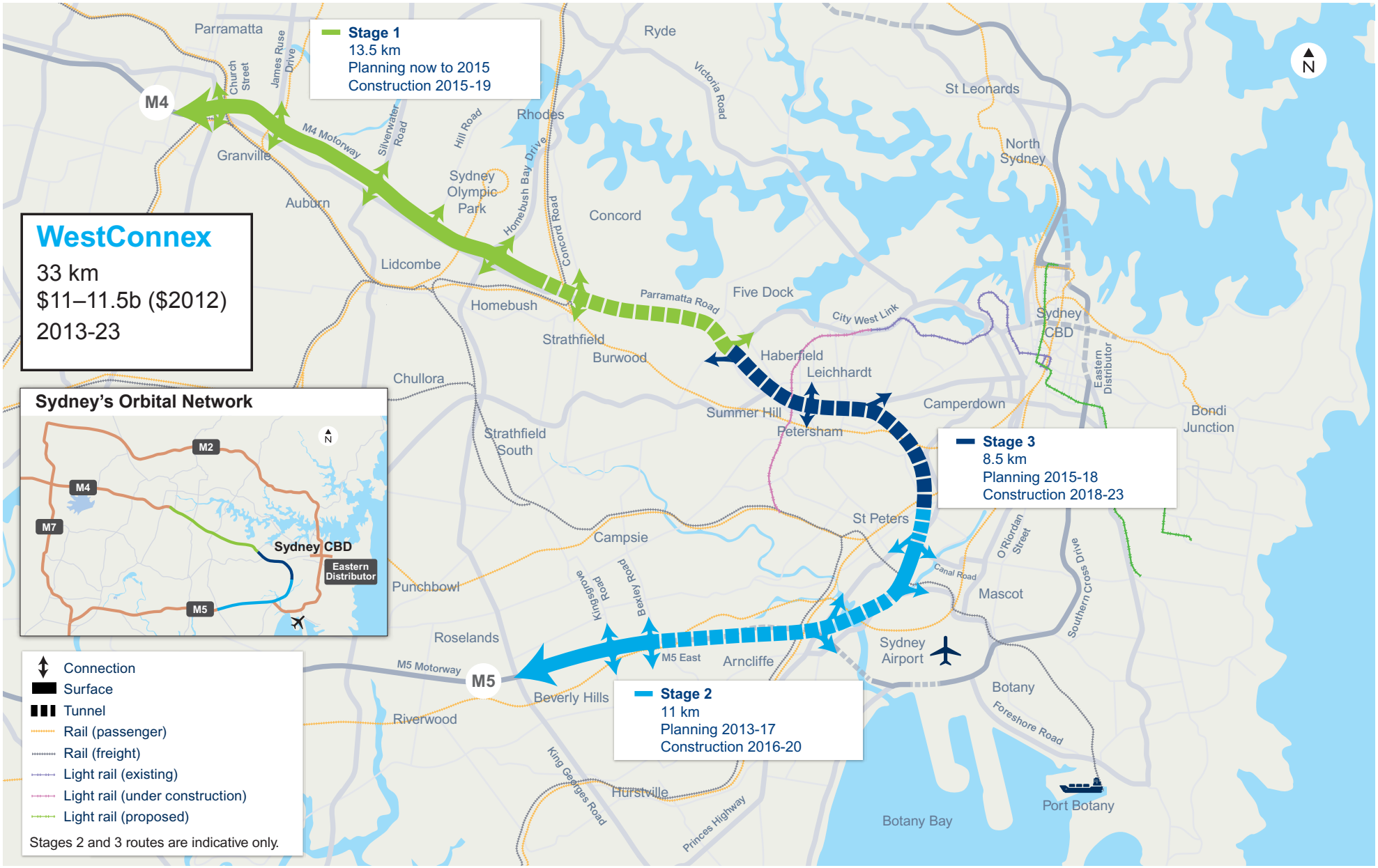

Figure 1-1 Overview of WestConnex

The M4 Widening project would include the following key features:

- Construction of a new two lane westbound viaduct south of the existing viaduct structure between Church Street, Parramatta and Wentworth Street, Granville.
- Reconfiguration of the traffic lanes on the existing viaduct structure to four lanes eastbound and two lanes westbound.
- Construction of a new bridge / viaduct over Duck River.
- Widening of the at-surface carriageway of the motorway predominantly within the existing motorway corridor, between Junction Street, Auburn and Homebush Bay Drive, Homebush to provide four traffic lanes westbound and four traffic lanes eastbound.
- Upgrades to existing interchanges including provision of additional ramps and widening and/or lengthening of existing ramps.
- Construction of a new westbound G-type entry ramp to the M4 Motorway at Homebush Bay Drive.
- Provision for new connections at:
  - Hill Road - an eastbound entry ramp
  - Church Street – a westbound entry for southbound traffic on Church Street
  - Westmead – eastbound exit ramp.
- Provision of road infrastructure and services to support the future implementation of the managed motorway including Intelligent Transport Systems (ITS) infrastructure which would include:
  - Traffic signals.
  - Vehicle detection devices.
  - Variable Message Signs (VMS).
  - Closed circuit television (CCTV).
  - Emergency telephones.
  - Variable speed limit signs.
  - Cabling and fixed signage.
- Widening and/or lengthening of existing ramps to provide for the Managed Motorway implementation at Church Street, James Ruse Drive, Silverwater Road, Hill Road and Homebush Bay Drive.
- Installation of tolling infrastructure such as gantries and control systems.

A description of the project is provided in Section 3. Key features of the project are shown in Figure 1-2.

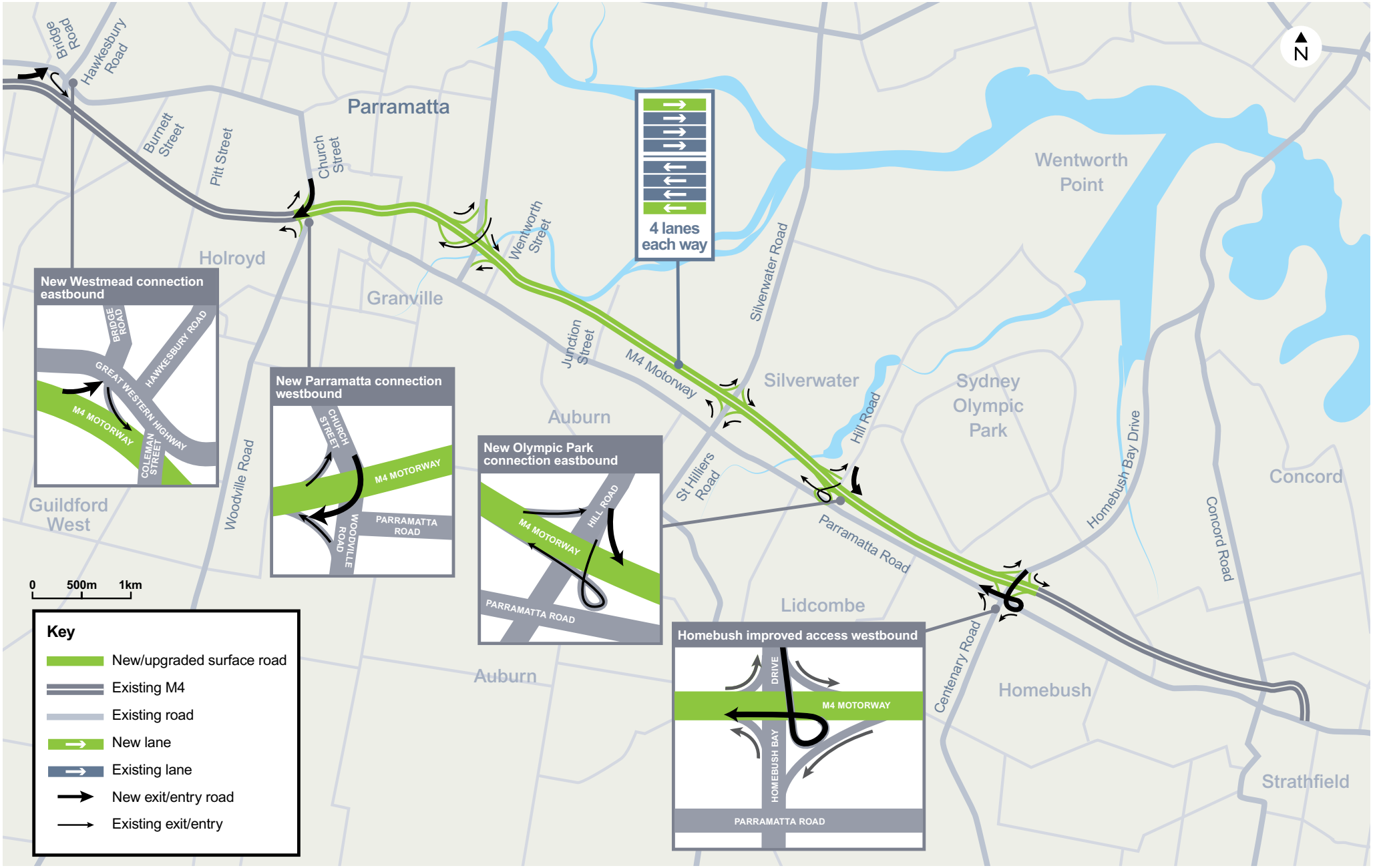

Figure 1-2 M4 widening project location and key features

1.2 Purpose of this document

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

RMS has formed the opinion that the impact of the project on noise and vibration, traffic, socio-economic, land use and property and urban design considerations would be likely to significantly affect the environment and would require an environmental impact statement to be obtained under Part 5 of 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 State significant infrastructure under Part 5.1 of the EP&A Act and requires the approval of the Minister for Planning and Infrastructure.

The requirements of clause 192 of the *Environmental Planning and Assessment Regulation 2000* for applications seeking approval of the Minister for Planning and Infrastructure 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 Director-General under section 115Y of the EP&A Act. The application report:

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

The application report and Director-General'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*.

2 Background

2.1 Strategic context and project need

The M4 Widening project is one component of the WestConnex scheme which is one of the NSW Government's major infrastructure priorities. The M4 Widening would be the first project for the WestConnex scheme.

The M4 Motorway is an important link between people living in western Sydney and jobs located in the east within the Sydney Central Business District (CBD) and surrounding suburbs. Currently the M4 Motorway finishes at Strathfield about 12 kilometers west of the CBD where it joins Parramatta Road, resulting in the lack of a high quality road network in the inner west. Both the M4 Motorway and Parramatta Road experience heavy congestion, slow speeds and unreliable travel times especially in the morning and afternoon peak, as well as at other times of the day.

The M4 Widening project, as the first part of the WestConnex scheme, would provide opportunities to transform local centres that exist alongside the M4 Motorway and better connect them as they grow. The M4 Widening is needed to:

- Support the economic development of Sydney's regional cities including Parramatta and Penrith and provide a high quality road connection between Parramatta and the Global Economic Corridor (GEC) to support Parramatta's evolution as a potential second CBD to Sydney.
- Provide additional capacity to address existing traffic congestion on the M4 Motorway and on existing parallel arterial routes of Parramatta Road and Victoria Road. This traffic congestion is currently causing poor amenity along the arterial routes and places constraints on the operation of existing businesses and efficient movement of freight.
- Make provision for predicted increased traffic demand due to population and employment growth in the local area including high growth localities in the Parramatta to Strathfield corridor, including Sydney Olympic Park.

The project, together with Stage 1(b): M4 East – Homebush Bay Drive to Parramatta Road and City West Link, will form an important connection and provide better amenity along Parramatta Road.

It is a NSW Government commitment to deliver WestConnex for Sydney in response to the recommendations from Infrastructure NSW in its State Infrastructure Strategy (Infrastructure NSW 2012) and Transport for NSW's (TfNSW's) *Long Term Transport Master Plan (*LTTMP*)* (TfNSW 2102a). In addition, the *Draft Metropolitan Strategy for Sydney to 2031* (Draft Metropolitan Strategy) (NSW Government 2013) identifies WestConnex as an important corridor and a catalyst for major urban renewal.

WestConnex aims to accommodate the growing transport needs of greater Sydney and strengthen access for industry to commercial centres, improving growth opportunities for local businesses. It is also designed to stimulate urban renewal along the Parramatta Road corridor.

WestConnex seeks to address the challenges that road users and the community encounter on a daily basis, moving between Western Sydney, the CBD and the Port Botany/Sydney Airport precincts including:

- The missing link in the Sydney motorway network's east-west spine created by the M4 Motorway terminating at North Strathfield – constraining movements between Sydney's west, its international gateways and key places of business.
- Congestion, low travel speeds and unreliable travel times on the M4 Motorway and M5 East Motorway, Parramatta Road and in the Sydney Airport/Port Botany precinct that delay freight, private and business trips and public transport (buses) adding cost to doing business in Sydney.
- Poor urban amenity along Parramatta Road and Sydney's inner west due to heavy traffic volumes and congestion throughout weekdays and on weekends.

The impacts of these challenges are significant given around 30 per cent of Sydney's population (1.2 million people) and around 30 per cent of its employment (600,000 jobs) is located within the broader M4 Motorway and M5 East corridors (BTS 2012). These corridors comprise highly urbanised and complex communities with local concerns and issues which need to be incorporated into the detail of the transport solutions for the area.

WestConnex also responds to future strategic challenges pertinent to Sydney's economic productivity and liveability, including:

- Population growth of around 1.3 million people and jobs growth of 625,000 by 2031 (BTS 2012) in the Sydney Region, generating significant demand for travel on an already constrained network. This represents almost one-quarter of Sydney's population growth and around one-third of new jobs.
- An additional 36 million passengers forecast at Sydney Airport by 2033 (SACL 2013, p.38), resulting in significant vehicle trip generation on a heavily constrained and complex part of the road network. Traffic in the Sydney Airport precinct is a mixture of airport traffic and through traffic destined for Port Botany, Sydney CBD and Sydney's north.
- Annual container trade through Port Botany in 2010 was around two million standard containers measured as twenty-foot equivalent units (TEUs) and is growing at a faster rate than previously forecast (TfNSW 2012a). Given available capacity at the port, it is assumed that Port Botany will remain the primary container facility for NSW if landside access is improved. There is the potential for Port Botany to cater for seven million TEUs in the longer term. While freight rail will play an increasing role in the future, this high growth in trade would need to be accommodated by road. In line with population and employment growth, non-containerised freight and commercial trips are also forecast to grow across a wide range of sectors, all of which will be road-based trips.
- The Enfield Intermodal Terminal located about 18 kilometres west of Port Botany (currently under construction) is likely to generate more freight vehicle trips on the M4 Motorway and King Georges Road, once completed.

The Draft Metropolitan Strategy (NSW Government 2013) sets the framework for Sydney's growth and prosperity to 2031 and beyond. To drive the sustainable growth of Sydney, the strategy has identified 'Balanced Growth' as a key outcome. To achieve this outcome, nine 'City Shapers' to guide and influence future development in the Greater Sydney Metropolitan Area have been identified because of their scale and the opportunities they present for change and investment in Sydney. Parramatta and the Parramatta Road corridor (which includes a section of the M4 Motorway) are identified as two of the City Shapers. Parramatta is the economic focal point for Western Sydney and considered Sydney's second largest concentration of employment in the Sydney Region. The Parramatta Road corridor has been identified as an important connection

between the Sydney CBD and North Sydney with Parramatta via Sydney Olympic Park. Improved road connections and urban renewal have been identified as key priorities along the Parramatta Road corridor.

2.2 Core project objectives

The core objectives of the M4 Widening project 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 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 renewal, 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 a way that is affordable and equitable.

These core objectives are consistent with the core objectives of the WestConnex scheme. An additional specific objective of the M4 Widening project is to enable integration with the subsequent stages of WestConnex while not significantly impacting on the surrounding environment in the interim period.

Additionally, the M4 Widening project, consistent with the WestConnex scheme, includes an objective to protect natural and cultural resources and enhance the environment through the following key approaches:

- Manage noise in accordance with the NSW Road Noise Policy and realise opportunities to reduce or mitigate noise impacts
- Minimise impacts on natural systems including biodiversity.
- Minimise impact on Aboriginal and European cultural heritage.
- Protect surface and groundwater sources and water quality including management of contaminated areas.
- Reduce susceptibility and minimise impact on flooding.
- Minimise construction and operational energy use.
- Integrate sustainability considerations throughout the design, construction and operation of the project including consideration of the Infrastructure Sustainability Council of Australia (ISCA) Sustainability Rating tool scorecard.
- Provide for improvement of social and visual amenity.

