WestConnex

M4-M5 Link

Environmental Impact Statement

August 2017

Main Volume Chapters 1 to 8

Volume 1A

Since finalisation of the Environmental Impact Statement, the project has been declared by Ministerial Order to be State significant infrastructure and critical State significant infrastructure under sections 115U (4) and 115V of the *Environmental Planning and Assessment Act 1979*. The Ministerial Order also amended Schedule 5 of *State Environmental Planning Policy (State and Regional Development) 2011*. The project remains subject to assessment under Part 5.1 of the *Environmental Planning and Assessment Act 1979* and requires the approval of the Minister for Planning.

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WestConnex

Australian Government
BUILDING OUR FUTURE

NSW GOVERNMENT

M4-M5 Link

Environmental Impact Statement

August 2017

Executive Summary

Executive summary

What is proposed?

NSW Roads and Maritime Services (Roads and Maritime) is seeking approval to construct and operate the WestConnex M4-M5 Link (the project), which would comprise a new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (the Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange.

Together with the other components of the WestConnex program of works and the proposed future Sydney Gateway, the project would facilitate improved connections between western Sydney, Sydney Airport and Port Botany and south and south-western Sydney, as well as better connectivity between the important economic centres along Sydney's Global Economic Corridor and local communities. A more comprehensive description of the project elements and construction work is provided in **Chapter 5** (Project description) and **Chapter 6** (Construction work) respectively.

The M4-M5 Link is part of the WestConnex program of works. Separate planning applications and assessments have been completed for each of the approved WestConnex projects. Roads and Maritime has commissioned Sydney Motorway Corporation (SMC) to deliver WestConnex, on behalf of the NSW Government. However, Roads and Maritime is the proponent for the project.

The project is generally located in the inner west region of Sydney within the Inner West and City of Sydney local government areas (LGAs). The project traverses the suburbs of Ashfield, Haberfield, Leichhardt, Lilyfield, Rozelle, Annandale, Stanmore, Camperdown, Newtown and St Peters.

In addition to linking to other WestConnex projects, the M4-M5 Link would provide connections to the proposed future Western Harbour Tunnel and Beaches Link, the Sydney Gateway (via the St Peters interchange) and the F6 Extension (via the New M5).

WestConnex (including the approved component projects and the M4-M5 Link) and other proposed future projects including Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension, would form a network of motorways to improve the efficiency of traffic flows between western Sydney, the Sydney central business district (CBD), Sydney Airport and Port Botany precinct, with onward connectivity to both the south and north of Sydney.

Roads and Maritime has commissioned Sydney Motorway Corporation (SMC) to finance, deliver and operate WestConnex, on behalf of the NSW Government. However, Roads and Maritime is the proponent for the project. The M4-M5 Link would be operated as part of the combined WestConnex program of works.

Key features of the project

The proposed alignment and key operational features of the project include:

- Twin mainline motorway tunnels between the M4 East at Haberfield and the New M5 at St Peters. Each tunnel would be around 7.5 kilometres long and sized to accommodate up to four lanes of traffic in each direction
- Connections of the mainline tunnels to the M4 East project, comprising:
  - A tunnel-to-tunnel connection to the M4 East mainline stub tunnels, east of Parramatta Road near Alt Street at Haberfield
  - Entry and exit ramp connections between the mainline tunnels and the Wattle Street interchange at Haberfield (which is currently being constructed as part of the M4 East project)
  - Minor physical integration works with the surface road network at the Wattle Street interchange including road pavement and line marking

- Connections of the mainline tunnels to the New M5 project, comprising:
  - A tunnel-to-tunnel connection to the New M5 mainline stub tunnels north of the Princes Highway, near the intersection of Mary Street and Bakers Lane at St Peters
  - Entry and exit ramp connections between the mainline tunnels and the St Peters interchange at St Peters (which is currently being constructed as part of the New M5 project)
  - Minor physical integration works with the surface road network at the St Peters interchange including road pavement and linemarking
- An underground interchange at Leichhardt and Annandale (the Inner West subsurface interchange) that would link the mainline tunnels with the Rozelle interchange and the Iron Cove Link (see below)
- A new interchange at Lilyfield and Rozelle (the Rozelle interchange) that would connect the M4-M5 Link mainline tunnels with:
  - City West Link
  - Anzac Bridge
  - The Iron Cove Link (see below)
  - The proposed future Western Harbour Tunnel and Beaches Link
- Construction of connections to the proposed future Western Harbour Tunnel and Beaches Link project as part of the Rozelle interchange, including:
  - Tunnels that would allow for underground mainline connections between the M4 East and New M5 motorways and the proposed future Western Harbour Tunnel and Beaches Link (via the M4-M5 Link mainline tunnels)
  - A dive structure and tunnel portals within the Rozelle Rail Yards, north of the City West Link/ The Crescent intersection
  - Entry and exit ramps that would extend north underground from the tunnel portals in the Rozelle Rail Yards to join the mainline connections to the proposed future Western Harbour Tunnel and Beaches Link
  - A ventilation outlet and ancillary facilities as part of the Rozelle ventilation facility (see below)
- Twin tunnels that would connect Victoria Road near the eastern abutment of Iron Cove Bridge and Anzac Bridge (the Iron Cove Link). Underground entry and exit ramps would also provide a tunnel connection between the Iron Cove Link and the New M5/St Peters interchange (via the M4-M5 Link mainline tunnels)
- The Rozelle surface works, including:
  - Realigning The Crescent at Annandale, including a new bridge over Whites Creek and modifications to the intersection with City West Link
  - A new intersection on City West Link around 300 metres west of the realigned position of The Crescent, which would provide a connection to and from the New M5/St Peters interchange (via the M4-M5 Link mainline tunnels)
  - Widening and improvement works to the channel and bank of Whites Creek between the light rail bridge and Rozelle Bay at Annandale, to manage flooding and drainage for the surface road network
  - Reconstructing the intersection of The Crescent and Victoria Road at Rozelle, including construction of a new bridge at Victoria Road
  - New and upgraded pedestrian and cyclist infrastructure
  - Landscaping, including the provision of new open space within the Rozelle Rail Yards

– The Iron Cove Link surface works, including:
  - Dive structures and tunnel portals between the westbound and eastbound Victoria Road

carriageways, to connect Victoria Road east of Iron Cove Bridge with the Iron Cove Link

  - Realignment of the westbound (southern) carriageway of Victoria Road between Springside Street and the eastern abutment of Iron Cove Bridge
  - Modifications to the existing intersections between Victoria Road and Terry, Clubb, Toelle and Callan streets
  - Landscaping and the establishment of pedestrian and cycle infrastructure
- Five motorway operations complexes; one at Leichhardt (MOC1), three at Rozelle (Rozelle West (MOC2), Rozelle East (MOC3) and the Iron Cove Link (MOC4)) and one at St Peters (MOC5). The types of facilities that would be contained within the motorway operations complexes would include substations, water treatment plants, ventilation facilities and outlets, offices, on-site storage and parking for employees
- Tunnel ventilation systems, including ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels
- Three new ventilation facilities, including:
  - The Rozelle ventilation facility at Rozelle
  - The Iron Cove Link ventilation facility at Rozelle
  - The Campbell Road ventilation facility at St Peters
- Fitout (mechanical and electrical) of part of the Parramatta Road ventilation facility at Haberfield (which is currently being constructed as part of the M4 East project) for use by the M4-M5 Link project
- Drainage infrastructure to collect surface and groundwater for treatment at dedicated facilities. Water treatment would occur at:
  - Two operational water treatment facilities (at Leichhardt and Rozelle)
  - The new constructed wetland within the Rozelle Rail Yards
  - A bioretention facility for stormwater runoff within the informal car park at King George Park at Rozelle (adjacent to Manning Street). A section of the existing informal car park would also be upgraded, including sealing the car park surface and landscaping
- Treated water would flow back to existing watercourses via new, upgraded and existing infrastructure
- Ancillary infrastructure and operational facilities for electronic tolling and traffic control and signage (including electronic signage)
- Emergency access and evacuation facilities, including pedestrian and vehicular cross and long passages and fire and life safety systems
- Utility treatments including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities. A Utilities Management Strategy has been prepared for the project that identifies management options for utilities, including relocation or adjustment
- Temporary construction facilities and temporary works to facilitate the construction of the project.

The project does not include:

- Site management works[1] at the Rozelle Rail Yards. These works were separately assessed and determined by Roads and Maritime through a review of environmental factors under Part 5 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act)
- Ongoing motorway maintenance activities during operation. These would be subject to separate assessment and approval as appropriate
- Operation of the components of the Rozelle interchange which are the tunnels, ramps and associated infrastructure being constructed to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project. That project would be subject to separate assessment and approval as appropriate.

The delivery mechanism for the design and construction of the M4-M5 Link differs from the approach adopted for the M4 East and New M5 projects. For the M4 East and New M5 projects, a design and construction contractor was appointed early and had direct input into the design development, environmental impact statement (EIS) preparation and construction planning for those projects. This meant that the EIS for the M4 East and New M5 projects assessed the construction contractor's design. For the M4-M5 Link project, design and construction contractors would be appointed to undertake the detailed design and construction planning following determination of the application for project approval, should it be approved.

This means the detail of the design and construction approach presented in this EIS is indicative only based on a concept design and is subject to detailed design and construction planning to be undertaken by the successful contractors. The intent of the concept design for the project is to provide a sound and clear basis for refinement during the detailed design to a standard required to minimise impacts of the permanent infrastructure as much as possible.

Staged construction and opening of the project

It is anticipated that the project would be constructed and opened to traffic in two stages.

Stage 1 would include:

- Construction of the mainline tunnels between the M4 East at Haberfield and the New M5 at St Peters, stub tunnels to the Rozelle interchange (at the Inner West subsurface interchange) and ancillary infrastructure at the Darley Road motorway operations complex (MOC1) and Campbell Road motorway operations complex (MOC5)
- These works are anticipated to commence in 2018 with the mainline tunnels open to traffic in 2022. At the completion of Stage 1, the mainline tunnels would operate with two traffic lanes in each direction. This would increase to generally four lanes at the completion of Stage 2, when the full project is operational.

Stage 2 would include:

- Construction of the Rozelle interchange and the Iron Cove Link including:
  - Connections to the stub tunnels at the Inner West subsurface interchange (built during Stage 1)
  - Ancillary infrastructure at the Rozelle West motorway operations complex (MOC2), Rozelle East motorway operations complex (MOC3) and the Iron Cove Link motorway operations complex (MOC4)
  - Connections to the surface road network at Lilyfield and Rozelle
  - Construction of tunnels, ramps and associated infrastructure as part of the Rozelle interchange to provide connection to the proposed future Western Harbour Tunnel and

[1] The site management works at the Rozelle Rail Yards will remove waste, existing stockpiles, vegetation, above ground rail infrastructure, redundant services and railway ballast, generally to a depth of around 500 millimetres below ground level. As the site management works will be completed prior to construction of the M4-M5 Link commencing, the environment at the completion of these works is considered to be the baseline environment against which activities of the project at that location have been assessed.

Beaches Link project

- Stage 2 works are expected to commence in 2019 with these components of the project open to traffic in 2023.

The total construction period for both stages of the project is expected to be around five years.

Why is it needed?

The transport network in Sydney is expected to be put under increasing pressure over the next 20 years. *A Plan for Growing Sydney* (NSW Government 2014) indicated that from 2011 to 2031, Sydney’s population is forecast to increase from 4.3 to 5.9 million, which equates to an average of 80,000 additional residents per year. Moreover, by 2036, the number of trips made around Sydney each day is forecast to increase by 31 per cent, from 16 to 21 million vehicle trips. This growth will place increasing pressure on the NSW transport network and the key travel demand corridors connecting regional cities and major centres across the greater Sydney metropolitan area.

The road network in the study area for the traffic and transport assessment currently functions under high levels of traffic demand, which often exceeds the operational capacity, especially citybound during the AM peak period. This includes some of the most highly congested road corridors in Sydney. Major routes in the study area, such as Parramatta Road, City West Link, Victoria Road, Anzac Bridge/Western Distributor, Southern Cross Drive, Princes Highway and King Street experience significant congestion, with resultant increases in travel time and variability, which can cause typical morning and evening peak hours to spread over longer periods.

The current congestion on arterial roads and the missing links in the motorway network impede the efficient flow of traffic to the important economic centres along Sydney’s Global Economic Corridor. The Global Economic Corridor extends from the Sydney Airport and Port Botany precinct, through the Sydney central business district (CBD) and North Sydney to Macquarie Park and Sydney’s geographical centre, Parramatta, with connections also to the developing economic hubs on the Rhodes peninsular.

The *NSW Long Term Transport Master Plan* (Transport for NSW 2012) and the *State Infrastructure Strategy Update 2014* (*State Infrastructure Strategy*) (Infrastructure NSW 2014) identified the need to plan and invest in the future of Sydney’s motorway network, which provides vital infrastructure connections within and between travel demand corridors. Any investment in motorway infrastructure must be aligned with supporting public and active transport initiatives, while aiming to reduce the reliance on and demand for private vehicles on the future road network.

The WestConnex program of works is one part of a broader solution to these growing pressures. While public transport is also part of the overall transport plan for Sydney, it is recognised that not all trips across Sydney can be served by public transport, especially trips to dispersed destinations, commercial trips requiring the movement of large or heavy goods/materials, or trade and service-related journeys. In addition, Sydney is home to two-thirds of NSW’s manufacturing sector, with the many of the state’s major aviation, pharmaceuticals, biotechnology, electronics and automotive industries based in western Sydney. These businesses rely heavily on the road network and its connectivity to the port and airport precincts.

A congested road network also affects road-based public transport, resulting in increased bus travel times and journey time variability. Providing a tunnel alternative to sections of the arterial road network will improve road-based public transport travel times on surface roads and provide opportunities for new rapid transit options.

For these reasons, the NSW Government is investing in light rail, metro rail, bus, rapid-transit and motorways to provide a multi-modal response to current and future transport challenges. In this context, the project supports the actions and recommendations from the *NSW Long Term Transport Master Plan* and the *State Infrastructure Strategy.* The project would also act as an enabler of integrated transport and land use planning, supporting the development of initiatives including those outlined in *The Bays Precinct Transformation Plan* (UrbanGrowth NSW 2015b) and the *Parramatta Road Corridor Urban Transformation Strategy* (UrbanGrowth NSW 2016).

What are the project objectives?

The specific objectives of the project include:

- Linking the M4 East and New M5 motorways so that further benefits of, and opportunities arising from, WestConnex can be realised
- Improving traffic conditions and reducing congestion on key arterial roads in proximity to the project
- Improving accessibility and reliability for commercial vehicle movement in the M4 and M5 motorway corridors to economic centres, including to the Sydney Airport and Port Botany precincts
- Facilitating urban renewal in areas where the project would reduce traffic
- Minimising impacts associated with acquisition of residential and commercial properties
- Delivering a project with a beneficial urban design outcome
- Enabling long-term motorway network development by providing a connection to the proposed future Western Harbour Tunnel and Beaches Link project to the north.

The objectives of the project are consistent with those of the WestConnex program of works, as stated in the *WestConnex Updated Strategic Business Case* (Sydney Motorway Corporation 2015).

How would the project satisfy project objectives?

The project would provide a motorway standard tunnel connection between the M4 and M5 motorways, as an alternative to congested arterial roads. By connecting these two motorways, the project would help to link major employment centres that are critical in supporting the creation of jobs and businesses.

The project would also support the Western Sydney Employment Area, which is outside the Global Economic Corridor. This would support Greater Sydney Commission's metropolitan priority of enhancing access to a broader range of jobs and services within 30 minutes of home, which would reduce commuting times, in turn improving the quality of life for residents and supporting business growth.

Improved network productivity on the metropolitan network is also forecast as a result of the addition of a motorway standard tunnel alternative, with more trips forecast to be made or longer distances travelled on the surface road network in a shorter time. Reduced traffic is forecast on sections of major arterial roads including City West Link, Parramatta Road, Victoria Road, King Street, King Georges Road and Sydenham Road. Almost 2,000 heavy vehicles are forecast to be removed from Parramatta Road, east of the M4 East Parramatta Road ramps, each weekday. Non-motorway roads in the Inner West LGA are forecast to experience faster trips with the daily average speed increasing by about 10 per cent. Similarly, the vehicle distance travelled on non-motorway roads is forecast to reduce by about 12 per cent.

As part of the WestConnex program of works, the project would enable future opportunities for improved connectivity in Sydney's transport network to be realised by allowing for connections to proposed motorway projects, including the Western Harbour Tunnel and Beaches Link project to the north, the Sydney Gateway project (via the St Peters interchange) and the F6 Extension (via the New M5 Motorway) to the south.

The project, as part of the WestConnex program of works, would also act as a catalyst for urban renewal along parts of Parramatta Road and Victoria Road and would support the development of The Bays Precinct, as outlined in *The Bays Precinct Transformation Plan* (UrbanGrowth NSW 2015b).

In addition, the project would improve connectivity for pedestrians and cyclists around Rozelle by delivering new and upgraded east–west and north–south connections to Lilyfield, Balmain, Annandale, Glebe, Leichhardt and the Sydney CBD. The project would also deliver significant new open space and passive recreational facilities at Rozelle, including within the Rozelle Rail Yards and along Victoria Road near Iron Cove Bridge.

What is the approval process for the project?

The project is State significant infrastructure under the State Environmental Planning Policy (State and Regional Development) 2011 and the EP&A Act. The project requires assessment and approval of the NSW Minister for Planning under Part 5.1 of the EP&A Act.

An application for project approval was made by Roads and Maritime. The purpose of the application was to assist the formulation of the Secretary's Environmental Assessment Requirements (SEARs) by the NSW Department of Planning and Environment (DP&E) and inform the preparation of an EIS for the project. SEARs for the project were issued by DP&E on 3 March 2016, and were revised on 9 November 2016 and on 3 May 2017 to respond to amendments made to the SSI application. A request has been made for the NSW Minister for Planning to specifically declare the project to be State significant infrastructure and critical State significant infrastructure.

Public exhibition of the EIS gives the community, government agencies and stakeholders, and other interested parties an understanding of, and the opportunity to comment on, the project. Roads and Maritime will consider this feedback in the further development of the project and will respond to issues raised in a Submissions and Preferred Infrastructure Report which will then be submitted to DP&E. The Secretary of DP&E will prepare an assessment report which will be provided to the NSW Minister for Planning who will then determine whether or not to grant the approval under Part 5.1 of the EP&A Act and, if so, the conditions to be imposed on the approval.

What alternatives and options were considered?

In the context of the WestConnex program of works, the M4-M5 Link project concept was first described in the *State Infrastructure Strategy 2012-2023* (Infrastructure NSW 2012) (*State Infrastructure Strategy*). The M4-M5 Link project concept was further developed in the *State Infrastructure Strategy Update 2014* (Infrastructure NSW 2014), the *WestConnex Business Case Executive Summary* (Sydney Motorways Project Office 2013) and updated in the *WestConnex Updated Strategic Business Case* (Sydney Motorway Corporation 2015).

Strategic alternatives

The merits of the M4-M5 Link were considered in the context of a range of other strategic alternatives, based on the extent to which they could meet the project objectives and how well they performed with reference to other transport, environmental, engineering, social and economic factors.

The following strategic alternatives were considered:

- Alternative 1 – improvements to the existing arterial road network
- Alternative 2 – investment in alternative transport modes
- Alternative 3 – demand management (reducing the number of vehicle kilometres travelled on the network
- Alternative 4 – the 'do nothing'/'do minimum' case
- Alternative 5 – development of the M4-M5 Link.

Improvements to the arterial road network (such as improving intersection performance and implementing traffic calming measures, lane closures or clearways) would only provide incremental change in the efficiency of the road network, and would not support the additional capacity required for regional traffic growth, which is associated with the forecast increase in Sydney's population and subsequent increases in vehicle kilometres travelled.

As part of a broader integrated transport solution, WestConnex supports a coordinated approach to the management of freight and passenger movements, and is complementary to other modes of transport including rail, bus, ferries, light rail, cycling and walking. However, Sydney's freight, commercial and services tasks require distribution of goods and services across the Sydney basin, which relies on diverse and dispersed point-to-point transport connections that are most efficiently provided by the road network.

While the NSW Government is investing $41.5 billion (2016–2017 NSW Budget) in transport projects over the next four years (including roads and public transport) there are no feasible strategic public transport or freight alternatives to the project that, on their own, would meet the diverse range of needs for travel in the Sydney metropolitan area.

Public transport is best suited to providing concentrated, high volume flows of people to and from established centres. It is less suited to providing dispersed cross-city or local trips. In 2014, around 17.6 million trips were made each average weekday in Sydney, with around 75 per cent of these by road. Even with significant investment and high levels of patronage growth forecast for Sydney's public transport network, about 72 per cent of around 27.5 million journeys in 2031 are expected to be made on the road network each weekday by private vehicles, equal to an additional 4.3 million new trips compared to 2014 (Infrastructure NSW 2014).

Population growth, combined with the increasing road freight task in the Sydney metropolitan area, will result in a continued demand for use of roads providing east-west and north-south connections such as the M4 Motorway, M5 Motorway, M1 Motorway and A3 and A6 corridors. Without infrastructure investment and significant changes to how people travel, the continued demand and use of these corridors will result in additional, prolonged congestion.

The project would provide:

- Additional motorway capacity through a new, motorway standard north-south tunnel connection between the M4 East and New M5 motorways to support Sydney's freight, commercial and passenger needs
- More reliable trips, both in terms of travel time and safety, between south-western and western Sydney and the inner west
- Faster trips on non-motorway roads in the Inner West LGA, with the daily average speeds increasing by around 10 per cent
- New and upgraded pedestrian and cyclist infrastructure around Rozelle, making trips safer and more efficient and linking disconnected communities
- An urban design and landscaping outcome that would integrate motorway infrastructure with the existing landscape and activate residual spaces
- Forecast reductions in two-way future year average weekday traffic demand along sections of City West Link and Parramatta Road (east of the M4 East Parramatta Road ramps), Victoria Road (east of the Iron Cove Link portals), King Street at Newtown, Stanmore Road at Stanmore, Lyons Road at Russell Lea, Southern Cross Drive and the Sydney Harbour Tunnel.

Following selection of the preferred alignment, a number of options were considered in development of the preferred design including different approaches to the tunnel corridor; interchange locations; ventilation system design and locations; excavation methods; and construction ancillary facility locations. The preferred design provides a combination of benefits compared with other options assessed, including improved access, minimised impacts on properties and minimised impacts on future development potential.

How did the community participate in selecting the preferred project?

Engagement on WestConnex started with early consultation during the development of the original WestConnex Strategic Environmental Review (Sydney Motorways Project Office 2013b) and the WestConnex Business Case in 2012. The Strategic Environmental Review and an executive summary of the business case (Sydney Motorways Project Office 2013a) were published on the WestConnex website.

During development of the WestConnex program of works since 2012, the focus of communication and engagement was to articulate the local and broader regional and state-wide benefits of WestConnex. The aims were to build awareness and understanding of the program, identify key issues and community and stakeholder concerns and develop design solutions to mitigate impacts on local communities.

Project-specific consultation with stakeholders began following the lodgement of the SSI application report in January 2016. Stakeholders (including the community) have been provided with project specific information and opportunities to raise questions and provide suggestions and feedback.

Consultation and feedback received on both the project and the WestConnex program of works has informed project development, the environmental assessment activities and ongoing communications. The consultation process for the M4-M5 Link project to date has included:

- Targeted stakeholder discussions and briefings with NSW Government agencies, local councils, advocacy groups, elected representatives and peak bodies
- Roundtable discussions with stakeholders such as councils, the freight industry and business groups
- Information sessions and one-on-one meetings/briefings with community members and stakeholders in key communities
- Two rounds of community information sessions, comprising:
  - Between August and September 2016: consultation on early design to inform the design development
  - Between May and June 2017: early consultation on the draft design prior to the EIS exhibition phase, and in response to feedback from the community
- Discussions with individual stakeholders, landowners and community members
- Business impact surveys with potentially affected business owners adjacent to the project footprint
- Presentations to key regulatory agencies during the preparation of key technical assessments
- Regular interactive sessions with Inner West Council and City of Sydney Council during the preparation of the urban design and active transport concepts for the project
- Community updates via the WestConnex website, social media and newsletters
- Research groups involving residents, professional road users and business operators.

Permanent communication channels have been established for the WestConnex program of works and the project, to seek input from stakeholders and communities and to support ongoing engagement.

What are the environmental issues associated with the project?

Traffic and transport

The project would provide a motorway standard tunnel connection between the M4 and M5 motorways, as an alternative to congested arterial roads. An assessment of the potential traffic and transport impacts of the project during construction and operation has been carried out. The study area for the operational assessment was informed by the forecast traffic and transport changes from the WestConnex Road Traffic Model (WRTM) version 2.3. The WRTM is a strategic traffic model that covers the Sydney metropolitan area and includes land use forecasts for current and planned development, including along Parramatta Road and around The Bays Precinct and Mascot town centre.

Traffic modelling assessed the following scenarios:

- Existing traffic conditions (2015)
- Construction (2021, representing the peak construction traffic from the project)
- 2023 and 2033 with and without the project
- 2023 with all WestConnex projects, NorthConnex, and the proposed future Western Harbour Tunnel and Sydney Gateway projects
- 2033 with all WestConnex projects, NorthConnex, and the proposed future Western Harbour Tunnel and Beaches Link, Sydney Gateway and F6 Extension projects.

Construction impacts

To minimise construction traffic impacts, the project's construction ancillary facilities that provide tunnelling support (and would therefore generate the most construction traffic) have been strategically located to provide direct access to and from major arterial roads where possible and the M4 East Motorway (when opened). Only limited on-site parking for construction personnel would be provided at the more constrained construction ancillary facilities. Opportunities to provide additional parking and minimise impacts on on-street parking around construction sites would be investigated during detailed design and construction planning.

The roadway level of service analysis carried out for the project indicates that construction traffic is forecast to reduce mid-block traffic level of service (LoS) at four locations:

- At two locations – Wattle Street at Haberfield, east of Parramatta Road, and Darley Road Leichhardt, west of James Street – the mid-block level of service drops but remains at an acceptable LoS C or LoS D
- On City West Link, west of Darley Road at Leichhardt, the eastbound mid-block level of service is forecast to decrease from LoS E to LoS F in the PM peak hour
- On City West Link, west of The Crescent at Lilyfield, the westbound mid-block level of service is forecast to decrease from LoS D to LoS E in the PM peak hour.

The levels of service at intersections are not expected to be significantly impacted, with the exception of the Wattle Street/Ramsay Street, Dobroyd Parade/Timbrell Drive, City West Link/James Street and City West Link/The Crescent intersections. This is due to City West Link and Wattle Street being one of the key routes for construction traffic. Impacts due to temporary lane closures and speed reductions, particularly during traffic staging, would also occur.

Management of potential impacts – construction

Prior to the commencement of construction, a Construction Traffic and Access Management Plan (CTAMP) would be prepared as part of the Construction Environmental Management Plan (CEMP). It would set out the approach that will be adopted to minimise delays and disruptions, and identify and respond to any changes required to ensure road safety. The CTAMP would propose a car parking strategy for construction staff at the various worksites, developed in consultation with relevant local councils and stakeholders and would identify measures to manage the movements of construction-related traffic to minimise traffic and access disruptions in the public road network.

Operational impacts

The road network in the study area currently functions under high levels of traffic demand that often exceeds the operational capacity, especially citybound during the AM peak period. The four main travel demand corridors mentioned above include some of the most highly congested road corridors in Sydney. Major routes in the study area, such as Parramatta Road, City West Link, Victoria Road, Anzac Bridge/Western Distributor, Southern Cross Drive, Princes Highway and King Street, all experience significant congestion with resultant increase in travel time and variability, which can cause typical morning and evening peak hours to spread over longer periods, and extend the peak period.

The M4-M5 Link motorway is forecast to operate at a good level of service in the 2023 and 2033 'with project' scenarios, with levels of service between LoS A and LoS D (depending on the section of the motorway) during the AM and PM peak periods.

The addition of the M4-M5 Link would provide a significant improvement to the traffic network, with an overall increase in daily vehicle kilometres travelled (VKT) and a forecast reduction in daily vehicle hours travelled (VHT) on the road network. This means that more trips could be made or longer distances travelled on the network in a shorter time, mainly due to traffic using the new motorway, with reductions in daily VKT and VHT forecast on the non-motorway roads. This indicates the additional network capacity provided by the project would assist in accommodating the forecast growth in population and travel demand that would otherwise contribute to worsening road network and traffic conditions without the project.

Where the project would connect to the existing road network, increased congestion is forecast in parts of Mascot, along Frederick Street at Haberfield, Victoria Road north of Iron Cove Bridge, Johnston Street at Annandale and on the Western Distributor. Many of these areas would be improved when the full WestConnex program of works and the proposed future Western Harbour Tunnel and Beaches Link and Sydney Gateway projects, if approved, are completed.

Key benefits forecast for the Sydney metropolitan road network as a result of the M4-M5 Link project include:

- Existing non-motorway (arterial and local) roads in the Inner West LGA are forecast to experience faster trips with the daily average speed increasing. Similarly, the vehicle distance travelled on non-motorway roads is forecast to reduce. This indicates that on average, these trips would be fewer in number and faster
- Reduced travel times are forecast on key corridors, such as between the M4 Motorway corridor and the St Peters interchange
- Reduced traffic forecast on sections of major arterial roads including City West Link, Parramatta Road, Victoria Road (Rozelle), King Street (Newtown), Sydenham Road and King Georges Road.

As a result of the additional road network capacity provided by the project, the two-way future year average weekday traffic demand compared to a 'without project' scenario is predicted to significantly decrease on:

- City West Link and Parramatta Road at Haberfield, east of the M4 East Wattle Street and Parramatta Road ramps respectively, by about 25 per cent in the 2023 and 2033 'with project' and 'cumulative' scenarios
- King Street at Newtown by about 20 per cent in the 2023 and 2033 'with project' scenarios
- Stanmore Road at Stanmore by about 15 per cent in the 2023 and 2033 'with project' and 'cumulative' scenarios
- Lyons Road at Russell Lea by about 15 per cent in the 2023 and 2033 'with project' scenarios, and about 20 per cent in the 2023 and 2033 'cumulative' scenarios
- Southern Cross Drive and the Sydney Harbour Tunnel by about 20 per cent and 25 per cent respectively in the 2023 and 2033 'cumulative' scenarios.

There are significant reductions in forecast daily traffic volumes along Victoria Road (south of the proposed Iron Cove Link), King Georges Road, Stanmore Road, Addison Road and Sydenham Road compared to the 'without project' scenario. A decrease in the daily volume of heavy vehicles on surface roads is also forecast, as heavy vehicles shift onto the M4-M5 Link. Daily heavy vehicle volumes on Parramatta Road and City West Link are forecast to drop by 40 to 50 per cent, and on roads in the Inner West, such as Stanmore Road, Sydenham Road, Marrickville Road and King Street, are forecast to drop by 20 to 50 per cent.

The project would enhance the benefits of the WestConnex program of works for travel between western Sydney and the Sydney CBD. For example, a person driving a car in 2017 from Penrith to the Sydney CBD currently has the option of travelling along the M4 Motorway, which ends at Concord, and then would need to travel on the congested surface road network to the Sydney CBD. An alternative route between Penrith and the Sydney CBD using the M4 Motorway, WestLink M7, the Hills M2 Motorway, Lane Cove Tunnel and the Sydney Harbour Bridge or the Sydney Harbour Tunnel would cost around $22.00 in tolls ($2017) and is a distance of around 55 kilometres. After opening in 2023, the project would provide a journey using the M4 Motorway straight through to Anzac Bridge, via the M4-M5 Link, for a toll capped at $8.60 ($2017) and a distance of around 40 kilometres. This would provide significant time and cost savings for motorists.

Management of potential impacts – operational

The management of operational traffic and transport impacts would be focused around the interchanges at Wattle Street, Rozelle and St Peters. Roads and Maritime would carry out an Operational Road Network Performance Review, in consultation with Transport for NSW and relevant councils. This would confirm the operational traffic impacts of the M4-M5 Link on surrounding arterial roads and major intersections at both 12 months and five years after the commencement of operation of the project. The assessment would be based on future updated traffic surveys taken during operation and the methodology used would be comparable with that used in this assessment.

Specific measures would be identified as investigations progress and their implementation would depend on their complexity and appropriate timing to minimise impact on the community. Roads and Maritime would carry out these investigations in consultation with councils and the DP&E to develop a program of works.

Air quality

Construction impacts

The potential impacts of the construction of the project on ambient air quality have been assessed using guidance published by the UK Institute of Air Quality Management[2]. The UK guidance was adapted for use in NSW, taking into account differences between the two locations. This included, for example, differences in ambient concentrations of airborne particulate matter with a diameter of less than 10 micrometres (PM_{10}).

The main risks during construction would be associated with dust soiling and the effects of airborne particles on human health and amenity. Several 'high risk' activities were identified. For example, the assessment found that there would be a high risk of dust impacts associated with activities in Rozelle, in particular demolition works. A range of mitigation measures are outlined below.

Management of potential impacts - construction

A wide range of management measures has been recommended to mitigate the effects of construction works on local air quality at the nearest receptors, including carrying out spoil handling within acoustic sheds or the cut-and-cover tunnels, stabilising disturbed ground and exposed soils, and using water to suppress dust. Most of the recommended measures are routinely employed as standard practice on construction sites.

Operational impacts

In-tunnel air quality

The tunnel ventilation system would be designed to maintain in-tunnel air quality within applicable criteria for all scenarios. The assessment of in-tunnel air quality used modelling scenarios that reflected the potential modes of operation of the tunnel ventilation system, and a worst case trip scenario for exposure to nitrogen dioxide (NO_2). This pollutant has become the critical vehicle exhaust pollutant for tunnel ventilation design and management and therefore for the design and operation of the tunnel ventilation system. The NO_2 criterion used was as prescribed in the NSW Government *In-Tunnel Air Quality (Nitrogen Dioxide) Policy* (February 2016). Consideration was given to peak in-tunnel concentrations of carbon monoxide (CO) and NO_2, as well as the peak extinction coefficient (for visibility).

Ambient air quality

Two types of scenarios have been considered for ambient air quality, comprising:

- Expected traffic scenarios

  The expected traffic scenarios used for the ambient air quality assessment of the operation of the project were the same as those used for the traffic assessment

- Regulatory worst case scenarios

  These scenarios assessed emissions from the ventilation outlets only, with pollutant concentrations at the ventilation outlets fixed at the regulatory limits 24 hours a day, seven days a week. The scenarios represented the theoretical maximum changes in air quality for all potential traffic operations in the tunnel, including unconstrained and worst case traffic conditions from an emissions perspective, as well as vehicle breakdown situations. The assumptions

[2] Institute of Air Quality Management (2014).*Guidance on the assessment of dust from demolition and construction*, London

underpinning these scenarios are very conservative, and resulted in predicted contributions from project ventilation outlets that are much higher than those that could occur under foreseeable operational conditions in the tunnel.

For the expected traffic scenarios, the predicted changes in pollutant concentrations were generally a result of changes in the traffic volumes on the surface roads, with very small contributions from the tunnel ventilation outlets.

For some air quality metrics (1-hour NO_2 and 24-hour PM_{10} and $PM_{2.5}$), exceedances of the criteria were predicted to occur both with and without the project. However, where this was the case the total numbers of receptors with exceedances decreased slightly with the project and in the cumulative scenarios. That is, the project resulted in a better outcome than the 'without project' scenario. In the case of $PM_{2.5,}$ the background levels are at or slightly above the criterion for both the annual and 24-hour means. However, in many locations there is a decrease with the project because of the reduction in surface road traffic.