2.3 Consultation

Community consultation has been previously undertaken in 2003 on potential route options for the M4 Motorway, which are of similar length and nature as the current design and encompass similar demographic characteristics and current local government areas. This previous consultation identified across the study area a particular interest in the environmental aspects of proposed tunnel projects, particularly around air quality, heritage and traffic impacts. Additionally consultation has been undertaken for the current project.

Issues raised during the community consultation pertinent to the M4 Widening include:

- Access and traffic impacts on local areas.
- Safe accessibility to homes, schools and services.
- Construction impacts (noise, dust, vibration, visual, traffic (heavy vehicles) etc).
- Environmental impacts (flora and fauna, surface water, groundwater, sedimentation, heritage etc).
- Impacts on properties and perceived impacts on property values.
- Need to consider alternative modes of transport, particularly public transport and cyclists.

Stakeholder consultation for the M4 Motorway to date has included an industry briefing held on 17 December 2012, online engagement survey conducted from 24 August to 1 October 2012 and from 6 November to 28 February 2013, discussions with a series of market research groups held during March 2013 and a roundtable discussion with local Councils held on 28 March 2013.

The purpose of the stakeholder consultation to date has been to raise awareness of the project through the website, a project information phone line, emails to registered stakeholders and a mail out of a postcard to about 20,000 residences.

A range of consultation methods have been utilised to seek input and identify issues including:

- A website www.westconnex.com.au with background information, maps, videos, customer surveys and details for how to provide feedback.
- A feedback telephone line 1300 660 248.
- A project email address WestConnex@smpo.nsw.gov.au to notify registered stakeholders, solicit comment and respond to community feedback.
- A postal address Sydney Motorways Project Office 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* and the *Daily Telegraph*, advertising targeting public transport users in *mX* magazine and online advertising targeting road users.
- Media announcements that were widely covered in metropolitan television, radio, print and digital news outlets along with trade and advocacy publications such as NRMA's *Open Road* magazine.
- 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.

Further detail is given below.

2.3.1 Animation and website

A website has been set up for the scheme at:
http://engage.haveyoursay.nsw.gov.au/westconnex

Animation explaining the key concepts of the WestConnex scheme is included on the website.

2.3.2 Stakeholder letter and targeted briefings

A letter introducing the scheme's 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.

2.3.3 Have your say

A mail-out to about 20,000 residences within the area of the WestConnex scheme was undertaken in 2012 to provide information regarding the M4 Motorway and contact details in order for residents to provide feedback concerning how they would like to be contacted. Other questions posed included:

- How frequently do you use the M4 and for what purpose?
- Do you usually use the M4 for most of your trips in peak periods (ie use the M4 when heavily congested) – in the am or pm and city-bound or west bound?
- How do you rate your current driving experience on the M4 (eg find it very frustrating and stressful due to heavy congestion)?
- Have you driven on a 'managed motorway' before? How would you rate your experience?

2.3.4 Media releases

A comprehensive media campaign is also ongoing for the scheme. Advertisements in various media such as *mX* magazine, as well as the *Sydney Morning Herald*, *Daily Telegraph* and local papers will be further enhanced by media coverage in newspapers, TV and radio in the Sydney metro area and suburban areas that are within the scheme area. The media releases have dealt with:

- WestConnex comes to life: first look at key section of the project (28 March 2013).
- WestConnex stakeholders asked for big ideas (15 March 2013).
- WestConnex must drive urban renewal as well as connectivity (4 March 2013).
- Expert appointments to develop WestConnex case (6 February 2013).
- WestConnex progress excellent but urban renewal must be focus (16 January 2013).
- Advisors appointed to WestConnex project (16 January 2013).
- WestConnex project office up and running and community consultation underway (13 December 2012).
- NSW Government formally seeks federal funding for WestConnex (16 October 2012).
- Premier welcomes Federal Coalition's $1.5 billion commitment to WestConnex (6 October 2012).
- WestConnex green light (3 October 2012).

2.3.5 Market research groups

The purpose of the market research group discussions was to research the views of residents, business operators and commercial road users on the big picture opportunities and consideration for WestConnex. Seven groups were organised as follows:

- Residents within a 2 kilometre radius of the northern portion of the WestConnex scheme (M4 Widening, New Parramatta Road, Inner West Tunnel).
- Residents within a 2 kilometre radius of the southern portion of the WestConnex scheme.
- Residents within a 2 kilometre radius of the M4 Motorway between Wentworthville and Penrith.
- Residents within a 2 kilometre radius of the M5 Motorway between Narwee and Ingleburn.
- Residents drawn from across Sydney.
- Business operators along Parramatta Road between Taverners Hill and Camperdown.
- Commercial road users and heavy vehicle drivers.

Issues raised by the groups included:

- Lack of awareness or understanding of the project.
- Tolling options.
- Tunnel issues including perception of air quality in tunnels.
- Potential for urban renewal and how this will follow from the project.

A comprehensive community consultation and stakeholder engagement strategy will be prepared and implemented in developing the WestConnex scheme and undertaking further environmental assessment. Continuing and specific stakeholder engagement for the M4 Widening project will be undertaken in accordance with the strategy.

2.4 Selection of the preferred option

The preferred option has evolved from a series of concept developments and evaluations which have been ongoing since 2003. Risk and value management workshops have been undertaken to date to develop the appropriate options for the motorway. Traffic modelling has been undertaken to determine demand levels for proposed ramps and vehicle forecasts for the motorway. Stakeholder consultation on the preferred option will be ongoing throughout the project with minor refinements and adjustments to be made as required.

The preferred option comprises widening and upgrading the existing M4 Motorway between Pitt Street, Parramatta and Homebush Bay Drive, Homebush and upgrades to existing interchanges. Further details are provided in Section 1.4.

The preferred option is largely located within the existing motorway corridor however some property acquisition would be required. Design development is ongoing and is aimed at optimising the function and cost of the project and also preventing or mitigating potential environmental impacts. Design options currently under consideration include:

- Structural options for widening of existing viaduct sections including either construction of a new adjacent viaduct or modifying the existing viaduct structure.
- Upgrades to existing interchanges including provision of additional ramps and widened ramps.
- Tolling structures at ramps and on the main carriageway of the motorway including various gantry structures.

3 Project description

RMS is proposing to widen and upgrade the M4 Motorway between Pitt Street, Parramatta and Homebush Bay Drive, Homebush. Key features of the project are shown in Figure 1-2. Details for each section of the project are outlined below. Construction staging has yet to be developed for the project but will be outlined in detail during further assessment of the project.

Section One: Pitt Street overpass to Wentworth Street:

- The current motorway provides three lanes each for the eastbound and westbound carriageways.
- A new viaduct is proposed to be located to the south of the existing viaduct between Church Street and Wentworth Street, Granville (just east of James Ruse Drive).
- The existing viaduct would be reconfigured to provide four lanes eastbound and two lanes westbound while the new viaduct would provide two additional westbound lanes.
- Managed motorway and tolling Intelligent Transport Systems (ITS) infrastructure would be installed.

Section Two: Wentworth Street to Junction Street, Auburn

- The current ground level carriageway provides three east- and westbound lanes. These would be widened with two additional lanes, to provide a total of four traffic lanes and a shoulder on each carriageway on completion of the widening.
- East and westbound lanes would be separated by a barrier.
- Managed motorway and tolling ITS infrastructure would be installed.
- Construction of a new bridge over Duck River to the south of the existing viaduct for two lanes of westbound traffic.

Section Three: Junction Street, Auburn to Homebush Bay Drive

- The current ground level carriageway continues in this section and would also be widened with two additional lanes to provide a total of four traffic lanes and a shoulder for each carriageway on completion of the widening.
- Managed motorway and tolling ITS infrastructure would be installed.
- Construction of a new, dedicated westbound G-turn on-load ramp for southbound traffic on Homebush Bay Drive.
- Provision would be made for a new eastbound on-load ramp from Hill Road.
- The widening would transition from four lanes eastbound and westbound to two lanes eastbound and wesbound in the vicinity of the Homebush Bay Drive overbridge.

Cycling and pedestrian provisions along the M4 Motorway/Parramatta Road corridor would be maintained.

3.1 Interchange upgrades and associated works

Widening of the M4 Motorway would require the upgrade and addition of grade separated interchanges at major arterial connections. All current connections to arterial roads along the M4 Motorway would be maintained. Upgrades to interchanges would include:

- Provision for a new eastbound off-ramp at Westmead.
- Provision for a new eastbound on-ramp from Hill Road.
- Provision for a new westbound G-turn on-ramp from Homebush Bay Drive.
- Widening and/or lengthening of existing ramps to provide for vehicle storage for managed motorways at:
  - Church Street – westbound on-ramp.
  - James Ruse Drive – eastbound and westbound on-ramps.
  - Silverwater Road – eastbound and westbound on-ramps.
  - Hill Road – westbound on-ramp.
  - Homebush Bay Drive – westbound on-ramp.

There would also be a number of installations for managed motorways and tolling ITS infrastructure both along the motorway and at interchanges including traffic signals, vehicle detection devices, VMSs, CCTV, emergency telephones, variable speed limit signs, cabling and fixed signage (as described above).

3.2 Ancillary facilities

The project would also include ancillary works during construction including, but not limited to, construction compounds, sedimentation basins, batch plants, and stockpile sites. The final locations of these ancillary sites would be determined during detailed design based on specific environmental criteria.

The project would not include surveys, test drilling, test excavations, geotechnical investigations or other tests, surveys, sampling or investigation for the purposes of the design or assessment of the project.

For the purposes of this report, the scope of the M4 Widening would not include ongoing maintenance works.

4 Key environmental issues

4.1 Overview

Key issues are those that 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 mitigate and manage the impacts.

Preliminary environmental investigations carried out for this application report indicate the following key environmental issues will require detailed assessment and may require project specific impact mitigation measures:

- Traffic and transport.
- Noise and vibration.
- Socio-economic.
- Land use and property.
- Urban design.

A number of other environmental issues have also been identified. These issues are outlined in Chapter 5 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 that these other environment issues would not likely be key issues; however the potential impacts would be assessed during preparation of the environmental impact statement.

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 and it is considered unlikely that the project would have a significant impact on a matter of National Environmental Significance. The search has identified the presence of four Commonwealth land parcels within a 500 metre wide study area. The location or nature of these parcels has not yet been identified and further studies such as title searches, would be required during preparation of future environmental assessment.

A study area of 500 metres (250 metres either side of the project) has been assessed for each of the key and other environmental issues, unless otherwise stated.

4.2 Traffic and transport

4.2.1 Overview

The M4 Motorway currently connects the Blue Mountains in the west, with Parramatta Road near Concord Road, in the east. From Concord Road at Strathfield, motorists can access Sydney's CBD, inner west and eastern suburbs via Parramatta Road.

The M4 Motorway carries 99,000 vehicles per day, of which 10 per cent are heavy vehicles. Substantial traffic delays are experienced inbound in the AM peak period in the western sections of the motorway from Woodville Road to beyond James Ruse Drive.

Between Church Street, Parramatta and Homebush Bay Drive, Homebush, the carriageway provides three traffic lanes in each direction. At the James Ruse Drive interchange, the mainline narrows to two lanes on approach to the merge with the on-ramps that restore the third lane. As the motorway approaches Parramatta Road, it narrows to two lanes each way east of Homebush Drive, and then widens to three lanes under Concord Road and onto the motorway's intersection with Parramatta Road at Concord. The speed limit from Church Street eastbound to Concord Road exit is 90 kilometres per hour (km/h). In the westbound direction, it is 60 km/h from Parramatta Road, Strathfield to the Concord Road on-ramp, then 70 km/h to Powell Street, Homebush and then 90 km/h to Church St, Parramatta.

The limited capacity of the section between James Ruse Drive and Silverwater Road is a major pinch-point in the effective capacity of the motorway, limiting through-put further along the motorway.

Travel times along the motorway between the Church Street, Parramatta off-ramp and Homebush Bay Drive are typically 15 minutes eastbound during the AM peak period, up to 23 minutes westbound during the PM peak period, while only 8 minutes during the inter-peak period.

One of the major constraints to travel along this corridor is at the James Ruse Drive interchange, where two lanes merge to accommodate the on-ramp traffic. The proposed widening would remove this major traffic constraint along this major east-west corridor, as well as provide additional capacity, giving rise to improved travel times and increased traffic opportunities for new trips. While adequate traffic capacity exists on the motorway at the project's western interface, traffic arriving at Parramatta Road, Concord would remain constrained until further stages of WestConnex are constructed.

Cyclists are permitted to utilise the shoulders of the M4 Motorway, but pedestrians are not permitted access to use the carriageway.

4.2.2 Summary of issues

Construction of the project has the potential for the following traffic and transport related impacts:

- Maintaining a safe environment for road users, including buses, pedestrians and cyclists: this would be a priority during construction. The potential for safety impacts, due to temporary road arrangements or the proximity of construction activities to normal traffic, would be assessed.
- Temporary disruptions and delays to traffic due to the narrowing of lanes, speed restrictions, additional spoil and truck movements and temporary road closures.
- Construction staging which would impact on traffic movement, access roads and different communities.
- The potential for a temporary shift of traffic movements from the motorway to alternative routes, such as Parramatta Road or Victoria Road, particularly during peak periods as motorists try to avoid congestion caused by road works. Currently, these road corridors are congested during peak periods, with minimal spare capacity available.
- Temporary impacts on pedestrian access on adjacent roads where access ramp modifications are required.
- Minimal or no delays to buses along Parramatta Road.

Operation of the project has the potential for the following traffic and transport related impacts:

- Increases and changes to M4 Motorway traffic:
  - Increase in M4 Motorway capacity would generate improvements in motorway travel time that would translate to economic benefits over the forecast future. These benefits may be offset by changes in the time of travel from the shoulder periods around each peak, diminishing the peak travel time benefits but adding to the overall economic efficiency of the M4 Motorway, ie more traffic operating at existing travel times, resulting in substantial overall economic benefit. This shoulder traffic needs to be taken into account in forecasting future traffic demand.
  - Traffic outcomes are likely to be toll dependent, and forecasts would need to be sensitive to toll levels and congestion on parallel routes.
- Changes in vehicle movements arising from network changes:
  - The scale of the upgrade would generate opportunities to change the way people travel. At times, where travellers currently use public transport due to delays along the M4, the project may free up opportunities to motorists previously denied access due to unacceptable congestion.
  - In parallel to this, opportunities will be made for more efficient and reliable public transport along less congested corridors such as Parramatta Road.
  - Increased M4 Motorway capacity would facilitate new opportunities for businesses in the M4 Motorway corridor and key approach roads, due to better connectivity and ability for commuters to access the areas off the M4 Motorway from further distances.
- Impacts on intersecting and parallel road network:
  - Increased capacity of the motorway would likely mean increased peak period demand on the M4 Motorway through the interchanges. These interchanges are planned to be upgraded in accordance with managed motorways. Levels of Service will need to be confirmed to ensure smooth entry and exit and to minimise congestion.
  - As congestion decreases, traffic would shift to the M4 Motorway which would alter the traffic levels on parallel roads, particularly Parramatta Road. Where traffic is reduced, this would create an opportunity to enhance public amenity on Parramatta Road. Future traffic levels need to be identified to ensure that performance is consistent with its role in the network hierarchy.
  - Upstream capacity is available west of Church Street to service the widened M4 Motorway, however Parramatta Road (to the east of Concord Road) may not have adequate capacity to service demand from the M4 Widening. The Level of Service on Parramatta Road needs to be identified, until the other stages of WestConnex are integrated.
- Opportunities and impacts on public transport, and pedestrian and cyclist accessibility:
  - Improvements to the road network would affect the mode choice. This has patronage implications for public transport that services trips through the M4 Motorway corridor. Opportunity may exist from the widening to develop enhancements to public transport services in and across the corridor. Use of the increased capacity to support improved public transport provision needs to be recognised, in a balance between public transport opportunities along parallel routes made available by general traffic diversion to the M4 Motorway.

- Where pedestrian and cycle routes are disrupted along the M4 Motorway/ Parramatta Road corridor by construction activities these would be rehabilitated and reinstated as soon as practicable. If necessary, routes would be relocated to provide better future access.

4.2.3 Proposed further assessments

A traffic and transport impact assessment would be undertaken as part of the environmental impact assessment. This assessment would identify potential impacts and nominate mitigation measures to minimise impacts. It would include:

- An assessment of construction traffic impacts including route identification, number, frequency and size of construction related vehicles, the nature of existing traffic, and the need to close, divert or otherwise reconfigure elements of the road network associated with construction of the project, including:
  - An assessment of traffic impacts on the surrounding network over the staged construction period.
  - Recommendations for appropriate traffic and transport management and mitigation measures.
- An assessment of operational traffic impacts 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 and public transport impacts.
- Forecast traffic volumes for the M4 Motorway and the local road network, based on detailed traffic modelling for the project and the local and regional road networks.
- Travel time analysis.
- Tolling strategy.
- An assessment of the performance of key interchanges and intersections by undertaking a Level of Service analysis at key locations.
- An assessment of the impacts of the project on road users including motorists, public transport, freight, pedestrians and cyclists; on local and regional road networks.
- Road safety analysis.

4.3 Noise and vibration

4.3.1 Overview

The M4 Motorway passes through areas of residential and non-residential land uses. Use of the motorway includes a large percentage of heavy vehicles that access commercial districts adjacent to the motorway.

During construction, the project is likely to result in localised construction noise and vibration impacts. During operation of the project, due to the high traffic volumes and the influence on connecting arterial roads, vehicle noise is likely to impact sensitive receivers adjacent to the existing road network.

Sensitive receivers identified within a 600 metre study area also include heritage structures of local and state significance and include:

- Residential properties.
- Educational facilities.
- Industrial and commercial premises.
- Mixed use residential/commercial properties.
- Sporting, recreation and open space areas.

4.3.2 Summary of issues

Construction of the project has the potential for the following noise and vibration related impacts:

- Areas of construction activity along the project may affect residential and non-residential sensitive receivers to varying degrees. The level of impact from construction works experienced by receivers would depend on the proximity to the works, the types of activities, the duration of activities, the existing noise level and the time of day.
- Increased noise levels during out-of-standard construction hours may affect sensitive receivers. Construction activities typically occur during daytime hours however, due to a need to maintain network capacity and safety considerations, work may need to be undertaken outside normal working hours due to construction methods.
- Increases in road traffic noise levels for receiver locations are expected around the areas of major construction such as the tie-in works and sections of viaduct duplication, which would provide a new source of traffic noise for sensitive receivers.
- Potential vibration impacts on nearby buildings and other structures due to small offset distances between the works and sensitive receiver locations.

A change to the road configuration for the proposed works has the potential to change noise levels at nearby receiver locations during operation of the project. Where impacts are found to exceed the *NSW Road Noise Policy* (DECCW 2011) guideline noise levels, feasible and reasonable management measures would be considered.

4.3.3 Proposed further assessment

Further noise and vibration assessment of the project would include:

- A detailed assessment of construction noise and vibration impacts, including the consideration of areas where out-of-hours or night-time works can be undertaken with minimal impacts, would be included in a noise and vibration report. This assessment would require preliminary information on construction schedules and methods proposed for the project as well as an activity based equipment list where available. The assessment will consider location of ancillary facilities such as compound sites.
- The assessment of impacts against project noise management levels for daytime, evening and night-time periods would be included in the noise and vibration assessment report as well as details of management measures to minimise construction noise impacts where necessary.

- An operational noise impact assessment would include a broader network traffic assessment incorporating on and off ramps for the motorway as well as adjoining arterial roads such as Homebush Bay Drive, Silverwater Road, and James Ruse Drive.
- Noise would also need to be assessed on the existing Parramatta Road with regard to changed traffic conditions.

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

- Department of Environment, Climate Change and Water (DECCW), 2011, *NSW Road Noise Policy*.
- Roads and Traffic Authority, 2011, *Interim approaches to apply the Road Noise Policy*.
- Roads and Traffic Authority, 2001, *Environmental Noise Management Manual*.
- DECC, 2006, *Assessing Vibration – a technical g*uideline
- DECC, 2009, *Interim Construction Noise Guidelines*.
- Standards Australia, 1997, Australian Standard AS2670.2 *Evaluation of human exposure to whole-body vibration*.
- British Standards Institution, 1993, BS7385: *Part 2 Evaluation and measurement of vibration in buildings, 0 580 22188 1.*
- British Standards Institution, 1992, BS 6472: - 1992 *Evaluation of Human Exposure to Vibration in Buildings.*
- British Standards Institution, 2009, BS5228:2009 *Part 2 Code of Practice for noise and vibration control on construction and open sites-Vibration*.
- Deutsches Institut für Normung, 1999, DIN 4150: *Part 3 – 1999 Effects of Vibration on Structures.*

4.4 Socio-economic

4.4.1 Overview

The project is located within the local government areas (LGAs) of Parramatta, Holroyd, Auburn and Strathfield.

In 2011, the LGAs had a combined population of 393,850 people (ABS 2011). Compared to NSW as a whole, the LGAs generally comprise a younger population, with a median age of 33 years. Auburn and Holroyd LGAs have a high proportion of people under age 14 (about 20 per cent). The main occupations comprise professionals, clerical and administrative workers and managers with many technicians and trades workers as well as labourers located in the western LGAs. About 60 per cent of the population is employed in full time work. On average 57 per cent of workers drive to work (or are a passenger) with the highest proportion from Holroyd using a car. Strathfield has the highest proportion who travel on the train (21.14 per cent).

The LGAs are ethnically diverse with large Chinese, Indian and Lebanese born populations to the west.

The M4 Motorway is an important connection between Sydney's CBD, Sydney Olympic Park and the growth area of western Sydney, which is Australia's fastest growing regional economy (Department of Premier and Cabinet 2013). The Draft Metropolitan Strategy (NSW Government 2013) identifies Sydney Olympic Park as a major future location for employment, high density housing, sports and entertainment. The M4 Motorway also provides access to other commercial and industrial areas, including the Parramatta CBD and industrial areas at the western end of the motorway, which are accessed by freight vehicles. To the north, the motorway provides access to the Shell Parramatta Terminal, Clyde Refinery, the Db Business Park and Newington Business Park. To the south, the motorway provides access to the Clyde Transfer Station, Clyde Marshalling Areas, Lidcombe Business Park, and Flemington Markets.

North Strathfield, Burwood and Homebush town centres are located adjacent to the existing motorway and generally provide local services and retail shopping to local residents. North Strathfield town centre has recently been revitalised with improved streetscapes, featuring the heritage listed former Arnott's Biscuit Factory and is popular with locals. Town centres located close to the study area provide services and retail shopping to a wider catchment, including Parramatta, Granville, Auburn, Lidcombe and Strathfield. The Auburn Homemaker Megamall is located to the south and is popular at weekends with locals and visitors.

The motorway also provides access to a range of regional tourist and recreational facilities located within or adjacent to the project. These include:

- Sydney Olympic Park, which offers a range of local, regional and international level sporting facilities as well as conference and exhibition facilities including the State Sports Centre, Sydney Olympic Park Tennis Centre, and Athletics Centre, as well as various informal facilities such as walking and cycling trails, picnic areas and parks including Bicentennial Park.
- Holroyd Sports Centre, Parramatta City Raceway/Sydney Speedway and Rosehill Racecourse located at the western end of the project, which provide multiple recreational facilities for locals and tourists.
- Flemington Markets.
- Local parks, including:
    - Wallawa Reserve, Granville.
    - Granville Memorial Park, Granville.
    - Warawara Reserve, Granville
    - Holroyd Sports Ground, Holroyd.
    - Kurong Reserve, Holroyd.
    - Deakin Park, Silverwater.
    - Hume Park, Silverwater.

The M4 Motorway forms the primary freight route together with Parramatta Road, with connections to Port Botany and Sydney Kingsford Smith Airport (Sydney Airport). Along these corridors, intermodal terminals are located at Cooks River and Clyde, as well as a proposed intermodal corridor at Enfield.

Community facilities, including churches, community halls and scout/guide halls are also located within suburbs adjacent to the motorway, particularly within the North Strathfield and Homebush town centres at the eastern end of the project and Parramatta and Merrylands town centres at the western end of the project.

Westmead Hospital is located to the west of the project, and is accessed from Hawkesbury Road. Concord Repatriation Hospital to the east of the motorway is accessed from Concord Road. A number of smaller hospitals such as Strathfield Private Hospital, are also located along the motorway.

The motorway primarily caters for private vehicles and freight vehicles, business trips, couriers and other commercial traffic. Private vehicles are the main form of transport for residents of the surrounding LGAs, with about 50 per cent travelling to work by private vehicle (ABS 2011). Buses operate on Parramatta Road and train stations are located nearby at Granville, Clyde, Auburn, Lidcombe and Flemington to the south and Harris Park, Rosehill, Olympic Park and North Strathfield to the north. A bicycle path is located between Cumberland Highway and Haslams Creek, partially adjacent to and to the south of the motorway. The bicycle path includes sections of dedicated bicycle path, shared path and the partial use of the shoulder of the motorway. The bicycle path links with Sydney Olympic Park, which provides over 35 kilometres of dedicated public cycle paths as well as other recreational opportunities. Rosehill Heliport can also be accessed from James Ruse Drive.

The existing amenity of suburbs adjacent to the M4 Motorway is characterised by transport infrastructure and an industrial/urbanised landscape. The amenity of nearby suburbs is currently affected by high levels of traffic noise.

4.4.2 Summary of issues

The project would provide improved access and connectivity for local and regional business and communities, including to the Sydney CBD, the growth area of Western Sydney, adjacent industrial areas and major community facilities in the region. The project would also improve access and connectivity between local centres to the north and south of the M4 Motorway, allowing for the development of local centres and potential for attracting new investment, which is a priority for the city shaper 'Parramatta Road Corridor' as defined in the Draft Metropolitan Strategy

Construction of the project has the potential for the following socio-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.
- Impacts on amenity for local residents and users of schools/community facilities, due to increased dust and noise from construction activities.
- Changed access and traffic delays during construction, including for motorists, local residents, public transport users, businesses, emergency services such as the Silverwater Fire Station, Auburn, and visitors to community facilities near the project.
- Impacts on road safety for vehicles, cyclists and pedestrians particularly at proposed interchange upgrade locations.
- Potential changes to access for pedestrians and cyclists near construction works, including the cycleway near Haslams Creek, and for pedestrians using the pedestrian overbridge at Silverwater.
- Impact on local businesses, particularly those located directly adjacent to or under the existing motorway eg businesses located under the existing viaduct.

Operation of the project has the potential for the following socio-economic related impacts:

- Community perceptions about increased severance or segregation between the north and south of the motorway, due to the widening of the motorway.
- Impacts on traffic movement on adjacent roads including Parramatta Road and Victoria Road.

4.4.3 Proposed further assessments

A detailed socio-economic impact assessment would assess the whole of life potential impacts of the project, including positive and negative direct and indirect impacts, and would include:

- A description of the socio-economic profile for the communities and businesses surrounding the project including, but not limited to:
  - Social characteristics, including population and demography; families and housing; travel behaviour; socio-economic indicators for areas; and need for assistance.
  - Economic characteristics, including labour force, income and employment; and business and industry.
- Identification of community values that may be affected by the project, such as population and demography community services and facilities, local access and connectivity, amenity and character, and business and industry.
- Detailed assessment of the potential impacts (positive and negative) of the project on the socio-economic values of the study area for both construction and operation. Consideration should also be given to the community's perceived impacts of the project, as community perceptions about possible impacts may influence tolerance of change.
- Identification of appropriate management and safeguard measures, including measures to enhance the project's benefits to avoid, manage or mitigate its potential impacts.
- Consultation with the public, managers of community facilities, and stakeholders to inform a description of existing values, impacts and management and safeguard measures.
- Consultation of directly affected property owners about property acquisition, including timing, compensation arrangements and potential impacts.

4.5 Land use and property

4.5.1 Overview

The area immediately adjacent to the project spans across several suburbs including Holroyd, Parramatta, Granville, Harris Park, Rosehill, Clyde, Auburn, Silverwater, Lidcombe, Newington, Sydney Olympic Park, Homebush West and Homebush.

The M4 Motorway is largely contained within an existing road corridor. Land uses immediately adjacent to the motorway are diverse and comprise a mix of industrial, residential, commercial, and retail development.

Land uses are characterised geographically by the local government areas (LGAs), as follows:

- The Holroyd, Parramatta and Auburn LGAs comprise light industrial warehouse type development and commercial precincts interspersed with areas of residential development. Sydney Olympic Park is located to the north of the M4 Motorway within the Auburn LGA which contains sporting facilities and commercial development parklands.

In March 2013, the NSW Government released the *Draft Metropolitan Strategy for Sydney to 2031* (Draft Metropolitan Strategy) (NSW Government 2013) which establishes the strategic planning framework for Sydney to 2031. The Draft Metropolitan Strategy supports the targets and actions identified within NSW 2021, the *NSW Long Term Transport Master Plan* (LTTMP) and the *State Infrastructure Strategy* (SIS) by providing integrated land use and infrastructure outcomes within NSW.

The project would provide improved road connections with better links servicing future areas of employment, housing and population growth identified within the Strategy. Of the 625,000 new jobs targeted across Sydney to 2031, the Draft Metropolitan Strategy specifically targets at least 50 per cent within Western Sydney. The continued growth of Parramatta as one of Sydney's Regional Cities is supported with a target of 21,000 jobs in the Parramatta CBD to 2031 (NSW Government 2013).

The Draft Metropolitan Strategy identifies the WestConnex scheme as a catalyst for major urban renewal and regeneration along the Parramatta Road Corridor which would also serve the Western Sydney Employment Area located at the intersection of the M4 and M7 motorways. Sydney Olympic Park is identified as a Specialised Precinct with capacity for major employment, recreation and housing growth. Urban Activation Precincts have been identified in the Draft Metropolitan Strategy around existing and planned public transport and infrastructure with the aim of transforming highly accessible suburbs to improve housing choices and local prosperity. One of the priorities for the Parramatta Road Corridor is to facilitate delivery of Urban Activation Precincts at Carter Street and Wentworth Point as part of the wider regeneration of Sydney Olympic Park.

The Sydney Olympic Park Master Plan 2030 is a 22 year vision for the sustainable development of Sydney Olympic Park, establishing guidelines and controls for the future development of the area (SOPA 2010). The Carter Street Precinct has been identified in the Master Plan as an area for new housing and employment uses at higher densities. The Wentworth Point Precinct currently functions as a transport interchange for Sydney Olympic Park and the Wentworth Point community comprising the Ferry Wharf, bus terminal and public parking. This use will be supplemented by mixed use development to support the overall growth of the peninsula (SOPA 2011).

4.5.2 Summary of issues

Construction of the project has the potential for the following land use related impacts:

- A small number of property acquisitions may be required, including partial or full acquisition of commercial and industrial tenancies, residential properties and areas of open space.
- Changes to property access to private and commercial/retail properties.
- Sections of roads surrounding the project area may need to be closed temporarily to the public during construction.

Operation of the project has the potential for the following land use related impacts:

- The project would largely be located within an established motorway corridor. As such, potential impacts would relate to potential property acquisition and existing access arrangements. The project may improve the connection for locals and visitors to a range of land uses within the study area and the broader region.
- There would be potential changes to existing land uses adjacent to the M4 Motorway resulting from full or partial acquisition of some properties for the road corridor which could impact on the following uses:
  - Residences in surrounding suburbs.
  - Businesses, including industrial and commercial, some of which are located directly under the motorway.
  - Flemington Markets.
  - The southern end of Sydney Olympic Park.
- Property access, particularly to residential suburbs immediately surrounding the M4 Motorway, may change potentially reducing the viability of existing or future uses or development of land.
- Existing access arrangements to surrounding residential suburbs, commercial precincts and onto the motorway may be altered.

4.5.3 Proposed further assessment

A detailed assessment on the land use and property values of the area would be undertaken. This would include:

- The identification of the local land uses, existing access arrangements and potential property acquisition for both public and private land adjacent to the project.
- Assessment of the potential impacts of the project on the property, land use and access arrangements during construction and operation of the project.
- Identification of appropriate management and safeguard measures to minimise these impacts.

4.6 Urban design and visual impact

4.6.1 Overview

The M4 Motorway traverses a varied urban environment with adjacent land uses, urban form and character comprising industrial, commercial and residential development and sport and recreational open space. Along the length of the project area the motorway passes through several distinct landscape character zones, each defined by factors such as form of the motorway, visual catchments and adjacent land use types.

Within the area between Pitt Street, Parramatta and the intersection of the motorway and Homebush Bay Drive, the motorway interface comprises distinct character zones consisting of predominantly larger warehouse type development within industrial and commercial precincts forming enterprise corridors around the road alignment.