The spatial changes in local air quality as a result of the project reflect the changes in traffic on the road network. For example:

- Marked reductions in pollutant concentration were predicted along Dobroyd Parade/City West Link and Parramatta Road to the south-east of the Parramatta Road ventilation facility at Haberfield. In the 2023 Do Minimum scenario, the traffic to and from the M4 East tunnel would access the tunnel using these roads. In the 'with project' scenarios, the M4-M5 Link tunnel connects to the M4 East tunnel, reducing emissions of pollutants from those surface roads
- A substantial reduction in pollutant concentrations was predicted along the Victoria Road corridor south of Iron Cove in Rozelle, due to surface traffic being diverted through the Iron Cove Link tunnel
- There would also be reductions in pollutant concentrations along General Holmes Drive, Princes Highway and the M5 East Motorway
- However, there would be an increase in pollutant concentrations on Victoria Road to the north of the Iron Cove Link and near Anzac Bridge as a result of the general increase in traffic due to population growth and the project at that location
- Pollutant concentrations were also predicted to increase along Canal Road, which would be used to access the St Peters interchange, and other roads associated with the proposed future Sydney Gateway project, as it is expected to be a surface road.

Modelling of the changes in air quality for elevated receptors (such as apartment buildings) showed that there would not be any substantial impact on existing buildings.

Management of potential impacts - operation

<u>In-tunnel air quality</u>

The project would be designed to reduce concentrations of emissions in the tunnel by:

- Designing tunnels to achieve minimal gradients to reduce vehicle emissions. The tunnels would generally have a gradient of less than four per cent. However, isolated locations connecting to the surface road network may require short lengths of steeper grades of up to eight per cent. Opportunities to avoid or minimise these sections of steeper grades would be investigated during detailed design
- Including large mainline tunnel cross-sectional area to allow for a greater volume of airflow, to dilute emissions within the tunnel. The mainline tunnels would have widths varying between 10.5 and 16 metres and be higher than most previous tunnels in Sydney
- Increased height of the tunnels to reduce the risk of incidents involving high vehicles blocking the tunnel and disrupting traffic. This would reduce the risk of higher pollutant concentrations associated with breakdown in traffic flow
- The project ventilation system has been designed and would be operated so that it would achieve some of the most stringent standards in the world for in-tunnel air quality, and would be effective at maintaining local and regional ambient air quality.

Ambient air quality

The design of the ventilation system would ensure zero portal emissions during normal operations. The ventilation outlets would be designed to effectively disperse the emissions from the tunnels and are predicted to have negligible impact on local air quality. The heights of the ventilation outlets have been optimised to provide the most effective dispersion within the constraints of height limitations imposed by air safety requirements.

Planning controls would need to be developed in the vicinity of St Peters to ensure future developments at heights of 10 metres or higher are not adversely impacted by emissions from the ventilation outlets. Development of planning controls would need to be supported by detailed modelling addressing relevant pollutants and averaging periods.

Noise and vibration

A noise and vibration assessment was carried out to evaluate and predict the potential impact of the construction and operation of the project.

Construction noise and vibration

Where possible, proposed ancillary facilities and construction sites have been located and designed to minimise noise and vibration impacts to sensitive receivers. This includes, wherever possible, selection of ancillary facility locations and positioning of exits and entrances to allow quick access to arterial roads to minimise traffic noise impacts to residential and other noise sensitive receivers.

In accordance with the *Interim Construction Noise Guidelines* (NSW Department of Environment and Climate Change 2009), the majority of surface construction would be carried out between 7.00 am and 6.00 pm Monday to Friday and 8.00 am and 1.00 pm Saturdays. Some surface works would need to be conducted out-of-hours to minimise traffic disruptions or for safety or operational reasons, such as design and quality requirements. Tunnelling activities and tunnel support activities, including spoil removal, would be conducted 24 hours a day, seven days a week.

Construction noise levels would exceed the relevant goals in most of the noise catchment areas (without additional mitigation) for work activities undertaken including earthworks, demolition of existing structures, site establishment road tie-in works, road and intersection modifications and utility adjustments. The most affected receivers are located around the Iron Cove Link study area at Rozelle, the Rozelle interchange study area and around the Parramatta Road West civil and tunnel site and Parramatta Road East civil site at Haberfield and Ashfield. For most construction activities, it is expected that the actual construction noise levels would generally be lower than the worst-case levels as predictions are representative of the highest noise level inclusive of all plant operating simultaneously at the closest location to each receiver. In reality, at any particular location the potential construction noise impacts can vary greatly depending on factors including the following:

- The position of the works within the site and distance to the nearest sensitive receiver
- The overall duration of the works
- The intensity of the noise levels
- The time at which the works are undertaken
- The character of the noise.

It is anticipated that the tunnels would be progressively excavated using a heading-and-bench construction methodology, which involves use of roadheaders to excavate the top part of the main alignment tunnels and then relatively small scale blasting or rock-breaking to remove the lower part of the tunnels (or bench).

The roadheader excavation would typically progress at around 20 to 25 metres per week subject to local geology and confirmation of the tunnel excavation methods. Ground-borne noise from roadheader activity is expected to impact about 494 properties, mostly where the tunnel entry and exit ramps would approach the surface road network around the Wattle Street interchange, the Rozelle interchange, the Iron Cove Link and on the approach to the St Peters interchange. It is likely that the excavation by the roadheaders may be perceptible in the evening and during the night for up to about

20 days at each affected receiver as the roadheader passes them, with exceedances of ground-borne noise goals at affected receivers during these periods.

Roadheaders used for tunnelling are also expected to result in temporary vibration above the preferred vibration dose value for human amenity during the night time, with no exceedances of the maximum vibration dose value. While vibration may be perceptible to some individuals, the vibration levels are predicted to be well below the level that could result in structural damage to property.

Management of potential impacts - construction

Construction noise impacts would be managed using measures including scheduling of works, noise reduction measures for plant and equipment and provision of respite periods for sensitive receivers. Construction contractors would be required to minimise time and duration of impacts to sensitive receivers and keep them proactively informed of likely timing and impacts of noisy activities.

Temporary noise walls or solid hoardings would be used for construction ancillary facilities where required to minimise noise impacts to residential receivers. Acoustic sheds would be installed over the temporary access tunnel portals and spoil stockpile areas within the Parramatta Road West civil and tunnel site (C1b), Darley Road civil and tunnel site (C4), Rozelle civil and tunnel site (C5), Pyrmont Bridge Road tunnel site (C9) and the Campbell Road civil and tunnel site (C10). In addition, spoil stockpiling and management would occur within cut-and-cover tunnel structures at the Wattle Street civil and tunnel site (C1a), at the eastern end of the Rozelle civil and tunnel site (C5) and the Campbell Road civil and tunnel site (C10), and within the M4 East stub tunnels at Haberfield.

Operational noise

The project has been designed to include traffic noise mitigation measures. Less than one per cent of receivers are predicted to experience an increase of more than 2 dB(A) due to the project. Marginal increases (1-2 dB(A)) are predicted on The Crescent and parts of Johnston Street, and also on some of the adjacent roads, such as Gordon Street, associated with increased volumes due to redistribution of traffic. In addition, significant reductions in noise (up to around -4 dB) are identified along sections of Victoria Road in Rozelle, where the project is forecast to significantly reduce traffic numbers.

Large increases in noise (up to around 15 dB(A)) are identified on Victoria Road near Iron Cove Bridge in the vicinity of the proposed tunnel portals and near the new Victoria Road bridge, where the project results in traffic lanes being moved closer to receivers, in combination with removing existing screening due to property acquisitions. These predicted increases are generally limited to the receivers that would have partial or direct line-of-sight to Victoria Road once the acquired buildings are demolished.

A total of 431 receivers (200 individual buildings) are predicted to have exceedances of the operational road traffic noise criteria for the project and are therefore eligible for consideration of additional noise mitigation. Forty-eight other sensitive receivers (27 individual buildings) are predicted to have exceedances of the operational road traffic noise criteria for the project and are therefore eligible for consideration of additional noise mitigation.

For residential buildings of two storeys or more, 64 per cent of the identified receivers are on the first two floors, with 15 per cent of the triggers being on level three, nine per cent being on level four, four per cent on level five, and eight per cent for all floors including and above level six. Noise emissions from fixed facilities in the Iron Cove area are predicted to exceed the criteria by up to 12 dB(A) at the most-affected receivers either side of Callan Street, Rozelle, adjacent to the substation. Proposed noise generating operational equipment would be reviewed at the detailed design stage of the project when specific plant selection is finalised and appropriate noise control measures can be determined to ensure compliance with relevant operational noise criteria.

Management of potential impacts - operation

The operational assessment has identified the potential noise benefits associated with the use of low noise pavement, noise barriers and at-property treatment. However, due to engineering uncertainties and urban design considerations, a provisional noise mitigation option in the form of at-property treatment has been recommended.

A preferred noise mitigation option (low noise pavement, noise barrier, architectural treatments, a combination or other) would be determined during detailed design, taking into account whole-of-life engineering considerations and the overall social, economic and environmental effects. The preference will be given to selecting noise mitigation measures that reduce outdoor noise levels and the number of at-property treatments. Detailed investigations would be carried out for the area around Victoria Road near Iron Cove Bridge to develop an optimum suite of mitigation options, in consultation with the community, to address the large predicted increases in road traffic noise at that location.

Human health risk

The human health risk assessment followed national guidelines and addresses requirements of key government agencies, such as NSW Health, in relation to air quality, noise and vibration, social aspects, public safety and the cumulative effects of construction.

In relation to air quality, dust emissions from construction activities need to be managed to ensure that impacts on local communities are minimised. As the larger part of the project alignment would be underground, the operation of the project is predicted to result in a decrease in total pollutant levels in the community. There would be a redistribution of vehicle emissions associated with redistribution of the traffic on surface roads. For much of the community this would result in no change or a small improvement (ie decreased concentrations and health impacts), however for some areas located near key surface roads, a small increase in pollutant concentration may occur. Potential health impacts associated with changes in air quality (specifically nitrogen dioxide and particulates) within the local community have been assessed and are considered to be acceptable.

The future development of land (including re-zonings) that may involve multi-storey residential buildings above 10 metres high in the vicinity of the St Peters interchange ventilation facilities would need to consider the dispersion performance of the ventilation facilities.

While concentrations of pollutants from vehicle emissions are higher within the tunnel (compared with outside the tunnel), and with the completion of a number of tunnel projects (approved or proposed) there is the potential for exposures to occur within a network of tunnels over varying periods of time, depending on the journey, exposure to nitrogen dioxide inside vehicles is expected to be well within the current health guidelines.

In congested conditions inside the tunnels, it is not considered likely that significant adverse health effects would occur due to the operation of the tunnel ventilation systems and the temporary nature of the potential exposure. Placing ventilation within vehicles on recirculation is also expected to minimise exposures to particulate matter during travel through the tunnels. For motorcyclists, where there is no opportunity to minimise exposures through the use of ventilation, there is the potential for higher levels of exposure to nitrogen dioxide. These exposures, under normal conditions, are not expected to result in adverse health effects.

In relation to noise and vibration, potential impacts during construction and operation have been considered. During construction, potential impacts from noise and vibration on the local community would require management and/or mitigation through the implementation of a range of measures. During operation of the project, a number of properties have been identified where specific mitigation measures are required to reduce impacts and protect the health of occupants. These mitigation measures include low noise pavement, noise barriers, and/or at-property acoustic treatment. The mitigation measures would ensure that the levels of road traffic noise experienced by residents would be reduced to as low as feasible and reasonable. No vibration impacts during operation are likely.

Changes in the urban environment associated with the project have the potential to result in a range of impacts on health and wellbeing of the community. Positive impacts include economic benefits, reduction in traffic volumes in some areas and increased public open space.

Management measures would be put in place to address temporary negative impacts that may occur as a result of traffic changes during construction, property acquisitions, visual changes, noise impacts and changes in access or loss of cohesion of local areas, which may result in increased levels of stress and anxiety.

Land use and property

The need to reduce impacts on property has been balanced with maximising opportunities for beneficial re-use of the areas required for construction that would be surplus to the operational needs of the project. The majority of the project, including a large part of the Rozelle interchange and Iron Cove Link, would be constructed underground and has been designed to minimise the need for surface property acquisition. In addition, construction ancillary facilities at Haberfield and St Peters that are being used by the M4 East and New M5 projects would be used for the M4-M5 Link, to minimise additional property acquisition at these locations for construction. The project would also seek to maximise the use of use government owned land, including land already owned by Roads and Maritime.

Notwithstanding this, construction and operation of the project would result in temporary and permanent impacts on property. As of August 2017, the project would require 51 property acquisitions. In addition to the properties affected by surface activities, land (or interests in land, such as easements) below the surface of the ground would be acquired.

An Urban Design and Landscape Plan would be prepared for the project and would be the primary mechanism for identifying and describing the design and treatment of operational facilities, public open space uses (including active and passive recreation), community and social infrastructure and/or development that would be delivered as part of the project.

Subject to detailed design and the requirements of the project, parts of the project footprint not required for operational infrastructure and/or landscaping may be contemplated for separate future redevelopment. Where this is the case, the land would be rehabilitated at the end of construction and made suitable for potential development for permissible uses under land use zoning provisions and relevant urban renewal strategies. Future development would be subject to separate development assessment and approval, and the restrictions of the relevant consent authority.

Overshadowing impacts

The project includes permanent buildings and structures that have the potential to result in overshadowing on neighbouring residential properties. Shadow diagrams for mid-winter (21 June) have been prepared for these buildings and structures. No assessment has been undertaken of overshadowing from potential noise barriers as no noise barriers are proposed as part of the concept design. Analysis of overshadowing impacts associated with noise barriers, if they are proposed, would be undertaken during detailed design. The shadowing analysis found that the only residential properties that would be overshadowed by any of the motorway infrastructure during operations would be adjoining residential properties on the west side of Callan Street at Rozelle which would be overshadowed by the Iron Cove link ventilation outlet for up to two hours on 21 June in the worst case scenario.

Settlement (ground movement)

Settlement, induced by tunnel excavation, and groundwater drawdown, may occur in some areas along the tunnel alignment. Areas most likely to be affected by settlement are usually where tunnelling is closest to the ground surface (shallowest), around the tunnel portals and entry and exit ramps, and where soils are more likely to be compressible. This would include the estuarine and alluvial soils and fill material around the Rozelle Rail Yards.

Geotechnical and groundwater investigations have been carried out to inform the development of the concept design which has been assessed in the EIS and the assessment of potential settlement impacts. As a result of these investigations, a number of refinements to the project design have been made to minimise potential ground movement and groundwater impacts, including altering the horizontal and vertical alignment of the tunnels so that they are located in competent bedrock and dive beneath the palaeochannels (where feasible) and designing some localised sections of tunnel to be tanked to avoid groundwater ingress where the alignment intercepts alluvial soils and poor quality rock around the Rozelle Rail Yards.

For the majority of the proposed alignment the tunnels are located at depths of greater than 35 metres below ground level and in competent bedrock. As a result the risk of ground movement is limited. However, there are a number of discrete areas to the north and northwest of the Rozelle Rail Yards, to the north of Campbell Road at St Peters and in the vicinity of Lord Street at Newtown where ground movement above 20 millimetres is predicted. These discrete areas generally coincide with areas of shallower tunnelling and/or where multiple tunnels are located close to each other.

Management of potential impacts - settlement

Strict limits on the degree of settlement permitted would be imposed on the project. A range of design and construction measures would be adopted to meet relevant settlement criteria. Surveys of building condition would be undertaken in the zone of tunnel influence prior to construction and a settlement monitoring plan developed for construction and operation. Specific agreements would be developed with infrastructure and utility services providers to reduce risk to their infrastructure. In the event that damage occurs to a property as a result of the construction of the project, the damage would be rectified at no cost to the property owner.

Urban design and visual amenity

Urban design and visual impacts differ during construction and operational phases of the project. Visual impacts during construction would result from the introduction of construction ancillary facilities into the existing landscape. Construction facilities could include noise walls, acoustic sheds and other temporary buildings. This would include fixed night lighting at sites that involve tunnelling activities or that support tunnelling activities.

Where feasible and reasonable, ancillary facilities would be developed and established to minimise visual impacts (eg location of visible structures and plant, perimeter treatments). Glare and light spill from construction ancillary facilities would be minimised through the use of cut-off and directional lighting, and site hoarding where required would be erected early within the site establishment phase to minimise noise impacts and provide visual screening.

The urban design and landscape component for the project would include new and upgraded footpath and cycleways and the creation of new open space and landscaping. The development of the concept design has been influenced by urban design principles that have been established for the project including integrating motorway infrastructure into the surrounding context, prioritising local and regionally significant connections and creating holistic and integrated design solutions. A detailed review and finalisation of architectural treatment of the project operational infrastructure, including ventilation facilities, would be undertaken during detailed design.

Urban design and landscaping for the project would be guided by location specific urban design master plans that would follow the principles outlined in the Urban design report, *WestConnex Motorway Urban Design Framework* (Roads and Maritime Services 2013) and *Beyond the Pavement: Urban Design Procedures and Design Principles* (Roads and Maritime Services 2014) and would be overseen by an independent Urban Design Review Panel. Completion of the project would also enable the full realisation of the urban design and landscape plans for the M4 East and New M5 projects at Haberfield and St Peters respectively.

Social and economic aspects

Construction impacts

Construction of the project would directly benefit the economy, injecting economic stimulus benefits into the local, regional and state economies. The economic benefit of construction is multi-dimensional, including increased expenditure at local and regional businesses through purchases by construction workers, direct employment through on-site construction activities, direct expenditure associated with on-site construction activities and indirect employment and expenditure through the provision of goods and services required for construction.

It is estimated that over a five-year construction period, around 14,350 direct (onsite) job years would be created (between 2018 to 2023), which is equivalent to about 2,870 jobs per annum. Further, about 42,350 indirect (off-site) job years would be generated, equivalent to 8,470 jobs per annum based on a similar project period.

The economic multipliers also estimate that construction would generate a further $5.8 billion of activity in production induced effects and $7.7 billion in consumption induced effects. Total economic activity generated by the construction of the project would be approximately $19.6 billion.

Impacts associated with property acquisition would be managed through a property acquisition support service. Potential access and visibility impacts to businesses due to construction would be identified in consultation with the business owners and measures would be developed and implemented to manage those impacts. Although business clusters have heightened risk of being affected by construction, the significance of impact on businesses within the vicinity of the project footprint would be low. Although some construction impacts are negative (such as noise increases), the majority of higher risk business clusters have lower dependency on amenity and would not be noticeably affected beyond employee annoyance.

During construction, arterial roads are expected to experience impacts that would affect the efficiency of the regional road network. These would be minimised by planning and staging the works to minimise disruptions to the surface road network. The project may also result in alterations to parking availability and an increased demand for parking near project footprints and other work areas. This may affect the availability of parking for local residents, commuters, businesses and social infrastructure users, however impacts would be minimised through the development of a detailed construction car parking strategy as part of the CTAMP. The impact on active transport networks during construction would be minimised and safe alternative paths provided.

Operational impacts

The project would improve intersection performance, reduce travel times and increase average speeds across the Sydney metropolitan road network. The traffic modelling indicates that by 2033, there would be an overall increase of 498,000 kilometres travelled and a reduction of 46,000 VHT on the network. This increase is largely due to the redirection of vehicles (in particular heavy vehicles) from surface roads to the new, faster M4-M5 Link.

Traffic volumes on some sections of the surface roads in the study area are projected to reduce. This reduction would potentially improve environmental amenity by reducing congestion, noise and air pollution. This may increase pedestrian and cyclist activity in the area, which may lead to an increase in trade and business revenue. This would be particularly true for the commercial areas along Parramatta Road, east of the M4 East entry and exit ramps, and Victoria Road at Rozelle.

As a result, the project is expected to have a positive impact on existing business amenity, which would lead to a moderate positive impact on the broader socio-economic environment. The operation of the project would provide increased access to open space and increased pedestrian and cyclist connections, which would provide increased opportunities for the community to meet and interact. Rozelle Rail Yards currently acts as a substantial physical barrier between the communities of Annandale, Rozelle and Lilyfield. On operation, areas around motorway infrastructure at Rozelle would be transformed into public open space integrated with a network of active and transport links (both north–south and east–west), which would improve community cohesion.

The project would provide pedestrian and cyclist bridges that would increase the opportunities for communities to connect and interact, contributing to community and social cohesion. A new pedestrian footpath and separated cycleway would be provided between Springside Street and the Bay Run at Byrnes Street on the western side of Victoria Road. A pedestrian and cycle 'land bridge' at Rozelle Rail Yards would provide a north-south connection between Bicentennial Park, the Rozelle Rail Yards and beyond to Easton Park benefitting the communities in Annandale/Glebe and Rozelle.

The delivery of a substantial area of open space at Rozelle would be a significant positive benefit to the social and economic environment.

Soil and water quality

The project is located within the Sydney Harbour and Parramatta River and Cooks River catchments. Existing water quality in all waterways is generally poor, indicative of a highly urbanised catchment. However, a number of waterways are considered to be sensitive receiving environments, including Iron Cove at Rozelle, constructed wetlands along Whites Creek and Johnstons Creek and mapped Key Fish Habitat including at Rozelle Bay, White Bay, Alexandra Canal and downstream portions of Dobroyd Canal and Hawthorne Canal.

Construction impacts

The potential for erosion of exposed soils, sedimentation of waterways and exposure of contaminated soils and groundwater during construction would be managed through implementation of standard construction site mitigation measures including stabilising disturbed ground and exposed soils, water to suppress dust and using appropriate storage with secure bunding for chemicals and fuels.

During construction, temporary water treatment plants would be established at construction ancillary facilities that would support tunnelling, to treat water used during construction and groundwater encountered during tunnelling. With these controls in place, the project would not significantly impact on soils and surface water during its construction. A program to monitor potential surface water quality impacts would be developed that would commence prior to ground disturbance.

There is a high probability of encountering acid sulfate soils around Rozelle Bay, Manning Street at Rozelle and St Peters interchange. Further soil testing would occur during construction to confirm the presence of acid sulfate material. If acid sulfate soils are identified, they would be managed in accordance with the *Acid Sulfate Soil Manual* (Acid Sulfate Soil Management Advisory Committee 1998) which includes procedures for the investigation, handling, treatment and management of such soils.

Operational impacts

Permanent water treatment plants would be established at the Rozelle interchange and Darley Road at Leichhardt to treat groundwater, stormwater run-off that enters the tunnels, and water used for washing tunnel walls, fire testing and hydrant and deluge water during operation of the tunnel. Depending on the source and quality of the water collected it would be treated and discharged to local stormwater systems and waterways or disposed to sewer.

A constructed wetland would be provided at Rozelle that would provide ‘polishing’ treatment to the treated groundwater flows. A bioretention facility would be constructed within a section of the informal car park in King George Park at Rozelle, adjacent to Manning Street. This bioretention facility would capture and treat stormwater runoff from a section of the Victoria Road catchment to the north. A section of the existing informal car park would also be upgraded, including sealing the car park surface and landscaping.

Contamination

The contamination assessment included the area within the project footprint, which comprises the location of all operational infrastructure and areas where construction activities would occur. Emphasis has been given to those areas where historical land use activities have impacted soil, sediment and groundwater and which would require remediation and/or management during the construction and operation of the project.

Individual lots and areas located within or adjacent to the project footprint comprised a range of land uses including; residential, commercial/industrial, roadways, waterways and recreational open space.

There is potential for localised areas of soil, acid sulfate soil, sediment, fill and groundwater contamination associated with historically contaminating land uses to be encountered during construction, and further more detailed investigation may be warranted in some instances. The discovery of contaminated materials is considered most likely to occur during near surface excavation works associated with road and tunnel construction activities.

Potentially contaminated sites and activities that have the potential to generate and disturb existing contamination would be subject to detailed investigation (where warranted), and potentially remediation and/or management to ensure that risks to the environment, people and future land uses are minimised. In particular, the project may disturb contaminated sites at locations where construction ancillary facilities are proposed to be established, including within the Rozelle Rail Yards and adjacent to The Crescent.

Management measures would be implemented during the construction and operational phases of the project to achieve the desired performance outcome, which is to ensure that risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination. In addition, in the event of encountering unexpected finds of contamination (ie the observation of offensive odours, soil discoloration, buried waste or potential asbestos containing materials) during construction, work in the area would cease until an appropriately qualified environmental consultant can advise on the need for further assessment, remediation or other action (as appropriate).

Flooding and drainage

The project footprint is located within the Sydney Harbour, Parramatta River and Cooks River catchments. The local stormwater drainage systems that control runoff from these catchments are of limited capacity. As a result, the project corridor is presently impacted by both mainstream flooding and overland flows.

Flood modelling was carried out for the project and considered a range of annual recurrence interval (ARI) design floods, the Probable Maximum Flood (PMF), situations such as a partial blockage of a bridge structure, and impacts predicted due to climate change.

Construction impacts

The assessment found that a number of the construction ancillary facilities would be affected by flooding during relatively frequent storm events. The Rozelle civil and tunnel site is affected by both mainstream flooding from Whites Creek and major overland flows through the Rozelle Rail Yards.

Construction would have the potential to impact local overland flow paths and existing minor drainage paths. Disruption of existing flow paths could occur as a result of:

- Disruption of existing drainage networks during decommissioning, upgrade or replacement of drainage pits and pipes
- Interruption of overland flow paths by installation of temporary construction ancillary facilities and surface level alterations
- Sediment entering drainage assets and causing blockages
- Overloading the capacity of the local drainage system.

Operational impacts

Inundation of the project by floodwater during its operation would have the potential to cause damage to infrastructure, impact on the safe operation of the motorway tunnels and pose a safety risk to road users and motorway operations staff.

A recommended level of flood protection to each project element has been identified with due consideration of the consequences of flooding. The main design criterion is to prevent flooding of the portals, tunnels, ancillary facilities and emergency response facilities for events up to the PMF or the 100 year ARI event plus 0.5 metres freeboard (factor of safety above design flood levels, typically used in relation to the setting of floor levels).

The project would have a minor impact on flood behaviour in adjacent developments for storms with ARI’s up to 100 years. While it will be necessary to assess the detailed design, it is concluded that the minor nature of the changes in flood behaviour attributable to the project would not have a significant impact outside the project footprint.

Future climate change could lead to sea level rise and potential increase in rainfall intensity and frequency. Climate change scenarios were assessed, considering different combinations of design storm rainfalls and sea level conditions under 2050 and 2100 conditions. The assessment found that changes in the flood behaviour under future climate change conditions would not lead to a significant increase in the flood risk to the project or flood impacts to adjacent developments. The layouts of the different interchanges have been influenced by flood risk and drainage considerations.

Management of potential impacts

Detailed hydrologic and hydraulic modelling would be undertaken during the development of the detailed permanent and temporary designs to confirm flood risks and the extent of works required to mitigate flood impacts.

Biodiversity

The majority of the project footprint and surrounding area is modified and disturbed, and contains exotic species, weeds and planted native or non-indigenous species. The project footprint is considered to be in a poor ecological condition, with little ecological value and unlikely to have any native resilience or recovery potential. No plant community types defined as native vegetation by the Framework for Biodiversity Assessment (NSW Office of Environment and Heritage 2014) were recorded within the project footprint, and therefore no remnant native vegetation is considered to be present.

The Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), listed as vulnerable under state legislation, may be roosting intermittently in the cavities under the Victoria Road bridge. This and other bat species may also be using the area in the vicinity of the Rozelle Rail Yards as foraging habitat. The Grey-headed Flying Fox (*Pteropus poliocephalus*), listed as vulnerable under state and federal legislation, has been recorded adjacent to, and is considered likely to forage within, the project footprint.

Construction impacts

There would be no direct impacts to native vegetation communities due to construction. Further investigation would be carried out prior to construction to confirm whether the Victoria Road bridge is a potential roost site for microbats. If confirmed, measures to manage potential impacts will be identified and implemented. No impacts on endangered ecological communities listed under either State of federal legislation are expected.

The project would not directly harm marine vegetation or habitat of threatened species, communities or populations. Works within and adjacent to waterways would be managed to minimise erosion and sedimentation and other potential water quality impacts. Significant impacts on aquatic habitat downstream of the project are not expected.

An arboricultural assessment has been carried out based on the concept design to identify trees that would be impacted by construction. The majority of potentially impacted trees are as a result of the proposed works in Rozelle. Further investigations would be carried out during detailed design to confirm if any trees could be retained. Compensatory tree planting would be included in the Urban Design and Landscape Plan that will be prepared for the project.

Management of potential impacts

A Construction Flora and Fauna Management Plan will be developed during detailed design and will include measures to manage potential impacts on bats, aquatic habitats and trees.

Groundwater

A groundwater model was developed to simulate existing groundwater conditions and predict future groundwater conditions to assess the potential impacts of the project, and cumulative impacts, on groundwater. Field investigations, including drilling boreholes, packer tests, groundwater gauging, groundwater sampling and hydrogeochemical analysis, were conducted across the study area between June 2016 and May 2017. Desktop studies were also undertaken to identify existing groundwater users and sensitive environmental receptors.

Construction impacts

The groundwater modelling has predicted groundwater inflows to the tunnels during construction of between 0.45 megalitres per day and 2.87 megalitres per day. During construction, the lateral extent of drawdown impacts due to tunnel construction would be minimal, even though groundwater inflows are high.

During construction, groundwater that enters the tunnel excavations would be collected. Groundwater inflows are likely to be of poor quality due to elevated natural salinity and background metal concentrations. Wastewater from the tunnels would also have a high turbidity and pH and would be treated at construction water treatment plants prior to reuse or discharge.

Operational impacts

The project tunnels are to be constructed predominantly through the Hawkesbury Sandstone and, to a lesser extent, through the Mittagong Formation and Ashfield Shale. Some areas of alluvium with high permeability would be encountered. The tunnels would be designed and constructed to ensure that groundwater inflow does not exceed one litre per second per kilometre for any kilometre length of tunnel during operations. This would require lining sections of the tunnels to minimise groundwater inflow.

Assuming a worst case scenario of a uniform groundwater inflow rate of one litre per second per kilometre for any kilometre length of the tunnel, a maximum groundwater inflow rate of around 45 litres per second (3.9 megalitres per day) would be expected. This represents less than one per cent of the annual recharge of groundwater across the Sydney Basin Central. Tunnel inflows during operations would be collected and conveyed to permanent water treatment plants at Darley Road, Leichhardt and Rozelle. The facilities would be designed so that treated groundwater would be of suitable quality for discharge to the receiving environment. Groundwater drawdown would contribute to ground settlement with the potential to impact existing buildings that are above areas of alluvium. Strict limits on the degree of settlement permitted would be imposed on the project.

Management of potential impacts

Appropriate waterproofing measures would be identified during detailed design and installed to ensure that groundwater inflow into the tunnels does not exceed the design criterion. Groundwater monitoring would be carried out during construction. At the end of construction, six-monthly monitoring would occur for three years or as otherwise required by any project conditions of approval. The monitoring is likely to include measuring groundwater levels, groundwater quality and tunnel inflow volumes.

Non-Aboriginal heritage

The built heritage and landscape assessment has focused on a broad area comprising an appropriate buffer around the project footprint. This is to ensure indirect impacts on heritage items and heritage conservation areas (HCAs) are appropriately assessed (ie visual impacts). The assessment also included consideration of potential vibration and settlement impacts on heritage items and HCAs above underground works.

Construction impacts

The project has been designed to minimise impacts on heritage items, however some impacts have been unavoidable.

The project would directly affect five listed heritage items across the study areas, which are:

- Demolition of three statutory heritage items of local heritage significance, being:
  - Stormwater canal at Rozelle
  - ‘Cadden Le Messurier’ at Rozelle
  - Former hotel at Rozelle
- Partial demolition of one statutory heritage item of local heritage significance, being the Whites Creek Stormwater Channel No. 95
- The project temporarily encroaches into the south western boundary of the curtilage of the White Bay Power Station which is a State Heritage Register (SHR) listed item. The minor encroachment occurs during the construction phase of the project as a result of the alignment of the temporary Victoria Road bridge. However, the works would be some distance from the Power Station building itself and the building would not be physically impacted by the project.

Twenty-one other statutory heritage items of State or local heritage significance HCAs would be subject to indirect impacts through potential vibration, settlement and visual setting. The project would also directly affect nine individual buildings/structures assessed as being potential local heritage items which would be fully demolished and one landscape feature assessed as being a potential local heritage item which would be partially demolished.

One structure assessed as being a potential heritage item of State significance would be indirectly impacted through vibration. Six other individual buildings/structures assessed as being potential local heritage items would be subject to indirect impacts through potential vibration, settlement and visual setting changes.

Management of potential impacts

A Construction Heritage Management Plan would be prepared and implemented to investigate potential archaeological feature at key locations that would be affected by the project. Heritage specialists would provide input into the development of the detailed design and construction methodologies as required to avoid or minimise potential impacts to features of heritage significance.

Photographic archival recording would be carried out for listed heritage items and sites of potential heritage significance to be demolished as part of the project. Historic fabric and features would be salvaged for distribution back to the former landowners and the local community. Key heritage values and stories of the heritage areas affected by the project would be interpreted in the final urban design and landscaping outcome.

Aboriginal heritage

The Aboriginal heritage assessment study area falls within the traditional country of the Darug people. A significant portion of the project footprint is within disturbed terrain, being an area that has been impacted by past development or other human activity, limiting the potential for intact features of Aboriginal archaeological and cultural heritage significance to be present.

Construction impacts

No surface Aboriginal objects or places were identified within the study area. A Metropolitan Local Aboriginal Land Council (MLALC) representative attended the site visit however did not identify any specific areas of Aboriginal cultural attachment or intangible cultural heritage values. No issues were raised by the MLALC representative regarding the proposed works having an impact on known or potential Aboriginal sites or deposits or intangible cultural heritage values. Part of King George Park at Rozelle within the project footprint is subject to an undetermined land claim from the Metropolitan Aboriginal Land Council under the *Aboriginal Land Rights Act 1983* (NSW). If necessary, the site would be avoided.

A site (rockshelter with midden) site recorded in the Aboriginal Heritage Information Management System database is located about 50 metres to the north of the Rozelle Rail Yards site. It was not possible to confirm the location and condition of the site due to property access restrictions. While no surface works are proposed at this location, tunnelling would occur in the vicinity. The site is outside the minimum safe working distance for vibration intensive plant and vibration impacts are expected to be negligible.

Management of potential impacts

Any items of potential Aboriginal archaeological or cultural heritage conservation significance or human remains discovered during construction will be managed in accordance with an Unexpected Heritage Finds and Humans Remains Procedure. Attempts would be made to obtain access to the rockshelter with midden site to confirm and record its location and conditions. If the site is validated, an assessment would be carried out to confirm if any damage is likely and identify any required measures to manage potential impacts.

Greenhouse gas

Construction impacts

Around 60 per cent of greenhouse gas (GHG) emissions generated during construction would be indirect upstream/downstream emissions associated with third party supply chains and indirect upstream emissions associated with transmission and distribution losses within the electricity network. Emissions generated by sources owned or controlled by the project would account for around 25 per cent of GHG emissions. Indirect emissions from the use of electricity to power project equipment and facilities would account for around 15 per cent of GHG emissions.

Operational impacts

The GHG assessment demonstrates the benefits of road tunnel usage in urban areas, where travel along a more direct route at higher average speeds results in fewer GHG emissions being generated by road users, as reduced congestion and stop-start driving reduces the fuel used by vehicles. Despite increases to overall daily vehicle kilometres travelled on motorways and a reduction in performance of some non-motorway roads, a reduction in GHG emissions is estimated as a result of the project compared with the ‘do minimum’ traffic modelling scenario.

The results for 2023 indicate that the project is forecast to reduce annual GHG emissions by around 361,600 tonnes of carbon dioxide equivalent (t CO_2-e) for the ‘with project’ scenario when compared with the ‘do minimum’ scenario for 2023.

The project is forecast to reduce annual GHG emissions by around 504,750 t CO_2-e in 2033 for the ‘with project’ when compared with the ‘do minimum’ scenario. The predicted reduction in GHG emissions as a result of the project would be due to an improvement in vehicle fuel efficiency for some links within the study area as well as the operational efficiency of the project tunnels.

Management of potential impacts

The design of the project has been optimised such that measures to reduce energy and resource requirements, and therefore GHG emissions, are inherent in the design. These include (but are not limited to):

- Reducing the length of the mainline tunnels, thereby reducing the volume of spoil generated, materials used, lighting and ventilation required, and emissions generated from operational road use by vehicles
- Using roadheaders and drill and blast methodologies for tunnel excavation, as opposed to the use of a tunnel boring machine, which consumes more electricity, potable water and concrete, and generates more spoil
- Reduced power consumption through the design of the ventilation system, which incorporates low pressure fans that consume approximately 50 per cent less energy compared with a high pressure fan solution.

An Energy Efficiency and Greenhouse Gas Emissions Strategy and Management Plan would be prepared to identify initiatives to be implemented during construction and operation of the project to improve energy efficiency, reduce GHG emissions, energy use and embodied life cycle impacts.

Resource use and waste minimisation

Construction impacts

Resource requirements during construction may have an impact on resource availability within the local area.

<u>Water</u>

The total volume of water required for construction of the project is estimated to be around 6,000 kilolitres per day. Water would be sourced from various sources including:

- Stormwater harvesting (non-potable water)
- On-site construction water treatment and reuse (non-potable water)
- The mains supply (potable water).

Preference would be given to the use of non-potable water over potable water, in accordance with the *WestConnex Sustainability Strategy* (Sydney Motorway Corporation 2015). Non-potable water could be used during construction for dust suppression and end-of-project landscaping. It is anticipated that the local water supply network would have sufficient capacity to accommodate project construction water requirements.

Power

It is estimated that the total energy requirements to construct the project would be around 100,000,000 kilowatt hours. At least 20 per cent of the electricity requirements would be met from renewable sources and/or accredited Green Power, as required by the *WestConnex Sustainability Strategy* (Sydney Motorway Corporation 2015). Discussions with power supply authorities suggest that local substations have the required capacity to supply the construction ancillary facilities for the project without affecting the local supply network.

Waste

Various waste streams would be generated during construction of the project, including construction and demolition waste, vegetation waste, packaging materials and liquid wastes. All wastes would be managed using the hierarchy approach of waste avoidance and resource recovery before consideration of waste disposal.

All waste would be managed in accordance with the waste provisions contained within the *Protection of the Environment Operations Act 1997* (NSW) and, where reused off-site, would comply with relevant NSW Environment Protection Authority (NSW EPA) resource recovery exemptions and requirements. Spoil would be classified in accordance with the *Waste Classification Guidelines: Part 1 Classifying Waste* (NSW EPA, 2014) and reused on the project site where possible, reused at other approved developments or disposed of lawfully at an appropriate location.

The project would ensure that around 95 per cent of uncontaminated spoil generated is recycled or reused for beneficial purposes, either within the project footprint or at other locations, in accordance with the project spoil management hierarchy.

Climate change risk assessment

The climate change risk assessment undertaken for the project considers the impact of future climate change on the project, rather than the impacts of the project on the future of climate change.

Construction impacts

Climate change projections for the near future (2030) represent an average of projections for the period 2020–2039. Projections for the near future are considered relevant to the project's proposed construction timeframes, planned for the period between 2018 and 2023.

Potential climate change risks to project construction, with a risk rating of medium or higher, included an increase in the intensity and frequency of extreme rainfall and storm events, which could lead to localised flooding of construction ancillary facilities and unsuitable conditions for undertaking construction works. An increase in frequency and intensity of extreme heat events could also occur, resulting in increased work health and safety risks and potential delays to project program.

Operational impacts

Seventeen climate change risks to the operation of the project were identified, including one extreme risk of flooding at Rozelle as a result of intense rainfall combined with sea level rise and an increase in extreme storm surges into Rozelle Bay. Four of the other risks to operation of the project were rated as high, including an increase in the intensity and frequency of extreme rainfall and an increase in frequency and intensity of extreme heat events.

Following the risk assessment, the design has been modified to reduce identified risks and a further detailed climate change risk assessment would be undertaken during the detailed design process to ensure the final design is adapted to the future (2030-2090) climate change scenarios.

Management of potential impacts

A detailed climate change risk assessment will be undertaken during detailed design in accordance with AS 5334-2013 Climate change adaptation for settlements and infrastructure – A risk based approach. The assessment will identify and implement adaptation measures to address high and extreme risks. The decision to implement adaptation measures for medium risks will also be considered during detailed design.

Hazard and risk

The project has been designed to minimise the likelihood of incidents and risks to public safety during construction. A Work Health and Safety Plan (WHSP) would be developed to support and augment the measures and procedures included in the CEMP. The WHSP would be supplemented by site-and activity-specific Safe Work Method Statements. An Incident Response Plan will also be developed and implemented in the event of an accident or incident.

The storage, transportation, handling and use of dangerous goods and hazardous substances would be undertaken in accordance with the *Work Health and Safety Act 2011* (NSW), the *Storage and Handling of Dangerous Goods Code of Practice* (Workcover NSW 2005), the Dangerous Goods (Road and Rail Transport) Regulation 2014 (NSW) and relevant Australian Standards and codes.

Cumulative impacts

When completed, the WestConnex program of works is expected to deliver beneficial cumulative impacts including significant increases in travel speeds through sections of the surface road network, increased reliability, and a reduction in average travel times.

Adverse cumulative impacts could be encountered during the construction phases of the different WestConnex projects. In particular:

- The New M5 project is expected to be finished in 2020, and may overlap the construction period of the M4-M5 Link project by around 12 months
- The M4 East project is expected to be finished in 2019, and may overlap the construction period of the M4-M5 Link project by around six months.

Construction of the project may also overlap construction of the proposed future Western Harbour Tunnel and Beaches Link project, which is anticipated to be carried out from an area within the Rozelle civil and tunnel site (C5) (when no longer needed for M4-M5 Link construction). Cumulative impacts from the concurrent construction of these two projects would predominantly comprise a minor worsening of the performance of the road network along City West Link as a result of spoil haulage and potential noise impacts on nearby receivers from concurrent construction activities.

Significant cumulative impacts with other planned developments in the area are not considered likely. However, consultation would be undertaken with local communities potentially affected by the impacts of multiple projects in addition to the M4-M5 Link project. Where relevant, proponents of other nearby developments would also be consulted to increase the overall awareness of project timeframes and impacts.

Consideration would also be given to the creation of a project working group, or equivalent, with the aim of managing project impacts and disruptions through the sharing of relevant project information (ie timing, duration and location of construction activities). The group mandate would also include how project information would be appropriately disseminated to stakeholders and communities to ensure transparency and adequate prior notification of work activities at a local level (street/suburb level).

Sustainability

The *WestConnex Sustainability Strategy* (Sydney Motorway Corporation 2015) describes how sustainability initiatives are being integrated into the design, construction and operation of projects across the WestConnex program of works. The Sustainability Strategy outlines a sustainability vision, commitments, guiding principles, objectives and overarching targets across a range of sustainability themes, and was prepared to align with the *Transport for NSW Sustainability Framework* as well as other relevant government sustainability instruments.

The overarching sustainability objectives for the project would be met through the implementation of a Sustainability Management Plan and project specific sustainability initiatives. The implementation of these initiatives would contribute to the project achieving an Infrastructure Sustainability rating of 'Excellent'.

How can I comment on the proposal and/or the environmental impact statement?

During the exhibition period, the EIS will be available for inspection at:

- The DP&E website (http://www.majorprojects.planning.nsw.gov.au)
- The WestConnex website (http://www.westconnex.com.au)
- Electronically at a NSW Service Centre located near you (http://www.service.nsw.gov.au/service-centre/service-nsw)
- The Roads and Maritime office in Milsons Point, selected local council offices and libraries in the Inner West, City of Sydney and Canada Bay LGAs as well as the Nature Conservation Council of NSW
- At various staffed displays in the region.

Details of the location and opening hours of staffed displays would be provided through a community update, letters to interest groups who have registered for the project, email notifications to registered stakeholders, information on the project website and advertisements in the local and metropolitan media. During the exhibition period, a project information line (1300 660 248) and email address (info@westconnex.com.au) will be available to answer questions from the community relating to the project.

Feedback on the project during the exhibition period should be made via a written submission to the Secretary of DP&E, quoting the project number (SSI 16_7485). All submissions received during the exhibition period will be placed on the DP&E website. Submissions can be made electronically through the DP&E website (http://www.majorprojects.planning.nsw.gov.au).

Written submissions may also be directed to:

Director Infrastructure Projects
Planning Services
Department of Planning and Environment
Application number SSI 7485
GPO Box 39
Sydney NSW 2001

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Certification

Submission of environmental impact statement

Prepared under Part 5.1 of the *Environmental Planning and Assessment 1979 Act* (NSW).

Environmental impact statement prepared by:

Name:	Andrew Cook
Qualifications:	Bachelor of Town and Regional Planning
Address:	AECOM, Level 21 420 George Street Sydney NSW 2000
Responsible person:	Philip Knudsen Director Motorway Delivery Program Roads and Maritime Services Level 22, 101 Miller Street North Sydney NSW 2060

Address of the land to which the statement relates:

Land within the Inner West and City of Sydney local government areas as described within the environmental impact statement.

Description of the infrastructure to which this statement relates:

Construction and operation of the WestConnex M4-M5 Link, which would comprise a new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange.

Environmental impact statement:

An environmental impact statement is attached addressing all matters in accordance with Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) and Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (NSW).

Declaration:

I certify that I have prepared this environmental impact statement in accordance with the Secretary's Environmental Assessment Requirements as issued on 3 March 2016, and revised on 9 November 2016 and further revised on 3 May 2017. The environmental impact statement contains all available information that is relevant to the environmental assessment of the infrastructure to which the statement relates. To the best of my knowledge, the information contained in the environmental impact statement is neither false nor misleading.

Signature:

Name: Andrew Cook

Date: 16 August 2017

Glossary

WestConnex

Glossary and terms of abbreviation

Term	Meaning
A	
AAQ NEPM	National Environment Protection (Ambient Air Quality) Measure
Aboriginal archaeological site	The present spatial extent of visible Aboriginal archaeological material(s) at a given location
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, song lines and places) cultural practices and traditions associated with past and present day Aboriginal communities
Aboriginal object	Any deposit, object or material evidence (not being a handicraft made for sale), including Aboriginal remains, relating to the Aboriginal habitation of NSW
Aboriginal place	Any place declared to be an Aboriginal place under section 94 of the *National Parks and Wildlife Act 1974* (NSW)
ABS	Australian Bureau of Statistics
Abutment	A support structure at the end of a bridge
Acid sulfate soils	Naturally occurring soils, sediments or organic substrates (eg peat) that are formed under waterlogged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, acid sulfate soils are benign. However if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulfides react with oxygen to form sulfuric acid
ACM	Asbestos containing material
Acoustic louvre	Equipment that provides ventilation and reduces noise from operational facilities
ACTAQ	Advisory Committee on Tunnel Air Quality
Acute exposure	Contact with a substance that occurs once or for only a short time (up to 14 days)
Adit	A temporary access tunnel
ADR	Australian Design Rule
ADT	Average daily traffic
AECOM	AECOM Australia Pty Ltd
AEP	Annual exceedance probability
Afflux	An increase in water level resulting from obstacles in the flow path
AHD	Australian Height Datum The standard reference level used to express the relative height of various features. A height given in metres AHD is the height above mean sea level
AHIMS	Aboriginal Heritage Information Management System A register of NSW Aboriginal heritage information maintained by the NSW Office of Environment and Heritage
AIP	NSW *Aquifer Inference Policy*
Airshed	A part of the atmosphere that shares a common flow of air and is exposed to similar influences
Alignment	The geometric layout (eg of a road) in plan (horizontal) and elevation (vertical)
Alluvium	Soil or sediment left by flowing water
ALRA	*Aboriginal Lands Right (Northern Territory) Act 1976* (Commonwealth)
AM peak hour	Unless otherwise stated, this refers to vehicle trips arriving at their destination during the average one hour peak in the AM peak period between 7.00 am and 9.00 am on a normal working weekday

Term	Meaning
ANSTO	Australian Nuclear Science and Technology Organisation
ANZECC	Australian and New Zealand Environment Conservation Council
AQM	Air quality management
Aquifer	A groundwater bearing formation sufficiently permeable to transmit and yield groundwater or water bearing rock
Aquitard	A low permeability unit that can store groundwater and also transmit it slowly from one aquifer to another
Archaeological potential	The likelihood of undetected surface and/or subsurface archaeological materials existing at a location
ARI	Average recurrence interval An indicator used to describe the frequency of floods. The average period in years between the occurrence of a flood of a particular magnitude or greater. In a long period of say 1,000 years, a flood equivalent to or greater than a 100 year ARI event would occur 10 times. The 100 year ARI flood has a one per cent chance (ie a one-in-100 chance) of occurrence in any one year. Floods generated by runoff from the study catchments is referred to in terms of their ARI, for example the 100 year ARI flood
ARTC	Australian Rail Track Corporation
Artefact	Any object which has been physically modified by humans
Arterial roads	The main or trunk roads of the state road network that carry predominantly through traffic between regions
AS	Australian Standard
Asphalt or asphaltic concrete	A dense, continuously graded mixture of course and fine aggregates, mineral filler and bitumen usually produced hot in a mixing plant
At-grade	A road at ground level, not on an embankment or in a cutting
ATC	Automatic traffic count
ATN	Active transport network
ATSIHP Act	*Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Commonwealth)
AWS	Automatic weather station
AWT	Average weekday traffic
B	
Background concentration (air quality)	Describes all contributing sources of a pollutant concentration other than road traffic. It includes, for example, contributions from natural sources, industry and domestic activity
Background noise level	The ambient sound-pressure noise level in the absence of the sound under investigation exceeded for 90 per cent of the measurement period. Normally equated to the average minimum A-weighted sound pressure level
BAM	Beta attenuation monitor
Bank cubic metres	A measure of volume representing a cubic metre of unexcavated material. Once material is excavated, it expands to varying degrees depending on its constituents
BaP	Benzo(a)pyrene
BAR	Biodiversity Assessment Report
Benefit cost ratio	A measure of the magnitude of net benefit to society derived from the capital investment in the project
Biodegradation	Decomposition or breakdown of a substance through the action of micro-organisms (such as bacteria or fungi) or other natural physical processes (such as sunlight)
Bioretention facility	Landscaped depression designed to treat stormwater runoff to remove contaminants and sediment

Term	Meaning
Blasting	Rock blasting is the controlled use of explosives and other methods such as gas pressure blasting pyrotechnics or plasma processes, to excavate, break down or remove rock
BOD	Biological oxygen demand
BoM	Australian Government Bureau of Meteorology
Bore	Constructed connection between the surface and a groundwater source that enables groundwater to be transferred to the surface either naturally or through artificial means
BS	British standard
BTEX	Benzene, toluene, ethylbenzene and xylenes
BTEXN	Benzene, toluene, ethylbenzene, xylenes and naphthalene
BTS	NSW Bureau of Transport Statistics
Bund	A small embankment designed to retain water
Bus lane	A traffic lane dedicated to buses, but which can also be used by taxis, bicycles and motorcycles
C	
Campbell Road civil and tunnel site	A construction ancillary facility for the M4-M5 Link project at St Peters
Campbell Road motorway operations complex	An area where operational ancillary facilities are established. Located within the St Peters interchange, south of Campbell Road at St Peters, on land occupied during construction by the Campbell Road civil and tunnel site
Campbell Road ventilation facility	Ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels. Located at St Peters, within the St Peters interchange site
Capacity	The nominal maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or roadway in one direction during a given time period under prevailing roadway conditions
Carcinogen	A substance that causes cancer
Carriageway	The portion of a roadway used by vehicles including shoulders and ancillary lanes
CASA	Civil Aviation Safety Authority
Catchment	The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location
CBD	Central business district
CCTV	Closed circuit television
CEEC	Critically endangered ecological community A threatened ecological community with a ‘critically endangered’ listing status under environmental legislation
CEMP	Construction Environmental Management Plan A plan developed for the construction phase of the project to ensure that all contractors and sub-contractors comply with the environmental conditions of approval for the project and that the environmental risks are properly managed
CFFMP	Construction Flora and Fauna Management Plan
Chronic exposure	Contact with a substance or stressor that occurs over a long time (more than one year) [compared with acute exposure and intermediate duration exposure]
CHL	Commonwealth Heritage List
City Centre Access Strategy	Sydney Centre Access Strategy (Transport for NSW 2013)
Climate change	A change in the state of the climate that can be identified (eg by statistical tests) by changes in the mean and/or variability of its properties, and that persists for an extended period of time, typically decades or longer (CSIRO and BoM 2015)

Term	Meaning
Climate projection	A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases and aerosols, generally derived using climate models. Climate projections are distinguished from climate predictions by their dependence on the emission/concentration/radiative forcing scenario used, which in turn is based on assumptions concerning, for example, future socio-economic and technological developments that may or may not be realised (CSIRO and BoM 2015)
CLM Act	*Contaminated Land Management Act 1997* (NSW)
CMA	Catchment management authority
CMP	Conservation Management Plan
CNVG	*Construction Noise and Vibration Guideline* (Roads and Maritime, 2016)
CNVIS	Construction Noise and Vibration Impact Statements
CNVMP	Construction Noise and Vibration Management Plan
CO	Carbon monoxide
CO_2	Carbon dioxide A naturally occurring gas, also a by-product of burning fossil fuels from fossil carbon deposits, such as oil, gas and coal, of burning biomass, of land use changes and of industrial processes (eg cement production). It is the principle anthropogenic greenhouse gas that affects the Earth's radiative balance (CSIRO and BoM 2015)
CO_2-e	Carbon dioxide equivalents
COAG	Council of Australian Governments
Coffer dam	Temporary enclosure built within a body of water to allow the enclosed area to be pumped out
COHb	Carboxyhaemoglobin
Concept design	Initial functional layout of a road/road system or other infrastructure. Used to facilitate understanding of a project, establish feasibility and provide basis for estimating and to determine further investigations needed for detailed design
Confluence	A point at which streams combine
Construction	Includes all physical work required to construct the project
Construction ancillary facilities	Temporary facilities during construction that include, but are not limited to construction sites (civil and tunnel), sediment basins, temporary water treatment plants, precast yards and material stockpiles, laydown areas, workforce parking, maintenance workshops and offices
Construction fatigue	Impact on receivers in the vicinity of concurrent and/or consecutive construction activities
Contributory item	Place within a Heritage Conservation Area that contributes to its heritage significance
CORTN	*Calculation of Road Traffic Noise* algorithms (UK Department of Transport 1988)
CPI	Consumer price index
CPTED	Crime Prevention Through Environmental Design
CSA	Cross-sectional area
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSELR	CBD and South East Light Rail
CSSI	Critical State significant infrastructure
CSWMP	Construction Soil and Water Management Plan
CTAMP	Construction Traffic and Access Management Plan
Cul-de-sac	A street or road that is open for vehicular traffic at one end only
Culvert	A structure that allows water to flow under a road

Term	Meaning
Cumulative impacts	Impacts that, when considered together, have different and/or more substantial impacts than a single impact assessed on its own
Cut-and-cover	A method of tunnel construction whereby the structure is built in an open excavation and subsequently covered
Cutting	Formation resulting from the construction of the road below existing ground level, the material is cut out or excavated
D	
Darley Road civil and tunnel site	A construction ancillary facility for the M4-M5 Link project located at Leichhardt
Darley Road motorway operations complex	An area where operational ancillary facilities are established. Located at Leichhardt, south of City West Link and the Inner West Light Rail line on land occupied during construction by the Darley Road civil and tunnel site
dB	Decibel - sound level measurement
dBA	A-weighted decibels A-weighting is applied to instrument-measured sound levels in effort to account for the relative loudness perceived by the human ear, as the ear is less sensitive to low audio frequencies
dBL	Linear weighted decibels
DCP	Development Control Plan
DE	Diesel exhaust
DEC	NSW Department of Environment and Conservation (now OEH and EPA)
DECC	NSW Department of Environment and Climate Change (now OEH)
DECCW	NSW Department of Environment, Climate Change and Water (formerly DECC, now OEH)
DEFRA	(UK) Department for Environment, Food and Rural Affairs
DEH	Australian Government Department of Environment and Heritage
DERM	(Queensland) Department of Environment and Resource Management
Design speed	A nominal speed which determines the geometric design features of a road
Detailed design	The phase of the project following concept design where the design is refined, and plans, specifications and estimates are produced, suitable for construction
Detection limit	The lowest concentration of a chemical that can reliably be distinguished from a zero concentration
Detour	An alternative route, using existing roads, made available to traffic
Deviation	An alteration to the alignment of a portion of a road
DEWHA	Australian Government Department of Environment, Water, Heritage and the Arts
DGA	Dense graded asphalt
DIN	German standard
DIRD	Australian Government Department of Infrastructure and Regional Development
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m^3/s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving (eg metres per second (m/s))
Divided road	A road with a separate carriageway for each direction of travel created by placing a physical separation (eg median) between the opposing traffic directions
DLWC	NSW Department of Land and Water Conservation
Do minimum	A model scenario that does not incorporate the proposed project infrastructure

Term	Meaning
Do something	A model scenario that incorporates the proposed project infrastructure
Do something cumulative	A model scenario that incorporates the proposed project infrastructure and other relevant project infrastructure
DoEE	Australian Government Department of the Environment and Energy
DoP	NSW Department of Planning (now Department of Planning and Environment)
Dose	The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure
DP&E	NSW Department of Planning and Environment
DP&I	NSW Department of Planning and Infrastructure (now Department of Planning and Environment)
DPC	Department of Premier and Cabinet
DPF	Diesel particulate filter
DPI	NSW Department of Primary Industries
DPI-Fisheries	NSW Department of Primary Industries (Fisheries)
DPI-Water	NSW Department of Primary Industries (Water)
DPM	Diesel particulate matter
DPSW	NSW Department of Public Works and Services
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water
Drawdown	Reduction in the height of the water table caused by changes in the local environment
DRIS	Decision Regulation Impact Statement
DSEWPC	Australian Government Department of Sustainability, Environment, Water, Population and Communities
DSITIA	(Queensland) Department of Science, Information Technology, Innovation and the Arts
E	
Earthworks	All operations involved in loosening, excavating, placing, shaping and compacting soil or rock
EB	Eastbound
EC	Elemental carbon
Ecological community	An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat
EDMS	(NSW) Emissions Data Management System
EF	Emission factor A quantity which expresses the mass of a pollutant emitted per unit of activity. For road transport the unit of activity is usually either distance (ie g/km) or fuel consumed (ie g/litre)
Egress	Exit
EHC Act	*Environmentally Hazardous Chemicals Act 1985* (NSW)
EIA	Environmental Impact Assessment
EIS	Environmental impact statement
Electrical conductivity	The measure of a material's ability to accommodate the transport of an electric charge
Embankment	An earthen structure where the road (or other infrastructure) subgrade level is about the natural surface
Emergency management	A range of measures to manage risks to communities and the environment. In the flood context it may include measures to prevent, prepare for, respond to and recover from flooding
EMF	Electromagnetic field
Emission rate	A quantity which expresses the mass of a pollutant emitted per unit of time (eg g/second)

Term	Meaning
Emissions scenario	A plausible representation of the future development of emissions of substances that are potentially radiatively active (eg greenhouse gases, aerosols) based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socio-economic development, technological change) and their key relationships (CSIRO and BoM 2015)
Enabling works	Works which are required to enable the commencement of the main construction works
Endangered ecological community	A threatened ecological community with an 'endangered' listing status under environmental legislation
ENMM	Environmental Noise Management Manual
Entry ramp	A ramp by which one enters a limited-access highway/tunnel
Environment	As defined within the *Environmental Planning and Assessment Act 1979* (NSW), all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings
EOI	Expressions of interest
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2000 (NSW)
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPHC	Environment Protection Heritage Council
EPL	Environment Protection Licence under the *Protection of the Environment Operations Act 1997* (NSW)
Erosion	A natural process where wind or water detaches a soil particle and provides energy to move the particle
ERS	Eastern Regional Sequence
ESP	Electrostatic precipitator
EU	European Union
Exit ramp	A ramp by which one exits a limited-access highway/tunnel
Extreme rainfall	There is no consistent global definition for extreme rainfall. It can be defined by either relative rainfall at a location (amount relative to averages), or absolute rainfall amounts (eg over 100 millimetres in a single day). In this report, an extreme rainfall event is defined as the wettest day in 20 years
Extreme temperature	Definitions vary, however this report refers to extreme temperature as hot days (days above 35˚C) and very hot days (days above 40˚C)
F	
F6 Extension (previously referred to as SouthLink)	A proposed motorway link between the New M5 at Arncliffe and the existing M1 Princes Highway at Loftus, generally along the alignment known as the F6 corridor. The project is being delivered by NSW Roads and Maritime Services and would be subject to separate assessment and planning approval
FBA	*Framework for Biodiversity Assessment* (Office of Environment and Heritage 2014)
Feasible and reasonable	Consideration of standard or good practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. 'Feasible' relates to engineering considerations and what is practical to build. 'Reasonable' relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community expectations and nature and extent of potential improvements
FFDI	Forest Fire Danger Index
Fill	The material placed in an embankment

Term	Meaning
Fire weather	Weather conditions conducive to triggering and sustaining wild fires, usually based on a set of indicators and combinations of indicators including temperature, soil moisture, humidity, and wind. Fire weather does not include the presence or absence of fuel load (CSIRO and BoM 2015)
Flash flooding	Flooding which is sudden and unexpected. It is often caused by sudden local or nearby heavy rainfall. It is often defined as flooding which peaks within six hours of the rain event
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami
Flood prone land	Land susceptible to flooding by the probable maximum flood. Note that the flood prone land is also known as flood liable land
Flood storage area	Those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. It is necessary to investigate a range of flood sizes before defining flood storage areas
Floodplain	Area of land which is inundated by floods up to and including the probable maximum flood event (ie flood prone land)
Floodplain Risk Management Plan	A management plan developed in accordance with the principles and guidelines in the NSW Floodplain development manual (DIPNR 2005). Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defined objectives
FM Act	*Fisheries Management Act 1994* (NSW)
FMS	Flood management strategy
FPL	Flood planning level
Fracture	Cracks within the strata that develop naturally or as a result of underground works
Freeboard	A factor of safety typically used in relation to the setting of floor levels, levee crest levels, etc. It is usually expressed as the difference in height between the adopted flood planning level and the peak height of the flood used to determine the flood planning level. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour and impacts that are specific event related, such as levee and embankment settlement, and other effects such as ‘greenhouse’ and climate change. Freeboard is included in the Flood Planning Level
Freight Strategy	NSW Freight and Ports Strategy (Transport for NSW 2013b)
FRNSW	Fire & Rescue NSW
G	
Gateway to the South	An accelerated pinch points program, the Gateway to the South Pinch Points Program aims to ease congestion and improve journey reliability on Sydney’s key southern corridors. The NSW Government has committed $300 million to address critical pinch points along the A1, A3 and A6 routes south of the M5 Motorway
GCCSA	Greater Capital City Statistical Area

Term	Meaning
GDE	Groundwater dependent ecosystem Refers to communities of plants, animals and other organisms whose extent and life process are dependent on groundwater, such as wetlands and vegetation on coastal sand dunes
Genotoxic carcinogens	Chemicals that alter the genetic material of target cells and could cause cancer
Geomorphology	Physical features of the earth's surface and their relation to its geological structures
Geotechnical investigation	Below ground investigation including soil and groundwater sampling and testing
GHG	Greenhouse gas
GI	Ground integrity
GIS	Geographical information system
GLC	Ground-level concentration
Global Sydney	As defined in A Plan for Growing Sydney (NSW Government 2014), Global Sydney includes the Sydney CBD, North Sydney CBD, Barangaroo, Darling Harbour, The Bays Precinct, Pyrmont-Ultimo, Broadway and Camperdown Education and Health Precinct, Central to Eveleigh, Surry Hills and City East
GMA	Greater Metropolitan Area
GMP	Groundwater monitoring program
GMR	NSW Greater Metropolitan Region
GPS	Global positioning system
Grade	The rate of longitudinal rise (or fall) with respect to the horizontal expressed as a percentage or ratio
Grade separation	The separation of road, rail or other traffic so that crossing movements at intersections are at different levels
GRAL	Graz Lagrangian (dispersion model) An air quality modelling package
GRAMM	Graz Mesoscale Model
Greenhouse gas	Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere (CSIRO and BoM 2015)
Groundwater	Water that is held in rocks and soil beneath the earth's surface
Groundwater aggressivity	The extent to which groundwater may corrode or degrade materials
Groundwater gauging	Obtaining data from groundwater wells
GSV	Ground surface visibility
GVA	Gross value add
GVM	Gross vehicle mass
H	
ha	Hectare
Haberfield civil and tunnel site/Haberfield civil site	Construction ancillary facilities for the M4-M5 Link project located at Haberfield
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (OEH 2014a)
HAMU	Historical archaeological management unit
HARD	Historical archaeological research design
Hazard	A source of potential harm or a situation with a potential to cause loss of human life or damage to physical assets
HCA	Heritage conservation area

Term	Meaning
HCV	Heavy commercial vehicle (interchangeable with HGV – see below)
HDV	Heavy-duty vehicle, which includes heavy goods vehicles, buses and coaches
Heavy vehicles	A heavy vehicle is classified as a Class 3 vehicle (a two axle truck) or larger, in accordance with the Austroads Vehicle Classification System
Heritage Act	*Heritage Act 1977* (NSW)
Heritage Council	Heritage Council of NSW
Heritage item	Any place, building or object listed on a statutory heritage register
HGV	Heavy goods vehicle (truck)
HHRA	Human health risk assessment
HI	Hazard Index
HIA/HIS	Heritage impact assessment / heritage impact statement
HVAS	High volume air sampler
Hydraulic conductivity	A characteristic of soil that describes how easily water moves through it
Hydrogeochemical	Chemical characteristics of groundwater
Hydrogeology	The area of geology that deals with the distribution and movement of groundwater in soils and rocks
Hydrology	The study of rainfall and surface water runoff processes
Hz	Hertz. A measure of frequency
I	
IARC	International Agency for Research on Cancer
ICNG	*Interim Construction Noise Guideline* (NSW DECC 2009a)
IFD	Intensity-Frequency-Duration
ILCR	Incremental lifetime carcinogenic risk
ILUA	Indigenous Land Use Agreement
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment
In situ	In the natural or original position. Applied to a rock, soil, or fossil when occurring in the situation in which it was originally formed or deposited
Infiltration	The downward movement of water into soil and rock. It is largely governed by the structural condition of the soil, the nature of the soil surface (including presence of vegetation) and the antecedent moisture content of the soil
Infrastructure SEPP	*State Environmental Planning Policy (Infrastructure) 2007* (NSW)
Ingress	Enter
Inner West Council	The amalgamation of the former local government areas of Ashfield, Leichhardt and Marrickville, proclaimed on 12 May 2016
Inner West subsurface interchange	A subsurface interchange at Leichhardt and Annandale that would link the mainline tunnels with the Rozelle interchange and the Iron Cove Link
INP	Industrial Noise Policy
Inside shoulder	The area of pavement outside the traffic lanes that is closest to the 'fast' lane
Interchange	A grade separation of two or more roads with one or more interconnecting carriageways
Intrusive item	Place within a heritage conservation area that detracts from its heritage significance
IPCC	Intergovernmental Panel on Climate Change
Iron Cove Link	Around one kilometre of twin tunnels that would connect Victoria Road near the eastern abutment of Iron Cove Bridge and Anzac Bridge

Term	Meaning
Iron Cove Link civil site	A construction ancillary facility for the M4-M5 Link project located at Rozelle
Iron Cove Link motorway operations complex	An area where operational ancillary facilities are established. Located south of the realigned Victoria Road carriageway between Callan Street and Springside Street at Rozelle, on land occupied during construction by the Iron Cove Link civil site
Iron Cove Link ventilation facility	Ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels. Located at Rozelle
ISCA	Infrastructure Sustainability Council of Australia
ITS	Intelligent Transport Systems Systems in which information and communication technologies are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport
IVA	Industry value add
J	
Just Terms Act	*Land Acquisition (Just Terms Compensation) Act 1991* (NSW)
K	
KFH	Key fish habitat
KGRIU	King Georges Road Interchange Upgrade A component of the WestConnex program of works. Upgrade of the King Georges Road interchange between the M5 West and the M5 East at Beverly Hills, in preparation for the New M5 project
kL	Kilolitre
kL/day	Kilolitres per day
Km	kilometres
kN	Kilonewton
KTP	Key threatening process
L	
L/s/km	Litres per second per kilometre
L_{Aeq}	The ‘energy average noise level’
L_{A90}	The “background noise level” in the absence of construction activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods respectively. The LAeq(15minute) construction Noise Management Levels (NMLs) are based on the LA90 background noise levels
L_{AFmax}	The maximum fast time weighted noise level from road traffic noise occurring at a particular location
LALC	Local Aboriginal land council
Landscape character	The aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. Includes all aspects of a tract of land – built, planted and natural topographical and ecological features
Landscape design	The design of the natural and built environment. Soft landscape design involves design using vegetative materials such as trees, shrubs, groundcovers. Hard landscape design involves design using hard materials such as pavement, walls and ramps
Lane	A portion of the carriageway allotted for the use of a single line of vehicles
LCV	Light commercial vehicle
LCZ	Landscape character zone
Leachate	Liquid that ‘leaches’ (drains) from a landfill or stockpile
LEP	Local environmental plan
LGA	Local government area

Term	Meaning
Licensed discharge point	A location where a licensed operation discharges water to the environment in accordance with conditions stipulated within the site environment protection licence (EPL)
LIDAR	Light Detection and Ranging
LOAEL	Lowest observed adverse effect level
Local road	A road or street used primarily for access to abutting properties
Localised flooding	Localised flooding occurs when components of the drainage system are undersized or blocked and cannot accommodate the incoming overland surface flows, resulting in the flooding of a localised area
LOR	Limit of reporting
LoS	Level of service
LTAAEL	Long term average annual extraction limits
M	
m	Metres
m^2	Square metres
m^3	Cubic metres
M4 East mainline stub tunnels	Eastbound and westbound extensions of the M4 East mainline tunnel being built as part of the M4 East project (to connect with the M4-M5 Link)
M4 East mainline connection	The underground connection between the M4-M5 Link mainline tunnels and the M4 East mainline stub tunnels
M4 East Motorway/project	A component of the WestConnex program of works. Extension of the M4 Motorway in tunnels between Homebush and Haberfield via Concord. Includes provision for a future connection to the M4-M5 Link at the Wattle Street interchange
M4 Motorway	The M4 Motorway is a 40 kilometre motorway that extends from Concord in Sydney's inner west to Lapstone at the foothills of the Blue Mountains
M4 Widening	A component of the WestConnex program of works. Widening of the existing M4 Motorway from Parramatta to Homebush
M4-M5 Link	The project which is the subject of this EIS. A component of the WestConnex program of works
M5 East Motorway	Part of the M5 motorway corridor. Located between Beverly Hills and Sydney Airport (General Holmes Drive)
M5 motorway corridor	The M5 East Motorway and the M5 South West Motorway
M5 South West Motorway	Part of the M5 Motorway corridor. Located between Prestons and Beverly Hills
Mainline tunnels	The M4-M5 Link mainline tunnels connecting with the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters
Mainstream flooding	Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam
Managed motorway	A managed motorway uses active traffic management to reduce congestion, improve reliability of travel times and inform travellers of real-time incidents and expected travel times to set destination along the motorway
MCA	Multi-criteria analysis
Mean rainfall	The arithmetically averaged total amount of precipitation recorded during a calendar month or year
Median	The central reservation which separates carriageways from traffic travelling in the opposite direction
mg/L	Milligrams per litre
microSiemens per centimetre (mS/cm)	A measure of electrical conductivity. Commonly used to measure the salinity of water
Mid-block	Section of road between two intersections
ML	Megalitre