The current scenic values from businesses surrounding the road alignment suggest a low level of aesthetic significance and the landscapes associated with these land uses is generally of low amenity. Some pockets of medium to high density residential are

interspersed along this area with local parks, mature trees and river connections providing some aesthetic values within these suburbs.

The M4 Motorway is largely built at-grade (ground level) to the adjoining landscape with some sections built on a viaduct where the landscape undulates. A regionally connected cycleway/footpath system runs beneath the length of the viaduct sections of the motorway and parallel with it along the at-grade sections. Where the motorway is at-grade, it is largely screened from adjoining development from a combination of mounding, gently undulating topography, vegetation and visual screening, particularly to the areas of residential development. This combination of landscape and built form results in the visual catchment of the motorway being fairly contained within the most adjacent streetscapes, except for the viaduct which is more visually prominent. It is likely however that in certain locations the proposed works would impact areas adjoining the corridor.

The widened and upgraded sections of the motorway would generally run beside the existing M4 Motorway and be contained within the motorway corridor, however the project may encroach on some views. Some views from higher areas in Sydney Olympic Park and surrounding high rise buildings may be altered however the urban landscape would be similar to the existing road infrastructure and would be expected to include similar visual screening measures.

From within the motorway, the landscape and urban character is generally contained within the vegetation screen planting, topography and visual screening along each side of the corridor. When views are available beyond these limits, they generally comprise long views over the top of the most adjacent streetscapes to the nearest adjacent ridgelines. The visual character of the road from within the road corridor is not expected to be greatly altered from the addition of extra lanes.

4.6.2 Summary of issues

Construction of the project has the potential for the following urban design and visual assessment related impacts, particularly to the adjoining visual catchment:

- Visual impacts associated with construction activities, sites/compounds including machinery, temporary structures and physical impacts on existing public open space and use of land.
- The visual amenity of road users would be impacted during construction.
- Removal of visual screens and vegetation planting along the motorway corridors to facilitate construction may cause negative visual impacts to motorists and adjoining residents and businesses.

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

- Visual impact of new infrastructure on existing views from residences and surrounding development, including visibility of new motorway infrastructure, bridges, viaducts, retaining walls, ramps, gantries, and signs.
- Landscape character and visual impact associated with the possible creation of residual land areas adjacent to the motorway.
- The existing vegetated embankments on steep slopes and visual screens are of important value within the visual catchment around the project area and would be retained wherever possible. It would be expected that some impact would occur in

locations where the proposed widening extends into existing vegetated embankments.

- Impact on the landscape characteristics of existing open spaces adjacent to the motorway and views of important local landmarks and features.
- Impact on the motorist experience of the corridor due to changes to the existing landscape and visual characteristics of the corridor, the visual quality of new motorway infrastructure, structures and elements, and possible impact to views from the motorway to key local or regional landmarks or features.
- Impact to existing pedestrian and cycle pathways adjacent to, along and across the corridor.

4.6.3 Proposed further assessment

Key areas where urban design and landscape issues would need to be addressed include:

- The design of the proposed motorway infrastructure including bridges, viaducts, retaining walls, ramps, gantries, signs, cuttings and embankments.
- Residential suburbs and local parklands interfacing with the M4 Motorway to ensure new infrastructure is well designed and integrated within existing areas.
- Immediately adjoining stakeholders including the light industrial areas and commercial precincts forming enterprise corridors, particularly between the M4 Motorway and Parramatta Road.
- Any key views from Sydney Olympic Park or other key areas.
- Noise or visual mitigation barriers or screens.
- Construction activities and storage of equipment would impact on the visual amenity looking towards the road infrastructure.

The following urban design tasks would be carried out:

- A contextual analysis to identify the community, natural and built values, landscape types and character zones and opportunities and constraints.
- Refinement of urban design objectives for the project that would be incorporated into the design of the project to ensure that least possible impact on landscape character and visual amenity.
- Production of landscape character and visual impact assessment to improve the design outcome and report on landscape character and visual impacts and their management.
- Development of an urban design strategy to mitigate landscape character and visual impacts to be integrated with the overall design of the project, including structures and landscape design outcomes.
- Identification of appropriate management, mitigation and safeguard measures which would need to be considered.

5 Other environmental issues

5.1 Overview

Other environmental issues listed below are considered to be of lesser consequence taking into account the scope of the project, the existing environment and the implementation of standard and best practice management and mitigation measures. It is considered unlikely that these would be key issues for the project; however, further assessment would be undertaken as part of any future environmental impact assessment for the project. Any environmental management and safeguard measures required to minimise and mitigate impacts would be documented as part of the environmental impact statement (EIS).

5.2 Air quality

5.2.1 Overview

The NSW Environment Protection Authority (EPA) has air quality criteria for a range of air pollutants that are known to cause health and/or environmental effects. Most of the criteria refer to National Environment Protection Council standards for air quality. The air pollutants most relevant to motor vehicles are carbon monoxide (CO), nitrogen dioxide (NO_2), and particulate matter (fine particles with equivalent aerodynamic diameters of 10 microns or less, that is, PM_{10}). Health research also identifies $PM_{2.5}$ as a particular concern; however there are currently no EPA assessment criteria for $PM_{2.5}$. Ozone (a secondary air pollutant formed when primary air pollutants react with other substances) is relevant on regional scale. To measure compliance with air quality criteria, the Office of Environment and Heritage (OEH) established a network of monitoring stations across the state and up-to-date records are published on the OEH website.

The closest OEH air quality monitoring stations to the project area are at Chullora, Prospect and Rozelle. A review of data collected from these stations in 2012 showed that there were no exceedances of CO or NO_2 criteria. For PM_{10}, there was one day in August 2012 when the criteria was exceeded at Chullora. Typically exceedances of PM_{10} criteria are driven by unavoidable events, such as dust storms, bushfires and hazard reduction burns, though other emission sources may include industry, motor vehicles, and domestic activities such as solid fuel heaters.

Air quality in the Sydney region has improved since the 1980s; largely due to initiatives to reduce air pollution from industry, motor vehicles, business and homes. The *NSW State of the Environment 2012* (EPA 2012) report notes that concentrations of four of the six main indicators of air quality (carbon monoxide, nitrogen dioxide, sulfur dioxide and lead) have complied with national air quality standards in recent years. However, national standards of ozone and particulate matter (PM_{10}) continue to be exceeded in some regions of the state, including Sydney.

There are many locations in the vicinity of the project area which may be sensitive to changes in air quality. Such locations include residences, businesses, hospitals, and schools.

5.2.2 Potential impacts

The project has the potential to impact on local air quality during both construction and operational phases. Construction of the project has the potential for the following air quality related impacts:

- Temporary, localised increases in dust (particulate matter) during clearing, earthworks and construction activities. The nature of any increase in dust would depend on the scale of activities and quantities of material handled.
- Temporary, localised increases in air quality impacts from emissions, such as exhaust fumes, generated by the operation of machinery and other construction vehicles. The impact of these emissions would be limited to the construction phase.

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

- Potential increases in near roadside air pollutant concentrations due to changes in traffic volumes. The nature of any changes in concentrations would depend on the projected traffic volumes, mode of travel, road grade and mix of vehicles.

5.2.3 Proposed further assessment

Further assessment would involve a detailed air quality impact assessment of the project, covering both construction and operational phases. The assessment would assist in the development of air emission management measures, where relevant and would include:

- Identification of best practice air quality management measures and practices for construction activities.
- A screening level air quality assessment of potential near roadside air pollutant concentrations during operations.

5.2.4 Management and safeguard measures

Air quality issues can arise during the construction of most road projects if emissions to air are not properly managed. However, in most cases air quality impacts can be avoided through the development and implementation of a suitable construction environmental management plan (CEMP). Best practice management measures and safeguards (particularly dust suppression measures) would be detailed in the EIS and implemented during construction of the project.

5.3 Greenhouse gas and climate change

5.3.1 Overview

Climate change refers to the warming temperatures and altered climatic conditions associated with the concentration of gases in the atmosphere, known as greenhouse gases. There is a need to understand how these potential changes can impact future climatic conditions and the effect they could have on the project.

Greenhouse gases generated through construction and operation of the project have the potential to contribute to altered climatic conditions.

In 2010 the NSW Government published refined climate change projections for each region in NSW including the Greater Sydney Metropolitan Area. In summary, climate change predictions identified by the NSW Government for the Sydney region are:

- More intense extreme rainfall events.
- Increased spring and summer precipitation decrease in winter precipitation.
- Increased evaporation in spring and summer.
- Higher average temperatures.
- More frequent occurrence of extreme temperatures.

5.3.2 Potential impacts

Construction of the project has the potential for the following climate change related impacts:

- Direct generation of greenhouse gas emissions due to construction works such as the transport of materials, operation of plant and equipment.
- Indirect generation of greenhouse gas emissions that are produced off-site such as the consumption of electricity for lighting and signage and the energy used to produce construction materials such as concrete, bitumen and steel.

Operation of the project has the potential for the following climate change related impacts:

- Generation of greenhouse gas emissions due to the operation of the road.
- Increased damage to road surfaces through more frequent inundation or extreme rainfall.
- More frequent subsidence/geotechnical issues including erosion impacts, resulting in sediment loss from the site.

5.3.3 Proposed further assessments

Further assessment of greenhouse gas and climate change impacts for the project would include:

- Quantify operational greenhouse gas emissions, including embodied emissions and compare against existing scenarios.
- Quantify construction greenhouse gas emissions.
- Identify measures to avoid and reduce emissions from both operation and construction of the project.

5.3.4 Management and safeguard measures

Climate change issues are commonly encountered on all road projects and are generally adequately managed through the development of construction management plans and appropriate consideration to climate change issues during the detailed design process. Best practice management measures and safeguards would be implemented during construction of the project such as:

- Identify ways to improve efficiency and provide resilience against the impacts of climate change through design of the project.

- Assess energy efficiency when selecting construction equipment.
- Undertake periodic maintenance of equipment to retain fuel efficiency.
- Substitute for low greenhouse intensity material where appropriate and where it meets engineering requirements.
- Establish recycling practices, including partial replacement of cement with fly ash and using recycled aggregate and recycled content in steel.
- Establish "green" supply procurement guidelines in consultation with design engineers to ensure quality is not compromised.

Management of risks posed by climate change for road infrastructure involves the completion of a climate change risk assessment and detailed discussions with project design engineers to adequately design and plan for predicted changes in climatic conditions.

5.4 Aboriginal heritage

5.4.1 Overview

Aboriginal occupation of the Sydney area focused on accessing resources from diverse ecological areas, seasons and conditions. Smaller rivers, creeks and swamps remained constant and reliable places that attracted camping, fishing and inter-clan contact, as well as facilitating travel. Aboriginal occupation in the Sydney area is known to have extended beyond the last glacial maximum, when the environment was drier and significantly cooler and the permanent water sources even more critical to survival.

The project traverses the boundaries of several Local Aboriginal Land Council (LALC) groups; the Metropolitan, Deerubbin and Gandangara LALCs. Consultation has not been undertaken with any Aboriginal stakeholders at this stage, but would be a necessary and important component of the project going forward.

Aboriginal people living in the area around Parramatta Road relied on the bountiful supply of food from Parramatta River which runs east into Sydney Harbour and this area would also have provided access to resources in the foothills and in the Blue Mountains themselves. The long Aboriginal occupation and use of this area and also throughout the greater Sydney area is amply supported by archaeological evidence.

5.4.2 Potential impacts

The project area has been subject to ground disturbing activities over a long period of time during the original road construction, associated ancillary activities and the development of the densely populated city of Sydney. Despite this, there are still areas of known Aboriginal cultural heritage significance, as well as areas of potential Aboriginal archaeological significance, within the urban landscape which must be considered in design and construction plans.

This preliminary Aboriginal archaeological assessment has included a search of the Aboriginal Heritage Information Management System (AHIMS March 2013) which revealed there is one recorded Aboriginal site (HP-1, site ID 45-6-2627) which could potentially be impacted by the project.

The *Parramatta Historical Archaeology Landscape Management Study* (NSW Heritage Office 2000) identified a'Beckett Creek, running west to east into Duck Creek near the M4 Motorway as a 'Zone of Aboriginal Camp Sites recorded by Europeans'.

Given the presence of Aboriginal heritage within an urban context it should be assumed that unrecorded Aboriginal heritage may exist within the study area.

Construction of the project has the potential for the following Aboriginal heritage related impacts:

- Permanent loss of cultural heritage values from direct impact to potential Aboriginal archaeological deposits due to construction works for the project.
- Direct impact to known Aboriginal archaeological sites (isolated finds) due to construction works for the project.
- Potential direct impacts to unknown/unidentified archaeological items that may be uncovered, disturbed, damaged or destroyed during construction works.

5.4.3 Proposed further assessment

An Aboriginal cultural heritage assessment report (CHAR), including completion of at least stage 1 of PACHCI in liaison with RMS Aboriginal office, for the project would be prepared in accordance with the following policy documents and heritage guidelines:

- RTA Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI), 2011.
- DECCW Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010.
- Code of Practice for Archaeological investigation of Aboriginal Objects in NSW (DECCW 2010).

Given the known historical observations of Aboriginal people living on Parramatta's fringes particular attention should be given to better understanding potential post-contact sites in the development of the CHAR.

The preparation of a CHAR would also fulfil the requirements of the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010). This assessment would also include:

- Ongoing consultation with OEH and the local Aboriginal community throughout the environmental impact assessment process.
- The development of management measures to identify opportunities to minimise impacts on Aboriginal heritage.

5.4.4 Management and safeguard measures

Appropriate management and safeguard measures would be identified in consultation with the registered Aboriginal stakeholders and in accordance with approved methodologies outlined within the CHAR. For unexpected finds, application of the RMS *Unexpected finds procedure*, or a project-specific variant, would identify relevant reporting and assessment actions to be initiated. This could include the requirement to test a potential archaeological deposit or to seek necessary approvals under the *National Parks and Wildlife Act 1974*.

5.5 Non-Aboriginal heritage

5.5.1 Overview

In 1793 the first land grants were made within the modern suburbs of Homebush, Lidcombe, Concord, Auburn and Strathfield. Groups of free settlers moved to the area, which was known as Liberty Plains. The area was connected to the settlement in the City of Sydney by track and by river. By 1788 Rose Hill/Parramatta was the alternative capital of NSW and a major township. By 1789 the Rose Hill Packet was carrying goods and passengers up the Parramatta River and a three metre wide track, later called Parramatta Road, was constructed between 1789 and 1791 using convict labour. The area has always been a hub of industrial activity, which intensified with the railway link between Sydney and Granville. Haslams Creek Station at Lidcombe and Homebush Station were first opened in 1855 as part of the first railway line in NSW.

Major utilities and industrial buildings in the area include the Arnott's complex in North Strathfield, constructed in 1906 and Electricity Substation 167 in Auburn, built in the 1920s. Many intact and interesting examples of Victorian, Federation, interwar and post-war residential architectural styles are listed in the area.

5.5.2 Potential impacts

A preliminary non-Aboriginal heritage assessment has been undertaken for the proposal. The assessment included:

- A search of all relevant statutory and non-statutory heritage registers.
- Review of relevant heritage studies.
- Review of the relevant LEPs along the project study area (250 metres either side of the proposed alignment).

Thirty-five non-Aboriginal heritage items are currently identified within the project study area and curtilage. All non-Aboriginal heritage items identified within the study area are presented in Attachment B.

Two items are listed on the State Heritage Register as being of State significance. The Homebush Railway Station Group is not within the study area but has been included as it is adjacent to the area.

- Electricity Substation No.167, Auburn.
- Homebush Railway Station Group, Homebush.

Numerous items of local heritage significance have been identified within the study area. All local heritage items listed in Table 5-1 can be found on the Local Environmental Plans (LEP) for Parramatta 2011 and Auburn 2010.

Table 5-1 Non-Aboriginal heritage items of local significance

Items of local heritage significance within the study area	
Moreton Bay fig tree at Auburn Public School	Milestones along south side of Parramatta Road
Eucalyptus tree stands at Olympic Drive and Parramatta Road	Haslams Creek Bridge, Lidcombe
Capral Aluminium, Rosehill	Haslams Creek Culvert, Lidcombe
Wentworth Hotel, Homebush West	RTA Depot, Rosehill
Former Ford factory building façade, Homebush West	24 Silverwater Road, Silverwater
Shops 72-76 Parramatta Road	Inter-War Bungalow-style group: 2-14 Welfare Street, Homebush
Auburn North Public School	Welfare Street conservation group: 1-11 Flemington Road, Homebush

One item is listed in the *Parramatta Historical Archaeological Landscape Management Study* (PHALMS) (NSW Heritage Office 2000) as having moderate archaeological potential. The area indicated is currently occupied by Capral Aluminium, CSR Emoleum and Multibuild Australia. Capral Aluminium is listed on the Parramatta LEP 2011.