Term	Meaning
MLALC	Metropolitan local Aboriginal land council
MNES	Matters of national environmental significance
MODFLOW	A three-dimensional finite-difference groundwater model
Motorway	Fast, high volume controlled access roads. May be tolled or untolled
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
MVA	Megavolt-amp
MVKT	Million vehicle kilometres travelled
N	
NARCliM	NSW/ACT Regional Climate Modelling
National Road Network	AusLink National Land Transport Network
Naturalisation works	Restoring the natural values of a river by works such as replacing concrete walls with natural looking banks made of rocks and native plants to improve health and natural character
NB	Northbound
NCA	Noise catchment area
NCG	*Noise Criteria Guideline* (Roads and Maritime, 2015)
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
New M5 Motorway/project	A component of the WestConnex program of works. Located from Kingsgrove to St Peters (under construction)
New M5 mainline stub tunnels	Northbound and southbound extensions of the New M5 mainline tunnel being built as part of the New M5 project (to connect with the M4-M5 Link)
New M5 mainline connection	The underground connection between the M4-M5 Link mainline tunnels and the New M5 mainline stub tunnels
NH_3	Ammonia
NHL	National heritage list
NHMRC	National Health and Medical Research Council
NIWA	National Institute of Water and Atmospheric Research (New Zealand)
NLA	National Library of Australia
NMG	*Noise Mitigation Guideline* (Roads and Maritime, 2015)
NML	Noise management level
NMVOC	Non-methane volatile organic compound
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOAEL	No observed adverse effect level
Northcote Street civil site	A construction ancillary facility for the M4-M5 Link project located at Haberfield
NO_X	Oxides of nitrogen
NoW	NSW Office of Water
NPI	National Pollutant Inventory
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSW	New South Wales
NSW EPA	NSW Environment Protection Authority
NSW Health	NSW Department of Health
NT Act	*Native Title Act 1993* (Commonwealth)
NV Act	*Native Vegetation Act 2003* (NSW)
NW Act	*Noxious Weeds Act 1993* (NSW)
NWQMS	National Water Quality Management Strategy
NZ	New Zealand
O	
O_3	Ozone
Obstruction Limitation Surface	An invisible level that defines the limits to which objects may project into the airspace around an aerodrome so that aircraft operations may be conducted safely

Term	Meaning
OC	Organic carbon
OCP	Organochlorine Pesticides
OEH	NSW Office of Environment and Heritage (Formerly DECCW)
OEMP	Operational Environmental Management Plan
OLS	Obstruction limitation surface
OOHW	Out-of-hours work
ONVR	Operational Noise and Vibration Review
OPP	Organophosphate Pesticides
Outcrop	Bedrock exposed at the ground surface
Outside shoulder	The area of pavement outside the traffic lanes that is closest to the 'slow' lane
Overbridge	Bridge that conveys another road, rail or pedestrians over the described road
Overland flooding	Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam
P	
PACHCI	*Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime 2011)
PAH(s)	Polycyclic aromatic hydrocarbon(s)
Palaeochannel/palaeovalley	Ancient river systems eroded deeply into the landscape and infilled with saturated alluvial sediments
PANS-OPS	Procedures for air navigation systems operations
Parcel of land	Refers to an individual lot number (lot) and deposited plan (DP)
Parramatta Road corridor	The area from Parramatta CBD to Sydney CBD, generally between the Main Western Rail line in the south and the Parramatta River to the north
Parramatta Road East civil site	A construction ancillary facility for the M4-M5 Link project at Haberfield
Parramatta Road Transformation Strategy	*The Parramatta Road Corridor Urban Transformation Strategy* (UrbanGrowth NSW 2016a)
Parramatta Road ventilation facility	A ventilation facility located on the south-eastern corner of the Parramatta Road / Wattle Street intersection (referred to as the Eastern ventilation facility in the M4 East project EIS). The facility is being built as part of the M4 East project. As part of the M4-M5 Link project, fitout works would be carried out on a section of this facility
Parramatta Road West civil and tunnel site	A construction ancillary facility for the M4-M5 Link project at Ashfield
PASS	Potential acid sulfate soils
Pavement	The portion of a carriageway placed above the subgrade for the support of, and to form a running surface for, vehicular traffic
PCB	Polychlorinated biphenyls
PCT	Plant community type
PCU	Passenger car unit
Peak discharge	The maximum discharge occurring during a flood event
Peak flood level	The maximum water level occurring during a flood event
Permeability	Ability of a material to transmit water
PFAS/PFOS/PFHxS	Per- and poly-fluoroalkyl substances
Photo-ionisation detector measurements	A measurement of the concentration of volatile organic compounds and other gases within the soil
pH	Numeric scale ranging from zero to 14 used to specify the acidity or alkalinity of an aqueous solution. Solutions with a pH less than seven are acidic and solutions with a pH greater than seven are alkaline. Pure water has a pH of seven and is neutral
PIARC	Permanent International Association of Road Congresses

Term	Meaning
Piezometer (monitoring well)	A non-pumping monitoring well, generally of small diameter that is used to measure the elevation of the water table or potentiometric surface. A piezometer generally has a short well screen through which water can enter
PM	(Airborne) particulate matter
PM_{10}	Airborne particulate matter with an aerodynamic diameter of less than 10 micrometres (μm)
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of less than 2.5 micrometres (μm)
PM peak hour	Unless otherwise stated, this refers to trips travelling on the network during the average one hour peak period between 3pm to 6pm on a weekday
PMF	Probable maximum flood The flood that occur as a result of the probable maximum precipitation on a study catchment. The probable maximum flood is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The probable maximum flood defines the extent of flood prone land (ie the floodplain)
ppb	Parts per billion
ppbv	Parts per billion by volume
PPV	Peak Particle Velocity
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
Pollutant	Any measured concentration of solid or liquid matter that is not naturally present in the environment
Portal	The entry and/or exit to a tunnel
Potential heritage item	Place identified in this report as potentially having heritage significance, which is not recognised on the heritage register
ppm	Parts per million
ppmv	Parts per million by volume
Pre-construction	All work prior to, and in respect of the State significant infrastructure, that is excluded from the definition of construction
Priority List	Infrastructure Australia's *Australian Infrastructure Plan: The Infrastructure Priority List*
Prescribed airspace	The airspace above any part of either an Obstruction Limitation Surface or a 'procedures for air navigation systems – aircraft operations' (PANS-OPS) surface for Sydney Airport. The obstacle limitation surface is an invisible level that defines the limits to which objects may project into the airspace around an aerodrome so that aircraft operations may be conducted safely
Probability	A statistical measure of the expected chance or likelihood of occurrence
Project	A new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange
Project footprint	The land required to construct and operate the project. This includes permanent operational infrastructure (including the tunnels), and land required temporarily for construction
Property	Based on ownership, with the potential to contain more than one lot and DP

Term	Meaning
Proponent	The person or organisation that proposes to carry out the project or activity. For the purpose of the project, the proponent is NSW Roads and Maritime Services
Public transport	Includes train, bus (government and private), ferry (government and private) and light rail (government and private) services
PV	Passenger vehicle
Pyrmont Bridge Road tunnel site	A construction ancillary facility for the M4-M5 Link project at Annandale
Q	
R	
RAP	Remedial action plan
RAP	Registered Aboriginal parties
RBL	Rating background levels
RCBC	Reinforced concrete box culvert
RCP	Representative concentration pathways
REF	Review of environmental factors
Representative concentration pathways	Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases and aerosols and chemically active gases, as well as land use/cover (Dowdy et al 2015)
Residual land	Acquired land not required during operation of the project
Revegetation	Direct seeding or planting (generally with native species) within an area in order to re-establish vegetation that was previously removed from that area
RH	Relative humidity
Riparian	The part of the landscape adjoining rivers and streams that has a direct influence on the water and aquatic ecosystems within them
RNP	Road Noise Policy
Road reserve	A legally defined area of land within which facilities such as roads, footpaths and associated features may be constructed for public travel
Road Safety Strategy	National Road Safety Strategy for Australia 2011 – 2020
Roadheader	A commonly used machine for excavation in sandstone using picks mounted on a rotary cutter head attached to a hydraulically operated boom
Roads and Maritime	NSW Roads and Maritime Services
Roadside furniture	A general term covering all signs, street lights, protective devices for the control, guidance and safety of traffic and convenience of road users
Rozelle civil and tunnel site	A construction ancillary facility for the M4-M5 Link project located at Lilyfield and Rozelle
Rozelle East motorway operations complex	An area where operational ancillary facilities are established. Located at the western end of the Rozelle Rail Yards on land occupied during construction by the Rozelle civil and tunnel site
Rozelle interchange	A new interchange at Lilyfield and Rozelle that would connect the M4-M5 Link mainline tunnels with City West Link, Anzac Bridge, the Iron Cove Link and the proposed future Western Harbour Tunnel and Beaches Link
Rozelle Rail Yards	The Rozelle Rail Yards is bound by City West Link to the south, Lilyfield Road to the north, Balmain Road to the west, and White Bay to the east. Note that the project only occupies part of the Rozelle Rail Yards site
Rozelle ventilation facility	Ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels. Located at the Rozelle Rail Yards, the ventilation supply facility is located at the Rozelle West motorway operations complex and a ventilation exhaust facility at the Rozelle East motorway operations complex

Term	Meaning
Rozelle West motorway operations complex	An area where operational ancillary facilities are established. Located at the central/eastern end of the Rozelle Rail Yards, on land occupied during construction by the Rozelle civil and tunnel site
RPA Hospital	Royal Prince Alfred Hospital
RTA	NSW Roads and Traffic Authority (now NSW Roads and Maritime Services)
Runoff	The amount of rainfall that ends up as streamflow, also known as rainfall excess
RWR	Residential, workplace and recreational This term refers to all discrete receptor locations along the project corridor, and mainly covers residential and commercial land uses
S	
s	Second
S170	State Agency Section 170 Heritage and Conservation Register. Section 170 of the *Heritage Act 1977* (NSW) requires NSW Government agencies to keep a register of heritage items/assets owned, occupied or managed by that government agency
SA1	Statistical area level 1 district
SA2	Statistical area level 2 district
SACL	Sydney Airport Corporation Limited
Salinity	The concentration of dissolved salts in water
SB	Southbound
SCATS	Sydney coordinated adaptive traffic system
SCR	Selective catalytic reduction
Scour	Removal of sediment such as sand and gravel from around bridge abutments or piers caused by moving water
SEARs	Secretary's Environmental Assessment Requirements Requirements and specifications for an environmental assessment prepared by the Secretary of the NSW Department of the Planning and Environment under section 115Y of the *Environmental Planning and Assessment Act 1979* (NSW)
Sediment	Material, both mineral and organic, that is being or has been moved from its site of origin by the action of wind, water or gravity and comes to rest either above or below water level
Sedimentation basin	A stormwater detention system that promotes the settling of sediments trough the reduction of flow velocities and temporary detention. Key elements include purpose designed inlet and outlet structures, settling pond and high flow, overflow structures
SEIA	Socio-economic impact assessment
SEIFA	Socio-Economic Index for Areas
Sensitive receiver/receptor	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), active recreation areas (including parks and sports grounds), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, retail spaces and industrial premises)
SEPP	State Environmental Planning Policy
SEPP 19	State Environmental Planning Policy No. 19 – Bushland in Urban Areas
SEPP 33	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
SEPP 55	State Environmental Planning Policy No. 55 – Remediation of Land
SER	Strategic Environmental Review
SF_6	Sulfur hexafluoride

Term	Meaning
Settlement	Refers to how ground can move due to the construction of new infrastructure
SHI	NSW State Heritage Inventory database
SHFWDCP	Sydney Harbour – Foreshores and Waterways Area Development Control Plan: Ecological Communities and Landscape Characters and Wetlands Protection Map
SHPRC	Sydney Harbour and Parramatta River Catchment
SHR	State Heritage Register
SHWQIP	Sydney Harbour Water Quality Improvement Plan
Shotcrete	The spraying of concrete and mortar onto a surface at high velocity
Shoulder	The portion of the carriageway beyond the traffic lanes adjacent to and flush with the surface of the pavement
SLNSW	State Library of NSW
Smart motorway operations	A Smart Motorway uses technology to monitor, provide intelligence and control the motorway to ease congestion and keep traffic flowing more effectively. Technology, including lane use management signs, vehicle detection equipment, CCTV cameras and on-ramp signals, allows road operators to manage, in real-time, traffic entering, exiting and traversing the motorway
SMC	Sydney Motorway Corporation
SMCMA	Sydney Metropolitan Catchment Management Authority
SMPO	Sydney Motorways Project Office
SO_2	Sulfur dioxide
SO_X	Sulfur oxides
SOA	Secondary organic aerosol
Socio-economic	Involving combination of social and economic matters
Soil salinity	Salt content of soil
Span	The distance between the centres of adjacent supports of a bridge
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Species Profile Database
Spoil	Surplus excavated material
SREP	Sydney Regional Environmental Plan
SREP 26	*Sydney Regional Environmental Plan No. 26 – City West*
SSFL	Southern Sydney Freight Line
SSI	State significant infrastructure
SSIAR	State significant infrastructure application report
SSWAHS	City of Sydney and Sydney South West Area Health Service
St Peters interchange	A component of the New M5 project, located at the former Alexandria Landfill site at St Peters. Approved and under construction as part of the New M5 project. Additional construction works proposed as part of the M4-M5 Link project
Staging	Refers to the division of the project into multiple contract packages for construction purposes, and/or the construction or operation of the overall project in discrete phases
State and Regional Development SEPP	State Environmental Planning Policy (State and Regional Development) 2011
State Infrastructure Strategy	State Infrastructure Strategy 2012–2032 (Infrastructure NSW 2012)
STM	Strategic Traffic Model
Stockpile	Temporary stored materials such as soil, sand, gravel, spoil/waste
Storativity	The volume of water an aquifer releases from, or takes into storage, per unit surface area of the aquifer per unit change in head. It is equal to the product of specific storage and aquifer thickness. In an unconfined aquifer the storativity is known as the specific yield
Strata	Geological layers below the ground surface

Term	Meaning
Stream order	A classification system which assigns an ‘order’ to waterways according to the number of additional tributaries associated with each waterway, to provide a measure of system complexity
Structure (soil)	The way soil particles group together to form aggregates
Stub tunnel	Driven tunnels constructed to connect to potential future motorway links
Surface road concentration (air quality)	Describes the contribution of pollutants from the surface road network. It includes not only the contribution of the nearest road at the receptor, but also the net contribution of the modelled road network at the receptor
Surface water	Water flowing or held in streams, rivers and other wetlands in the landscape
Sustainable development	Development which meets the needs of the present, without compromising the ability of future generations to meet their own needs (Brundtland 1987)
SW	Water quality monitoring sample ID
SVOC	Semi Volatile Organic Hydrocarbons
Sydney Gateway	A high-capacity connection between the St Peters interchange (under construction as part of the New M5 project) and the Sydney Airport and Port Botany precinct
Sydney Harbour Catchment SREP	*Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005*
T	
T90	Distillation temperature where 90% of the fuel is evaporated
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure
TBM	Tunnel boring machine
TEC	Threatened ecological community A naturally occurring group of native plants, animals and other organisms living in a unique habitat at risk of extinction and listed under the EPBC Act and/or *Threatened Species Conservation Act 1995* (NSW)
TEOM	Tapered Element Oscillating Microbalance
TEOM-FDMS	TEOM with Filter Dynamic Measurement System
TEQ	Toxicity equivalent
TEUs	20-foot equivalent units
The Bays Precinct Transformation Plan	*Transformation Plan: The Bays Precinct, Sydney* (UrbanGrowth NSW 2015)
The Blue Book	*Managing Urban Stormwater – Soils and Construction Volumes 1 and 2* (NSW Government 2004 and 2006)
The Crescent civil site	A construction ancillary facility for the M4-M5 Link project located at Annandale
THC	Total hydrocarbons
TMC	Transport Management Centre
Topography	Surface features in an area of land
Total concentration (air quality)	The sum of the background, surface road and ventilation outlet concentrations. It may relate to conditions with or without the project under assessment
Toxicity	The degree of danger posed by a substance to human, animal or plant life
TPA	Transport Performance Analytics
TPH	Total petroleum hydrocarbons
Transport for NSW	NSW Government Department Transport for NSW
TRAQ	Tool for Roadside Air Quality
TRH	Total recoverable hydrocarbons
Truck and dog construction vehicle	A vehicle with 20 cubic metre capacity and maximum length of 19 metres
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

Term	Meaning
TSP	Total suspended particulate (matter)
TSS	Total suspended solids
Tunnel boring machine	An excavation machine that ‘bores’ through soil or rock to create a tunnel with a circular cross section (as opposed to drilling and blasting methods)
Turbidity	A measure of light penetration through a water column containing particles of matter in suspension
Typical cross section	A cross section of a carriageway showing typical dimensional details, furniture locations and features of the pavement construction
U	
UDLP	Urban Design and Landscape Plan
UDLP land	Project land that has been identified as subject to the UDLP
UFP	Ultrafine particles
UK	United Kingdom
Ultrafines	Particulate matter below 0.1 microns in diameter
UN	United Nations
Urban design	The process and product of designing human settlements, and their supporting infrastructure, in urban and rural environments
US	United States
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
V	
V/C	Volume to capacity ratio
VDV	Vibration dose value
Ventilation facility	Facility for the mechanical removal of air from the mainline tunnels, or mechanical introduction of air into the tunnels. May comprise one or more ventilation outlets
VENM	Virgin excavated natural material
Ventilation outlet	The location and structure from which air within a tunnel is expelled
Ventilation outlet concentration	Describes the contribution of pollutants from tunnel ventilation outlets
VIA	Visual impact assessment
Victoria Road civil site	A construction ancillary facility for the M4-M5 Link project located at Rozelle
Visual amenity	Pleasantness or attractiveness of a place or area
VHT	Vehicle hours travelled
VKT	Vehicle kilometres travelled
VMS	Variable message signs
VOCs	Volatile organic compounds
VTTS	Value of travel time savings
Vulnerable	As defined under the *Threatened Species Conservation Act 1995* (NSW), a species that is facing a high risk of extinction in NSW in the medium-term future
VWP	Vibrating wire piezometers
W	
WARR Act	*Waste Avoidance and Resource Recovery Act 2001* (NSW)
Waste hierarchy	Approach of prioritising waste avoidance and resource recovery (including reuse, reprocessing, recycling and energy recover) before consideration of waste disposal
Water table	The surface of saturation in an unconfined aquifer at which the pressure of the water is equal to that of the atmosphere
Waterway	Any flowing stream of water, whether natural or artificially regulated (not necessarily permanent)
Wattle Street civil and tunnel site	A construction ancillary facility for the M4-M5 Link project located at Haberfield

Term	Meaning
Wattle Street interchange	An interchange to connect Wattle Street (City West Link) with the M4 East and the M4-M5 Link tunnels. Approved and under construction as part of the M4 East project. Additional construction works proposed as part of the M4-M5 Link project
Wayfinding	This refers to navigation signage or roadway markers such as in the tunnels or along surface roads
WDA	WestConnex Delivery Authority (now Sydney Motorway Corporation)
Western Harbour Tunnel and Beaches Link	The Western Harbour Tunnel component would connect to the M4-M5 Link at the Rozelle interchange, cross underneath Sydney Harbour between the Birchgrove and Waverton areas, and connect with the Warringah Freeway at North Sydney. The Beaches Link component would comprise a tunnel that would connect to the Warringah Freeway, cross underneath Middle Harbour and connect with the Burnt Bridge Creek Deviation at Balgowlah and Wakehurst Parkway at Seaforth. It would also involve the duplication of the Wakehurst Parkway between Seaforth and Frenchs Forest
WestConnex program of works	A program of works that includes the M4 Widening, King Georges Road Interchange Upgrade, M4 East, New M5 and M4-M5 Link projects
Wetland	Wetlands are areas of land that are wet by surface water or groundwater, or both, for long enough periods that the plants and animals in them are adapted to, and depend on, moist conditions for at least part of their lifecycle
WHO	World Health Organization
WM Act	*Water Management Act 2000* (NSW)
WQIP	Water quality improvement plan
WQPMP	Water quality plan and monitoring program
WRTM	WestConnex Road Traffic Model
WSROC	Western Sydney Regional Organisation of Councils Ltd
WSUD	Water sensitive urban design
WQO	Water quality objective
Other	
β coefficient	Beta coefficient A measure of sensitivity
µg	microgram
mg/m^3	micrograms per cubic metre

1 Introduction

This chapter provides a brief overview of the M4-M5 Link (the project), including its location and key features. This chapter also describes the purpose and structure of this environmental impact statement (EIS).

1.1 Project overview

NSW Roads and Maritime Services (Roads and Maritime) is seeking approval to construct and operate the WestConnex M4-M5 Link (the project), which would comprise a new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange.

Together with the other components of the WestConnex program of works and the proposed future Sydney Gateway, the project would facilitate improved connections between western Sydney, Sydney Airport and Port Botany and south and south-western Sydney, as well as better connectivity between the important economic centres along Sydney's Global Economic Corridor and local communities. A more comprehensive description of the project elements and construction work is provided in **Chapter 5** (Project description) and **Chapter 6** (Construction work) respectively.

The M4-M5 Link is part of the WestConnex program of works. Separate planning applications and assessments have been completed for each of the approved WestConnex projects. Roads and Maritime has commissioned Sydney Motorway Corporation (SMC) to deliver WestConnex, on behalf of the NSW Government. However, Roads and Maritime is the proponent for the project.

In addition to linking to other WestConnex projects, the M4-M5 Link would provide connections to the proposed future Western Harbour Tunnel and Beaches Link, the Sydney Gateway (via the St Peters interchange) and the F6 Extension (via the New M5). The WestConnex program of works, as well as related projects, are shown in **Figure 1-1** and described in **Table 1-1**.

Table 1-1 WestConnex and related projects

Project	Description	Status
WestConnex program of works		
M4 Widening	Widening of the existing M4 Motorway from Parramatta to Homebush.	Planning approval under the EP&A Act granted on 21 December 2014. Open to traffic.
M4 East	Extension of the M4 Motorway in tunnels between Homebush and Haberfield via Concord. Includes provision for a future connection to the M4-M5 Link at the Wattle Street interchange.	Planning approval under the EP&A Act granted on 11 February 2016. Under construction.
King Georges Road Interchange Upgrade	Upgrade of the King Georges Road interchange between the M5 West and the M5 East at Beverly Hills, in preparation for the New M5 project.	Planning approval under the EP&A Act granted on 3 March 2015. Open to traffic.

Project	Description	Status
New M5	Duplication of the M5 East from King Georges Road in Beverly Hills with tunnels from Kingsgrove to a new interchange at St Peters. The St Peters interchange allows for connections to the proposed future Sydney Gateway project and an underground connection to the M4-M5 Link. The New M5 tunnels also include provision for a future connection to the proposed future F6 Extension.	Planning approval under the EP&A Act granted on 20 April 2016. Commonwealth approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) granted on 11 July 2016. Under construction.
M4-M5 Link (the project)	Tunnels connecting to the M4 East at Haberfield (via the Wattle Street interchange) and the New M5 at St Peters (via the St Peters interchange), a new interchange at Rozelle and a link to Victoria Road (the Iron Cove Link). The Rozelle interchange also includes ramps and tunnels for connections to the proposed future Western Harbour Tunnel and Beaches Link project.	The subject of this EIS.
Related projects		
Sydney Gateway	A high-capacity connection between the St Peters interchange (under construction as part of the New M5 project) and the Sydney Airport and Port Botany precinct.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval.
Western Harbour Tunnel and Beaches Link	The Western Harbour Tunnel component would connect to the M4-M5 Link at the Rozelle interchange, cross underneath Sydney Harbour between the Birchgrove and Waverton areas, and connect with the Warringah Freeway at North Sydney. The Beaches Link component would comprise a tunnel that would connect to the Warringah Freeway, cross underneath Middle Harbour and connect with the Burnt Bridge Creek Deviation at Balgowlah and Wakehurst Parkway at Seaforth. It would also involve the duplication of the Wakehurst Parkway between Seaforth and Frenchs Forest.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval.
F6 Extension	A proposed motorway link between the New M5 at Arncliffe and the existing M1 Princes Highway at Loftus, generally along the alignment known as the F6 corridor.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval.

The delivery mechanism for the design and construction of the M4-M5 Link differs from the approach adopted for the M4 East and New M5 projects. For the M4 East and New M5 projects, a design and construction contractor was appointed early and had direct input into the design development, EIS preparation and construction planning for those projects. This meant that the EIS for the M4 East and New M5 projects assessed the construction contractor’s design. For the M4-M5 Link project, design and construction contractors would be appointed to undertake the detailed design and construction planning following determination of the application for project approval, should it be approved.

This means the detail of the design and construction approach presented in this EIS is indicative only based on a concept design and would be subject to detailed design and construction planning to be undertaken by the successful contractors. However, the design developed by the contractors would need to be consistent with any environmental management measures, changes identified in a Submissions and Preferred Infrastructure Report, the conditions of approval for the project and other requirements identified during the assessment of the project. Issues raised during public consultation on the EIS or in the assessment of the project by NSW Department of Planning and Environment (DP&E) would also be taken into account during the detailed design process.

Approval is being sought under Part 5.1 of the EP&A Act for the project. A request has been made for the NSW Minister for Planning to specifically declare the project to be State significant infrastructure and also critical State significant infrastructure. An EIS is therefore required. Further details on the environmental assessment and approvals process are provided in **Chapter 2** (Assessment process).

Separate planning applications and assessments have been completed for each of the approved projects of WestConnex. In addition to linking or connecting to other WestConnex projects, the M4-M5 Link would provide connections to the proposed future Western Harbour Tunnel and Beaches Link project. The operation of these connections, as well as construction of the remainder of the proposed future Western Harbour Tunnel and Beaches Link project, does not form part of the M4-M5 Link project and would be subject to future environmental impact assessment and planning approval. These connections are described further in **Chapter 5** (Project description).

WestConnex (including the approved component projects and the M4-M5 Link) and other proposed future projects including Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension, would form a network of motorways to improve the efficiency of traffic flows between western Sydney, the Sydney central business district (CBD), Sydney Airport and Port Botany precinct, with onward connectivity to both the south and north of Sydney.

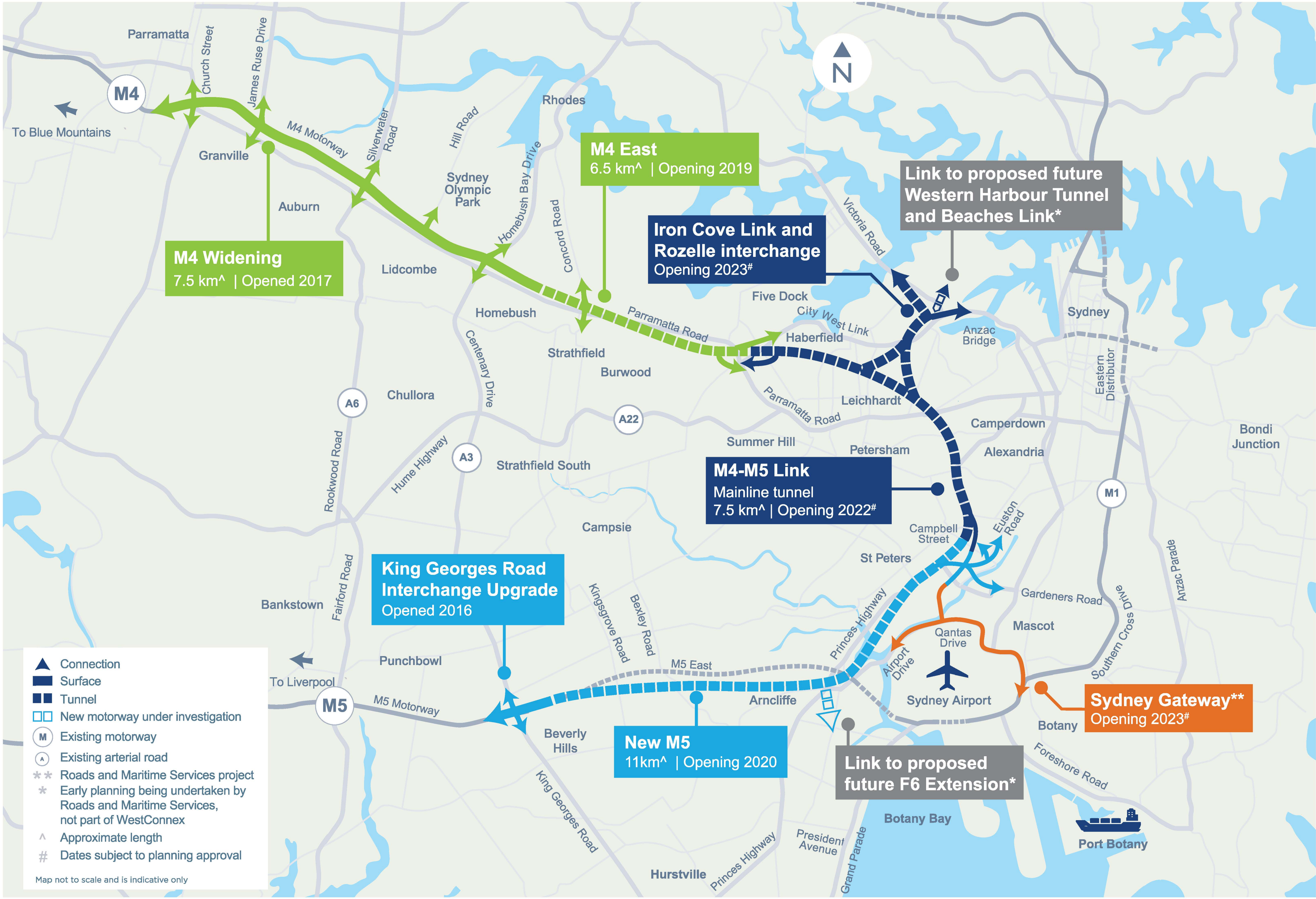


Figure 1-1 Overview of WestConnex and related projects

1.2 Project location

The project would be generally located within the City of Sydney and Inner West local government areas (LGAs). The project is located about two to seven kilometres south, southwest and west of the Sydney CBD and would cross the suburbs of Ashfield, Haberfield, Leichhardt, Lilyfield, Rozelle, Annandale, Stanmore, Camperdown, Newtown and St Peters. The local context of the project is shown in **Figure 1-2**.

1.3 Project features

Key components of the project are shown in **Figure 1-2** and would include:

- Twin mainline motorway tunnels between the M4 East at Haberfield and the New M5 at St Peters. Each tunnel would be around 7.5 kilometres long and would generally accommodate up to four lanes of traffic in each direction
- Connections of the mainline tunnels to the M4 East project, comprising:
  - A tunnel-to-tunnel connection to the M4 East mainline stub tunnels east of Parramatta Road near Alt Street at Haberfield
  - Entry and exit ramp connections between the mainline tunnels and the Wattle Street interchange at Haberfield (which is currently being constructed as part of the M4 East project)
  - Minor physical integration works with the surface road network at the Wattle Street interchange including road pavement and line marking
- Connections of the mainline tunnels to the New M5 project, comprising:
  - A tunnel-to-tunnel connection to the New M5 mainline stub tunnels north of the Princes Highway near the intersection of Mary Street and Bakers Lane at St Peters
  - Entry and exit ramp connections between the mainline tunnels and the St Peters interchange at St Peters (which is currently being constructed as part of the New M5 project)
  - Minor physical integration works with the surface road network at the St Peters interchange including road pavement and line marking
- An underground interchange at Leichhardt and Annandale (the Inner West subsurface interchange) that would link the mainline tunnels with the Rozelle interchange and the Iron Cove Link (see below)
- A new interchange at Lilyfield and Rozelle (the Rozelle interchange) that would connect the M4-M5 Link mainline tunnels with:
  - City West Link
  - Anzac Bridge
  - The Iron Cove Link (see below)
  - The proposed future Western Harbour Tunnel and Beaches Link
- Construction of connections to the proposed future Western Harbour Tunnel and Beaches Link project as part of the Rozelle interchange, including:
  - Tunnels that would allow for underground mainline connections between the M4 East and New M5 motorways and the proposed future Western Harbour Tunnel and Beaches Link (via the M4-M5 Link mainline tunnels)
  - A dive structure and tunnel portals within the Rozelle Rail Yards, north of the City West Link / The Crescent intersection
  - Entry and exit ramps that would extend north underground from the tunnel portals in the Rozelle Rail Yards to join the mainline connections to the proposed future Western Harbour Tunnel and Beaches Link

- A ventilation outlet and ancillary facilities as part of the Rozelle ventilation facility (see below)

- Twin tunnels that would connect Victoria Road near the eastern abutment of Iron Cove Bridge and Anzac Bridge (the Iron Cove Link). Underground entry and exit ramps would also provide a tunnel connection between the Iron Cove Link and the New M5 / St Peters interchange (via the M4-M5 Link mainline tunnels)
- The Rozelle surface works, including:
  - Realigning The Crescent at Annandale, including a new bridge over Whites Creek and modifications to the intersection with City West Link
  - A new intersection on City West Link around 300 metres west of the realigned position of The Crescent, which would provide a connection to and from the New M5/St Peters interchange (via the M4-M5 Link mainline tunnels)
  - Widening and improvement works to the channel and bank of Whites Creek between the light rail bridge and Rozelle Bay at Annandale, to manage flooding and drainage for the surface road network
  - Reconstructing the intersection of The Crescent and Victoria Road at Rozelle, including construction of a new bridge at Victoria Road
  - New and upgraded pedestrian and cyclist infrastructure
  - Landscaping, including the provision of new open space within the Rozelle Rail Yards
- The Iron Cove Link surface works, including:
  - Dive structures and tunnel portals between the westbound and eastbound Victoria Road carriageways, to connect Victoria Road east of Iron Cove Bridge with the Iron Cove Link
  - Realignment of the westbound (southern) carriageway of Victoria Road between Springside Street and the eastern abutment of Iron Cove Bridge
  - Modifications to the existing intersections between Victoria Road and Terry, Clubb, Toelle and Callan streets
  - Landscaping and the establishment of pedestrian and cycle infrastructure
- Five motorway operations complexes; one at Leichhardt (MOC1), three at Rozelle (Rozelle West (MOC2), Rozelle East (MOC3) and Iron Cove Link (MOC4)), and one at St Peters (MOC5). The types of facilities that would be contained within the motorway operations complexes would include substations, water treatment plants, ventilation facilities and outlets, offices, on-site storage and parking for employees
- Tunnel ventilation systems, including ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels
- Three new ventilation facilities, including:
  - The Rozelle ventilation facility at Rozelle
  - The Iron Cove Link ventilation facility at Rozelle
  - The Campbell Road ventilation facility at St Peters
- Fitout (mechanical and electrical) of part of the Parramatta Road ventilation facility at Haberfield (which is currently being constructed as part of M4 East project) for use by the M4-M5 Link project
- Drainage infrastructure to collect surface and groundwater for treatment at dedicated facilities. Water treatment would occur at
  - Two operational water treatment facilities (at Leichhardt and Rozelle)
  - The constructed wetland within the Rozelle Rail Yards
  - A bioretention facility for stormwater runoff within the informal car park at King George Park at Rozelle (adjacent to Manning Street). A section of the existing informal car park would also be

upgraded, including sealing the car park surface and landscaping

- Treated water would flow back to existing watercourses via new, upgraded and existing infrastructure
- Ancillary infrastructure and operational facilities for electronic tolling and traffic control and signage (including electronic signage)
- Emergency access and evacuation facilities, including pedestrian and vehicular cross and long passages and fire and life safety systems
- Utility works, including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities. A Utilities Management Strategy has been prepared for the project that identifies management options for utilities, including relocation or adjustment. Refer to **Appendix F** (Utilities Management Strategy) of the EIS.

The project does not include:

- Site management works at the Rozelle Rail Yards. These works were separately assessed and determined by Roads and Maritime through a Review of Environmental Factors under Part 5 of the EP&A Act (refer to **Chapter 2** (Assessment process) of the EIS)
- Ongoing motorway maintenance activities during operation
- Operation of the components of the Rozelle interchange which are the tunnels, ramps and associated infrastructure being constructed to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project.

Temporary construction ancillary facilities and temporary works to facilitate the construction of the project would also be required.

1.3.1 Staged construction and opening of the project

It is anticipated the project would be constructed and opened to traffic in two stages (see **Figure 1-2**).

Stage 1 would include:

- Construction of the mainline tunnels between the M4 East at Haberfield and the New M5 at St Peters, stub tunnels to the Rozelle interchange (at the Inner West subsurface interchange) and ancillary infrastructure at the Darley Road motorway operations complex (MOC1) and Campbell Road motorway operations complex (MOC5)
- These works are anticipated to commence in 2018 with the mainline tunnels open to traffic in 2022. At the completion of Stage 1, the mainline tunnels would operate with two traffic lanes in each direction. This would increase to generally four lanes at the completion of Stage 2, when the full project is operational.

Stage 2 would include:

- Construction of the Rozelle interchange and Iron Cove Link including:
  - Connections to the stub tunnels at the Inner West subsurface interchange (built during Stage 1)
  - Ancillary infrastructure at the Rozelle West motorway operations complex (MOC2), Rozelle East motorway operations complex (MOC3) and Iron Cove Link motorway operations complex (MOC4)
  - Connections to the surface road network at Lilyfield and Rozelle
  - Construction of tunnels, ramps and associated infrastructure as part of the Rozelle interchange to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project
- Stage 2 works are expected to commence in 2019 with these components of the project open to traffic in 2023.

The total construction period for both stages of the project is expected to be around five years, which includes commissioning that would occur concurrently with the final stages of construction. Further staging details would be confirmed when construction contractors have been engaged.

The potential benefits of a staged opening of the project are detailed in **Chapter 4** (Project development and alternatives). A more detailed description of how the project would be constructed in stages is provided in **Chapter 6** (Construction work). An assessment of the traffic and transport impacts of opening the project in stages is included in **Chapter 8** (Traffic and transport).

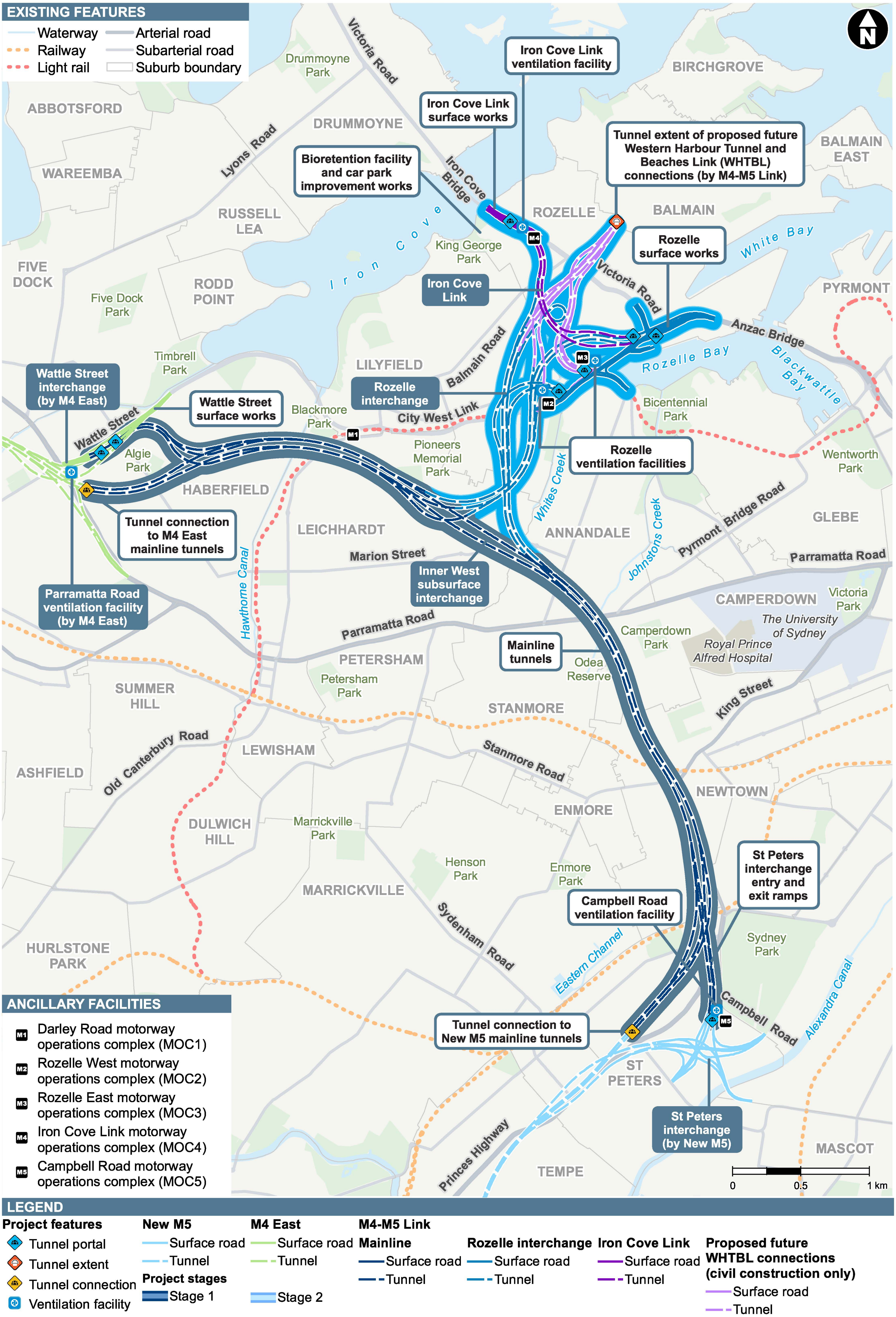


Figure 1-2 Local context of the project

1.4 Purpose of this EIS

This EIS has been prepared in accordance with the relevant provisions of the EP&A Act. It has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued by the Secretary of DP&E on 3 March 2016 and the relevant provisions of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (NSW). On 9 November 2016, modified SEARs were issued to Roads and Maritime to reflect project changes including the addition of the Iron Cove Link. Further modifications to the SEARs were provided to Roads and Maritime on 3 May 2017 to reflect project changes including the removal of the Camperdown interchange, changes to the Rozelle interchange and the inclusion of the construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project. The EIS has been prepared in accordance with the modified SEARs.

In accordance with Part 5.1 of the EP&A Act, this EIS presents an assessment of all potential environmental issues identified during the planning and assessment of the project. The assessment considers the areas directly or indirectly affected by construction and operation of the project, as relevant to each technical assessment.

Public exhibition of the EIS gives the community, government agencies and other interested parties an understanding of the project and provides the opportunity to comment on the project. Roads and Maritime will consider this feedback in the further development of the project and will respond to issues raised in a Submissions Report. Further details on the assessment process for the project are provided in **Chapter 2** (Assessment process).

1.5 Directions used in this EIS

In this EIS, the mainline tunnels are described as being aligned in a north–south direction for consistency, even though some parts of the tunnels are actually aligned in an east–west direction (between the Rozelle interchange and the Wattle Street interchange). References to northbound and southbound tunnels reflect the general direction of traffic flow, as shown in **Figure 1-3**.

Similarly, the alignments of components of the Rozelle interchange have been named for clarity and consistency, as shown in **Figure 1-3**.

1.6 Timing for implementation of management measures

The indicative timing for the implementation of management measures outlined in the technical issue chapters (**Chapter 8** to **Chapter 27**) and summarised in **Chapter 29** (Summary of environmental management measures) refers to the following project stages:

- Construction (including detailed design and pre-construction activities)
- Operation.

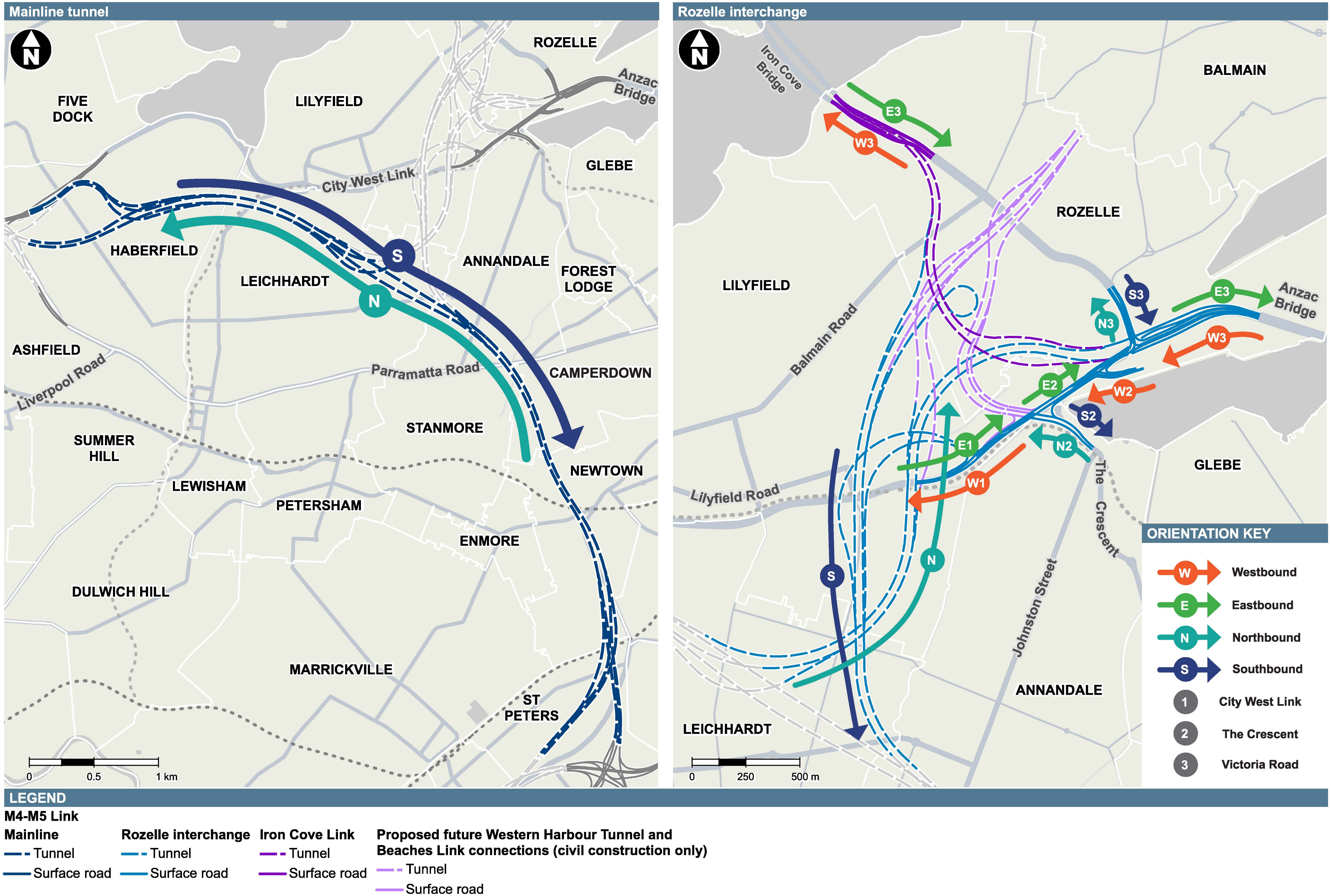


Figure 1-3 Orientation and directional description in this EIS

1.7 Structure of this EIS

This EIS is divided into two volumes.

Volume 1 comprises:

- **Chapter 1** (Introduction) provides an overview of the project, its scope and location
- **Chapter 2** (Assessment process) outlines the statutory assessment requirements and explains the steps in the assessment and approval process
- **Chapter 3** (Strategic context and project need) provides the strategic context and explains the need for the project
- **Chapter 4** (Project development and alternatives) outlines the alternatives and options considered in developing the project, including the consequences of not proceeding
- **Chapter 5** (Project description) provides a detailed description of the project including the route alignment, design standards and key design features
- **Chapter 6** (Construction work) describes the proposed construction methodologies and staging
- **Chapter 7** (Consultation) outlines the consultation activities undertaken, issues raised and how these issues have been addressed, as well as outlining the consultation activities planned during the public exhibition of the EIS and before and during the construction of the project
- **Chapter 8** to **Chapter 25** (assessment of environmental issues) identify the relevant environmental issues, assess the impacts of the project and present environmental management measures in response to those impacts
- **Chapter 26** (Cumulative impacts) assesses the impacts of the project, when combined with other relevant projects
- **Chapter 27** (Sustainability) outlines how the project would be delivered in a manner that meets sustainability requirements as part of its planning, construction and operation
- **Chapter 28** (Environmental risk analysis) details the risk analysis process by which the potential environmental issues for assessment were identified
- **Chapter 29** (Summary of environmental management measures) collates the environmental management measures for the project identified through the impact assessment
- **Chapter 30** (Project justification and conclusion) presents the justification for the project, including consideration of the principles of ecologically sustainable development and the objectives of the EP&A Act.

Volume 2 comprises the following supporting appendices:

- Appendix A – Project synthesis
- Appendix B – Secretary's Environmental Assessment Requirements checklist
- Appendix C – Cumulative impact assessment methodology
- Appendix D – Environmental Planning and Assessment Regulation 2000 (NSW) requirements
- Appendix E – Geological long-sections
- Appendix F – Utilities Management Strategy
- Appendix G – Draft community consultation framework
- Appendix H – Technical working paper: Traffic and transport
- Appendix I – Technical working paper: Air quality
- Appendix J – Technical working paper: Noise and vibration
- Appendix K – Technical working paper: Human health risk assessment
- Appendix L – Technical working paper: Urban design

- Appendix M – Shadow diagrams and overshadowing
- Appendix N – Technical working paper: Active transport strategy
- Appendix O – Technical working paper: Landscape and visual impact
- Appendix P – Technical working paper: Social and economic
- Appendix Q – Technical working paper: Surface water and flooding
- Appendix R – Technical working paper: Contamination
- Appendix S – Technical working paper: Biodiversity
- Appendix T – Technical working paper: Groundwater
- Appendix U – Technical working paper: Non-Aboriginal heritage
- Appendix V – Technical working paper: Aboriginal heritage
- Appendix W – Detailed greenhouse gas calculations
- Appendix X – Climate change risk assessment framework.

2 Assessment process

This chapter describes the planning approval process for the M4-M5 Link project (the project) as well as other relevant environmental planning and statutory approval requirements.

2.1 Approval framework

The project requires approval from the NSW Minister for Planning under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) for the reasons set out below.

Clause 94 of the State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) provides that development for the purpose of a road or road infrastructure facilities may be carried out by or on behalf of a public authority without development consent on any land. The project is characterised as being for the purpose of a road and road infrastructure facilities for the purposes of the Infrastructure SEPP, and is to be carried out by NSW Roads and Maritime Services (Roads and Maritime), being a public authority. Accordingly, the project is permissible without obtaining development consent under Part 4 of the EP&A Act. Nevertheless, section 115U(2) of the EP&A Act provides that a State Environmental Planning Policy (SEPP) may declare any development or class of development to be State significant infrastructure (SSI), which requires approval from the NSW Minister for Planning under section 115W of the EP&A Act.

Clause 14(1) of the State Environmental Planning Policy (State and Regional Development) 2011 (State and Regional Development SEPP) declares development to be SSI if the development is permissible without consent under Part 4 of the EP&A Act and is a type of development specified in Schedule 3 of the State and Regional Development SEPP. Schedule 3 of the State and Regional Development SEPP includes any infrastructure or other development for which the proponent is also the determining authority and would, in the opinion of the proponent, require an environmental impact statement (EIS) to be obtained under Part 5 of the EP&A Act.

Roads and Maritime, as the proponent and determining authority for the project within the meaning of Part 5 of the EP&A Act, has formed the view that the impact of the project is likely to significantly affect the environment and, therefore, would require the preparation of an EIS. On this basis, the project is declared to be SSI under section 115U(2) of the EP&A Act. The effect of the EP&A Act and the relevant SEPPs is that Roads and Maritime would have been the determining authority for the project under Part 4 of the EP&A Act, were it not for the application of section 115U(2) of the EP&A Act. In this instance, section 115U(2) of the EP&A Act is triggered by reason of the operation of clause 14 and Schedule 3 of State and Regional Development SEPP.

Accordingly, the project is subject to assessment under Division 2, Part 5.1 of the EP&A Act and requires the approval of the NSW Minister for Planning under section 115W of Part 5.1. A request has been made for the NSW Minister for Planning to specifically declare the project to be State significant infrastructure and also critical State significant infrastructure.

The assessment and approvals process under Part 5.1 of the EP&A Act is illustrated in **Figure 2-1**. Further information on the assessment process is available on the NSW Department of Planning and Environment (DP&E) website (www.planning.nsw.gov.au).

In January 2016, Roads and Maritime prepared a SSI application report (SSIAR) for the project under section 115X of the EP&A Act. The SSIAR describes the project and identifies and considers the potential environmental issues arising from the project. The purpose of the SSIAR was to assist the formulation of the Secretary's Environmental Assessment Requirements (SEARs) by DP&E under section 115Y of the EP&A Act and inform the preparation of an EIS for the project. On 3 March 2016, SEARs for the project were issued by DP&E. The SEARs were revised on 9 November 2016 and further revised on 3 May 2017. A copy of the SEARs and an indication of where they are addressed in the EIS is provided in **Appendix B** (Secretary's Environmental Assessment Requirements checklist).

Preliminary design development further refined the project design with the addition of a tunnel connection from the eastern abutment of Iron Cove Bridge to the proposed Rozelle interchange (the 'Iron Cove Link'). The Iron Cove Link was not considered in the SSIAR, but has now become a component of the project. Since the preparation of the SSIAR, Roads and Maritime also identified a separate project involving site management works to be undertaken at part of the former Rozelle Rail Yards. As outlined in further detail in **section 2.5**, the site management works at the Rozelle Rail Yards were subject to a separate environmental assessment and are being undertaken separately from the construction of the project.

To address these items, Roads and Maritime prepared and submitted an SSIAR Addendum (SSIAR Addendum 1) to DP&E in September 2016, which provided a preliminary environmental assessment of the potential impacts of the Iron Cove Link. For clarity, the site management works at the Rozelle Rail Yards were excluded from the SSI application. These site management works were assessed separately in a review of environmental factors (REF) under Part 5 of the EP&A Act and determined by Roads and Maritime in April 2017. The revised SEARs issued by DP&E on 9 November 2016 addressed SSIAR Addendum 1.

Following submission of the SSIAR Addendum 1, further developments were made to the project design and scope, comprising:

- Refinement of the Rozelle interchange design to include tunnel connections which extend beyond the boundaries of the Rozelle Rail Yards, including civil construction of tunnels linking to a proposed future Western Harbour Tunnel and Beaches Link. The interchange design also includes civil construction of infrastructure for, and ramps into, a proposed future Western Harbour Tunnel as part of the Rozelle interchange
- Removal of the road interchange at Camperdown
- Realignment of the mainline tunnels
- Amendment of the mainline tunnel configuration from up to three lanes to up to four lanes
- Removal of Easton Park from the project footprint.

Roads and Maritime prepared and submitted SSIAR Addendum 2 for the purpose of undertaking a preliminary environmental assessment of the five design refinements and scope changes. Addendum 2 was lodged with DP&E in March 2017. The revised SEARs issued by DP&E on 3 May 2017 reflected the design refinement and project scope expansions currently being considered and assessed in this EIS.

The SEARs require, among other things, that the EIS be prepared in consideration of all relevant legislative requirements, and that the EIS assess key issue impacts objectively and thoroughly to provide confidence that the project would be constructed and operated within acceptable levels of impact. **Table 2-1** sets out the SEARs with respect to the assessment process and the assessment of key issues only (the other SEARs are set out elsewhere in this EIS). **Table 2-1** further identifies the associated desired performance outcomes that relate to the assessment of key issues for the project, and identifies where they have been addressed in this EIS.

Table 2-1 SEARs – impact assessment process and assessment of key issues

Desired performance outcome	SEARs	Where addressed in the EIS
1. Environmental Impact Assessment Process The process for assessment of the proposal is transparent, balanced, well focussed and legal.	1. The Environmental Impact Statement must be prepared in accordance with Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation).	Refer to **Appendix D** (Environmental Planning and Assessment Regulation 2000 (NSW) checklist).
	2. It is the Proponent's responsibility to determine whether the project needs to be referred to the Commonwealth Department of the Environment for an approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Proponent must contact the Commonwealth Department of the Environment immediately if it is determined that an approval is required under the EPBC Act, as supplementary environmental assessment requirements may need to be issued to ensure a streamlined assessment under the Bilateral agreement can be achieved.	Potential impacts on matters of national environmental significance under the EPBC Act are discussed in **section 2.4.1**.
	3. Where the project requires approval under the EPBC Act and is being assessed under the Bilateral Agreement the EIS should address: (a) consideration of any Protected Matters that may be impacted by the development where the Commonwealth Minister has determined that the proposal is a Controlled Action; (b) identification and assessment of those Protected Matters that are likely to be significantly impacted; (c) details of how significant impacts to Protected Matters have been avoided, mitigated and, if necessary, offset; and (d) consideration of, and reference to, any relevant conservation advices, recovery plans and threat abatement plans.	Potential impacts on matters of national environmental significance under the EPBC Act are discussed in **section 2.4.1**.
	4. The onus is on the Proponent to ensure legislative requirements relevant to the project are met.	Discussed in this chapter.

Desired performance outcome	SEARs	Where addressed in the EIS
2. Environmental Impact Statement The project is described in sufficient detail to enable clear understanding that the project has been developed through an iterative process of impact identification and assessment and project refinement to avoid, minimise or offset impacts so that the project, on balance, has the least adverse environmental, social and economic impact, including its cumulative impacts.	1. The EIS must include, but not necessarily be limited to, the following: (h) a concise description of the general biophysical and socio-economic environment that is likely to be impacted by the project (including offsite impacts). Elements of the environment that are not likely to be affected by the project do not need to be described;	Descriptions of the existing general biophysical and socio-economic environment that is likely to be impacted by the project (including offsite impacts) are provided for each key issue in **Chapter 8** (Traffic and transport) to **Chapter 25** (Hazard and risk).
	(j) the identification and assessment of key issues as provided in the 'Assessment of Key Issues' performance outcome;	Identification and assessment of key issues is provided in **Chapter 8** (Traffic and transport) to **Chapter 27** (Sustainability).
	(k) a statement of the outcome(s) the Proponent will achieve for each key issue;	Key issues outcomes are stated in **Appendix A** (Project synthesis).
	(l) measures to avoid, minimise or offset impacts must be linked to the impact(s) they treat, so it is clear which measures will be applied to each impact;	Measures to avoid, minimise or offset impacts specific to identified impacts are provided in **Appendix A** (Project synthesis) and **Chapter 29** (Summary of environmental management measures).
	(m) consideration of the interactions between mitigation measures, between impacts and between measures and impacts;	Refer to **Chapter 29** (Summary of environmental management measures).
	(n) identification of other environmental impacts (such as protective and sensitive lands, sedimentation and erosion and impacts to water front land) and proposed measures for managing and/or mitigating the level of impact;	Identification and assessment of key issues is provided in **Chapter 8** (Traffic and transport) to **Chapter 27** (Sustainability).
	(p) statutory context of the project as a whole, including: • how the project meets the provisions of the EP&A Act and EP&A Regulation; and • a list of any approvals that must be obtained under any other Act or law before the project may lawfully be carried out	Discussed in this chapter, **Chapter 30** (Project justification and conclusion) and **Appendix D** (Environmental Planning and Assessment Regulation 2000 (NSW) checklist).

Desired performance outcome	SEARs	Where addressed in the EIS
	(q) a chapter that synthesises the environmental impact assessment and provides: • a succinct but full description of the project for which approval is sought; • a description of any uncertainties that still exist around design, construction methodologies and/or operational methodologies and how these will be resolved in the next stages of the project; • a compilation of the impacts of the project that have not been avoided; • a compilation of the proposed measures associated with each impact to avoid or minimise (through design refinements or ongoing management during construction and operation) or offset these impacts; • a compilation of the outcome(s) the proponent will achieve; and • the reasons justifying carrying out the project as proposed, having regard to the biophysical, economic and social considerations, including ecologically sustainable development and cumulative impacts; and	Refer to **Appendix A** (Project synthesis).
	(r) relevant project plans, drawings, diagrams in an electronic format that enables integration with mapping and other technical software.	Project plans are provided in **Chapter 5** (Project description) and **Chapter 6** (Construction work). Electronic copies of project plans, drawings and diagrams will be provided to DP&E.
	2. The EIS must only include data and analysis that is reasonably needed to make a decision on the proposal. Relevant information must be succinctly summarised in the EIS and included in full in appendices. Irrelevant, conflicting or duplicated information must be avoided.	Addressed throughout this EIS.

Desired performance outcome	SEARs	Where addressed in the EIS
3. Assessment of Key Issues* Key issue impacts are assessed objectively and thoroughly to provide confidence that the project will be constructed and operated within acceptable levels of impact. * Key issues are nominated by the Proponent in the CSSI project application and by the Department in the SEARs. Key issues need to be reviewed throughout the preparation of the EIS to ensure any new key issues that emerge are addressed. The key issues identified in this document are not exhaustive but are key issues common to most CSSI projects.	1. The level of assessment of likely impacts must be proportionate to the significance of, or degree of impact on, the issue, within the context of the proposal location and the surrounding environment. The level of assessment must be commensurate to the degree of impact and sufficient to ensure that the Department and other government agencies are able to understand and assess impacts.	A description of the biophysical and socio-economic environment, as far as it is relevant to that issue, a description of the relevant legislative and policy context and an assessment of the impacts relating to issues, including the likelihood and consequence of the impact are described in: **Chapter 8** (Traffic and transport), **Chapter 9** (Air quality), **Chapter 10** (Noise and vibration), **Chapter 11** (Human health risk), **Chapter 12** (Land use and property), **Chapter 13** (Urban design and visual amenity), **Chapter 14** (Social and economic), **Chapter 15** (Soil and water quality), **Chapter 16** (Contamination), **Chapter 17** (Flooding and drainage), **Chapter 18** (Biodiversity), **Chapter 19** (Groundwater), **Chapter 20** (Non-Aboriginal). heritage), **Chapter 21** (Aboriginal heritage), **Chapter 22** (Greenhouse gas), **Chapter 23** (Resource use and waste minimisation), **Chapter 24** (Climate change and risk adaptation), **Chapter 25** (Hazard and risk). Cumulative impacts, including impacts arising from concurrent project construction activities and from proposed and
	2. For each key issue the Proponent must:	
	(a) describe the biophysical and socio-economic environment, as far as it is relevant to that issue, including adequate baseline data, in terms of temporal, spatial and parameters monitored;	
	(b) describe the legislative and policy context, as far as it is relevant to the issue;	
	(c) identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence of the impact (comprehensive risk assessment), and the cumulative impacts of: i) concurrent project construction activities; and ii) proposed and approved projects (where information is available at the time of writing);	
	(d) demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies);	

Desired performance outcome	SEARs	Where addressed in the EIS
	(e) detail how likely impacts that have not been avoided through design will be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant); and	approved projects are assessed and described in **Chapter 26** (Cumulative impacts) and each of the Technical working papers (**Appendix H** to **Appendix V**), **Appendix W** (Detailed greenhouse gas calculations), **Appendix X** (Climate change risk assessment framework), **Chapter 22** (Greenhouse gas), **Chapter 23** (Resource use and waste minimisation), **Chapter 24** (Climate change and risk adaptation), **Chapter 25** (Hazard and risk) and **Chapter 27** (Sustainability). A comprehensive environmental risk analysis that considers the likelihood and consequence of the potential impacts has been carried out and is included in **Chapter 28** (Environmental risk analysis).
	(f) detail how any residual impacts will be managed or offset, and the approach and effectiveness of these measures.	Residual impacts and a process for how they will be managed are outlined in **Chapter 28** (Environmental risk analysis) and **Appendix A** (Project synthesis).
	3. Where multiple reasonable and feasible options to avoid or minimise impacts are available, they must be identified and considered and the proposed measure justified taking into account the public interest.	Reasonable and feasible options to avoid or minimise impacts have been identified and considered for each key issue. These are summarised in **Chapter 29** (Summary of environmental management measures). The public interest has been taken into account in the development of the concept design and the construction methodology that has been assessed in this EIS.

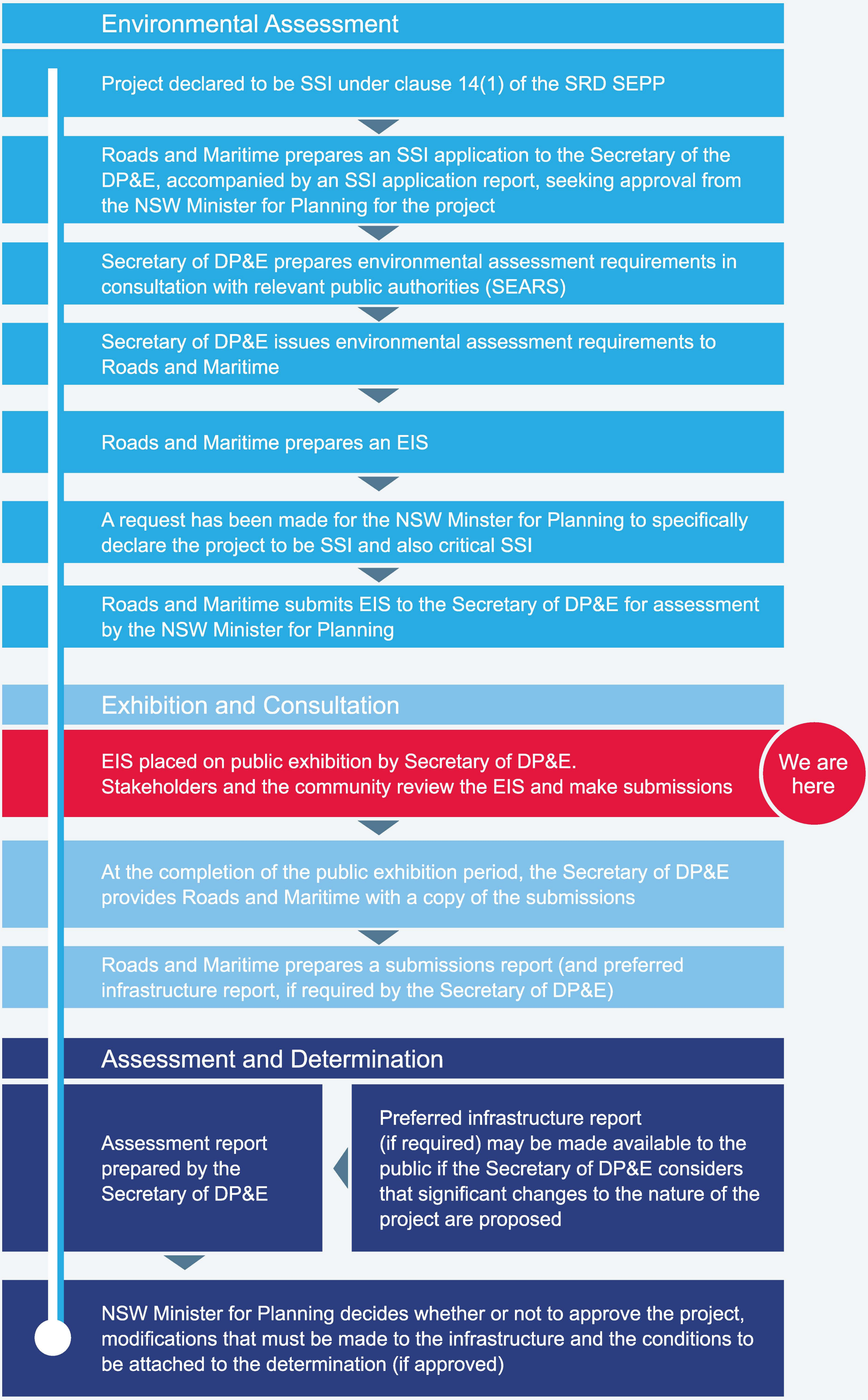


Figure 2-1 Assessment and approvals process

2.2 Environmental planning instruments

2.2.1 State environmental planning policies

In general, section 115ZF(2) of the EP&A Act excludes the application of environmental planning instruments to SSI projects (except as those instruments apply to the declaration of SSI or critical SSI – see **section 2.1**). Notwithstanding this, the provisions of the following SEPPs and deemed SEPPs have been considered to be consistent with good environmental assessment practice.

State Environmental Planning Policy (Infrastructure) 2007

The Infrastructure SEPP aims to facilitate the effective delivery of infrastructure across the state. Clause 94 of the Infrastructure SEPP applies to development for the purpose of a 'road' or 'road infrastructure facilities.' It provides that these types of works are development which is permissible without consent, if undertaken by or on behalf of a public authority. The project is appropriately classified as being for the purpose of a 'road' and a 'road infrastructure facility' under the Infrastructure SEPP. However, as discussed in **section 2.1**, approval is required for the project under Part 5.1 of the EP&A Act.

State Environmental Planning Policy No. 19 – Bushland in Urban Areas

State Environmental Planning Policy No. 19 – Bushland in Urban Areas (SEPP 19) aims to protect and preserve bushland within urban areas including within the former Ashfield, Leichhardt and Marrickville local government areas (LGAs) (now amalgamated as the Inner West LGA) and the City of Sydney LGA. For the purposes of SEPP 19, bushland is defined as 'land on which there is vegetation which is either a remainder of the natural vegetation of the land or, if altered, is still representative of the structure and floristics of the natural vegetation'. Clause 7 of SEPP 19 states that works undertaken by public authorities (such as Roads and Maritime) shall not disturb bushland zoned or reserved for public open space for specific purposes, which include the purpose of constructing or maintaining roads, without first considering the aims of SEPP 19.

As outlined in **Chapter 18** (Biodiversity), the project would involve clearance of vegetation at the locations of interchanges, surface infrastructure and areas within the project footprint, including ancillary construction facilities. Vegetation in the project footprint comprises 'urban exotic' and 'native cover' (NSW Office of Environment and Heritage 2013a) and no bushland as defined in Clause 4 of SEPP 19 is present.

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) is not strictly applicable to infrastructure. However, the provisions of the policy have been considered in **Chapter 25** (Hazard and risk) in relation to the storage of hazardous substances and dangerous goods during the construction and operation of the project.

State Environmental Planning Policy No. 55 – Remediation of Land

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) provides a State-wide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. In accordance with Clause 7(1) of SEPP 55, a consent authority must not consent to the carrying out of development on any land unless:

- It has considered whether the land is contaminated
- If the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or would be suitable, after remediation) for the purpose for which the development is proposed to be carried out
- If the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land would be remediated before the land is used for that purpose.

A contamination investigation has been carried out for the project to inform the design and EIS. The outcomes of the contamination investigations and recommended environmental mitigation measures are addressed in **Chapter 16** (Contamination).

Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 (Sydney Harbour Catchment SREP), a deemed SEPP, provides planning principles and development controls for the Sydney Harbour Catchment. In Rozelle, at the Rozelle interchange and at the northern extent of the Iron Cove Link, the project footprint is located within a mapped foreshore and waterway area. The project, as described in the EIS, is not located at a strategic foreshore site and would not affect any mapped heritage or wetland areas under the Sydney Harbour Catchment SREP. As discussed in **Chapter 15** (Soil and water quality) and **Chapter 19** (Groundwater), the project is not considered to result in an adverse impact on the water quality of Sydney Harbour.

Sydney Regional Environmental Plan No. 26 – City West

Sydney Regional Environmental Plan No. 26 – City West (SREP 26) is a deemed SEPP under clause 120 of Schedule 6 of the EP&A Act that provides planning principles and development controls for land at City West covering the Ultimo-Pyrmont Precinct, The Bays Precinct and Eveleigh Precinct. Part of the project footprint is located within the boundary of The Bays Precinct as defined in SREP 26.

The principal aims of SREP 26 are to promote the orderly and economic use and development of City West by establishing planning principles and controls for the City West area. The provisions of SREP 26 would not apply to the project as it is SSI. Nevertheless, Roads and Maritime has considered the intent of the policy during the development of the project. The relevant SREP 26 objectives, planning principles and policies for The Bays Precinct are discussed in **Table 2-2**.