- AMU 2968: Unwin Street, Rosehill, part of former Elizabeth Farm Estate.

Construction and operation of the project has the potential for the following non-Aboriginal related impacts:

- The heritage vistas from adjacent buildings may be changed due to the construction and operation of the project.
- There is the potential for heritage values of Duck River and Haslams Creek to be impacted by construction activities.
- Potential indirect impacts to nearby heritage listed housing.
- Only one archaeological site is currently identified but there is likely to be further unidentified sites, especially adjacent to Parramatta Road which was a main thoroughfare through the area. Potential archaeological sites include former inns, former house sites, ruined bridges, individual burials, commercial and industrial sites, old railway infrastructure, and early road and culverts.

5.5.3 Proposed further assessments

The potential for additional non-Aboriginal heritage items to occur would be further investigated as part of the environmental impact assessment, including:

- Updated searches of non-Aboriginal heritage items.
- Detailed historical research to identify potential non-Aboriginal archaeological sites. To include analysis of historic, maps, plans and aerial photos in archives and libraries, such as Mitchell Library, State Archives and Local Studies Libraries.
- An understanding and assessment of the visual heritage aspects of the local area.
- Targeted surveys to identify curtilages of heritage items.

- Understand/assess the significance of all known State and local heritage items adjacent to the project in accordance with the Burra Charter and the NSW Heritage Office, *Assessing Heritage Significance, NSW Heritage Manual 2*, (NSW Heritage Office 2001), and *Assessing Significance for Historical Archaeological Sites and Relics* (Heritage Branch 2009) including cumulative impacts and cultural landscape impacts.
- An assessment of potential impacts to the known State and local heritage items adjacent to the project.
- Where required, undertake archaeological investigations to determine the presence of potential archaeological items and the potential impacts as a result of the project.
- Consultation with stakeholders such as the Heritage Branch, Office of Environment and Heritage and local councils would be conducted.
- Community consultation to identify additional heritage places and intangible heritage values of the project area.
- Identify appropriate management and safeguard measures to minimise impact on the heritage values of the area.

5.5.4 Management and safeguard measures

Implementation of standard approaches is expected to mitigate and manage the potential non-Aboriginal heritage impacts identified. Standard management and safeguard measures would be detailed in the EIS for the project. These would include:

- For unexpected finds, application of the RMS's *Unexpected Finds Procedure* (RMS 2012), or one that is project specific would identify relevant reporting and assessment actions to be initiated. This could include the requirement to test a potential archaeological deposit or to seek necessary approvals under the Heritage Act.
- Known heritage sites would, where required, be identified and avoided during construction through implementing no-go zones.
- Where direct impact cannot be avoided, photographic archival recording would be undertaken in accordance with the Heritage Council of NSW guidelines (NSW Heritage Office 1998).
- Potential vibration impacts would be assessed and appropriate mitigation measures implemented that recognise the heritage values to be maintained.

5.6 Biodiversity

5.6.1 Overview

The project is located within the Sydney Basin Bioregion within the Sydney Metro - Cumberland catchment management sub-region. Prior to European settlement, the natural vegetation of this area was dominated by grassy eucalypt woodlands, interspersed with taller eucalypt forests in regularly inundated floodplain areas (LPI 2013a).

The Cumberland Plain is one of the most heavily disturbed areas within the bioregion being highly altered with severe pressure from the growth of the Greater Sydney Metropolitan Area (DEWHA 2010). Extensive vegetation clearing, initially for agriculture and subsequently for residential and infrastructure development has since resulted in the loss of the vast majority of this native vegetation (LPI 2013b). Native vegetation on the Cumberland Plain, including the study area, has been reduced to a patchwork of small isolated forest and woodland fragments.

Much of this vegetation is in poor condition due to weed invasion and other disturbances associated with urban expansion and infrastructure development, resulting in the loss of a large proportion of the region's pre-European biodiversity (NSW Scientific Committee 2009). Mammal and bird species have been particularly badly affected with many species in these groups considered likely to be extinct on the Cumberland Plain (NSW Scientific Committee 2009).

The study area (250 metres either side of the alignment) is largely cleared and developed for residential purposes, transport infrastructure and industry with remnant native vegetation restricted to the banks and intertidal zone of the Duck River. Plantings of a mixture of locally indigenous native plants, non-indigenous native plants and exotic species are found along the edges of the existing motorway in addition to areas dominated by entirely by exotic plants.

Despite the limited habitat in the study area, some Threatened species of plants and animals listed under the *Threatened Species Conservation Act 1995* (TSC Act) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or their habitats are likely to occur.

5.6.2 Potential impacts

Vegetation communities

Some patches of vegetation in the study area may be consistent with Threatened Ecological Communities listed under the TSC Act and/or the EPBC Act. The possible presence of Threatened Ecological Communities is discussed in Table 5-2. With the exception of the Estuarine Mangrove Forest, most of the vegetation potentially affected is likely to have been highly disturbed during the construction of the M4 Motorway or consist of landscape plantings.

Table 5-2 Status of vegetation communities possibly impacted upon by the project

Vegetation communities likely to be affected[1]	Possible corresponding Threatened Ecological Community	Comment
Urban Exotic/Native	Some areas of planted native vegetation may correspond to poor condition Threatened Ecological Communities.	Requires field survey to determine whether any Threatened Ecological Communities present
Weed and exotics	-	-
Estuarine Mangrove Forest	Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions (TSC Act)	Small patches of Coastal saltmarsh may exist at the edges of Mangrove Forest. Requires field survey to determine. Mangrove Forest is protected marine vegetation under the *Fisheries Management Act 1994* (FM Act).
Estuarine Swamp Oak Forest	Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions (TSC Act)	Likely to be located immediately adjacent to but outside the subject site. Requires field survey to confirm.

Notes: 1: Vegetation communities based on the Native Vegetation of the Sydney Metro Catchment Management Authority Area mapping (DECCW 2009a).

Threatened and migratory species

Six Threatened species of animal, two Threatened species of plant, one Threatened population of animal and one Threatened population of plant are considered to be likely to occur in the habitats within the study area. No Threatened aquatic species are likely to occur in the study area. Table 5.3 describes the threatened species that may occur in the study area. Only species that have a moderate to high probability of occurring in the area have been listed – for a full listing refer to Attachment C1.

Seven Migratory species of bird listed under the EPBC Act may also use the area (refer Attachment C1). The site would not be classed as an 'important habitat' for any Migratory species as defined under the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines - matters of national environmental significance* (DEWHA 2009) in that the site is unlikely to contain:

- Habitat utilised by a Migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species.
- Habitat utilised by a Migratory species which is at the limit of the species range.
- Habitat within an area where the species is declining.

As such, it is unlikely that the project would substantially impact migratory species.

Table 5-3 Threatened species potentially occurring within the study area

Common name	Scientific name	TSC Act status[1]	EPBC Act Status[1]	Likelihood of occurrence & risk
Animals				
Green and Golden Bell Frog	*Litorea aurea*	*E*	*V*	**Moderate** possibility of occurring north of the motorway and west of Homebush Bay Drive near Haslams Creek and near Duck River.
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	*V*	-	**High** probability of foraging by this species throughout the study area. Moderate probability that existing bridges may be roost sites.
Southern Myotis	*Myotis macropus*	*V*	-	**Moderate** possibility of occurring around major waterways in the study area. Existing bridges over water bodies may be roost sites.
Grey-headed Flying-fox	*Pteropus poliocephalus*	*V*	*V*	**High** probability of foraging by this species in trees of the study area. A flying-fox camp is located approximately 200-300m south of the study area near the rail crossing of Duck River.
Long-nosed Bandicoot	*Perameles nasuta*	*E2*	-	**Moderate** probability of occurring in Urban Exotic/Native and Weeds and Exotics vegetation
Black Bittern	Ixobrychus flavicollis	*V*	-	**Moderate** possibility of occurring in mangroves around Duck River.
Plants				
Downy Wattle	*Acacia pubescens*	*V*	*V*	**Moderate** likelihood of occurrence in the Urban Exotic/Native vegetation community. Sometimes found in disturbed environments.
Tadgells Bluebell[2]	Wahlenbergia multicaulis Endangered Population	*E2*	-	**Moderate** probability of presence in Urban Exotic/Native vegetation community. Sometimes found in disturbed environments.
Narrow-leafed Wilsonia	*Wilsonia backhousei*	*V*	-	**Moderate** probability of presence in Estuarine Mangrove Forest if Coastal Saltmarsh present.

1: E = Endangered, E2 = Endangered Population, V = Vulnerable

2: Population areas of Auburn, Bankstown, Canterbury, Hornsby, Parramatta and Strathfield

Summary of potential impacts

Construction and operation of the project has the potential for the following biodiversity related impacts:

- Clearing of a small area of Threatened Ecological Communities; eg Swamp oak floodplain forest.
- Clearing and overshadowing of mangroves; possible habitat for the Black Bittern.
- Clearing of mixed native and exotic vegetation and associated habitat for native fauna; eg the Threatened Grey-headed Flying-fox.
- Possible introduction or spread of environmental weeds.
- Mortality of native animals during clearing and operation of the project; including the Endangered Green and Golden Bell frog.
- Disturbance and/or mortality of bats roosting under bridges or in culverts; including the Threatened Eastern Bent-wing Bat and Southern Myotis.
- Possible impacts on the aquatic ecosystem of the Duck River and other waterways in the study area as a result of sedimentation.
- Impacts on fish passage along minor streams due to the extension of existing waterway crossing and associated impacts on flow depths and velocities and light levels.

5.6.3 Proposed further assessments

Further assessment of the project on biodiversity impacts would include:

- Vegetation survey to determine the extent to which Threatened Ecological Communities and Threatened species of plant would be impacted.
- Assessment of the likelihood of vegetation within the subject site to provide habitat for Threatened species of animals based on field surveys.
- Inspection of existing bridges and culverts for the presence or evidence of bats and potential roost sites.
- Inspection of land near Duck River and Haslams Creek for potential green and Golden Bell Frog breeding and over wintering habitat.
- Additional field surveys may be required to target any Threatened species of animal considered likely to occur based on field habitat assessment.
- Detailed impact assessment as required under the NSW TSC Act and the EPBC Act for any Threatened species, populations and ecological communities considered likely to be present in the study area based on the findings of field surveys.
- 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.

5.6.4 Management and safeguard measures

Management and safeguard measures for the project would include:

- Minimising removal of existing native vegetation.
- Revegetation with indigenous species suitable as habitat for Threatened species (eg Grey-headed Flying-fox) and consistent with the native vegetation of the locality.
- Implementation of weed management and hygiene measures to minimise possible weed proliferation.
- Preparation and implementation of detailed management plans for Threatened species which are detected during surveys and likely to be at risk of significant impact (eg roosting bats, Green and Golden Bell Frog).

Additional measures may be identified based on the findings of field investigations as part of the environmental assessment.

5.7 Geology, soils and water quality

5.7.1 Overview

The motorway is contained within the Lower Parramatta River Catchment and is located in low relief landscape with elevations generally below 20 metres AHD and slopes less than five per cent. Elevated sections of the existing motorway (between Pitt St, Parramatta and James Ruse Drive, Granville) raise the road surface over creeks, roads and other infrastructure.

The geology of the area is derived from the Wianamatta Group and is predominantly underlain by the Ashfield Shale formation, capping the Hawkesbury Sandstone formation. In some parts of the study area, the Ashfield Shale and Hawkesbury Sandstone formations are overlain by discontinuous Quaternary age alluvium deposits associated with streams, which comprise sand, silt and clay. The alluvium deposits associated with streams are relatively limited in extent and unlikely to be a significant groundwater resource. The Hawkesbury Sandstone is a significant aquifer and groundwater flow is mainly via fracture networks and faults, with minor flow via primary porosity.

Three soil landscapes (Birrong, Blacktown and Disturbed) are encountered across the study. The M4 Motorway is located near the Parramatta River, and therefore there is the potential for some of the study area to be reclaimed land or landfill and consequently classified as a disturbed soil (McLoughlin 2000).

The project is located on the southern side of the Parramatta River within the A'Becketts Creek, Duck Creek, Duck River, Haslams Creek and Powell's creek sub-catchments, which all drain to the Parramatta River. These catchments are highly urbanised with large sections of open channels replaced with concrete lined channels. The remaining natural channels are impacted by erosion and sedimentation.

The water quality of creeks is largely influenced by stormwater, aquatic weeds and erosion which are attributable to the catchment in which these creeks reside. High pollutant loads including cadmium, copper and zinc have been recorded in Powells Creek. Duck River has elevated concentrations of lead, iron, chromium, mercury, zinc, chlordane, dieldrin, PCBs, DDT and oils and grease, which reflects the highly urbanised nature of the catchments found in the area (Birch and Rochford 2010 and SKM 1999).

Sewer overflows, particularly during high rainfall events, also influence water quality in these catchments, providing additional sources of nitrogen, phosphorus, suspended solids and faecal coliforms (SKM 1999).

There is a potential for acid sulfate soils to occur along the M4 Motorway corridor due to its proximity to the Parramatta River estuary. Mapping has also identified a high probability of the occurrence for acid sulfate soils around Haslams and Powells Creeks (Cardno Lawson Treloar 2008) as well as Duck River. Salinity is part of the natural landscape of the Parramatta River sub-catchments with salt being found in the rocks, soils and the estuarine sections of the sub-catchments. These salts can potentially be mobilised during construction.

5.7.2 Potential impacts

Construction of the project has the potential for the following soil and water quality related impacts:

- Direct impacts to bank stability and erosion of small creeks that the motorway crosses due to removal of riparian vegetation.
- Direct erosion impacts due to the exposure and mobilisation of soils during construction. This may potentially impact on water quality of the Powells Creek, Haslams Creek, Duck River, Duck Creek and A'Becketts Creek.
- Direct impacts to water quality from accidental chemical spills or materials during construction or improper management of run-off, sediment control and discharge from the construction site.
- Potential for contamination of groundwater where groundwater intersection occurs during construction.
- Potential disturbance and exposure of acid sulfate soils to the air as a result of excavation and construction works, resulting in the potential for sulphuric acid to impact groundwater, soils and waterways in addition to the built environment.
- Potential impact on salinity as a result of changes to the local landscape, which affects the way salt and water move through the environment and where they concentrate.

Operation of the project has the potential for the following soil and water quality related impacts:

- Contamination of local waterways as a result of any spills that may occur during operation from maintenance activities or vehicle crashes.
- Increase in sediment and pollution loads in stormwater due to the removal of buffer vegetation, increase in road surface and increase in vehicular traffic. This has the potential to impact on water quality through road runoff containing suspended solids, nutrients from atmospheric fallout and other pollutants from vehicle, tyre and pavement wear.

- Potential changes to flow patterns in the creeks that the motorway crosses due to the construction of bridges and culverts. This could lead to increased scour and/or sedimentation which impacts on water quality.

5.7.3 Proposed further assessment

Further investigations and assessments are required to detail the potential soil and water quality issues that this project presents, including:

- Obtain confirmation as to the location of the construction site compounds with respect to water courses.
- Detailed assessment of soil and water impacts and identification of management and safeguard measures.
- Obtain water quality data to establish a baseline of water quality
- Assessment of the risk of erosion and sedimentation in accordance with the RMS Erosion and Sedimentation Management Procedure.
- Identification of surface and groundwater that may be impacted by the project and subsequent assessment of the potential impacts and potential management measures.
- Determine location and capacity of existing sedimentation and treatment basins along the existing M4 Motorway. Assess the current state and performance of basins and where appropriate, resize or construct new basins accordingly.
- Investigate the occurrence and extent of any actual or potential acid sulfate soils and identify an appropriate management approach, in accordance with RMS's Acid Sulfate Materials Guideline (RMS 2005a).

5.7.4 Management and safeguard measures

- Soil and water issues are commonly encountered on all road projects and are generally adequately managed through standard RMS management measures and safeguards, which include consideration during the detailed design process and the development of construction soil and water management plans.
- Identification of potential management measures to reduce the impact on soil and water quality during operation. These would be prioritised in order to select the most appropriate course of action.
- Establish a management plan for actual and potential acid sulfate soils including the testing, identification and control of such areas to minimise the impact on soil and water quality.
- Identify options for containment of spills during operation such as the use of baffles at drainage basins.
- Investigate scour protection at high risk sites with the option to retain existing vegetation where appropriate/feasible.

5.8 Hydrology and flooding

5.8.1 Overview

The motorway is located within the Lower Parramatta River catchment and crosses the A'Becketts Creek, Duck Creek, Duck River, Haslams Creek and Powells Creek sub-catchments. These highly urbanised catchments comprise an area of approximately 104 square kilometres and are characterised by gently sloping/undulating plains.

Drainage occurs in the sub-catchments generally through concrete lined channels in upstream areas and unlined natural channels in areas closer to the Parramatta River. The downstream reaches are classified as estuarine with the presence of mangroves increasing as the tidal influence increases. Flooding occurs in the sub-catchments through overbank flooding of the open channel systems and the surcharging of the pipe drainage systems during heavy rainfall events (SKM 2005).

There is a long history of flooding in the Parramatta River sub-catchments dating back to the late 1800s. The most recent flood events occurred in 1986, 1988, 1990 and 1991 (SKM 2005). Flood level information is very limited for the catchments perhaps due to the few businesses and people that directly access the sub-catchments or because the flood rise and fall is too rapid to be recorded (SKM 2005). Flood rise and fall is rapid due to swift response of runoff from the catchment and conveyance of floodwaters along the concrete lining of channels. Hydraulic modelling of existing culverts and bridges of the M4 Motorway has indicated some obstruction of flows leading to afflux upstream of the motorway at Haslams Creek (Bewsher Consulting 2003).

Climate variability could cause more intense and extreme rainfall into the future over the various sub-catchments. Further discussion on climate change is provided in Section 5.2 Climate Change and Greenhouse Gas.

5.8.2 Potential impacts

Construction of the project has the potential for the following hydrology and flooding related impacts:

- Potential changes to flood behaviour and changes to flood flow distribution from earthworks and construction activities.
- Potential direct impacts to the project in the case that a large flood event occurs during the construction period.

Operation of the project has the potential for the following soil and water quality related impacts:

- Potential obstruction to flood flows as a result of construction of new bridges, viaducts and culverts.
- Potential impacts to peak flood levels in the various sub-catchments that may impact existing development.
- Increased roadway and removal of vegetated median strips could increase runoff resulting in larger stormwater flows.
- Downstream flooding behaviour could be modified as a result of new bridges, batters and culverts.
- New motorway on-ramps requiring fill may change the local flow behaviour and re-route flood flows.

5.8.3 Proposed further assessment

A hydrology and flood impact assessment would determine the impacts of the proposed works. The assessment would advise the design of the project and would detail management and safeguard measures for hydrology and flooding across all the sub-catchments. This further assessment would consider the impacts of projected climate variability.

5.8.4 Management and safeguard measures

RMS standard safeguards and management measures for hydrology and flooding would be applied to the project. These include:

- Limiting the extent of obstructions within rivers, creeks and drains as far as practicable at all times during construction.
- Removing construction infrastructure and equipment in the event of a forecast flood on any of the sub-catchments.
- Providing suitable scour protection to the bridge abutments, piers and banks during construction.

Additional management measures for the project may include:

- Consideration of water sensitive urban design (WSUD) principles in the design of the motorway.
- Upgrades to existing stormwater infrastructure, such as culverts, may need to be considered to account for a change in the stormwater runoff regime.
- Incorporation of climate variability impacts into the design.

Outcomes from further hydrology and flooding assessment would be considered and, where appropriate to the project, also be applied.

5.9 Resource use and waste management

5.9.1 Overview

Raw and processed materials would be required for construction of the project. These materials would include concrete, steel, quarried aggregates, imported fill, fuel to power construction equipment and water. The quantity and types of materials required for construction would be further defined during detailed design.

For operations, only relatively small quantities of asphalt, concrete and other materials would be used to maintain the road.

Construction and operation of the project would see varying amounts of waste produced. Construction wastes generated would include fill material, general construction and demolition waste, vegetation waste, packaging materials and liquid wastes. Operational wastes (which would be much smaller in quantity) may include spills and leakages from vehicles, litter generated by road users and sediment from the water quality control basin.

5.9.2 Potential impacts

Construction of the project has the potential for the following resource use and waste management related impacts:

- Depletion of natural resources such as virgin quarried materials and sand required as construction materials
- Demolition wastes (building materials, vegetation, kerbs and pavements).
- Excavation wastes.
- Vegetation waste from the removal of trees, shrubs and groundcovers.
- Packaging materials such as crates, pallets, cartons, plastics and wrapping materials.
- General waste from construction sites (including office wastes, scrap materials and biodegradable wastes).
- Disposal of hazardous materials.
- Generation of sediment, hydrocarbons (oils and greases) and gross pollutants.
- Spill and leaks from vehicles.
- Litter generated by road users.
- Wastes generated from operational maintenance activities.

5.9.3 Proposed further assessment

The EIS would provide further assessment, including:

- Identification of the indicative resource requirements for the project and an assessment of the resource use impacts of the project.
- Identifying opportunities to use recycled materials within pavements provided they are fit for purpose and meet engineering requirements.
- Strategies for minimising the export of excavated materials off-site, maximising re-use opportunities and minimising the volume of excavated material disposal to landfill.
- Identification of specific waste impacts of the project and the waste management approach, to be outlined within the CEMP.
- Strategies for reducing waste would be discussed in the EIS such as the use of recycled materials, bulk delivery of good to minimise packaging and arrangements with suppliers to return any unused construction materials.

5.9.4 Management and safeguard measures

The following waste management measures would be implemented:

- Structures would be designed to minimise materials use and use recycled materials where possible.
- All wastes would be managed and disposed of in accordance with relevant state legislation and government policies including the *WRAPP (Waste Reduction and Purchasing Policy) reporting guidelines* (OEH 2011).

Waste management measures would be based upon the philosophy of reduce, reuse, recycle and appropriate disposal.

- The project induction would cover waste management measures in the CEMP.
- All waste material requiring off-site disposal would be classified using the *Waste Classification Guidelines* (DECCW 2009b) and disposed of at an appropriately licensed facility.

Standard management and safeguard measures would be detailed in the EIS for the project.

5.10 Contaminated land

5.10.1 Overview

The project is surrounded by a number of areas of potential contaminated land that could impact upon human and/or environmental receptors during construction of the project. Historical aerial photographs (1930 to 2005) show that past land use activities on and/or adjacent to the project, as well as numerous contaminated sites notified to the NSW EPA, pose a potential risk to the project with respect to contamination.

The areas of potential contamination within or near to the project would be primarily associated with past land uses and urban expansion and include:

- Landfills (nutrients, hydrocarbons, metals, organic acids, asbestos in waste materials, groundwater and gas).
- Railway facilities (hydrocarbons, solvents, phenolics, metals, asbestos in soils, groundwater and vapour).
- Industrial sites (hydrocarbons, solvents, phenolics, pesticides, nutrients, metals, asbestos in soil, groundwater and vapour).
- Quarries (heavy end hydrocarbons, heavy metals, general water quality parameters in soil and groundwater).
- Sediments within waterways (ie Duck River and Haslams Creek) (hydrocarbons, pesticides, metals in sediments).
- Point sources of contamination (eg service stations, workshops, garages) (hydrocarbons, solvents, metals in soil, groundwater and vapour).
- Contamination associated with road usage (eg fuel and chemical spillage, emissions/deposition from vehicles, road degradation) (hydrocarbons, heavy metals, asbestos, polycyclic aromatic hydrocarbons).

5.10.2 Potential impacts

Spoil generated by excavation for the project may be contaminated from contaminated land on and/or adjacent to the project and, if not managed appropriately, could potentially impact upon receptors during construction.

Additionally, if contamination is identified and the design of the construction elements incorporates management of contamination, there is likely to be an ongoing liability to manage and/or monitor construction materials and risk to receptors. This could affect the location of proposed construction elements and/or the methods of construction.

Exposure or disturbance of contaminated land during construction of the project may have the following impacts:

- Spread of contamination via migration pathways (ie groundwater, surface water, airborne dust, vapour, and subsoils)
- Risk of exposure to site workers, site users, and the public
- Risk of exposure to surrounding environmental receptors (ie flora, fauna, surrounding ecosystems).
- Based on the information reviewed, the potential areas of contamination identified present a low risk of impacting upon human and/or environmental receptors. This is due to the nature of the contamination, the possible migration pathways, and the distance and location of these sites relative to the project.

5.10.3 Proposed further assessment

Further assessment of the areas of potential contamination that could impact upon receptors during construction of the project would be required. Where applicable, further assessments would be undertaken in accordance with the NSW EPA endorsed guidelines and RMS's *Contaminated Land Management Guideline* (RMS 2005b).

5.10.4 Management and safeguard measures

Once the additional assessments have been undertaken and, if no further contamination is identified, the existing contamination (if present) can be managed by a project CEMP. The CEMP would detail contingency measures to manage potentially contaminated materials if suspected and/or encountered during the construction phase.

5.11 Hazard and risk

5.11.1 Overview

Hazards and risks arising from construction and operation of the project have the potential to impact the environment and human health.

The key potential hazard to arise during construction would be impacts to environmental and human health resulting from accidental releases, or improper handling and storage of hazardous substances within the project area. The quantities of hazardous substances that would be stored on the project are anticipated to be small.

Operational hazards are not considered likely given that the M4 Motorway is currently a major transport route and the addition of extra lanes would not result in a change to the motorway's existing use. Despite this, vehicle collision could result in the accidental spill of dangerous goods and has the potential to adversely affect the quality of the local environment and impact human safety.

5.11.2 Potential impacts

During construction, the following hazards and risks may be associated with the project:

- Environmental and human health impacts from accidental release of hazardous substances as a result of improper handling and storage within the project area, or vehicle accident during transport to the project area.
- Occupational health and safety hazards, such as dangers to construction workers, road users and the general public.
- Potential rupture or interference with underground utility services.

During operation, potential release of hazardous substances from vehicles transporting these substances along the project may occur. This would have the potential to adversely affect the quality of the local environment and impact human health.

5.11.3 Management and safeguard measures

Specific hazards and risks from construction and operation of the project would be considered in the EIS along with a project specific environmental risk analysis.

Management and safeguard measures would be implemented to avoid, minimise or manage hazard and risk. These management measures would include:

- Preparation and implementation of site specific Hazard and Risk Management Plans as part of the CEMP.
- Preparation and implementation of an occupational health and safety plan to deal with occupational health and safety risks associated with construction activities.
- The risks associated with the use and storage of hazardous substances during construction would be mitigated through appropriate design, and establishment of bunded areas in accordance with relevant legislation and codes of practice.
- Any chemical storage areas would be located outside areas subject to a 1 in 100 flood event.
- Transportation of all hazardous substances would be in accordance with relevant legislation and codes.
- Consultation with relevant utility owners would be undertaken to identify necessary protection measures in the vicinity of utilities.

ITS infrastructure installed at interchanges and along the motorway would facilitate the management and response to incidents.

Hazards and risks associated with the project during operation are considered low and would be managed with the implementation of standard management and safeguard measures including:

- Operational water quality control measures would be designed to reduce the environmental effects of pollutant runoff from the road surface and to contain spills of chemicals and hazardous substances.

5.12 Utilities

5.12.1 Overview

Avoiding or relocating utilities is a common issue encountered on many road projects. There are a number of public utilities that cross, or are located adjacent to, the existing M4 Motorway.

The project may require the relocation, adjustment or protection of existing public utilities such as electricity transmission and distribution lines, sewer trunks, stormwater infrastructure, communications cables and gas mains.

5.12.2 Potential impacts

Construction of the project has the potential for the following utility management related impacts:

- Disruption to electricity services from protection or relocation of power lines near James Ruse Drive, Wentworth Street and near North Strathfield.
- Relocation of optic fibre cables along the current M4 Motorway alignment.
- Protection of sewer trunk utilities beneath the existing carriageway.
- Minor disruptions to the provision of utilities for properties on either side of the river may occur during construction.
- Indirect damage to utilities from vibration or other construction related activities.

5.12.3 Management and safeguard measures

Management and safeguard measures would be implemented to avoid, minimise or manage disruptions to utilities. These management measures would include:

- Consultation with local councils, service providers, asset owners and any affected landowners would be undertaken throughout detailed design.
- Identifying the location of utilities through survey.
- Notifying residents of any disruptions to services, should these be required. Protection measures would be incorporated into design of the project with an aim to minimising disruption to customers using those services.
- Adjustment or relocation of utilities.
- Physical protection of utilities where necessary.
- Alternative construction methods may be considered where utilities are likely to be impacted.

Management and safeguard measures would be detailed in the assessment for the project.

5.13 Cumulative impact

5.13.1 Overview

Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that is generally the focus of cumulative impact assessment.

The prediction and evaluation of cumulative impacts is not straightforward since it is not always possible to directly combine different types of environmental impacts on an objective basis.

The project level environmental assessments will need to consider construction impacts from a cumulative perspective and may require adjustments to the typical mitigation and management measures.

5.13.2 Potential impacts

The following cumulative impacts may arise from WestConnex and staging:

- Within the NSW Government's *Sydney's rail future, modernising Sydney's trains* (TfNSW 2012b), service improvements on the Western Line over the concurrent time frame may result in increased patronage for trips in the M4 Motorway corridor. The effect of this would be reflected in traffic forecasts for the M4 Widening.
- Given the high usage of the M4 Motorway by users from north-west Sydney, development of the North West Rail Line has the prospect of altering current car-based travel from the sector. This effect would be reflected in traffic forecasts.
- As part of the WestConnex, the upgraded M4 and M5 corridors would feed into a new motorway standard north-south link between Camperdown and Mascot. This would have a substantial impact on the operation on the M4 Motorway. The M4 Widening and M4 East projects would reduce traffic volumes on the existing Parramatta Road, diverting them instead to the underground connection. This would further improve travel times on the M4 Motorway, as the congestion currently experienced would be reduced. The overall staging of the project would be addressed as a cumulative assessment.

The project has the potential for cumulative impacts during both construction and operational phases should other large scale developments within the Sydney region be planned and delivered during the same timeframe as the project. Potential issues include:

- Construction noise and vibration (particularly night time works).
- Construction traffic.
- Air quality impacts from construction activities.
- Visual impact and amenity effects of construction compounds and associated sites and activities.
- Non-Aboriginal and Aboriginal heritage impacts.
- Ecological impacts such as impacts to biodiversity, hydrology and resource usage.
- Economic and social impacts including construction fatigue due to large and ongoing construction works for surrounding residents and businesses.

Construction impacts on communities adjacent to the project are expected to be a key issue and would be addressed in detail.

5.13.3 Proposed further assessment

Additional project specific investigations and assessments would be undertaken to detail the potential cumulative impacts that this project would present as well as proposed mitigation and management measures. This would include:

- Potential amenity issues for the community including air quality/visual/noise and socio-economic considerations due to cumulative impacts of WestConnex and other large construction projects.
- Potential impacts on air quality, due to the net effect of emissions to air from the project and existing sources, and assessed in accordance with the EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005).
- Assessment of potential impacts, including cumulative impacts on threatened ecological communities and flora and fauna species listed under the TSC Act, FM Act and/or the EPBC Act and their habitats.
- Assessment of the potential cumulative impacts on Aboriginal archaeological and cultural heritage values, including intangible cultural values.

5.13.4 Management and safeguard measures

As indicated above, and subject to the time and location of impact overlaps with other projects associated with the WestConnex scheme, the mitigation and management measures identified may need to be enhanced and strengthened beyond that typically provided for a project to take into account the potential for significant construction fatigue. These adjustments (if necessary) would be identified as part of the detailed assessments.

6 Conclusion

RMS is proposing to widen and upgrade the M4 Western Motorway to provide four traffic lanes in each direction between Pitt Street, Parramatta and Homebush Bay Drive, Homebush (the project). It would include widening of existing viaduct sections, and upgrades to existing interchanges.

RMS has formed the opinion that the impacts of the project on the issues listed below would be likely to significantly affect the environment and require the preparation of an EIS under the EP&A Act. Accordingly, the project is state significant infrastructure under Part 5.1 of the EP&A Act. Approval from the Minister for Planning and Infrastructure is required for the project.

The key environmental issues identified for the project include:

- Traffic and transport.
- Noise and vibration.
- Socio-economic impacts.
- Land use and property.
- Urban design (including visual impact).