Table 2-2 Relevant SREP 26 matters

SREP Policy	Discussion
Clause 11 – Planning Principles of regional significance for City West	This clause requires that development within City West is consistent the following planning principles: • Regional Role – The project would not conflict with this principle being achieved in the future. In addition, the project would address existing traffic congestion, which would benefit the people of Sydney and NSW • Land Use Activities – The project would not conflict with this principle being achieved in the future • Mixed Living and Working Environment – The project would not conflict with this principle being achieved in the future • Education – No educational establishment is proposed as part of the project, however, this would not conflict with this principle being achieved in the future • Leisure and Recreation – The project would deliver up to 10 hectares of new public open space for recreational use within the Rozelle Rail Yards • Port Functions – This principle is not relevant to the project • Social Issues – Active transport and open space to be delivered as part of the project would promote social cohesion within the area • Environment Issues – Environmental management measures would be implemented throughout development of the project as outlined in **Chapter 29** (Summary of environmental management measures). **Chapter 27** (Sustainability) addresses the assessment of the project against the principles of ecologically sustainable development • Urban Design and Public Domain – The project would provide an improved urban design outcome for the Rozelle Rail Yards by creating public open space for recreational use within the disused rail yards (refer to **Chapter 13** (Urban design and visual amenity))

	• Heritage – An assessment of the impact of the project on heritage items listed in the SREP (and other heritage items) and how impacts would be managed is provided in **Chapter 20** (Non-Aboriginal heritage) • Movement and Parking – The project would not conflict with this principle being achieved in the future • Implementation and Phasing – The project would not conflict with achieving this principle in the future.
Division 3 – Planning principles for precincts	Clause 15 of Division 3 requires that development within The Bays Precinct is consistent with a number of planning principles. These are discussed below with the following planning principles: • Role and land use activities – The project would not conflict with this principle being achieved in the future • Urban Design – The project would provide an improved urban design outcome for the former Rozelle Rail Yards through the delivery of up to 10 hectares of new public open space for recreational use as outlined in **Chapter 13** (Urban design and visual amenity) • Public domain – The urban design solution at the former Rozelle Rail Yards would promote this area as public domain and encourage recreational uses, active transport and community cohesion (refer to **Chapter 13** (Urban design and visual amenity)).
Division 6 – Heritage Conservation (supported by Schedule 4)	This division provides for the protection of heritage items and conservation areas shown on Map 4 of the SREP. Clause 30 requires that the consent authority considers the significance of a heritage item or conservation area, the potential impacts on this area from the development and measures to conserve the heritage significance. It also requires that the consent authority considers any archaeological sites or potential. An assessment of the potential impacts of the project on non-Aboriginal heritage values and how impacts would be managed, including measures to conserve significance, is provided in **Chapter 20** (Non-Aboriginal heritage).
Division 9 – Miscellaneous provisions	Clause 50 of this division requires that development must not be carried out on any land until arrangements have been made for the supply of water, sewerage and drainage which are satisfactory to the Water Board. A description of the water supply, wastewater and drainage design for the project, potential impacts on these factors and how impacts would be managed is provided in is provided in **Chapter 5** (Project description) and **Chapter 17** (Flooding and drainage). Potential impacts of the project on utilities, including relocation or adjustment of utilities are identified in the Utilities Management Strategy in **Appendix F** (Utilities Management Strategy).

2.2.2 Local environmental plans

Local environmental plans (LEPs) do not apply to SSI projects. The project is located within two LGAs, being the City of Sydney and the Inner West. The Inner West LGA was formed on 12 May 2016 upon the amalgamation of the former Ashfield, Leichhardt and Marrickville LGAs. Existing LEPs for the former Ashfield, Leichhardt and Marrickville LGAs remain in force until a combined LEP has been gazetted for the Inner West LGA.

City of Sydney and Inner West councils have been consulted during the development of the project and preparation of the EIS. Further details on consultation carried out for the EIS are provided in **Chapter 7** (Consultation).

Notwithstanding the above, the provisions of the following LEPs are considered in **Chapter 12** (Land use and property):

- Ashfield Local Environmental Plan 2013
- Leichhardt Local Environmental Plan 2013
- Marrickville Local Environmental Plan 2011
- Sydney Local Environmental Plan 2012.

2.3 Other NSW legislation

Approval of a project under Part 5.1 of the EP&A Act (EP&A Act s 115ZG) means that certain other approvals are not required. The potential impacts anticipated by those approvals have nevertheless been assessed as part of this EIS. Approvals not required for the project include:

- Permits under sections 201, 205 and 219 of the *Fisheries Management Act 1994* (NSW) (FM Act) to carry out dredging and reclamation works, to harm marine vegetation in a protected area or to block fish passage (refer to **Chapter 18** (Biodiversity))
- Approvals under Part 4 (to disturb or excavate a place, building, work, relic, moveable object, precinct or land to which an interim heritage order or listing on the State Heritage Register applies) and excavation permits under section 139 of the *Heritage Act 1977* (NSW) (refer to **Chapter 20** (Non-Aboriginal heritage))
- Aboriginal heritage impact permits under section 90 of the *National Parks and Wildlife Act 1974* (NSW) (NPW Act) to harm an Aboriginal object or place (refer to **Chapter 21** (Aboriginal heritage))
- Authorisations under the *Native Vegetation Act 2003* (NSW) to clear native vegetation or State protected land (refer to **Chapter 18** (Biodiversity))
- Various approvals under the *Water Management Act 2000* (NSW), namely water use approvals under section 89, water management work approvals under section 90, and activity approvals (other than aquifer interference approvals) under section 91 (refer to **Chapter 15** (Soil and water quality)).

Approvals under other NSW legislation that would be required for the project include the following:

- An Environment Protection Licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (NSW) (POEO Act). In accordance with clause 35 of Schedule 1 of the POEO Act an Environment Protection Licence would be required for construction of the project. In accordance with section 115ZH of the EP&A Act, such a licence cannot be refused for an approved project and is to be substantially consistent with any approval granted to the project under Part 5.1 of the EP&A Act.

Other NSW legislation that would apply to the project includes:

- The *Land Acquisition (Just Terms Compensation) Act 1991* (NSW), which applies to the acquisition of any land by an Authority of the State which is authorised to acquire the land by compulsory process. Acquisition is further discussed in **Chapter 5** (Project description) and **Chapter 12** (Land use and property)
- The *Contaminated Land Management Act 1997* (NSW), which outlines the circumstances in which notification of the NSW Environment Protection Authority is required in relation to contamination of land. This is discussed further in **Chapter 16** (Contamination)
- The *Roads Act 1993* (NSW) is relevant as the project would result in a road classified as a freeway or tollway under the Act as it contains four or more traffic lanes over a distance of more than one kilometre in the Sydney metropolitan area
- The FM Act is relevant as notification to the NSW Department of Primary Industries – Fisheries is required if dredging or reclamation work are required in water land classed as key fish habitat. This is discussed further in **Chapter 18** (Biodiversity)

- The *Crown Lands Act 1989* (NSW), which applies to the acquisition of land reserved under that Act. The project would impact Crown land at Rozelle (Refer to **Chapter 12** (Land use and property)).

Because the project has been declared to be SSI, section 115ZG(2) of the EP&A Act precludes the following directions, orders or notices being made to prevent or interfere with the carrying out of the project once approved:

- An order restricting harm to buildings, works, relics or places that are not the subject of an interim heritage order or listing under the State Heritage Register under Division 8 of Part 6 of the *Heritage Act 1977* (NSW).

Further, if the project is declared as critical SSI, section 115ZG(3) of the EP&A Act precludes the following directions, orders or notices being made to prevent or interfere with the carrying out of the project once approved:

- An interim protection order within the meaning of the NPW Act or the *Threatened Species Conservation Act 1995* (NSW) (TSC Act)
- An order under Division 1 (Stop work orders) of Part 6A of the NPW Act, Division 1 (Stop work orders) of Part 7 of the TSC Act or Division 7 (Stop work orders) of Part 7A of the FM Act
- A remediation direction under Division 3 of Part 6A of the NPW Act
- An environmental protection notice under Chapter 4 of the POEO Act
- An order from a council to demolish or move a building, to repair or make structural alterations to a building, or to do or refrain from doing things under section 124 of the *Local Government Act 1993* (NSW).

2.4 Commonwealth legislation

2.4.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, proposed ‘actions’ that have the potential to significantly impact matters of national environmental significance or the environment of Commonwealth land, or 'actions' that are being carried out by a Commonwealth agency, must be referred to the Australian Government. If the Australian Government Minister for the Environment determines that a referred project is a ‘controlled action’, the approval of that Minister will be required for the project in accordance with the EPBC Act and in addition to the approval required from the NSW Minister for Planning under Part 5.1 of the EP&A Act.

As discussed in **Chapter 18** (Biodiversity) and **Chapter 20** (Non-Aboriginal heritage), the impact assessments carried out for the project indicate that the project would not be likely to result in a significant impact on any matter of national environmental significance under the EPBC Act, including threatened and migratory species, world heritage properties, national heritage places or Commonwealth land. Accordingly, the project has not been referred to the Australian Government Department of the Environment and Energy for further assessment or approval under the EPBC Act.

2.4.2 Airports Act 1996

Under section 183 of the *Airports Act 1996* (Commonwealth) and the Airports (Protection of Airspace) Regulations 1996 (Commonwealth), a controlled activity must not be undertaken in relation to ‘prescribed airspace’ without the approval of the Secretary of the Australian Government Department of Infrastructure and Regional Development (DIRD). Controlled activities are defined in section 182 (1) of the *Airports Act 1996* (Commonwealth) and include activities that result in turbulence, such as from exhaust plumes, that exceeds the level ascertained in the regulations. Regulation 6A provides that for subparagraph 182(1)(f)(i) of the *Airports Act 1996* (Commonwealth), the level of air turbulence for turbulence caused by an emission from a vent is upward vertical velocity of 4.3 metres per second.

Under section 9 of the *Civil Aviation Act 1988* (Commonwealth), the Civil Aviation Safety Authority (CASA) is responsible for the safety regulation of civil air operations in Australian territory. Consequently, CASA stipulates requirements for the construction and operation of new infrastructure that has the potential to influence aviation safety. Part 139.70 of the Civil Aviation Safety Regulations

1998 (Commonwealth) provides that CASA may determine that a plume is a hazardous object if the vertical velocity of the exhaust exceeds 4.3 metres per second.

'Prescribed airspace' is the airspace above any part of either an obstruction limitation surface (OLS) or procedures for air navigation systems operations (PANS-OPS) surface for Sydney Airport:

- The OLS is the maximum height that objects may project into the airspace around an aerodrome so that aircraft operations may be conducted safely
- PANS-OPS protection surfaces establish the airspace that is to remain free of any potential disturbance (including physical objects and other disturbances such as turbulence due to operation of ventilation outlets) so that aircraft operations may be conducted safely.

The PANS-OPS is generally higher than the OLS. Where structures may (under certain circumstances) be permitted to penetrate the OLS, they will not ordinarily be permitted to penetrate any PANS-OPS surface.

The project would include the construction and operation of ventilation facilities at:

- Haberfield, at the corner of Parramatta Road and Walker Avenue (this ventilation facility is being built as part of the M4 East project with fitout (mechanical and electrical) as part of the M4-M5 Link project)
- Rozelle, within the Rozelle Rail Yards
- Rozelle, in the Victoria Road carriageway between Callan Street and Springside Street at Rozelle
- St Peters, within the St Peters interchange near Campbell Road.

The exhaust plumes from all of the ventilation facilities have the potential to penetrate either or both the OLS or PANS-OPS levels. The project has been designed to satisfy requirements set by DIRD in relation to erected structures (such as ventilation outlets), equipment manoeuvring and lighting. To determine whether plume rise resulting from the operation of these ventilation facilities would be a controlled activity as defined in section 183 of the *Airports Act 1996* (Commonwealth), a plume rise assessment would be carried out in accordance with the CASA *Advisory Circular Plume Rise Assessments AC 139-5(1) November 2012* prior to the operation of the project.

Further discussion of potential impacts on prescribed airspace is provided in **Chapter 25** (Hazard and risk).

2.5 Site management works at the Rozelle Rail Yards

Roads and Maritime is carrying out a suite of site management works on part of the Rozelle Rail Yards site. The works are needed to manage the existing environmental and safety issues at the site and would also improve access to surface conditions, which would allow for further investigation into the location of utilities and the presence of contamination and waste. The works would benefit future uses of the site (including construction of the M4-M5 Link project if it is approved) because the works would remove material and redundant facilities associated with rail and rail related infrastructure from the site.

The site management works were subject to a separate environmental assessment. The works were assessed in an REF which was approved by Roads and Maritime under Part 5 of the EP&A Act in April 2017.

The key features of the site management works are:

- Site establishment – including fencing, installing temporary site offices, arranging site access, erosion, sediment and drainage controls and defining lay down, stockpile and transfer areas
- Utility location and site investigations
- Removal of waste, existing stockpiles and vegetation
- Removal of existing above ground rail infrastructure, including gantries, railway lines, ballast, sleepers and buildings (but excluding the southern penstock, the switching station, the transformer and rail infrastructure to the east of Victoria Road bridge) and redundant services

where intercepted when removing infrastructure (eg gantries and ballast) generally to a depth of 500 millimetres below ground level, except where drainage channels and sediment basins are required

- Site stabilisation comprising reshaping of the ground surface as a result of the site management works and installation of stormwater controls including the construction of drainage channels and sediment basins
- Site completion and handover – demobilise all temporary construction materials, plant and equipment installed for the works and leave the site secure.

Site management works commenced in mid-2017 and will be carried out over a period of around 12 months. After completion of the works, the ‘finished site’ would be managed and maintained to ensure that the surface cover and stormwater controls are operating effectively. For the purposes of this EIS, it has been assumed that the site management works are completed prior to construction of the project commencing.

2.6 Modifications to the project approval

Should the project be approved, the proponent can apply to the NSW Minister for Planning to modify an approval. Any modification requests would be lodged with DP&E for assessment. The modification request would be appropriately notified and/or exhibited depending on the scale of the proposed modification and the potential for environmental or social impacts.

3 Strategic context and project need

Sydney's population is forecast to increase to 5.9 million by 2031 (NSW Government 2014). With this increase in population it is anticipated there will be an increase in vehicles travelling on Sydney's roads, with the number of trips made around Sydney each day forecast to increase by 31 per cent, from 16 million to 21 million vehicle movements, by 2036 (Infrastructure Australia 2015). This growth would place increasing pressure on the NSW transport network and the key travel demand corridors connecting regional cities and major centres across the greater Sydney metropolitan area.

Investment in infrastructure is needed to meet the demands of a growing population and the increased amount of vehicles travelling between the regions of Sydney, which is reflected in the aims of various NSW Government policies and plans. Plans such as *A Plan for Growing Sydney* (NSW Government 2014), *Towards our Greater Sydney 2056* (Greater Sydney Commission 2016b) and the draft District Plans (Greater Sydney Commission 2016) identify investment in transport infrastructure as achieving the objectives of these plans.

This chapter describes the strategic context of the M4-M5 Link project (the project) within the state and national planning and policy framework, explains the need and justification for the project from both regional and local perspectives, and outlines the project's objectives.

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued environmental assessment requirements for the project. These are referred to as the Secretary's Environmental Assessment Requirements (SEARs). **Table 3-1** sets out the SEARs and the desired performance outcomes that relate to the strategic context and need for the project and identifies where these SEARs have been addressed in this environmental impact statement (EIS).

Table 3-1 SEARs – strategic context and project need

Desired performance outcome	SEARs	Where addressed in the EIS
2. Environmental Impact Statement The project is described in sufficient detail to enable clear understanding that the project has been developed through an iterative process of impact identification and assessment and project refinement to avoid, minimise or offset impacts so that the project, on balance, has the least adverse environmental, social and economic impact, including its cumulative impacts.	1. The EIS must include, but not necessarily be limited to, the following:	A description of the project objectives and how this relates to the objectives of the WestConnex program of works is provided in **section 3.3**.
	(c) a statement of the objective(s) of the project, including how it meets the objectives of the overall WestConnex program;	
	(d) a summary of the strategic need for the project with regard to its State significance and relevant State Government policy;	The need and justification for the project is described in **section 3.2**. Reference to the project's State significance and relevant State Government's policies is provided in **section 3.2**.

3.1 Strategic planning and policy framework

3.1.1 Overview

The following sections describe the compatibility of the project with relevant Australian Government and NSW Government policies and plans. The project is listed as a ‘high priority initiative’ in the *Australian Infrastructure Plan: The Infrastructure Priority List* (Infrastructure Australia 2016a). The project is also part of the NSW Government’s commitment to deliver WestConnex for Sydney in response to the recommendations from the *State Infrastructure Strategy 2012–2032* (Infrastructure NSW 2012), the *State Infrastructure Strategy Update 2014* (Infrastructure NSW 2014), the *Long Term Transport Master Plan* (Transport for NSW 2012a), the NSW State Priorities announced in September 2015 (NSW Government 2015) and the *NSW Freight and Port Strategy* (Transport for NSW 2013b). The WestConnex program of works, which includes the project, also has the potential to be a catalyst for major urban renewal, as identified in *A Plan for Growing Sydney* (NSW Government 2014) and the *Draft Central District Plan* (Greater Sydney Commission 2016a).

In addition, *A Plan for Growing Sydney* (NSW Government 2014) presents a vision for Sydney as a strong global city and the nation’s economic and financial powerhouse. It emphasises the need to improve access to major employment hubs and global gateways.

The project, as part of the WestConnex program of works, would aid in the delivery of these strategies and plans as it would:

- Provide a new motorway link between the M4 East at Haberfield and the New M5 at St Peters
- Reduce future traffic volumes on north- south and east- west road corridors, including City West Link and parts of Victoria Road
- Enhance the benefits achieved by the operation of the M4 East and New M5 projects by reducing traffic volumes on Parramatta Road, Southern Cross Drive, the Princes Highway, King Georges Road and the M5 East Motorway
- Together with the other components of the WestConnex program of works and the proposed future Sydney Gateway, the project would facilitate improved connections between western Sydney, Sydney Airport and Port Botany and south and south-western Sydney, as well as better connectivity between the important economic centres along Sydney’s Global Economic Corridor and local communities
- Reduce travel times and improve reliability for bus services, business, personal and freight journeys along the Sydney road network
- Improve road safety by reducing traffic congestion on Sydney’s arterial roads
- Facilitate opportunities for future urban renewal in precincts adjoining the project, including The Bays Precinct (in accordance with *The Bays Precinct Transformation Plan*), along Parramatta Road east of Haberfield (in accordance with *the Parramatta Road Corridor Urban Transformation Strategy*), and along Victoria Road between Iron Cove Bridge and City West Link, by reducing surface road traffic on Victoria Road, creating opportunities for improved connectivity, potential active transport links and public transport improvements and improved urban design outcomes and local amenity
- Enable future opportunities for improved connectivity in Sydney’s transport network to be realised by allowing for connections to the proposed future Western Harbour Tunnel and Beaches Link project to the north and to the proposed future Sydney Gateway project and the proposed future F6 Extension (via the New M5 project) to the south.

Investment in the M4-M5 Link, together with the other WestConnex projects, would assist in facilitating the delivery of other major city-shaping improvements, such as the Parramatta Road Corridor Urban Transformation and The Bays Precinct Transformation, which would all contribute to delivering economic growth. As part of the broader WestConnex program of works, the project would support NSW’s major sources of economic activity and provide a strategic response to the future transport demands on the already congested road network.

3.1.2 Australian Infrastructure Plan: The Infrastructure Priority List

Infrastructure Australia's *Australian Infrastructure Plan: The Infrastructure Priority List* (the Priority List) dated February 2016 sets out a number of projects and initiatives identified as priority infrastructure investments that Australia needs over the next 15 years. The projects and initiatives on the Priority List have been assessed for their economic viability, deliverability and strategic compliance with the principles of the *Australian Infrastructure Plan Report* (Infrastructure Australia 2016).

The Priority List is a reference point for Australia's most important infrastructure investments needs. The Priority List currently lists 100 major infrastructure proposals, including 18 projects that are all underpinned by a robust business case and have been approved by Infrastructure Australia. The Priority List provides independent, evidence-based advice to governments and industry on the projects that would most benefit Australia's growing communities. The list refers to high priority and priority projects and initiatives.

The Priority List identifies the project as a 'high priority initiative' to address urban congestion in Sydney's inner west and to realise the benefits of WestConnex. WestConnex, including the project, is listed as one of the seven 'high priority projects' on the 2017 *Infrastructure Priority List* (Infrastructure Australia 2017) (http://infrastructureaustralia.gov.au/policy-publications/publications/Infrastructure-Priority-List.aspx). A high priority project is defined as a potential infrastructure solution for which a full business case has been completed and assessed by Infrastructure Australia and which addresses a major problem or opportunity of national significance.

3.1.3 NSW State Priorities

In 2015, the NSW Premier announced a new set of State Priorities. These include a number of priorities relevant to WestConnex and therefore to the project:

- **Creating 150,000 new jobs by 2019** - creating jobs for the construction sector through infrastructure investment. WestConnex would create up to 10,000 direct and indirect jobs during construction (Sydney Motorway Corporation 2015). Job creation is discussed further in **Chapter 14** (Social and economic)
- **Building infrastructure** – key infrastructure across NSW would be delivered on time and on budget to support our growing population. WestConnex is a major infrastructure investment in NSW and would deliver more than $20 billion in economic benefits to NSW. The economic benefits of the project are discussed further in **Chapter 14** (Social and economic)
- **Encouraging business investment** – infrastructure delivered by the government would significantly improve the ease of doing business in NSW by reducing congestion, increasing reliability and productivity and driving business confidence. By connecting the M4 East Motorway and the New M5 Motorway, the project would link key employment centres such as the Sydney central business district (CBD) with priority growth areas in western Sydney and would also provide improved conditions for freight transport (from the Sydney Airport and Port Botany precinct), thereby improving business efficiencies
- **Protecting NSW's credit rating** – NSW is one of only two Australian states to retain its AAA credit rating, which is an indication of a strong and stable economy (the AAA rating is the highest possible credit rating and is associated with lower borrowing costs due to lower risk to financial lenders). Strong financial management would ensure this strong fiscal position is retained. WestConnex is delivering financial solutions to fund delivery of the motorway to ensure the net result for the NSW economy is positive and to minimise impacts on the state's budget. WestConnex is funded by the NSW and Australian governments, as well as private sector debt and equity capital raised against tolls on completed stages of WestConnex (Sydney Motorway Corporation 2015). Further details on the economic impacts of the project and the tolling regime are provided in **Chapter 14** (Social and economic)

- **Boosting apprenticeships** – the NSW Government is committed to training apprentices and providing the states with a lasting legacy of a highly skilled workforce with on-the-job training. WestConnex is delivering more than 500 apprenticeships, which is half of the NSW Government's target for major infrastructure projects. The WestConnex Training Academy was established in 2016, in partnership with Western Sydney TAFE and other registered training organisations, to deliver skills training, apprenticeships and traineeships. Refer to **Chapter 14** (Social and economic) for more information
- **Improving road travel reliability** – new road infrastructure would help ensure that consistency of journey times on key roads improves (through enabling better use of existing roads, building extra road capacity and encouraging commuters to use public transport and undertake more off-peak travel), thereby reducing travel times and boosting productivity. WestConnex would deliver travel time savings for motorists across Sydney. Refer to **Chapter 8** (Traffic and transport) for more information
- **Reducing road fatalities** – improved motorways and roads are linked to a reduction in traffic incidents. WestConnex would provide a free-flowing motorway alternative for through traffic, reducing traffic on surface roads and improving traffic flows. This is expected to correlate with a lower number of road crashes. Refer to **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport) for more information.

3.1.4 State Infrastructure Strategy

The *State Infrastructure Strategy 2012–2032* (Infrastructure NSW 2012) (*State Infrastructure Strategy*) is a 20-year strategy, which identifies and prioritises the delivery of critical public infrastructure to drive productivity and economic growth. Infrastructure NSW’s assessment of the state’s existing infrastructure highlighted critical deficiencies in urban road capacity. The *State Infrastructure Strategy* identifies strategic infrastructure options to meet the challenges of population growth and substantial increases in freight volumes.

The *State Infrastructure Strategy* recognises the economic impacts and other constraints created by congestion along the existing M5 and M4 motorway corridors and urban arterial roads that provide access to the centres of economic and social activity. The project would provide a vital link between the New M5 and the M4 East Motorways as well as connect to the proposed future Sydney Gateway project (via the St Peters interchange), which would provide access to Sydney Airport and Port Botany, in line with key *State Infrastructure Strategy* objectives.

The project is important for freight and business transport, and would provide connections to 'Global Sydney', which is part of a 'global economic corridor' (as defined in *A Plan for Growing Sydney)* discussed further in **section 3.1.7**). WestConnex is identified in the *State Infrastructure Strategy* as a critical program of work with a range of benefits including reducing congestion, improving access to the major international gateways of Sydney Airport and Port Botany (via the St Peters interchange), acting as a catalyst for urban regeneration along key corridors and supporting potential improvements in public transport, particularly along the Parramatta Road corridor. This is described in more detail in **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).

State Infrastructure Strategy Update

In November 2014, Infrastructure NSW released the *State Infrastructure Strategy Update 2014* (Infrastructure NSW 2014) (*State Infrastructure Strategy Update*), to guide the allocation of funds from the sale of the state’s ‘poles and wires’ electricity network businesses, as part of the NSW Government’s 2014 *Rebuilding NSW* initiative. The *State Infrastructure Strategy Update* recommends infrastructure projects and programs that should be prioritised to reduce congestion, support population growth and stimulate productivity across Sydney and regional NSW.

The *State Infrastructure Strategy Update* identified the possible expansion of WestConnex to include connections to Victoria Road and Anzac Bridge to the north and a connection to President Avenue at Rockdale to the south (the proposed future F6 Extension). These connections, together with a completed WestConnex and the proposed future Western Harbour Tunnel and Beaches Link, would provide a western bypass of the Sydney CBD, alleviating pressure on existing north−south corridors including the Southern Cross Drive, A1 (Princes Highway) and A3 (Centenary Drive/Roberts Road/King Georges Road) and the Sydney orbital network, as well as reducing traffic volumes on the

Sydney Harbour Bridge and Sydney Harbour Tunnel. These changes would reduce journey times between Sydney's northern and southern suburbs.

The project was updated to provide connections to Victoria Road, Anzac Bridge, City West Link, and the proposed future Western Harbour Tunnel and Beaches Link to the north and to support the connection to the proposed future Sydney Gateway project to the south (to connect with Sydney Airport and Port Botany), delivering on key parts of the *State Infrastructure Strategy Update*.

As a result of these changes to WestConnex outlined in the *State Infrastructure Strategy Update*, the WestConnex business case was updated in 2015 and published as the *WestConnex Updated Strategic Business Case* (Sydney Motorway Corporation 2015).

3.1.5 NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* (Transport for NSW 2012a) (*Transport Master Plan*) provides a framework for delivering an integrated, modern and multi-modal transport system by identifying NSW's transport actions and investment priorities for the next 20 years. Under the *Transport Master Plan*, WestConnex is identified as a critical link in Sydney's motorway network and an immediate priority for the NSW Government.

The *Transport Master Plan* recognises that WestConnex would support Sydney's long-term economic growth by supporting the growing freight task between Sydney's international gateways and greater western Sydney, facilitating the transfer of goods and services between Sydney's eastern and western economic centres by improving capacity and reducing travel times, and supporting the continued development of Sydney's global economic corridor.

The *Transport Master Plan* recognises that WestConnex would also relieve road congestion, and improve the speed, reliability and safety of travel. Strategies to deliver an integrated package of transport improvements in parallel with the construction of WestConnex are recognised in the *Transport Master Plan*. The connection of each of these strategies to the project and WestConnex is discussed in the following sections and also in **Chapter 8** (Traffic and transport).

Transport mode-specific strategies

Various strategies have been developed to support the *Transport Master Plan.* These strategies are being taken into account during the project development to ensure integration and connectivity with different transport modes as appropriate. As part of WestConnex, the project delivers on the NSW Government's plans to deliver an integrated transport solution, comprising roads and public transport, to address congestion on Sydney's roads. This is discussed further in **section 3.2** and in **Chapter 4** (Project development and alternatives). The project, as part of the WestConnex program of works, aims to support and facilitate the vision outlined in the strategies, including:

- *Sydney's Rail Future: Modernising Sydney's Trains* (Transport for NSW 2012b) complements the *Transport Master Plan* with a particular focus on improving Sydney's rail system. Key rail projects have since been identified and have been considered by the project, including the Sydney Metro City and Southwest (between Chatswood and Bankstown) and the proposed Sydney Metro West (linking the Sydney CBD with Parramatta). The project has taken into account future metro lines in the design of the mainline tunnels and in the assessment of potential cumulative impacts from possible concurrent construction activity
- *Sydney's Light Rail Future*: Expanding public transport, revitalising our city (Transport for NSW 2012c) guides the delivery of modern, efficient and reliable light rail networks that integrate with other transport modes. *Sydney's Light Rail Future* states that, in the longer term, WestConnex may allow road space on some sections of Parramatta Road to be re-allocated to public transport. The reduction in traffic along Parramatta Road as a result of the project supports the potential development of future light rail (or other public transport improvements) along this corridor
- Key light rail projects include the Sydney CBD and South East Light Rail. The development of the project design and the impact assessment has taken into account the Sydney CBD and South East Light Rail project, particularly as that project includes a light rail maintenance depot at Lilyfield, located adjacent to surface works that are proposed as part of the M4-M5 Link project at the Rozelle Rail Yards

- *Sydney's Bus Future*: Simpler, faster, better bus services (Transport for NSW 2013a) complements the *Transport Master Plan* by planning improvements to Sydney's bus network. Sydney's Bus Future states that investment in the bus network would occur in parallel with WestConnex. It also highlights that WestConnex would assist in introducing a 'bus rapid transit' route along Parramatta Road in the long term, by providing an alternative route for longer distance vehicle trips along the M4/Parramatta Road corridor
- The project, together with the other projects that comprise the WestConnex program of works, would result in a reduction of traffic along sections of Parramatta Road, in particular east of the M4 East entry and exit ramps on Parramatta Road. This reduction in traffic would deliver improvements in Parramatta Road bus travel times during the AM and PM peak periods and would also facilitate realisation of public transport improvements along the Parramatta Road corridor associated with the *Parramatta Road Corridor Urban Transformation Strategy* (UrbanGrowth NSW 2016a). Further, the project design does not present any constraints to potential future bus rapid transit or light rail developments on Parramatta Road
- The provision of an underground connection between the project at the Rozelle interchange and Victoria Road near the eastern abutment of Iron Cove Bridge (the Iron Cove Link) would reduce traffic on Victoria Road (east of Iron Cove Bridge). This would improve journey times for buses along parts of the Victoria Road corridor
- *Sydney's Cycling Future*: Cycling for everyday transport (Transport for NSW 2013c) supports the strategic policy direction for transport and transport infrastructure for NSW outlined in the *Transport Master Plan* (Transport for NSW 2012a). *Sydney's Cycling Future* (Transport for NSW 2013c) provides the long-term plan to prioritise and provide for cycling in Sydney. These two documents identify a policy direction to ensure that 'the needs of bike riders are built into the planning of new transport and infrastructure projects' and that NSW would 'deliver bicycle infrastructure through major transport and development projects'.

  The project would support *Sydney's Cycling Future* objectives by:

  - Maintaining and, where feasible, improving network connectivity
  - Where there is a substantial reduction in traffic as a result of the new infrastructure, enabling the future investigation of opportunities for enhanced cyclist facilities and connectivity for cyclists
  - Where existing cyclist infrastructure and facilities, or access to them, are directly affected during or after construction, relocating the cyclist infrastructure and facilities with the aim of long-term enhancement.

  Chapter 5 (Project description) describes the proposed changes and enhancements to cyclist infrastructure and facilities. The project provides access for cyclists through the Rozelle Rail Yards site, creating north- south and east- west connectivity across the site to adjacent urban renewal precincts (including The Bays Precinct), open space areas (along Whites Creek, Easton Park, Bicentennial Park), public transport stops and cycleways (including along Lilyfield Road). Improvements to the existing active transport network, such as along Victoria Road, would also be undertaken by the project. Further details on active transport connectivity are discussed in **section 3.2.1**. Potential impacts and improvements to active transport are discussed in **Chapter 8** (Traffic and transport) and **Appendix N** (Technical working paper: Active transport strategy). The new and improved active transport links created by the project serve to connect the communities of Rozelle and Annandale that are currently separated by the Rozelle Rail Yards (not publicly accessible), the Inner West light rail corridor and the arterial road network (City West Link and Victoria Road)

- *Sydney's Walking Future: Connecting people and places* (Transport for NSW 2013d) is the NSW Government's long-term plan to promote walking as an active transport mode throughout Sydney and an integral component in planning urban growth precincts and new transport infrastructure.

  The project would support the *Sydney's Walking Future* strategies through reductions in daily traffic volumes on sections of surface roads including Parramatta Road (east of the M4 East Parramatta Road ramps), City West Link and Victoria Road (south of Iron Cove Bridge), which would improve urban amenity and road safety for pedestrians.

  The project would also provide new and improved pedestrians paths through the open space areas to be created at the Rozelle Rail Yards and along the southern side of Victoria Road, improving pedestrian connections in the local area. Further details on active transport connectivity are discussed in **section 3.2.1**. Potential impacts and improvements to active transport are discussed in **Chapter 5** (Project description), **Chapter 8** (Traffic and transport) and **Appendix N** (Technical working paper: Active transport strategy).

3.1.6 Sydney City Centre Access Strategy

The *Sydney City Centre Access Strategy* (Transport for NSW 2013e) (*City Centre Access Strategy*) is the NSW Government's long-term strategy to deliver a fully integrated transport network in Sydney's city centre that meets the growing needs for all transport modes. The *City Centre Access Strategy* aims to prioritise and allocate street space for public transport, general traffic, pedestrians, cyclists, taxis and service vehicles, thereby helping to improve Sydney's transport capacity. While the *City Centre Access Strategy* is focused on improving public transport access to and from the Sydney CBD, it acknowledges that WestConnex is a key infrastructure project that aims to ease congestion, create jobs and connect communities, and that it would provide improved access for freight, commercial and business vehicles.

The *City Centre Access Strategy* identifies a number of actions to achieve its objectives. Traffic forecasts show that the project is generally anticipated to have little impact, or to reduce traffic on some roads that are identified in the strategy as city centre bypass routes, such as the Cahill Expressway. However, other roads identified as city centre bypass routes are forecast to have increased traffic as a result of the project, including the Western Distributor and the Cross City Tunnel. While these forecast increases are not counter to the *City Centre Access Strategy*, changes in traffic volumes on these roads should be considered in the planning and implementation of the traffic and bypass priority routes. This is discussed further in **Appendix H** (Technical working paper: Traffic and transport).

3.1.7 A Plan for Growing Sydney

A Plan for Growing Sydney (NSW Government 2014) is a regional level plan that aims to promote the growth of Sydney by providing guidance on land use planning decisions in Sydney for the next 20 years. The plan describes where people are likely to live and work, and how they would move around the city and its subregions. The plan acknowledges that Sydney is a global city, and defines 'Global Sydney' as including the Sydney CBD, North Sydney CBD, Barangaroo, Darling Harbour, The Bays Precinct, Pyrmont–Ultimo, Broadway and Camperdown Education and Health Precinct, Central to Eveleigh, Surry Hills and City East.

The four goals defined in *A Plan for Growing Sydney* are supported by the project:

- Goal 1 – A competitive economy with world-class services and transport
- Goal 2 – A city of housing choice with homes that meet our needs and lifestyles
- Goal 3 – A great place to live with communities that are strong, healthy and well connected
- Goal 4 - A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources.

The Plan also sets out specific directions and actions that would deliver these goals.

Goal 1 – A competitive economy with world-class services and transport

Several directions under Goal 1 of *A Plan for Growing Sydney* are relevant to the project and to WestConnex more broadly. The project, in combination with the M4 East and M4 Widening projects, would support access for goods and services to the new priority growth area of Greater Parramatta to the Olympic Peninsula, identified in Direction 1.3 of *A Plan for Growing Sydney*.

Direction 1.5.2 seeks to minimise the impacts of the movement of freight on the communities through which freight travels. The project would assist in reducing these impacts by providing a motorway alternative for heavy freight trucks and other through traffic, reducing the use of Parramatta Road (between Haberfield and the Sydney CBD), City West Link, Victoria Road (east of Iron Cove Bridge), King Georges Road and the existing M5 East motorway, for freight. This is expected to lead to associated improvements in local air quality and lower traffic noise.

In order for Sydney to continue to be a competitive economy, improved transport connections are required between all the major centres that form part of Sydney's economic corridor (termed the 'global economic corridor' in Direction 1.6), which include areas such as the Sydney CBD, Parramatta CBD, Sydney Airport and Port Botany precinct and Sydney Olympic Park (see **Figure 3-1**). WestConnex would assist in increasing productivity between these centres by improving road connections and reliability of journey times for the transport of goods and services and business travel.