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Attachment A

Requirements of the Environmental Planning and Assessment Regulation 2000

Clause 192 of the *Environmental Planning and Assessment Regulation 2000* requires that an application for approval of the Minister to carry out State significant infrastructure must include:

(a) details of any approval that would, but for section 115ZG of the Act, be required for the carrying out of the State significant infrastructure, and

(b) details of any authorisations that must be given under section 115ZH of the Act if the application is approved, and

(c) a statement as to the basis on which the proposed infrastructure is State significant infrastructure, including, if relevant, the capital investment value of the proposed infrastructure.

Approvals that would otherwise apply

Approvals that may be required to carry out the SSI, if not for section 115ZG of the EP&A Act, include:

- An approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977*.
- An Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974.*

Authorisations if the application is approved

Authorisations that may be required for the project under section 115ZH of the EP&A Act include:

- An environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (for any of the purposes referred to in section 43 of that Act).

State significant infrastructure statement

Clause 14(1) of State Environmental Planning Policy (State and Regional Development) 2011 provides that development is declared to be State significant infrastructure pursuant to section 115U(2) of the Act if it is permissible without development consent under Part 4 of the Act under a State environmental planning policy; and is specified in the categories of development in Schedule 3.

State Environmental Planning Policy (Infrastructure) (ISEPP) permits development for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. As the M4 Widening project is for a road and road infrastructure facilities, and is to be carried out by RMS, the project is permissible without development consent under Part 4 of the EP&A Act.

Schedule 3 of State Environmental Planning Policy (State and Regional Development) 2011 provides that general public authority activities for infrastructure or other development that (but for Part 5.1 of the EP&A Act and within the meaning of Part 5 of the Act) would be an activity for which the proponent is also the determining authority, and would, in the opinion of the proponent, require an EIS to be obtained under the EP&A Act.

For the M4 Widening, RMS has formed the opinion that the impact of the project on traffic and transport, noise and vibration and socio-economic amenity would be likely to significantly affect the environment and would require an EIS to be obtained under Section 112 of the EP&A Act.

On this basis the project is State significant infrastructure. Approval from the Minister for Planning and Infrastructure is required under section 115W of the EP&A Act.

Attachment B

Items of non-Aboriginal heritage located within the study area

Map/LEP No	Item Name	Address	Locality	Council	Signific-ance	Date	LEP	SHR	S170	NT	RNE
I1	Parramatta River Wetlands	Parramatta River, Camellia (and Ermington; Parramatta; and Rydalmere)	Various	Parramatta	Local		Parramatta LEP 2011	-	-	-	-
I576	RTA Depot	4a James Ruse Drive, Rosehill	Rosehill	Parramatta	Local	1944	Parramatta LEP 2011	-	-	-	-
I575	Capral Aluminium	3-11 Shirley Street	Rosehill	Parramatta	Local	1930	Parramatta LEP 2011	-	-	-	-
I4	Auburn North Public School and *Ficus macrophylla*, Moreton Bay Fig Tree	153–159 Parramatta Road, Auburn	Auburn	Auburn	Local	1889-1891	Auburn LEP 2010	-	-	-	-
A51	Parramatta Road Milestone	South side of Parramatta Road between Dartbrook and Station Roads	Auburn	Auburn	Local		Auburn LEP 2010	-	-	-	-
I1790	Electricity Substation No. 167	93 Parramatta Road/ 2 Silverwater Road	Auburn	Auburn	State	1924-1929		yes (01790)	yes		
I45	House	24 Silverwater Road	Silverwater	Auburn	Local	1876-1900	Auburn LEP 2010	-	-	-	-
A54	Haslams Creek Bridge	Parramatta Road at Haslams Creek	Lidcombe	Auburn	Local	1920-1930	Auburn LEP 2010	-	yes	-	-

Map/LEP No	Item Name	Address	Locality	Council	Signific-ance	Date	LEP	SHR	S170	NT	RNE
	Haslams Creek Culvert	Parramatta Road at Haslams Creek	Silverwater	Auburn	Local		-	-	yes	-	-
I20	Stand of *Eucalyptus longifolia*	Corner of Parramatta and Hill Roads	Auburn	Auburn	Local		Auburn LEP 2010	-	-	-	-
I41	Stand of Eucalyptus microcorys	Olympic Drive	Lidcombe	Auburn	Local	1960-1995	Auburn LEP 2010	-	-	-	-
A52	Parramatta Road Milestone	South side of Parramatta Road, east of Station Road, east of Delhi Street, east side of railway bridge abutments near Birnie Street	Lidcombe	Auburn	Local		Auburn LEP 2010	-	-	yes	-
I541	Bakehouse Quarter (former Arnott's complex)	11, 20-22 George Street	North Strathfield	Canada Bay	Local	1907-	Draft Canada Bay LEP 2012	-	-	-	-
I212	Shops	16-18 George Street, North Strathfield	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I1170	Homebush Railway Station Group	Great Southern and Western Railway	Homebush	Strathfield	State	1891-1993	Draft Strathfield LEP 2011	yes (01170)	yes	-	-
I357	Street Trees	Napier Street, North Strathfield	North Strathfield	Canada Bay	Local	1940	Canada Bay LEP 2008	-	-	-	-
I387	House "Sunnyside"	14 Princess Avenue	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I388	House	26 Princess Avenue	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-

Map/LEP No	Item Name	Address	Locality	Council	Signific-ance	Date	LEP	SHR	S170	NT	RNE
I64	House	2 Carrington Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I65	Concord Baptist Church	3 Carrington Street	North Strathfield	Canada Bay	Local	1910-1928	Canada Bay LEP 2008	-	-	-	-
I66	House	4 Carrington Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I67	House	7 Carrington Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I68	House	13 Carrington Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I69	House	14 Carrington Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I70	House	17 Carrington Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I71	House	19 Carrington Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I369	House	15 Queen Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I433	House	11 Sydney Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I434	House	23 Sydney Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I435	House	33 Sydney Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I539	House	35 Sydney Street	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-

Map/LEP No	Item Name	Address	Locality	Council	Signific-ance	Date	LEP	SHR	S170	NT	RNE
	Powell's Estate Conservation Area	Queen, Carrington & Sydney Street	North Strathfield	Canada Bay	Local	1880s-1940s	Canada Bay LEP 2008	-	-	-	-
I461	House & Garden	10 Thornleigh Road	Concord	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I108	House	64 Concord Road	North Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I99	Wesley Uniting Church - and hall	81 Concord Road	North Strathfield	Canada Bay	Local	1927	Canada Bay LEP 2008	-	-	-	-
I431	Street trees	Sydney Street	Concord	Canada Bay	Local	1950s	Canada Bay LEP 2008	-	-	-	-
I182	Street trees	Edward Street	Concord	Canada Bay	Local	1940-1950	Canada Bay LEP 2008	-	-	-	-
I284	House	5 Leicester Avenue	Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I285	House	7 Leicester Avenue	Strathfield	Canada Bay	Local		Canada Bay LEP 2008	-	-	-	-
I62	Wentworth Hotel	195 Parramatta Road	Homebush West	Canada Bay	Local		Draft Strathfield LEP 2011	-	-	-	-
	Electricity Substation No. 265	197 Parramatta Road	Homebush	Canada Bay		1928	-	-	yes	-	-
I 63	Former Ford Factory Building	350-374 Parramatta Road	Homebush West	Strathfield	Local		Draft Strathfield LEP 2011	-	-	-	-

Map/LEP No	Item Name	Address	Locality	Council	Signific-ance	Date	LEP	SHR	S170	NT	RNE
I29	Railway Bridge with Arnott's sign over road	Parramatta Road (south side) & Bridge Road (east side)	Homebush	Strathfield	Local		Draft Strathfield LEP 2011	-	-	-	-
I30	Parramatta Road Milestone - archaelogical	Parramatta Road (south side) & Bridge Road (east side)	Homebush	Strathfield	Local		Draft Strathfield LEP 2011	-	-	-	-
I31	Former Homebush Theatre/Niterider Theatre & Arnott's sign	55-57 Parramatta Road	Homebush	Strathfield	Local		Draft Strathfield LEP 2011	-	-	-	-
I32	Horse & Jockey Hotel	70 Parramatta Road & Knight Street	Homebush	Strathfield	Local		Draft Strathfield LEP 2011	-	-	-	-
I33	Commercial Building	72-76 Parramatta Road	Homebush	Strathfield	Local		Draft Strathfield LEP 2011	-	-	-	-
C6	Houses within Welfare Street Precinct Group	1-11 Flemington Road	Homebush	Strathfield	Local		Draft Strathfield LEP 2011	-	-	-	-
C6	Houses within Welfare Street Precinct Group	2-14 Welfare Street	Homebush West	Strathfield	Local		Draft Strathfield LEP 2011	-	-	-	-
I28	House & Garden	80 Park Road (formerly 80 Wentworth Road)	Homebush	Strathfield	Local		Draft Strathfield LEP 2011	-	-	-	-
AMU 2968/ PHALMS 2000	Capral Aluminium Manufacturing and Processing	Unwin Street, Rosehill	Rosehill	Parramatta	Local	Late 1930s	Parramatta LEP 2011	-	-	-	-

Attachment C1

Fauna species identified within the study area

Type of animal	Scientific name	Common Name	EPBC Act status	TSC Act status	Data source	Likelihood of occurrence	Risk of significant impact
Frog	*Crinia tinnula*	Wallum Froglet		V	Atlas of NSW Wildlife	**Low**	**No**
Frog	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Frog	*Litoria aurea*	Green and Golden Bell Frog	V	E	Atlas of NSW Wildlife, EPBC	**Moderate**	**Moderate**
Frog	*Litoria brevipalmata*	Green-thighed Frog		V	Atlas of NSW Wildlife	**Low**	**No**
Frog	*Litoria littlejohni*	Littlejohn's Tree Frog, Heath Frog	V	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Frog	*Litoria raniformis*	Southern Bell Frog	V	E	EPBC	**Low**	**No**
Frog	*Mixophyes balbus*	Stuttering Frog	V	E	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Frog	*Mixophyes iteratus*	Giant Barred Frog	E	E	EPBC	**Low**	**No**
Frog	*Pseudophryne australis*	Red-crowned Toadlet		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Actitis hypoleucos*	Common Sandpiper	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Anthochaera phrygia (syn. Xanthomyza phrygia)*	Regent Honeyeater	EM	CE	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Apus pacificus*	Fork-tailed Swift	M		EPBC	**Moderate**	**Low**
Bird	*Ardea ibis*	Cattle Egret	M		Atlas of NSW Wildlife, EPBC	**Moderate**	**Low**
Bird	*Ardea modesta*	Eastern Great Egret	M		EPBC	**Moderate**	**Low**
Bird	*Arenaria interpres*	Ruddy Turnstone	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**

Type of animal	Scientific name	Common Name	EPBC Act status	TSC Act status	Data source	Likelihood of occurrence	Risk of significant impact
Bird	*Botaurus poiciloptilus*	Australasian Bittern		E	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Burhinus grallarius*	Bush Stone-curlew		E	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Cacatua leadbeateri*	Major Mitchell's Cockatoo		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Calidris acuminata*	Sharp-tailed Sandpiper	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Calidris alba*	Sanderling	M	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Calidris bairdii*	Baird's Sandpiper	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Calidris canutus*	Red Knot	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Calidris ferruginea*	Curlew Sandpiper	M	E	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Calidris mauri*	Western Sandpiper	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Calidris melanotos*	Pectoral Sandpiper	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Calidris ruficollis*	Red-necked Stint	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Calidris tenuirostris*	Great Knot	M	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Callocephalon fimbriatum*	Gang-gang Cockatoo		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Calyptorhynchus lathami*	Glossy Black-Cockatoo		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Charadrius bicinctus*	Double-banded Plover	M		EPBC	**Low**	**No**
Bird	*Charadrius leschenaultii*	Greater Sand Plover	M	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Charadrius mongolus*	Lesser Sand Plover	M	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Charadrius veredus*	Oriental Plover	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Chlidonias leucopterus*	White-winged Black Tern	M		Atlas of NSW Wildlife	**Low**	**No**

Type of animal	Scientific name	Common Name	EPBC Act status	TSC Act status	Data source	Likelihood of occurrence	Risk of significant impact
Bird	*Chthonicola sagittata (syn. Pyrrholaemus sagittatus)*	Speckled Warbler		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Circus assimilis*	Spotted Harrier		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Cuculus opatus (syn. Cuculus saturatus)*	Oriental Cuckoo, Himalayan Cuckoo	M		Atlas of NSW Wildlife	**Moderate**	**No**
Bird	*Daphoenositta chrysoptera*	Varied Sittella		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Dasyornis brachypterus*	Eastern Bristlebird	E	E	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Egretta sacra*	Eastern Reef Egret	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Ephippiorhynchus asiaticus*	Black-necked Stork		E	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Epthianura albifrons*	White-fronted Chat		E2	Atlas of NSW Wildlife, Atlas of NSW Wildlife	**Low**	**No**
Bird	*Erythrotriorchis radiatus*	Red Goshawk	VM	CE	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Esacus neglectus*	Beach Stone-curlew		CE	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Gallinago hardwickii*	Latham's Snipe	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Glossopsitta pusilla*	Little Lorikeet		V	Atlas of NSW Wildlife	**Low**	**Low**
Bird	*Grantiella picta*	Painted Honeyeater		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Gygis alba*	White Tern		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Haematopus fuliginosus*	Sooty Oystercatcher		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Haematopus longirostris*	Australian Pied Oystercatcher		E	Atlas of NSW Wildlife	**Low**	**No**

Type of animal	Scientific name	Common Name	EPBC Act status	TSC Act status	Data source	Likelihood of occurrence	Risk of significant impact
Bird	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	M		Atlas of NSW Wildlife, EPBC	**Moderate**	**Low**
Bird	*Hieraaetus morphnoides*	Little Eagle		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Hirundapus caudacutus*	White-throated Needletail	M		Atlas of NSW Wildlife, EPBC	**Moderate**	**Low**
Bird	*Hydroprogne caspia (syn. Sternia caspia)*	Caspian Tern	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Ixobrychus flavicollis*	Black Bittern		V	Atlas of NSW Wildlife	**Moderate**	**Low**
Bird	*Lathamus discolor*	Swift Parrot	E	E	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Limicola falcinellus*	Broad-billed Sandpiper	M	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Limosa lapponica*	Bar-tailed Godwit	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Limosa limosa*	Black-tailed Godwit	M	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Lophoictinia isura*	Square-tailed Kite		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Melanodryas cucullata cucullata*	Hooded Robin (South-Eastern)		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Merops ornatus*	Rainbow Bee-eater	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Monarcha melanopsis*	Black-faced Monarch	M		EPBC	**Low**	**No**
Bird	*Myiagra cyanoleuca*	Satin Flycatcher	M		EPBC	**Low**	**No**
Bird	*Neophema chrysogaster*	Orange-bellied Parrot	ZM	E	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Neophema pulchella*	Turquoise Parrot		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Nettapus coromandelianus*	Cotton Pygmy-Goose		E	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Ninox connivens*	Barking Owl		V	Atlas of NSW Wildlife	**Low**	**No**

Type of animal	Scientific name	Common Name	EPBC Act status	TSC Act status	Data source	Likelihood of occurrence	Risk of significant impact
Bird	*Ninox strenua*	Powerful Owl		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Numenius madagascariensis*	Eastern Curlew	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Numenius minutus*	Little Curlew	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Numenius phaeopus*	Whimbrel	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Pandion cristatus (syn. P. haliaetus)*	Eastern Osprey	M	V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Petroica boodang*	Scarlet Robin		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Petroica phoenicea*	Flame Robin		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Petroica rodinogaster*	Pink Robin		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Pezoporus wallicus*	Ground Parrot		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Phaethon lepturus*	White-tailed Tropicbird	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Philomachus pugnax*	Ruff	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Plegadis falcinellus*	Glossy Ibis	M		Atlas of NSW Wildlife	**Moderate**	**Low**
Bird	*Pluvialis fulva*	Pacific Golden Plover			Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Pluvialis squatarola*	Grey Plover	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Ptilinopus superbus*	Superb Fruit-Dove		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Rhipidura rufifrons*	Rufous Fantail	M		EPBC	**Low**	**No**
Bird	*Rostratula australis (syn. R. benghalensis)*	Australian Painted Snipe (Painted Snipe)	VM	E	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Stagonopleura guttata*	Diamond Firetail			Atlas of NSW Wildlife	**Low**	**No**
Bird	*Stictonetta naevosa*	Freckled Duck		V	Atlas of NSW Wildlife	**Low**	**No**

Type of animal	Scientific name	Common Name	EPBC Act status	TSC Act status	Data source	Likelihood of occurrence	Risk of significant impact
Bird	*Tringa brevipes (syn. Heteroscelus brevipes)*	Grey-tailed Tattler	M		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Tringa glareola*	Wood Sandpiper	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Tringa incanus (syn. Heteroscelus brevipes)*	Wandering Tattler			Atlas of NSW Wildlife	**Low**	**No**
Bird	*Tringa nebularia*	Common Greenshank	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Tringa stagnatilis*	Marsh Sandpiper			Atlas of NSW Wildlife, EPBC	**Low**	**No**
Bird	*Tryngites subruficollis*	Buff-breasted Sandpiper	M		Atlas of NSW Wildlife	**Low**	**No**
Bird	*Tyto longimembris longimembris*	Eastern Grass Owl		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Tyto novaehollandiae novaehollandiae*	Masked Owl (southern mainland)		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Tyto tenebricosa*	Sooty Owl		V	Atlas of NSW Wildlife	**Low**	**No**
Bird	*Xenus cinereus*	Terek Sandpiper	M	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Fis	*Epinephelus daemelii*	Black Cod		V	EPBC	**Low**	**No**
Fis	*Macquaria australasica*	Macquarie Perch	E		EPBC	**Low**	**No**
Fis	*Pristis zijsron*	Green Sawfish		E4	EPBC	**Low**	**No**
Fis	*Prototroctes maraena*	Australian Grayling	V		EPBC	**Low**	**No**
Inv	*Meridolum corneovirens*	Cumberland Plain Land Snail		E	Atlas of NSW Wildlife	**Low**	**No**
Mam	*Cercartetus nanus*	Eastern Pygmy-possum		V	Atlas of NSW Wildlife	**Low**	**No**
Mam	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Mam	*Dasyurus maculatus maculatus*	Spotted-Tailed Quoll (Southern Subspecies)	E	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**

Type of animal	Scientific name	Common Name	EPBC Act status	TSC Act status	Data source	Likelihood of occurrence	Risk of significant impact
Mam	*Dasyurus viverrinus*	Eastern Quoll		E	Atlas of NSW Wildlife	**Low**	**No**
Mam	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle		V	Atlas of NSW Wildlife	**Low**	**No**
Mam	*Isoodon obesulus*	Southern Brown Bandicoot	E	E	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Mam	*Kerivoula papuensis*	Golden-tipped Bat		V	Atlas of NSW Wildlife	**Low**	**No**
Mam	*Miniopterus australis*	Little Bent-wing Bat		V	Atlas of NSW Wildlife	**Low**	**No**
Mam	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat		V	Atlas of NSW Wildlife	**Moderate**	**Moderate**
Mam	*Mormopterus norfolkensis*	Eastern Free-tail bat		V	Atlas of NSW Wildlife	**Low**	**No**
Mam	*Myotis macropus*	Southern Myotis		V	Atlas of NSW Wildlife	**Moderate**	**Moderate**
Mam	*Perameles nasuta*	Long-nosed Bandicoot		E2	Atlas of NSW Wildlife	**Moderate**	**No**
Mam	*Petaurus australis*	Yellow-bellied Glider		V	Atlas of NSW Wildlife	**Low**	**No**
Mam	*Petaurus norfolcensis*	Squirrel Glider		V	Atlas of NSW Wildlife	**Low**	**No**
Mam	*Petrogale penicillata*	Brush-tailed Rock-wallaby	V	E	EPBC	**Low**	**No**
Mam	*Phascolarctos cinereus*	Koala (NSW, ACT & QLD - excluding SE QLD)	V	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Mam	*Potorous tridactylus tridactylus*	Long-nosed Potoroo (SE mainland)	V	V	EPBC	**Low**	**No**
Mam	*Pseudomys novaehollandiae*	New Holland Mouse	V		Atlas of NSW Wildlife, EPBC	**Low**	**No**
Mam	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	Atlas of NSW Wildlife, EPBC	**High**	**Low**
Mam	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat		V	Atlas of NSW Wildlife	**Low**	**No**
Mam	*Scoteanax rueppellii*	Greater Broad-nosed Bat		V	Atlas of NSW Wildlife	**Low**	**No**

Type of animal	Scientific name	Common Name	EPBC Act status	TSC Act status	Data source	Likelihood of occurrence	Risk of significant impact
Rep	*Chelonia mydas*	Green Turtle	VM	V	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Rep	*Hoplocephalus bungaroides*	Broad-headed Snake	V	E	Atlas of NSW Wildlife, EPBC	**Low**	**No**
Rep	*Varanus rosenbergi*	Heath Monitor (Rosenberg's Goana)		V	Atlas of NSW Wildlife	**Low**	**No**

Attachment C2

Flora species identified within the study area

Species Name	Family Name	Common Name	EPBC Status	Threat Listing	Data Source	Likelihood of occurrence	Risk of significant impact?
Acacia baueri subsp. aspera	Fabaceae (Mimosoideae)			V	Atlas of NSW Wildlife	**Low**	**Low**
Acacia bynoeana	Fabaceae (Mimosoideae)	Bynoes Wattle	V	E	Atlas of NSW Wildlife	**Low**	**Low**
Acacia gordonii	Fabaceae (Mimosoideae)		E	E	Atlas of NSW Wildlife	**Low**	**Low**
Acacia prominens	Fabaceae (Mimosoideae)	Gosford Wattle		E2	Atlas of NSW Wildlife	**Low**	**Low**
Acacia pubescens	Fabaceae (Mimosoideae)	Downy Wattle	V	V	Atlas of NSW Wildlife	**Moderate**	**Low**
Acacia terminalis subsp. terminalis	Fabaceae (Mimosoideae)	Sunshine Wattle	E	E	Atlas of NSW Wildlife	**Low**	**Low**
Allocasuarina glareicola	Casuarinaceae		E	E	Atlas of NSW Wildlife	**Low**	**Low**
Astrotricha crassifolia	Araliaceae	Thick-leaf Star-hair	V	V	Atlas of NSW Wildlife	**Low**	**Low**
Bothriochloa biloba	Poaceae		V	V	Atlas of NSW Wildlife	**Low**	**Low**
Caesia parviflora var. minor	Anthericaceae	Small Pale Grass-lily		E	Atlas of NSW Wildlife	**Low**	**Low**
Caladenia tessellata	Orchidaceae	Thick Lip Spider Orchid	V	E	Atlas of NSW Wildlife	**Low**	**Low**
Callistemon linearifolius	Myrtaceae	Netted Bottle Brush		V	Atlas of NSW Wildlife, PlantNet	**Low**	**Low**
Camarophyllopsis kearneyi	Hygrophoraceae			E	Atlas of NSW Wildlife	**Low**	**Low**
Chamaesyce psammogeton	Euphorbiaceae	Sand Spurge		E	Atlas of NSW Wildlife	**Low**	**Low**
Cynanchum elegans	Asclepiadaceae	White-flowered Wax Plant	E	E	Atlas of NSW Wildlife	**Low**	**Low**

Species Name	Family Name	Common Name	EPBC Status	Threat Listing	Data Source	Likelihood of occurrence	Risk of significant impact?
Darwinia biflora	Myrtaceae		V	V	Atlas of NSW Wildlife, PlantNet	**Low**	**Low**
Deyeuxia appressa	Poaceae		E	E	Atlas of NSW Wildlife, EPBC, PlantNet	**Low**	**Low**
Dichanthium setosum	Poaceae	Bluegrass	V	V	Atlas of NSW Wildlife	**Low**	**Low**
Dillwynia tenuifolia	Fabaceae (Faboideae)		V	V	Atlas of NSW Wildlife	**Low**	**Low**
Epacris purpurascens var. purpurascens	Epacridaceae	-		V	Atlas of NSW Wildlife	**Low**	**Low**
Eucalyptus camfieldii	Myrtaceae	Heart-leaved Stringybark	V	V	Atlas of NSW Wildlife, EPBC	**Low**	**Low**
Eucalyptus fracta	Myrtaceae			V	Atlas of NSW Wildlife	**Low**	**Low**
Eucalyptus nicholii	Myrtaceae	Narrow-leaved Black Peppermint	V	V	Atlas of NSW Wildlife	**Moderate (planted)**	**Low**
Eucalyptus pulverulenta	Myrtaceae	Silver-leaved Gum	V	V	Atlas of NSW Wildlife	**Low**	**Low**
Eucalyptus scoparia	Myrtaceae		V	E	Atlas of NSW Wildlife	**Moderate (planted)**	**Low**
Genoplesium baueri	Orchidaceae	Bauers Midge Orchid		V	Atlas of NSW Wildlife, PlantNet	**Low**	**Low**
Genoplesium plumosum	Orchidaceae		E	CE	Atlas of NSW Wildlife	**Low**	**Low**
Grammitis stenophylla	Grammitaceae	Narrow-leaf Finger Fern		E	Atlas of NSW Wildlife	**Low**	**Low**
Grevillea caleyi	Proteaceae	Caleys Grevillea	E	E	Atlas of NSW Wildlife, PlantNet	**Low**	**Low**
Grevillea parviflora subsp. parviflora	Proteaceae	Small-flower Grevillea	V	V	Atlas of NSW Wildlife, EPBC	**Low**	**Low**

Species Name	Family Name	Common Name	EPBC Status	Threat Listing	Data Source	Likelihood of occurrence	Risk of significant impact?
Gyrostemon thesioides	Gyrostemonaceae			E	Atlas of NSW Wildlife	**Low**	**Low**
Haloragodendron lucasii	Haloragaceae		E	E	Atlas of NSW Wildlife	**Low**	**Low**
Hibbertia puberula	Dilleniaceae			E	Atlas of NSW Wildlife	**Low**	**Low**
Hibbertia sp. Bankstown	Dilleniaceae		CE	CE	Atlas of NSW Wildlife, EPBC, PlantNet	**Low**	**Low**
Hibbertia sp. nov. Menai	Dilleniaceae			E	Atlas of NSW Wildlife	**Low**	**Low**
Hibbertia superans	Dilleniaceae			E	Atlas of NSW Wildlife	**Low**	**Low**
Hygrocybe anomala var. ianthinomarginata	Hygrophoraceae			V	Atlas of NSW Wildlife	**Low**	**Low**
Hygrocybe aurantipes	Hygrophoraceae			V	Atlas of NSW Wildlife	**Low**	**Low**
Hygrocybe austropratensis	Hygrophoraceae			E	Atlas of NSW Wildlife	**Low**	**Low**
Hygrocybe collucera	Hygrophoraceae			E	Atlas of NSW Wildlife	**Low**	**Low**
Hygrocybe griseoramosa	Hygrophoraceae			E	Atlas of NSW Wildlife	**Low**	**Low**
Hygrocybe lanecovensis	Hygrophoraceae			E	Atlas of NSW Wildlife	**Low**	**Low**
Hygrocybe reesiae	Hygrophoraceae			V	Atlas of NSW Wildlife	**Low**	**Low**
Hygrocybe rubronivea	Hygrophoraceae			V	Atlas of NSW Wildlife	**Low**	**Low**
Isotoma sessiliflora	Lobeliaceae		X	E	PlantNet	**Low**	**Low**
Lasiopetalum joyceae	Sterculiaceae		V	V	Atlas of NSW Wildlife	**Low**	**Low**
Leptospermum deanei	Myrtaceae		V	V	Atlas of NSW Wildlife, EPBC	**Low**	**Low**

Species Name	Family Name	Common Name	EPBC Status	Threat Listing	Data Source	Likelihood of occurrence	Risk of significant impact?
Leucopogon exolasius	Epacridaceae	Woronora Beard-heath	V	V	Atlas of NSW Wildlife	**Low**	**Low**
Maundia triglochinoides	Juncaginaceae	-		V	Atlas of NSW Wildlife	**Low**	**Low**
Melaleuca biconvexa	Myrtaceae	Biconvex Paperbark	V	V	EPBC	**Low**	**Low**
Melaleuca deanei	Myrtaceae	Deanes Paperbark	V	V	Atlas of NSW Wildlife, EPBC	**Low**	**Low**
Microtis angusii	Orchidaceae		E	E	Atlas of NSW Wildlife	**Low**	**Low**
Pelargonium sp. Striatellum (G. W. Carr 10345), syn. Pelargonium sp., Pelargonium sp. 1	Geraniaceae	Omeo Stork's-bill	E	E	EPBC	**Low**	**Low**
Persoonia bargoensis	Proteaceae		V	E	Atlas of NSW Wildlife	**Low**	**Low**
Persoonia hirsuta	Proteaceae	Hairy Geebung	E	E	Atlas of NSW Wildlife	**Low**	**Low**
Persoonia nutans	Proteaceae	Nodding Geebung	E	E	Atlas of NSW Wildlife, EPBC, PlantNet	**Low**	**Low**
Pimelea curviflora var. curviflora	Thymelaeaceae		V	V	Atlas of NSW Wildlife, EPBC	**Low**	**Low**
Pimelea spicata	Thymelaeaceae	Spiked Rice-flower	E	E	Atlas of NSW Wildlife, EPBC, PlantNet	**Low**	**Low**
Pomaderris prunifolia var. prunifolia	Rhamnaceae	Plum-leaf Pomaderris		E2	Atlas of NSW Wildlife	**Low**	**Low**
Prasophyllum fuscum	Orchidaceae	Slaty Leek Orchid	V	V	Atlas of NSW Wildlife	**Low**	**Low**
Prostanthera densa	Lamiaceae	Villous Mint-bush	V	V	Atlas of NSW Wildlife, EPBC	**Low**	**Low**
Prostanthera marifolia	Lamiaceae		CE	CE	Atlas of NSW Wildlife, EPBC	**Low**	**Low**

Species Name	Family Name	Common Name	EPBC Status	Threat Listing	Data Source	Likelihood of occurrence	Risk of significant impact?
Pterostylis gibbosa	Orchidaceae		E	E	EPBC	**Low**	**Low**
Pterostylis saxicola	Orchidaceae	Sydney Plains Greenhood	E	E	EPBC, Atlas of NSW Wildlife	**Low**	**Low**
Pterostylis sp. Botany Bay	Orchidaceae			E	Atlas of NSW Wildlife	**Low**	**Low**
Pultenaea aristata	Fabaceae (Faboideae)		V	V	Atlas of NSW Wildlife	**Low**	**Low**
Pultenaea humilis	Fabaceae (Faboideae)	Dwarf Bush Pea		V	PlantNet	**Low**	**Low**
Pultenaea pedunculata	Fabaceae (Faboideae)	Matted Bush-pea		E	Atlas of NSW Wildlife, PlantNet	**Low**	**Low**
Sarcochilus hartmannii	Orchidaceae	Hartmans Sarcochilus	V	V	Atlas of NSW Wildlife	**Low**	**Low**
Senecio spathulatus	Asteraceae	Coast Groundsel		E	Atlas of NSW Wildlife	**Low**	**Low**
Streblus pendulinus	Moraceae	Whalebone Tree	E		EPBC	**Low**	**Low**
Syzygium paniculatum	Myrtaceae	Magenta Lilly Pilly	V	E	Atlas of NSW Wildlife, EPBC	**Moderate (planted)**	**Low**
Tetratheca glandulosa	Tremandraceae	Glandular Pink-bell	V	V	Atlas of NSW Wildlife, EPBC	**Low**	**Low**
Tetratheca juncea	Tremandraceae	Black-eyed Susan	V	V	Atlas of NSW Wildlife	**Low**	**Low**
Thelymitra atronitida	Orchidaceae	Black-hooded Sun Orchid		E	Atlas of NSW Wildlife	**Low**	**Low**
Thelymitra sp. Kangaloon	Orchidaceae	Kangaloon Sun Orchid	Z	CE	EPBC	**Low**	**Low**
Thesium australe	Santalaceae	Austral Toadflax	V	V	EPBC	**Low**	**Low**
Triplarina imbricata	Myrtaceae	Creek Triplarina	E	E	Atlas of NSW Wildlife, PlantNet	**Low**	**Low**
Wahlenbergia multicaulis	Campanulaceae	Tadgells Bluebell		E2	Atlas of NSW Wildlife	**Moderate**	**Moderate**

Species Name	Family Name	Common Name	EPBC Status	Threat Listing	Data Source	Likelihood of occurrence	Risk of significant impact?
Wilsonia backhousei	Convolvulaceae	Narrow-leafed Wilsonia		V	Atlas of NSW Wildlife	**Moderate**	**Moderate**
Wilsonia rotundifolia	Convolvulaceae	Round-leafed Wilsonia		E	Atlas of NSW Wildlife	**Low**	**Low**
Zannichellia palustris	Zannichelliaceae	-		E	PlantNet	**Low**	**Low**