WestConnex, along with the M4 Motorway, M5 Motorway, M7 Motorway and the proposed M12 Motorway (between the M7 Motorway, Cecil Hills and The Northern Road, Luddenham) motorway corridors would provide a motorway standard link to the western Sydney Airport and western Sydney Employment Area, which is a key focus for economic growth in Sydney over the medium to long term.

Goal 2 – A city of housing choice with homes that meet our needs and lifestyles

One of the primary benefits of the project, together with the M4 East and M4 Widening projects, would be a reduction in longer distance trips along Parramatta Road. Reducing these longer distance trips would lessen surface traffic on sections of Parramatta Road and facilitate the future renewal of nominated precincts along the Parramatta Road corridor. Direction 2.2 of *A Plan for Growing Sydney* outlines the need to promote urban renewal within Sydney, with Parramatta Road identified as one of the key corridors for renewal. Further discussion of the *Parramatta Road Corridor Urban Transformation Strategy* (UrbanGrowth NSW 2016a) can be found in **section 3.1.11**.

Goal 3 – A great place to live with communities that are strong, healthy and well connected

The project would be consistent with Direction 3.1 of *A Plan for Growing Sydney*, which seeks to revitalise existing suburbs. As traffic has increased with the growth of Sydney, many areas along Parramatta Road and Victoria Road have become degraded and unattractive, with reduced amenity and limited parking. The project would support initiatives for the revitalisation of precincts along Parramatta Road (including Taverners Hill, Leichhardt and Camperdown), and along Victoria Road at Rozelle, and would aid proposed developments included as part of The Bays Precinct Transformation. It would do this by improving regional traffic connectivity, providing open spaces, providing active transport links, and reducing surface traffic on Parramatta Road and Victoria Road.

Goal 4 – A sustainable and resilient city that protects the natural environment and has a balanced approach to the use of land and resources

The project is being designed in line with the WestConnex Sustainability Strategy (Sydney Motorway Corporation 2015), which outlines an integrated approach to sustainability through design, delivery and operation. In construction, the project would aim to achieve a rating of 'excellent', applying the Infrastructure Sustainability Council of Australia (ISCA) rating system. Resilience to climate change has been taken into account as part of the design of the project. **Chapter 24** (Climate change and risk adaptation) outlines potential project adaptation measures and **Chapter 27** (Sustainability) provides further detail of sustainability considerations while **Chapter 23** (Resource use and waste minimisation) outlines the project's approach to the efficient use of resources and the minimisation of waste. **Chapter 4** (Project development and alternatives) describes the design considerations in the evolution of the project and the options and alternatives considered to minimise environmental and social impacts.

Subregional planning

A Plan for Growing Sydney guides subregional planning by identifying the metropolitan priorities for each of the subregions across Sydney. Subregional planning demonstrates how the growth of the city would be closely integrated with long-term transport and infrastructure planning, as major renewal and growth programs capitalise on existing and planned transport.

The project is located within the Inner West and City of Sydney local government areas (LGAs), which are part of the 'Central Subregion' under *A Plan for Growing Sydney*. The priorities for the Central Subregion that are relevant to the project are to:

- Enable delivery of key transport projects to facilitate better connections to Global Sydney, including Sydney Rapid Transit, Sydney CBD and South East Light Rail, and WestConnex
- Work with local councils to identify suitable locations for housing intensification and urban renewal, including employment agglomerations, particularly around 'priority precincts', established and new centres, and along key public transport corridors
- Investigate a potential light rail corridor from Parramatta to the Sydney CBD via Parramatta Road.

The project would facilitate these priorities by reducing traffic on sections of Parramatta Road. This would potentially aid urban revitalisation and provide opportunity for improved public transport along Parramatta Road between Burwood and the Sydney CBD (also see **section 3.1.11**).

A priority for the Central Subregion includes the need to connect Port Botany and Sydney Airport to WestConnex. This would be achieved through the project and the New M5 project, which provides connection to the proposed future Sydney Gateway project (via the St Peters interchange). WestConnex is identified as a key transport project along with public transport projects such as the Sydney CBD and South East Light Rail, for the movement of people and freight within the Sydney basin.

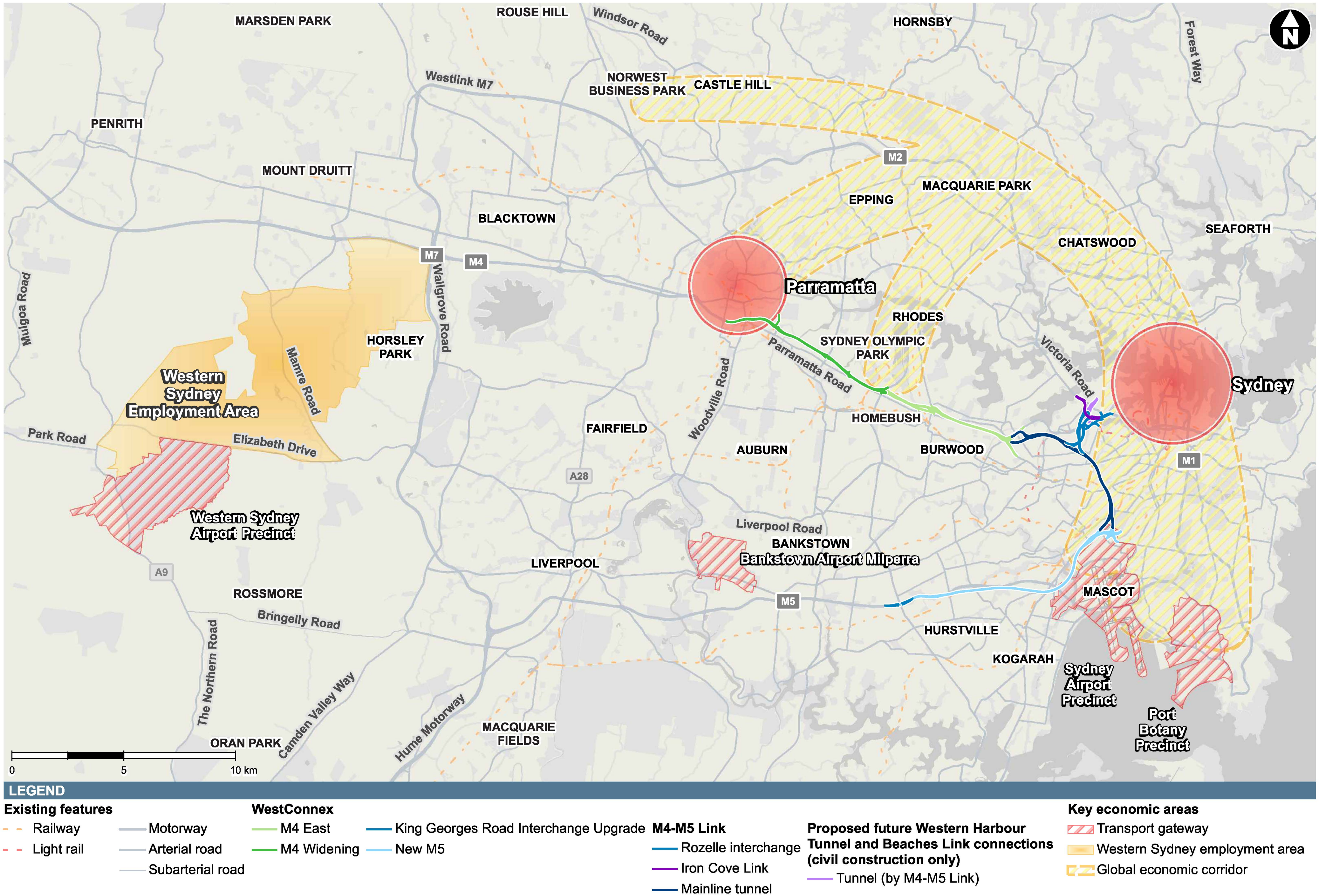


Figure 3-1 Key economic areas within Greater Sydney (adapted from *A Plan for Growing Sydney*)

3.1.8 Towards our Greater Sydney 2056

Towards our Greater Sydney 2056 (Greater Sydney Commission 2016b) is the proposed amendment to *A Plan for Growing Sydney* and was released as a draft for public exhibition in November 2016, alongside the draft District Plans (see **section 3.1.9**). *Towards our Greater Sydney 2056* presents a major shift in strategic planning for Greater Sydney, with a long term transformational focus on the regional significance of central and western Sydney.

Towards our Greater Sydney 2056 outlines a 'three cities' approach, with the Sydney CBD representing the 'Eastern City', the Parramatta CBD representing the 'Central City' and the future western Sydney Airport and surrounds representing the 'Western City'. The rationale for this approach is to create economic diversification and improve Greater Sydney's international competitiveness. Due to the magnitude of the changes associated with this new vision and the expected population and commercial growth in western Sydney, *Towards our Greater Sydney 2056* identifies the need for a sustainable supporting transport network.

The project, as part of the WestConnex program of works, complements this vision by providing improved connectivity between Eastern City, Central City and Western City of the greater Sydney metropolitan area.

3.1.9 Draft Central District Plan

In November 2016, the Greater Sydney Commission put on public exhibition draft District Plans for the six districts (North, Central, West Central, South, South West, and West) that make up Greater Sydney. A district represents neighbouring groups of council areas with similar features and common communities of interest. The aims of the draft District Plans are to provide a basis for strategic planning at a district level, establish planning priorities that are consistent with *A Plan for Growing Sydney* (see **section 3.1.7**), and identify actions to achieve those planning priorities. The district plans must also consider priorities identified by the Minister for Planning and other relevant plans, strategies, and NSW government policies. Proposed changes to regional planning, such as those outlined in *Towards our Greater Sydney 2056*, the proposed draft amendment to *A Plan for Growing Sydney* (see **section 3.1.7**), are also reflected in the draft District Plans.

The draft Central District Plan (Greater Sydney Commission 2016a) sets out priorities and actions for Greater Sydney's Central District, which includes the LGAs of Bayside, Burwood, Canada Bay, Inner West, Randwick, Strathfield, City of Sydney, Waverley and Woollahra. The Plan addresses issues influencing Greater Sydney to 2056 with the aim of achieving a productive, liveable and sustainable city.

The Plan identifies opportunities for investment and growth, including development of The Bays Precinct (see **section 3.1.12**), implementation of the *Parramatta Road Corridor Urban Transformation Strategy* (see **section 3.1.11**) and delivery of a range of transport projects including the Sydney Metro City and Southwest, the CBD and South East Light Rail, WestConnex and the proposed future F6 Extension.

The Plan identifies the project and other components of WestConnex as 'regionally significant transport infrastructure'. The Plan also acknowledges the opportunities provided by WestConnex to improve pedestrian and cyclist connections, enable urban renewal, improve transport services, and enhance amenity, especially along sections of Parramatta Road.

The objective of the Plan is to identify planning priorities for the Central District and the actions to achieve them. One of the identified actions includes 'improve connections and amenity along the WestConnex corridor'. It is expected that Roads and Maritime Services would deliver on this action by:

- Working with local councils to provide better north–south connections across Parramatta Road
- Work with the NSW Government to identify and fund opportunities to increase amenity and open space in the vicinity of the WestConnex corridor
- Examine opportunities to further improve active transport linkages.

The project would contribute to the delivery of improved amenity and creation of new open space and create and improve active transport links. These benefits are described further in **Chapter 13** (Urban design and visual amenity) and **Chapter 8** (Traffic and transport) respectively.

3.1.10 NSW Freight and Ports Strategy

The aim of the *NSW Freight and Ports Strategy* (Transport for NSW 2013b) (*Freight Strategy*) is to provide a transport network in NSW that allows for the efficient flow of goods to market.

The *Freight Strategy* states that the NSW freight task is expected to almost double over the next 20 years. Such growth has implications for the capacity of the road network, with increased heavy vehicle volumes forecast on King Georges Road, the M4 Motorway, M5 Motorway and M7 Motorway, as well as key connections to Port Botany. Sydney's heavy vehicle freight task is highly dependent on the motorway network. More than 37 per cent of all heavy vehicle freight kilometres travelled in the Sydney Metropolitan Area is on the motorway and highway network, even though the network represents less than 17 per cent of the arterial road network. The *Freight Strategy* also identifies that the NSW road network carried 63 per cent of the state's total freight volume in 2011, with 33 per cent of freight carried by rail in the same year. Heavy vehicles would continue to have a substantial role in moving freight across NSW for the foreseeable future. The *Freight Strategy* identifies the challenge of increasing the capacity of NSW roads to support the growth in freight.

The *Freight Strategy* has two main objectives: to deliver a freight network that efficiently supports the projected growth of the NSW economy, and to balance freight needs with those of the broader community and the environment. The project is consistent with the three strategic action programs identified in the *Freight Strategy*:

- Network efficiency – the project would improve network efficiency by delivering travel time savings and improved connectivity to the proposed future Western Harbour Tunnel and Beaches Link and providing connection to the proposed future Sydney Gateway project to the south (via the St Peters interchange). This would provide more efficient movement of freight, reducing operational freight costs
- Network capacity – the project would provide increased road capacity and connectivity for the M4/Parramatta Road and M5 corridors and increase the capacity on the north−south network for the movement of freight between Sydney Airport/Port Botany (via the St Peters interchange) and the north and western suburbs
- Network sustainability – traffic modelling indicates that the project (together with the other WestConnex projects) would remove a large number of heavy freight vehicles from Parramatta Road (between Haberfield and Camperdown), City West Link, Victoria Road (east of Iron Cove Bridge), King Georges Road and the existing M5 East Motorway, which would result in improved network operation and efficiency. The delivery of WestConnex would reduce travel time by improving capacity and reducing surface road traffic. The *Freight Strategy* identifies improvements to network capacity as 'Strategic Action Program SAP 2'. Within this program:
  - Task 2A-1 is to establish corridors to meet the long-term freight needs of NSW. The project is specifically identified in the *Freight Strategy* as a key link to be investigated
  - Task 2B-1 is to connect and complete Sydney's motorway network. The *Freight Strategy* identifies key motorway connections with benefits for freight, including WestConnex, which would provide the opportunity to streamline interstate movements around and through Sydney.

3.1.11 Parramatta Road Corridor Urban Transformation Strategy

The *Parramatta Road Corridor Urban Transformation Strategy* (UrbanGrowth NSW 2016a) (*Parramatta Road Transformation Strategy*) identifies areas along the corridor (between Granville in the west to Camperdown in the east) where there would be a focus on encouraging growth and changes over the long-term (about 30 years). The aim of the strategy is to create an environment with good design, land-use mix, housing choice and infrastructure, as well as improved access to community facilities and services and access to public and active transport.

It is envisaged that up to 27,000 new homes and 50,000 new jobs would be generated in the corridor in the next 30 years (UrbanGrowth NSW 2016a). To improve the corridor, the *Parramatta Road*

Transformation Strategy has identified eight urban renewal precincts at Granville, Auburn, Homebush, Burwood–Concord, Kings Bay, Taverners Hill, Leichhardt and Camperdown.

WestConnex is identified within the *Parramatta Road Transformation Strategy* as a catalyst for the restoration of the Parramatta Road corridor, as it would reduce through traffic on the surface roads in the corridor. 'Through traffic' in this context refers to traffic that travels more than five kilometres along Parramatta Road to destinations away from Parramatta Road. The reduction in traffic, particularly trucks, would assist in improving public transport and urban amenity, both of which would support future growth along the corridor, in particular residential development.

A key element of the *Parramatta Road Transformation Strategy* is the delivery of improved public transport services along Parramatta Road, including the potential development of bus rapid transit. This project, together with the M4 East project, would reduce traffic on Parramatta Road between Burwood and the Sydney CBD, which would in turn free up road space for future public transport initiatives that would benefit existing and new residents along the Parramatta Road corridor. One of the conditions of approval for the M4 East project includes a requirement for that project to dedicate at least two lanes of Parramatta Road between Burwood and Haberfield for the sole use of public transport. This requirement is incorporated into the design of the M4 East project so that future public transport initiatives on Parramatta Road can be integrated with the WestConnex program. The project, together with the M4 East project, therefore complements the plans envisaged in the *Parramatta Road Transformation Strategy*.

The *Parramatta Road Transformation Strategy* also plans for the future construction and delivery of walking and cyclist infrastructure at key locations along the Parramatta Road corridor. This new infrastructure is not part of the project and would be subject to separate planning assessment and approval. Improvements to the active transport network that would be delivered by the project are described in **Chapter 8** (Traffic and transport) and **Appendix N** (Technical working paper: Active transport strategy).

The project traverses or is in proximity to three of the urban renewal precincts identified in the *Parramatta Road Transformation Strategy* – Taverners Hill, Leichhardt and Camperdown. The Camperdown precinct is directly affected by construction of the project.

The *Parramatta Road Transformation Strategy* also identifies part of the Camperdown precinct, at the intersection of Parramatta Road, Pyrmont Bridge Road and Mallett Street, as the proposed 'Camperdown Triangle', which could become a potential biomedical hub, due its proximity to the RPA Hospital. The project would include a temporary ancillary facility to support tunnel construction on a portion of the Camperdown Triangle. Once construction for the project is complete, this site would be rehabilitated and would then be available for future redevelopment (subject to separate planning assessment and approval) in accordance with the *Parramatta Road Transformation Strategy*.

The *Parramatta Road Transformation Strategy* is supported by the *Parramatta Road Corridor Implementation Plan 2016–2023* (UrbanGrowth NSW 2016b), which sets out prioritised actions to facilitate transformation in the corridor over the short-term until 2023. The *Parramatta Road Corridor Precinct Transport Report* (UrbanGrowth NSW 2016c) outlines transport plans for each of the precincts to support urban transformation in the Parramatta Road corridor over the short, medium and long terms.

The *Parramatta Road Transformation Strategy* has informed the Greater Sydney Commission's draft District Plan for the Central District (see **section 3.1.9**) and is also discussed further in **Chapter 12** (Land use and property).

3.1.12 The Bays Precinct Transformation Plan

The *Transformation Plan: The Bays Precinct, Sydney* (UrbanGrowth NSW 2015b) (*The Bays Precinct Transformation Plan*) establishes the strategy for how The Bays Precinct would be developed over 20 years for residential, employment, entertainment and open space uses. The Bays Precinct, located about two kilometres west of the Sydney CBD, encompasses the areas surrounding Blackwattle Bay, Rozelle Bay and White Bay. The Bays Precinct comprises eight 'destinations', including the Rozelle Rail Yards, White Bay Power Station, White Bay and the Rozelle Bay and Bays Waterways.

The NSW Government's ambition for The Bays Precinct is 'to drive an internationally competitive economy, through the creation of great destinations on Sydney Harbour that would transform Sydney, NSW and Australia' (UrbanGrowth NSW 2015b). The NSW Minister for Planning has determined that the urban renewal of land within The Bays Precinct is a matter of state planning significance and has agreed to investigate the area as a State Significant Precinct. Refer to **Chapter 2** (Assessment process) for additional information on the planning implications of this proposed designation. The Bays Precinct delivery is intended to be staged and coordinated with the planning and delivery of WestConnex and the expansion of the Sydney Light Rail network as well as the long term considerations of The Bays Precinct's port uses. *The Bays Precinct Transformation Plan* recognises that an efficient transport system enables urban transformation, and that transport solutions for The Bays Precinct would need to be integrated with planning for a growing Sydney, including the consideration of varied transport modes.

Rozelle Rail Yards

The Rozelle Rail Yards site is bounded by City West Link to the south, Lilyfield Road to the north, Balmain Road to the west and White Bay to the east. *The Bays Precinct Transformation Plan* identifies the former rail yards as providing an opportunity for mixed housing as well as public spaces and employment uses. *The Bays Precinct Transformation Plan* also identifies the potential for opportunities provided by the redevelopment of the Rozelle Rail Yards for integration and connection of communities to the north and south through the creation of public open space and improved connections between Lilyfield and the waterfront.

While the project is consistent with *The Bays Precinct Transformation Plan* vision for the creation of new open spaces, provision of new pedestrian and cyclist links, connecting communities and the acknowledgment of the rail heritage of the area, it is inconsistent with the Plan with respect to the development of the Rozelle Rail Yards for mixed housing and potentially also for employment uses.

The reasons for the project being inconsistent with this vison can be attributed to the nature of the project and the geographical area required for its construction and operation and also the commitment made by the NSW Government (announced in July 2016) that the project would deliver up to 10 hectares of new open space and active transport links for the community.

Should the project not proceed, the Rozelle Rail Yards would likely be developed in accordance with *The Bays Precinct Transformation Plan,* including the provision of public spaces, employment uses and mixed housing.

White Bay Power Station

The White Bay Power Station is a recognised landmark in Sydney's inner west. The heritage-listed power station and surrounds have been earmarked under *The Bays Precinct Transformation Plan* for reuse as a hub for knowledge-intensive and advanced, technological industries. UrbanGrowth NSW is responsible for the redevelopment of the site, which is around 10 hectares in size. It was announced in August 2016 that UrbanGrowth NSW was in discussions with prospective tenants to occupy the redeveloped site. An announcement from UrbanGrowth NSW in April 2017 indicated a masterplan would be developed for the site and UrbanGrowth NSW would work with stakeholders and the community to identify appropriate uses for the area. The potential redevelopment would also consider opportunities for improving access to the proposed Waterfront Promenade at White Bay.

The project footprint includes part of the Rozelle Rail Yards, which is to the west of the White Bay Power Station on the other side of Victoria Road, and surface road changes at the intersection of Victoria Road and City West Link, as well as at the approach to Anzac Bridge. The project would not directly impact the White Bay Power Station building. The project would enable active transport connections between the White Bay Power Station site and the Rozelle interchange. This is described further in **Chapter 5** (Project description) and in **Appendix N** (Technical working paper: Active transport strategy).

The design and construction of the project has considered measures to minimise indirect impacts on the White Bay Power Station site. This includes minimising the project footprint in the vicinity of White Bay Power Station in order to reduce the indirect impacts associated with construction traffic, noise generation and air emissions. A further description of potential impacts on this heritage listed site and relevant mitigation measures is discussed in **Chapter 20** (Non-Aboriginal heritage).

White Bay

White Bay is one of only two deep water wharves, west of the Sydney Harbour Bridge and is used for a variety of port uses including bulk vessel loading and vessel repairs. It is also the location of the White Bay Cruise Terminal. *The Bays Precinct Transformation Plan* identifies that the future development of White Bay would include a mix of port, maritime recreation and employment uses.

While the project does not interact directly with the White Bay destination, the reduction in traffic and improvement in local traffic volumes on sections of Victoria Road east of Iron Cove Bridge as a result of the project (specifically the Iron Cove Link), and improvements in regional vehicle access to this destination (via the Rozelle interchange) for current and future uses, would support local economic activities. The project also includes new active transport links through the Rozelle Rail Yards which would enable connections to future developments at White Bay.

Rozelle Bay and the Bays Waterways

The Rozelle Bay and Bays Waterways destination (which includes Blackwattle Bay and Johnstons Bay) is home to a number of maritime and harbour industries and the foreshore is actively used for recreational fishing, private recreation craft and government patrol vessels. *The Bays Precinct Transformation Plan* identifies the future development of Rozelle Bay and the Bays Waterways as having new land and maritime uses including a mix of commercial and open space as well as working harbour industries and on-water recreation facilities. Opportunities to improve public access to the waterfront and waterways and to improve water quality are identified by UrbanGrowth NSW as objectives for this destination.

As with White Bay, the project is expected to improve vehicle and active transport accessibility to the Rozelle Bay and the Bays Waterways destination, which should improve the user experience. The project would interact directly with Rozelle Bay through proposed discharges of treated stormwater. This is discussed further in **Chapter 15** (Soil and water quality).

3.1.13 Action for Air

Action for Air (Department of Environment, Climate Change and Water 2009a) aims to improve the air quality in the greater Sydney metropolitan region. *Action for Air* identifies ozone and particles as the biggest air quality challenges for the region, and nominates actions and objectives specifically targeted towards reducing motor vehicle emissions.

The project would assist in meeting this goal by reducing vehicle emissions through anticipated faster travel times and improved road conditions for heavy vehicles, noting that heavy vehicles transporting dangerous goods would not be permitted to use the tunnels. This is reflected in the air quality impact assessment undertaken for the project (refer to **Appendix I** (Technical working paper: Air quality)), which is aligned with the objectives of the *Action for Air* policy. Further details regarding improvements to air quality as a result of the project are provided in **Chapter 9** (Air quality).

3.2 Project need and justification

The project is part of the NSW Government's commitment to deliver WestConnex for Sydney. Together with the WestConnex program of works, the project would facilitate improved connections between western Sydney and Sydney Airport and Port Botany (via the St Peters interchange), as well as better connectivity between key employment hubs and local communities.

The transport network in Sydney is expected to be put under increasing pressure over the next 20 years. *A Plan for Growing Sydney* (NSW Government 2014) indicated that from 2011 to 2031, Sydney's population is forecast to increase from 4.3 to 5.9 million, which equates to an average of 80,000 additional residents per year. Moreover, by 2036, the number of trips made around Sydney each day is forecast to increase by 31 per cent from 16 to 21 million vehicle movements. This growth would place increasing pressure on the NSW transport network and the key travel demand corridors connecting regional cities and major centres across the greater Sydney metropolitan area.

Key corridors currently accommodate high levels of daily traffic including freight, commuter and leisure travel. Users of these corridors frequently experience congestion and delay, particularly during weekday and weekend peak periods.

Both the *NSW Long Term Transport Master Plan* (Transport for NSW 2012a) and the *State Infrastructure Strategy Update 2014* (*State Infrastructure Strategy*) (Infrastructure NSW 2014) identified the need to plan and invest in the future of Sydney's motorway network, which provides vital infrastructure connections within and between travel demand corridors. Any investment in motorway infrastructure has to be aligned with supporting public and active transport initiatives to achieve an increase in capacity, while aiming to reduce the reliance on and demand for private vehicles on the future road network.

The WestConnex project is one part of a broader solution to these emerging pressures. While public transport is also part of this solution, it is recognised that not all trips in Sydney can be served by public transport, especially trips to dispersed destinations, or commercial trips requiring the movement of large or heavy goods/materials. A congested road network also affects road-based public transport, increased bus travel times and variable journey time.

For these reasons, the NSW Government is also investigating and investing in light rail, metro, bus rapid transit and motorways to provide a multi-modal response to the future challenges. In this context, WestConnex is an enabler of integrated transport and land use planning, supporting the development of initiatives including The Bays Precinct and the *Parramatta Road Corridor Urban Transformation Strategy*.

While the development of the project would have unavoidable impacts (associated with, for example, property acquisition, construction impacts from heavy vehicle traffic, noise, vibration and dust, access disruptions and visual impacts) and in some areas, reduced road capacity and travel times, overall, the project would deliver a large number of benefits. Further detail on the need and justification for the project is presented in the following sections.

3.2.1 Improved connectivity

In order to achieve the broad strategic objectives outlined in *A Plan for Growing Sydney* and the more detailed District Plans, Sydney's businesses and households require good access for workers and for the distribution of goods and services across the Sydney region. Improved connections for workers, suppliers, trades and customers through improvements to the transport network, including the strategic road network, are needed to support the growth of these centres and the 'global economic corridor'.

By providing a motorway link between the M4 East at Haberfield and the New M5 at St Peters, the project would help to connect major employment centres, which are critical in supporting the creation of jobs and businesses. This would include centres within the 'global economic corridor' (see **Figure 3-1**), which includes the Sydney Airport and Port Botany precinct, Sydney CBD, Sydney Olympic Park, Parramatta CBD and Norwest Business Park. The project would also support the Western Sydney Employment Area, which is outside the global economic corridor, southwest of Parramatta.

Furthermore, the Rozelle interchange (a key component of the project) would provide connectivity with the local surface road network at City West Link, The Crescent and Victoria Road. The Rozelle interchange would also connect to Victoria Road via the Iron Cove Link and includes ramps, tunnels and supporting infrastructure to provide connection to the proposed future Western Harbour Tunnel and Beaches Link project.

The Rozelle interchange would enable the following corridors:

- A north–south corridor between the New M5 at St Peters and Rozelle that would bypass the Sydney CBD
- An east–west corridor between the M4 East at Haberfield and Anzac Bridge, connecting to the Sydney CBD and the Sydney Harbour Bridge.

The predominantly below ground design of the Rozelle interchange would provide a number of free flow connections and minimise the number of intersections at the surface.

Further details on surface road connectivity and tunnel connections as a result of the project, including connectivity at the Rozelle interchange, is provided in **Chapter 5** (Project description). The current high volumes of traffic along Parramatta Road between Haberfield and Camperdown mean that east−west movements are given priority. This limits north−south movements across the

Parramatta Road corridor, including pedestrian and cyclist movements. The project, together with the M4 East and M4 Widening projects, would reduce traffic on Parramatta Road (east of Haberfield). This would create opportunities for improving north−south movements across the Parramatta Road corridor. Similarly, Victoria Road has become a barrier to east–west movements, as the high volumes of traffic travelling north–south along Victoria Road are given priority. The reduction in traffic along Victoria Road (between Iron Cove Bridge and City West Link) as a result of the Iron Cove Link would allow a more balanced surface road network in the Lilyfield/Rozelle area, including The Bays Precinct.

The project would further improve connectivity by delivering new and upgraded active transport network (ATN) links including cycleways and pedestrian paths. This infrastructure has been designed to maintain and enhance pedestrian and cyclist accessibility and connectivity, providing new and upgraded east–west and north–south connections, linking Lilyfield and Rozelle with Balmain, Annandale, Glebe, Leichhardt and the Sydney CBD.

Additional information on active transport links created or improved by the project is provided in **Chapter 5** (Project description) and **Appendix N** (Technical working paper: Active transport strategy).

3.2.2 Easing congestion

The WestConnex program of works, as part of an integrated transport solution for Sydney, is expected to reduce traffic on many parts of the Sydney road network. This investment in Sydney's road network would facilitate improvements across the network and generate benefits to the Australian economy. Further details on how the project would ease congestion and thereby aid economic benefits are described below.

Economic and social impact of road congestion

The road network in the traffic and transport study area currently functions under high levels of traffic demand, which often exceeds the operational capacity, especially citybound during the AM peak period. Major routes in the traffic and transport study area, such as Parramatta Road, City West Link, Victoria Road, Anzac Bridge/Western Distributor, Southern Cross Drive, Princes Highway and King Street, all experience significant congestion with resultant increase in travel time and variability, which can cause typical morning and evening peak hours to spread over longer periods, and extend the peak period.

The overall forecast growth in traffic demand is consistent with the forecast growth in population in the Sydney Metropolitan Area. Importantly, this growth in traffic is not confined to major routes – increased traffic on many roads in Sydney is forecast without the project in the 2023 and 2033 peak periods, as vehicles seek to avoid the congested arterial road network by travelling along lower order roads.

Without WestConnex, by 2031 travel speeds and congestion would significantly worsen on the road network serving western and southwestern Sydney (including the M4 Motorway, Parramatta Road, City West Link and the M5 Motorway corridor) and connections to Sydney Airport and Port Botany (eg the M1 corridor also known as Southern Cross Drive/Eastern Distributor). Congestion would also be a major issue on the key north–south links that connect the M4 and M5 motorway corridors (eg the A3 corridor also known as Centenary Drive/Roberts Road/King Georges Road), even with planned future public transport enhancements (Sydney Motorway Corporation 2015).

New road capacity is urgently required to meet the challenge of population growth and substantial increases in freight volumes. WestConnex plays a vital role in meeting these needs. The imbalance between population growth and employment growth rates in western Sydney means that there would remain strong demand for workers to travel by car or public transport to eastern Sydney and to centres that form part of the 'global economic corridor'. There would also be strong demand for non-peak hour business travel between the economic centres of eastern and western Sydney.

Congestion not only has detrimental economic effects, but also has human implications related to longer commute times and associated environmental and social impacts. The potential benefits of a reduced commute time may include more time spent with family and friends, increased productivity at work and lower stress levels.

Congestion also reduces the safety of road networks as it results in more frequent vehicle crashes and traffic incidents that impact personal safety, property and road network performance. Rear-end crashes result from stop−start conditions and are an indicator of road congestion. During the five-year period between 1 January 2011 and 31 December 2015, 60 per cent of crashes on key roads around the proposed Rozelle interchange, such as City West Link and Anzac Bridge, were rear-end crashes. This is consistent with roadways approaching capacity and on which a high level of queuing occurs. Further details of crash analysis undertaken for the project is provided in **Appendix H** (Technical working paper: Traffic and transport).

The project would also reduce traffic on parallel north−south and east−west corridors including City West Link and parts of Victoria Road. Further information is provided in **Chapter 8** (Traffic and transport).

Impact of congestion on freight services

By 2031, freight in NSW is projected to nearly double to 794 million tonnes as compared to 2011 (409 million tonnes). In the absence of any improvements to the road network, road freight would continue to be subject to capacity constraints and peak hour congestion in Sydney, particularly on the M4, M5 and M7 Motorways and within the M1 corridor (Southern Cross Drive/Eastern Distributor) and A3 corridor (Centenary Drive/Roberts Road/King Georges Road) (Transport for NSW 2013b).

Sydney Airport serves a growing freight market, with freight projected to increase from around 600,000 tonnes in 2012 to over one million tonnes per year by 2033 (Sydney Airports Company Limited 2014). Sydney Airport is in the same economic precinct as Port Botany. The port handles the second highest volume of containers in Australia and is NSW's primary container port. A third container terminal was added in mid-2014. In 2010, NSW container freight volumes were around 1.9 million units (measured in 'twenty-foot equivalent unit' containers or TEU). By 2020, this is forecast to grow to between three and 3.6 million TEU; reaching between 4.9 and seven million TEU by 2030 (Transport for NSW 2013b).

The project would reduce freight journey times and improve reliability by connecting the M4 and M5 motorway corridors and supporting the connection with the proposed future Sydney Gateway project (via the St Peters interchange) with the Sydney Airport and Port Botany precinct, leading to an overall increase in the capacity of the strategic freight network.

Impact of congestion on public transport

The Parramatta Road corridor is one of Sydney's busiest corridors for public transport. During the morning peak, Parramatta Road has one of the highest numbers of bus passengers of any major bus route in Metropolitan Sydney. Congestion on Parramatta Road has led to bus services being delayed and unreliable (ie not running to timetable).

During UrbanGrowth's consultation on the *Parramatta Road Transformation Strategy*, improved public transport services were identified by survey participants as the highest priority issue for the Parramatta Road corridor. By diverting traffic from the surface road network along major transit routes and reducing the traffic on Parramatta Road to the east of Haberfield, the project would create an opportunity to further improve bus service efficiency through to the Sydney CBD and enable further expansion of public transport services along the Parramatta Road corridor. This could potentially include development of on-street rapid transit, by either bus or light rail, between Burwood and the Sydney CBD.

Results from the operational traffic modelling undertaken for the project show that the general trend is an improvement in bus travel times during the morning and evening peak periods along Parramatta Road. This is more notable for buses travelling eastbound, due to extra bus lane provisions between Dalhousie Street and Sloane Street allowing buses to bypass much of the eastbound congestion leaving the network via Parramatta Road in the east. The westbound direction is less congested in the modelled traffic scenarios, and so benefits to buses are less significant, given there is reduced general traffic congestion.

As described in **section 3.1.11**, one of the conditions of approval for the M4 East project includes a requirement for that project to dedicate at least two lanes of Parramatta Road between Burwood and Haberfield for the sole use of public transport.

While the project, specifically the Iron Cove Link, would result in reduced surface traffic on Victoria Road (east of Iron Cove Bridge), this does not imply an improvement in bus travel times inbound along this corridor. This is because there are other factors associated with the existing road network that need to be considered, such as the existing capacity constraints on Anzac Bridge during peak periods. The project would impact on travel times for buses to and from the Sydney CBD via Anzac Bridge and Victoria Road. Results from the operational traffic modelling show that travel times would be slightly worse inbound to the city during the morning and evening peak periods but significantly improved outbound during both the morning and evening.

Further details on travel time changes for buses are provided in **Appendix H** (Technical working paper: Traffic and transport).

Impact of congestion on pedestrians and cyclists

The existing arterial road network comprising City West Link, The Crescent, Victoria Road and Parramatta Road, present a number of constraints to the movement of pedestrians and cyclists. Traffic congestion and the resultant noise and air quality impacts, as well as poor road safety conditions, reduces the attractiveness of these roads for cyclists, even though they are in many cases the quickest and most direct routes to the Sydney CBD and other destinations. Such amenity and safety impacts also contribute to the lack of appeal of these roads for pedestrians.

By reducing traffic along Victoria Road and providing a number of new or missing ATN links, the project would provide improve conditions for the use of these roads by pedestrians and cyclists. Similarly, as the project does help reduce traffic along Parramatta Road, it would help create opportunities for the development of future ATN links by others, such as the council or government agencies.

3.2.3 Viable economic proposal

The *WestConnex Updated Strategic Business Case* (Sydney Motorway Corporation 2015) appraised the economic benefits of WestConnex on an incremental basis, with and without each component project which are described in **Chapter 1** (Introduction), by considering the following parameters:

- The direct costs to the community, which included:
  - Capital costs, including construction costs
  - The costs of temporary traffic management and diversions during construction
  - Operating and maintenance costs
- The direct benefits to the community, which included:
  - Travel time saved by freight, service and passenger users
  - Travel time reliability improvements
  - Reductions in vehicle operating costs
  - Reductions in road incident costs
  - Externality reductions including air pollution, greenhouse gas emissions, noise pollution
  - Foregone local road maintenance
- The indirect benefits to the community, which included:
  - Benefits that other transport users derive from an expansion in the road network
  - Reductions in travel times and congestion costs on surrounding road links used by other transport users
  - Benefits that neighbouring businesses derive from better access to their businesses.

The benefit cost ratio is a measure of the net benefit to society derived from the capital investment in the project. The benefit cost ratio for the project alone identified in the *WestConnex Updated Strategic Business Case* is 2.38:1 when the wider economic benefits of the project are not taken into consideration. When the wider economic benefits are considered, the benefit cost ratio is 2.94:1. For the project, this means that for every dollar invested, the project would return $2.38 or $2.94 when considering the return in addition to the wider economic benefits. These ratios indicate an economically viable proposal. Benefits of the project are described in **section 3.4**.

The economic analysis for the WestConnex program of works, including the project, determined that WestConnex would create benefits that would outweigh the upfront construction costs and ongoing operational costs. The analysis found that WestConnex has a benefit cost ratio of 1.71:1, when assessed without reference to the wider economic benefits of the projects, and a benefit cost ratio of 1.88:1 when the wider economic benefits are considered. The wider economic benefits relate to agglomeration economies (ie improved connectivity between areas with high employment densities) and labour market deepening (ie benefits arising from a reduction in the cost of commuting, encouraging more people to take up employment). The 1.88:1 benefit cost ratio includes the M4-M5 Link and the proposed future Sydney Gateway project (which is being delivered by Roads and Maritime and subject to a separate assessment process) (Sydney Motorway Corporation 2015).

The *WestConnex Updated Strategic Business Case* was independently reviewed by Infrastructure for NSW and Infrastructure Australia. The latter confirmed that the full value of WestConnex would only be realised once the project (based on the preliminary design presented in that document) was completed.

Funding of WestConnex, as proposed in the WestConnex Updated Strategic Business Case, assumes a distance based toll would be implemented on operation of each component project. Distance based tolling means that motorists would only pay tolls for the sections of the motorway they use. The proceeds of the toll on each component project once operational would be applied to fund the construction of other components of the WestConnex program of works. A maximum toll for the use of the M4-M5 Link would be $6.50 ($2017). Tolls would escalate up to a maximum of four per cent or the consumer price index (CPI) per year (whichever is greater) until 2040. After that, CPI would apply. Tolls for the entire WestConnex Motorway would be capped at a maximum amount of $8.60 ($2017) for cars and light commercial vehicles and a distance of around 40 kilometres. This would provide significant time and cost savings for motorists. Cars and light commercial vehicles would pay around one third of the toll for heavy commercial vehicles.

The project would enhance the benefits of the WestConnex program of works for travel between western Sydney and the Sydney CBD. For example, a person driving a car in 2017 from Penrith to the Sydney CBD currently has the option of travelling along the M4 Motorway, which ends at Concord, and then would need to travel on the congested surface road network to the Sydney CBD. An alternative route between Penrith and the CBD using the M4 Motorway, WestLink M7, the Hills M2 Motorway, Lane Cove Tunnel and the Sydney Harbour Bridge or the Sydney Harbour Tunnel would cost around $22.00 in tolls ($2017) and is a distance of around 55 kilometres. After opening in 2023, the project would provide a journey using the M4 Motorway straight through to Anzac Bridge, via the M4-M5 Link, for a toll capped at $8.60 ($2017) and a distance of around 40 kilometres. This would provide significant time and cost savings for motorists.

3.2.4 Opportunities for public transport improvements

Traffic modelling undertaken for the project shows that around 100,000 vehicles would use the project each day in 2033. This would free up space on surface roads, which may create opportunities for dedicated public transport lanes for buses and light rail.

Over the coming years, significant population and employment growth is expected along the Parramatta Road corridor, The Bays Precinct, around Mascot, at Green Square and along the Central to Eveleigh corridor, which would increase the demand for travel. Long-term transport improvements (across all transport modes) are required to manage this growth and to promote urban renewal. Regardless of this growth, people already living and working in these areas and corridors need to be provided with improved transport infrastructure and services.

The project, together with the other projects that comprise the WestConnex program of works, would result in a reduction of traffic along sections of Parramatta Road, in particular east of the M4 East entry and exit ramps on Parramatta Road. This reduction in traffic would deliver improvements in Parramatta Road bus travel times during the AM and PM peak periods and would also facilitate realisation of public transport improvements along the Parramatta Road corridor associated with the *Parramatta Road Corridor Urban Transformation Strategy* (UrbanGrowth NSW 2016a).

The project has considered future public transport initiatives that are approved (but not yet under construction), in the planning stage, or reasonably expected to occur (as outlined in a government strategy or plan refer to **Appendix H** (Technical working paper: Traffic and transport)).

As discussed in **section 3.2.2**, by decreasing traffic along Victoria Road (east of Iron Cove Bridge) the project could improve travel times for some bus services, particularly outbound from the Sydney CBD.

3.2.5 Future trends in transport

Sydney's population is changing and would continue to change. In the last decade the number of train and bus trips grew faster than the rate of population growth, meaning that a greater percentage of the population is travelling on public transport. In the same timeframe, there were fewer vehicle drivers under 30 years of age on roads than drivers over 60 years of age (Bureau of Transport Statistics Household Travel Survey Highlights 2014/2015). This indicates that fewer young people are driving and owning cars and are using both public transport and other mobility service providers, such as ride sharing services and taxis, for their trips.

This is part of a worldwide trend known as 'mobility as a service' which includes hiring a car with a driver, such as traditional taxis and Uber type services, as well as the car-share services such as GoGet, which provide a range of vehicle types for urban drivers, including businesses, as needed. Data from GoGet shows that each car-share vehicle removes 10 privately owned vehicles from the road. Currently 88 per cent of GoGet members in Sydney do not own a car, and 80 per cent of GoGet members use active or public transport for their journey to work. This leads to an overall reduction in vehicles on the roads and it is estimated that, on current trends, in 20 years Sydney car-share users would drive 180 million kilometres less per year than if they owned cars. This outcome would not only reduce congestion but would free up on-road space for other uses such as cycle lanes.

Concurrent with these trends is the development of autonomous vehicles for both buses and cars. It is expected that fully autonomous vehicles would be active on our roads within the next 15 to 20 years, reducing the need for licensed drivers. They would provide greater opportunities for mobility impaired people and added convenience for other users. It is unlikely that the majority of these vehicles would be privately owned due to their cost, but fleets of autonomous vehicles could be provided as a service.

While the use of these vehicles could potentially increase the daily vehicle kilometres travelled, it would also substantially reduce the need for commuter car parks, freeing up existing car parks for other land uses. Policies are needed to ensure that autonomous vehicles augment and do not compete with public transport services. One example of the positive use of autonomous vehicles to augment public transport would be for the 'first and last kilometre' travel to and from bus or rail stations.

Irrespective of the timing and magnitude of these trends there is still a need to provide for the growth in commercial and freight travel demand and to reduce congestion across the Sydney road network. The project would provide the road connections for the future range of vehicles, and in particular reduce through traffic on local surface roads by providing efficient alternative routes through the underground tunnel network.

3.2.6 Facilitating urban renewal

The delivery of transport improvements is crucial to the realisation of urban renewal. The project, as part of the WestConnex program of works, would act as a catalyst for urban renewal along parts of Parramatta Road and Victoria Road and would support the development of The Bays Precinct, as outlined in *The Bays Precinct Transformation Plan* (UrbanGrowth NSW 2015b). The project would directly contribute to the following outcomes:

- Connected communities – improved balance between north−south and east−west movements without compromising traffic flow. This also applies to active transport connectivity. The project would create improved cyclist and pedestrian links, especially through the Rozelle Rail Yards, connecting the suburbs of Lilyfield, Rozelle, Annandale and Glebe and also providing improved connections to The Bays Precinct

- A safer environment – improved intersections and traffic flow would reduce traffic incidents, while changes to surface road layouts and provision of additional cyclist links and pedestrian bridges would make it safer for pedestrians and cyclists
- Additional open space – the project would deliver up to 10 hectares of new open space and recreational facilities, mainly at the Rozelle Rail Yards, through the development of the Rozelle interchange
- A sustainable transport route – by increasing traffic capacity, the project supports greater use of public and active transport (walking and cycling), reduces the number of vehicles on sections of Parramatta Road and Victoria Road, and allows for future growth and urban changes in the Parramatta Road and Victoria Road corridors as well as The Bays Precinct.

While urban renewal is not a direct outcome of the project, the project would enable other states agencies and local councils to realise urban renewal plans, resulting in an improvement to urban amenity.

3.3 Project objectives

The specific objectives of the project are:

- Linking the M4 East and New M5 motorways so that further benefits and opportunities of WestConnex can be realised
- Improving traffic conditions and reducing congestion on key arterial roads in proximity to the project
- Improving accessibility and reliability for commercial vehicle movement in the M4 and M5 motorway corridors to economic centres, including to the Sydney Airport and Port Botany precinct
- Facilitating urban renewal in areas where the project would reduce traffic
- Minimising impacts associated with acquisition of residential and commercial properties on communities
- Enabling long-term motorway network development by providing a connection to the proposed future Western Harbour Tunnel and Beaches Link project to the north
- Delivering a project with a beneficial urban design outcome.

As the project is part of the WestConnex program of works, the objectives of the project are consistent with those of WestConnex, as stated in the *WestConnex Updated Strategic Business Case*. **Table 3-2** outlines how the project would meet the broader WestConnex objectives.

Table 3-2 Meeting the WestConnex program objectives

WestConnex program objectives	How the project meets the WestConnex objectives
Support Sydney's long-term economic growth through improved motorway access and connections linking Sydney's international gateways with western Sydney and places of business across the city.	The project is a critical motorway link that contributes (together with the M4 East and New M5 projects) to connecting western Sydney's population and growth centres with employment and business opportunities in the Sydney CBD and in the Sydney Airport and Port Botany precinct. Further detail on the economic impacts and opportunities provided by the project is provided in **Chapter 14** (Social and economic) and **Appendix P** (Technical working paper: Social and economic).
Relieve road congestion so as to improve the speed, reliability and safety of travel on the M4, M5 and Sydney CBD/Sydney Airport/Port Botany corridors, including parallel arterial roads.	The traffic assessment undertaken for the project demonstrates that the project has the potential to reduce vehicle movements and improve travel times on Parramatta Road (east of Haberfield), Victoria Road (east of Iron Cove Bridge), City West Link, Southern Cross Drive, King Street and the Princes Highway.

WestConnex program objectives	How the project meets the WestConnex objectives
	The M4-M5 Link connects to the proposed future Sydney Gateway via the St Peters interchange, which would improve connectivity between Sydney's international gateways (Sydney Airport and Port Botany), western Sydney and places of business across the Sydney region. The road design, in conjunction with clear wayfinding (ie navigation signage/roadway markers), would provide a safe, legible and easily navigable series of tunnels that provide a high quality customer experience. Further detail on traffic impacts, including improvements to road safety and travel times, is provided in **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).
Cater for the diverse travel demands along these corridors that are best met by road infrastructure.	The key customers who would benefit from the project include: • Highly dispersed and long distance passengers • Heavy and light freight and commercial services • Businesses whose travel patterns are highly dispersed and diverse. The transport demands of these customers are best served by an efficient motorway connection. The project would meet this WestConnex objective by relieving congestion within and in proximity to the project footprint and facilitating efficient passenger and freight movements through Sydney.
Create opportunities for urban renewal, improved liveability, and public and active transport improvements along and around Parramatta Road.	The urban design and active transport improvements created by the project are principally focused on transforming the Rozelle Rail Yards where the motorway connections meet existing surface roads and along Victoria Road (south of Iron Cove Bridge). However, by reducing traffic along Parramatta Road (east of Haberfield) the project facilitates an opportunity for urban renewal and liveability improvements in communities along the Parramatta Road corridor. A reduction in vehicles on this corridor may result in greater safety for cyclists and pedestrians, making these alternative modes of transport more desirable. The Parramatta Road corridor is an important bus route servicing the inner west. As demand for public transport is forecast to grow, the WestConnex program of works has explored opportunities to facilitate the integrated use of public transport options on the road network. The reduction in traffic along Parramatta Road as a result of the project facilitates the future development of on-street rapid transport (either bus or light rail) as envisaged by the NSW Government. The project also includes use of land at Annandale, at the junction of Parramatta Road and Pyrmont Bridge Road, as a temporary construction ancillary facility. This

WestConnex program objectives	How the project meets the WestConnex objectives
	site would be rehabilitated and made, available for future redevelopment once construction of the project is complete. A description of the active transport improvements created by the project is provided in **Chapter 8** (Traffic and transport) and **Appendix N** (Technical working paper: Active transport strategy). An overview of potential land use impacts is provided in **Chapter 12** (Land use and property).
Enhance the productivity of commercial and freight-generating land uses strategically located near and along transport infrastructure.	By connecting the New M5 and M4 East motorways, the project provides improved access for commercial vehicles transporting freight from the Sydney Airport and Port Botany precinct to western Sydney. Reducing travel time may lead to increased business productivity and reduced costs. The project would also contribute to improved profitability for commercial and freight businesses through reduced transport costs, in terms of money and time lost to congestion and fuel consumption. It may also contribute to the desirability of services that rely on transport along the corridor.
Fit within the financial capacity of the State and Federal Governments, in partnership with the private sector.	The project, as part of WestConnex, is being funded by the NSW and Australian governments, as well as private sector debt and equity capital, raised against tolls on completed stages of WestConnex.
Optimise user pays contributions to support funding in a way that is affordable, equitable and fair.	A tolled motorway would facilitate user pays contributions and reduce the overall burden on the wider community in NSW. Inclusion of a toll makes construction of the project affordable and equitable, as the cost is shared between tax payers and individual users of the M4-M5 Link. The project comprises tolled and untolled components. Use of the mainline tunnel and Rozelle interchange for long distance trips would be tolled. The Iron Cove Link would remain untolled to provide relief to Victoria Road. Further information on project tolling is provided in **Chapter 14** (Social and economic).
Integrate with the preceding and proposed future stages of WestConnex projects without creating significant impacts on the surrounding environment or duplicating any potential issues across the construction periods.	As the project aims to link the M4 East and New M5 projects, opportunities for minimising impacts at both ends of the project have informed the design development process and high level construction programming from the earliest stages. The project has been designed to minimise the project footprint and maximise the use of land already disturbed or being used for road infrastructure (such as at Haberfield and St Peters). The potential impacts from consecutive construction activities across various WestConnex component projects are discussed in **Chapter 26** (Cumulative impacts) as these activities affect specific local communities.

WestConnex program objectives	How the project meets the WestConnex objectives
Provide the ability for an additional Sydney Harbour tunnel road crossing, the Western Harbour Tunnel and Beaches Link (subject to approval), to connect to WestConnex.	The project scope includes the civil construction of ramps, tunnels and associated infrastructure for the proposed future Western Harbour Tunnel and Beaches Link at the Rozelle interchange. These works include: • Tunnels that would allow for underground connections between the M4 East and New M5 motorways and the proposed future Western Harbour Tunnel and Beaches Link (via the M4-M5 Link mainline tunnels) • Entry and exit ramps extending north from the Rozelle interchange at the Rozelle Rail Yards below ground. This would enable future surface connections between the realigned City West Link/The Crescent intersection and the proposed future Western Harbour Tunnel and Beaches Link tunnels • A ventilation outlet and ancillary facilities as part of the Rozelle ventilation facility. Further description of how the project would provide the ability to connect to the proposed future Western Harbour Tunnel and Beaches Link is provided in **Chapter 5** (Project description) and **Chapter 6** (Construction work).
Support improved connectivity between Sydney, the Sutherland Shire, and the Illawarra, with the ability for the proposed future F6 Extension to connect to WestConnex.	While the project does not directly link to the proposed future F6 Extension, by connecting the Rozelle interchange to the New M5 (which would connect to the F6 Extension), the project would provide a connection between the Sydney CBD and the southern regions. A description of this connectivity and the potential impact on traffic flow is discussed in **Chapter 8** (Traffic and transport).

3.4 Benefits of the project

The project would deliver the following key benefits and opportunities:

- Ease congestion on surface roads by providing an underground motorway alternative and allowing for increased use of surface roads by pedestrians and cyclists and for public transport
- Reduce through traffic on sections of major arterial roads including City West Link, Parramatta Road, Victoria Road, King Street, King Georges Road and Sydenham Road, facilitating urban renewal opportunities to be realised along parts of the Parramatta Road and Victoria Road corridors
- Improve network productivity on the metropolitan network, with more trips forecast to be made or longer distances travelled on the network in a shorter time. The forecast increase in vehicle kilometres travelled (VKT) and reduction in vehicle hours travelled (VHT) is mainly due to traffic using the new motorway, with reductions in daily VKT and VHT also forecast on non-motorway roads
- Reduce travel times on key corridors, such as between the M4 Motorway corridor and the Sydney Airport/Port Botany precinct and between the main centres on the Global Economic Corridor, including Sydney CBD, Sydney Olympic Park, Parramatta CBD and Norwest Business Park

- Deliver up to 10 hectares of new open space at the Rozelle interchange which would provide an open space link between Bicentennial Park at Glebe and Easton Park at Rozelle
- Deliver new north–south and east–west pedestrian and cycleway connections to link Rozelle and Lilyfield with Annandale, Balmain, Glebe and The Bays Precinct
- Facilitate future growth in Sydney's transport network by allowing for connections to the proposed future Western Harbour Tunnel and Beaches Link and Sydney Gateway projects.

Further benefits to road network performance, traffic conditions and ATN links, are discussed further in **Chapter 8** (Traffic and transport) while social and economic benefits associated with the project are discussed further in **Chapter 14** (Social and economic).

4 Project development and alternatives

This chapter describes the alternatives to the M4-M5 Link project (the project), as well as the options that were considered as part of the design development process. It explains how and why the project design was selected as the preferred option for assessment in this environmental impact statement (EIS). Design options and refinements for particular elements of the project are also addressed, noting that the project described and assessed in this EIS is based on a concept design that is subject to further refinement during detailed detail and construction planning, as described in **Chapter 1** (Introduction). This chapter aims to:

- Provide a brief history of the development of the WestConnex program of works and the project
- Describe the strategic alternatives to achieve the project objectives that were considered
- Summarise the project evolution and design refinements for the key components of the project
- Outline the approach to the staging of the project including for construction of the mainline tunnels and Rozelle interchange, and within the overall WestConnex program of works
- Describe the options development process for permanent and temporary infrastructure, facilities and processes
- Summarise the preferred option assessed in this EIS.

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued environmental assessment requirements for the project. These are referred to as the Secretary's Environmental Assessment Requirements (SEARs). **Table 4-1** sets out these requirements and the associated desired performance outcomes as they relate to the consideration of project options and alternatives, and identifies where they have been addressed in this EIS.

Table 4-1 SEARs – project development and alternatives

Desired performance outcome	SEARs	Where addressed in the EIS
2. Environmental Impact Statement The project is described in sufficient detail to enable clear understanding that the project has been developed through an iterative process of impact identification and assessment and project refinement to avoid, minimise or offset impacts so that the project, on balance, has the least adverse environmental, social and economic impact, including its cumulative impacts.	1. The EIS must include, but not necessarily be limited to, the following:	
	(e) an analysis of any feasible alternatives to the project[1]	Strategic alternatives that were considered are discussed in **section 4.4**.
	(f) a description of feasible options within the project[2], including: – alternative methods considered for the construction of the project, including the tunnels; and – staging of the proposal and the broader WestConnex scheme	Project alternatives and options considered for the construction of the project are described in **section 4.4** and **section 4.6**. Staging of WestConnex component projects and staging of the project construction, including the mainline tunnel and Rozelle interchange, is described in **section 4.3**.
	(g) a description of how alternatives to and options within the project were analysed to inform the selection of the preferred alternative/option. The description must contain sufficient detail to enable an understanding of why the preferred alternative to, and options(s) within, the project were selected, including:	Project alternatives and options are discussed in **section 4.4** and **section 4.6**. Details of the mainline tunnel alignment and design considerations are discussed in **section**

Desired performance outcome	SEARs	Where addressed in the EIS
	– details of the short-listed route and tunnel options considered, and the criteria that was considered in the selection of the preferred route and tunnel design – the alternative tunnel design and ventilation options considered to meet the air quality criteria for the proposal – need for construction facilities and sites – a justification for the preferred proposal taking into consideration the objects of the *Environmental Planning and Assessment Act 1979* (EP&A Act)	**4.5.2**. Ventilation facility options are discussed in **section 4.6.1** and in **Chapter 9** (Air quality). Justification for the project with consideration of the objects of the NSW EP&A Act is provided in **Chapter 30** (Project justification and conclusion).
	(i) a demonstration of how the project design has been developed to avoid or minimise likely adverse impacts;	Details about the project evolution and design refinement process that has been used to avoid or minimise likely adverse impacts are included in **section 4.5** and **section 4.6**.

Notes:

1 Alternatives to a project are different projects which would achieve the same project objective(s) including the consequences of not carrying out the project.

2 Options within the project are variations of the same project.

4.1 History of WestConnex, the M4-M5 Link and related projects

WestConnex is part of the NSW Government's long-term, integrated transport and land use planning solution. The WestConnex program of works has been developed to provide an integrated transport network solution, recognising that the constraints on the current M4 Motorway and the M5 East Motorway cannot be resolved in isolation from each other.

The holistic solution builds on previous preliminary proposals for upgrade and/or expansion works along the M4 and M5 East motorways, as well as the former Marrickville Tunnel concept, and incorporates feedback from the community and stakeholders as part of the historic development of these schemes. **Figure 4-1** shows the development of the WestConnex program of works, including the M4-M5 Link, the subject of this EIS.

4.1.1 The M4 Motorway

The M4 Motorway is a 40 kilometre urban motorway which extends from Concord in Sydney's inner west to Lapstone, at the foothills of the Blue Mountains. Construction of the existing M4 Motorway occurred in several stages between the late 1960s and the mid-1980s. The original motorway was opened to traffic in 1971. An additional section, between Concord and Parramatta opened in 1992. Since then, various schemes and multiple options have been explored, developed and built to complement the M4 Motorway.

Between 2003 and 2004 a preferred option for an eastern extension of the M4 Motorway to the Sydney central business district (CBD) was developed and publicly exhibited. This option, referred to as the M4 East, proposed extending the M4 Motorway to City West Link and Parramatta Road at Ashfield as well as widening the existing motorway between Homebush Bay Drive and Concord Road. At the time, the NSW Government determined not to proceed with the M4 East scheme as publicly exhibited.

Design work resumed in 2003 to further develop and improve the M4 East scheme. This design work culminated in the concept design for the M4 East project, which together with the M4 Widening project, comprises the already approved Stage 1 of WestConnex. The M4 East project will extend the M4 Motorway, through twin underground tunnels, from Homebush Bay Drive at Homebush to Parramatta Road and City West Link (Wattle Street) at Ashfield and Haberfield. Planning approval for the M4 East project was granted by the NSW Minister for Planning on 11 February 2016 and construction of the project is underway and is scheduled to be complete in 2019.

Stage 1 of WestConnex also involves widening the M4 Motorway to up to four lanes in each direction between Pitt Street at Parramatta and Homebush Bay Drive at Homebush. Planning approval for the M4 Widening project was granted by the NSW Minister for Planning on 21 December 2014 and construction commenced in March 2015. The M4 Widening project is now open to traffic.

4.1.2 The M5 Motorway

The current M5 East Motorway was proposed in the mid-1990s to provide a motorway connection between Fairford Road at Padstow and General Holmes Drive at Mascot. The purpose of the M5 East Motorway was to improve the east−west road transportation route between south−west Sydney and the Sydney CBD, Port Botany and Sydney Airport. The M5 East Motorway received planning approval from the (then) NSW Minister for Urban Affairs and Planning in 1997 and opened to traffic in 2001.

Since its opening, the M5 East Motorway has reached its capacity and currently experiences significant levels of congestion Continued congestion on the M5 East Motorway is recognised as impeding access to and from the Sydney CBD, Port Botany and Sydney Airport, resulting in significant congestion and delays. Options to alleviate congestion and improve amenity along the M5 East Motorway and surrounding road network were considered in the M5 Transport Corridor Feasibility Study (NSW Roads and Traffic Authority 2009). The study identified a preliminary preferred option, being the M5 East Duplication scheme. This scheme broadly involved duplication of the existing M5 East motorway tunnels with connection to the east of Sydney Airport.

In response to feedback received from key stakeholders and the community on the M5 East Duplication scheme, its design has been further developed and improved. This further design development has been used to inform the motorway options development for Stage 2 of WestConnex, which includes the already approved New M5 project, to the west of Sydney Airport, and the King Georges Road Interchange Upgrade project.

The New M5 project includes twin underground motorway tunnels between the existing M5 East Motorway east of King Georges Road and a new interchange at St Peters. Planning approval for the New M5 project was granted by the NSW Minister for Planning on 20 April 2016. The New M5 project was also subject to Commonwealth approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act), which was obtained on 11 July 2016. Construction of the New M5 project is currently underway and is scheduled to be completed in 2020.

Stage 2 of WestConnex also includes the widening of King Georges Road at Beverly Hills, which comprises improvements to all on-ramps and off-ramps at the interchange of the M5 Motorway with King Georges Road and an additional motorway lane in each direction. Planning approval for the King Georges Road Interchange Upgrade project was granted by the NSW Minister for Planning on 3 March 2015. Construction commenced in July 2015 and the road was opened to traffic in December 2016.

4.1.3 Link between the M4 Motorway and M5 Motorway

Consideration of a motorway link between the M4 Motorway and southern Sydney began in around 2004 with the Marrickville Tunnel scheme. The Marrickville Tunnel was intended to create a direct connection between the M4 East Motorway and Mascot, to provide a direct route for traffic between Port Botany, Sydney Airport and western Sydney. One option considered for this scheme was a truck only tunnel, recognising that the main function of this link would be to enhance freight access between Port Botany, Sydney Airport and north-western Sydney. This scheme was not progressed and was never released for public comment. The Enfield Intermodal Terminal was instead developed to increase the volume of freight carried by rail to and from Port Botany (see **section 4.4.2**), with distribution by road from Enfield using existing arterial roads and the M4 Motorway. Even so, the continual requirement for road freight meant that an alternative solution was still required to resolve congestion on the arterial road network. Further development of the connection between the M4 and M5 motorways is described in **section 4.2**.

The concept of a connection between the M4 Motorway and the M5 East Motorway has progressed as the WestConnex M4-M5 Link, the subject of this EIS (refer to **Chapter 5** (Project description) for a detailed description of the project). The M4-M5 Link would complete the orbital road network between western Sydney and the eastern gateways of Port Botany and Sydney Airport.

4.1.4 Sydney Gateway

The proposed future Sydney Gateway project comprises a new road link between the St Peters interchange (which is being delivered as part of the New M5 project) and Sydney Airport, with connections towards Port Botany.

The *WestConnex Strategic Business Case Executive Summary* (Sydney Motorways Project Office 2013) identified the initial concept of a link to Sydney's international gateways and called this 'Airport Link'. The *WestConnex Updated Strategic Business Case* (Sydney Motorway Corporation 2015a) defined Sydney Gateway as including the duplication of the Port Botany Rail Line to support the Moorebank and Enfield Intermodal Terminal projects.

Given the Sydney Gateway road and Port Botany rail duplication corridors are located next to each other, these two projects have been integrated into a single initiative. The proposed future Sydney Gateway project would assist in addressing the high volumes of heavy vehicle traffic generated by the Sydney Airport and Port Botany precincts.

Options consideration and design development is continuing on the proposed future Sydney Gateway. Once a preferred option and a concept design are identified, the Sydney Gateway project will be subject to a separate environmental assessment and planning approval. For the purposes of this EIS, the Sydney Gateway project is assumed to be completed and open to traffic in 2023. Potential cumulative construction and operational impacts of the Sydney Gateway project and the M4-M5 Link project are discussed in relevant technical working papers and summarised in **Chapter 26** (Cumulative impacts).

Project development process

WestConnex

2012	WestConnex identified in the State Infrastructure Strategy 2012-2032
2013	September: WestConnex Business Case developed September: State significant infrastructure application lodged for the M4 Widening project November: State significant infrastructure application lodged for the M4 East project
2014	May: State significant infrastructure application lodged for the King Georges Road Interchange Upgrade project November: State significant infrastructure application lodged for the New M5 project November: Northern and southern extensions to WestConnex (including connections to Victoria Road and Anzac Bridge) are identified in the Updated State Infrastructure Strategy December: Planning approval granted for the M4 Widening project
2015	March: M4 Widening project construction starts March: Planning approval granted for the King Georges Road Interchange Upgrade project July: King Georges Road Interchange Upgrade project construction starts November: Proposal for the M4-M5 Link included in the WestConnex Updated Strategic Business Case
2016	January: State significant infrastructure application lodged for the M4-M5 Link project February: Planning approval granted for the M4 East project March: M4 East project construction starts April: Planning approval granted for the New M5 project July: New M5 project approved by the Australian Government Department of the Environment July: New M5 project construction starts September: Iron Cove Link included in the M4-M5 Link State significant infrastructure application report Addendum 1 December: The King Georges Road Interchange Upgrade project opens to traffic
2017	March: Removal of the Camperdown interchange and inclusion of ramps and construction ancillary facilities for the proposed future Western Harbour Tunnel project are included in the M4-M5 Link State significant infrastructure application report Addendum 2 July: M4 Widening project opens to traffic

Figure 4-1 Development of the WestConnex program of works

4.2 Development of M4-M5 Link concept

In the context of the WestConnex program of works, the M4-M5 Link project concept was first described in the NSW *State Infrastructure Strategy 2012-2023* (Infrastructure NSW 2012). This was further developed in the *WestConnex Business Case Executive Summary* (Sydney Motorways Project Office 2013) and updated in the *WestConnex Updated Strategic Business Case* (Sydney Motorway Corporation 2015a).

4.2.1 State Infrastructure Strategy

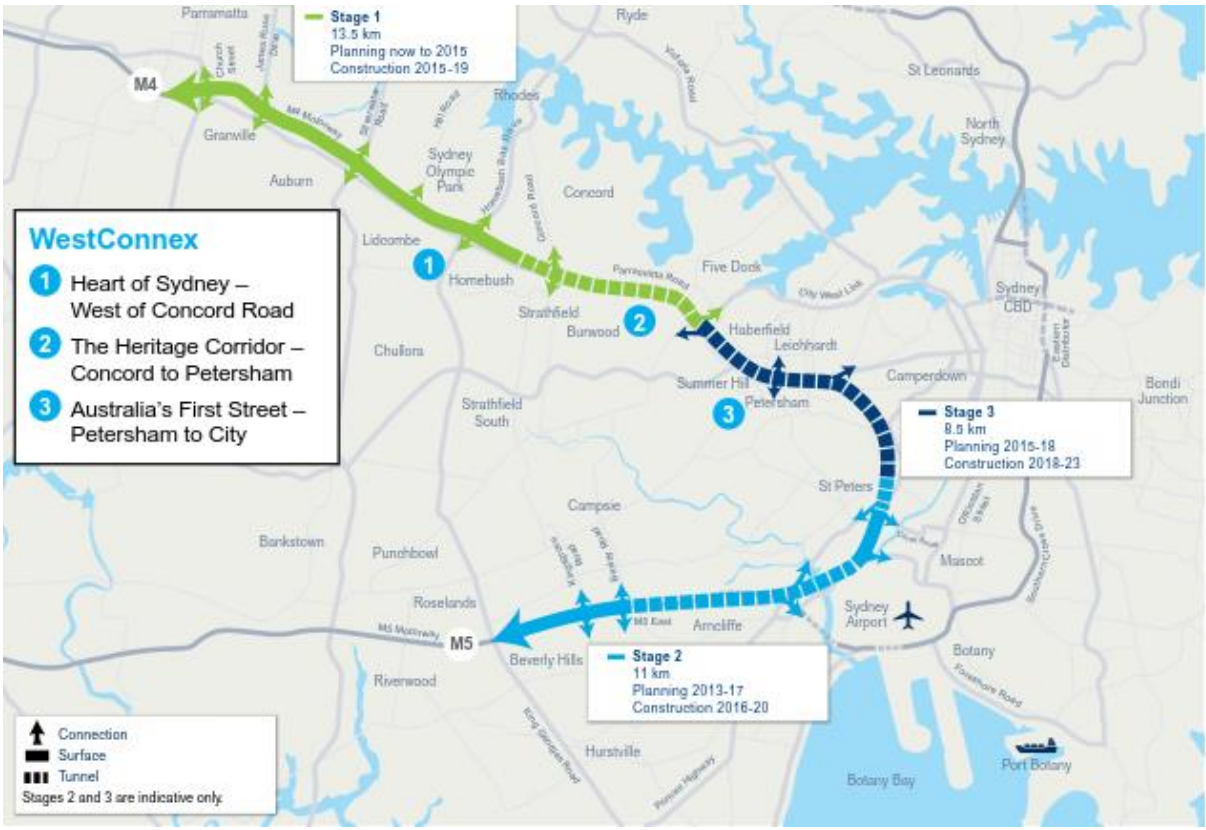
The project was included as part of the WestConnex reference scheme described in the *State Infrastructure Strategy 2012-2032* and in *WestConnex – Sydney's next motorway priority* (Infrastructure NSW 2012). The reference scheme showed an early indicative alignment for WestConnex, aligned with the strategic transport objectives at that time. The scheme included a tunnel connection from around Taverners Hill to the St Peters area via Camperdown and roughly followed the alignment of Parramatta Road before turning south to St Peters. This design provided connections to the southern part of the Sydney CBD via Camperdown. The reference scheme is shown in **Figure 4-2.**

Source: Infrastructure NSW 2012

Figure 4-2 WestConnex reference scheme from the State Infrastructure Strategy 2012-2032

4.2.2 2013 WestConnex Business Case

In September 2013, the *WestConnex Business Case Executive Summary* was released. The alignment of the project presented in this business case summary did not differ significantly from the reference scheme alignment in the *State Infrastructure Strategy 2012-2032* (see **Figure 4-3**), although the business case did include the project as a distinct component of WestConnex. The project was described as a new 8.5 kilometre twin tunnel with three lanes in each direction, following the Parramatta Road corridor and connecting Haberfield and St Peters via Camperdown.



Source: Sydney Motorways Project Office 2013

Figure 4-3 WestConnex overview 2013

4.2.3 State Infrastructure Strategy Update 2014

In March 2014, the NSW Government approved funding to commence studies for initial business cases into a number of missing links on the motorway network beyond WestConnex, including a potential connection along the historically planned F6 corridor and the proposed future Western Harbour Tunnel and Beaches Link (which comprises a new tunnel crossing of Sydney Harbour and a motorway link to Sydney's northern beaches). During initial investigations it became evident that there was an opportunity to design the WestConnex program of works to support the connectivity to these future motorways. This southern extension motorway corridor was subsequently named SouthLink and is now referred to as the proposed future F6 Extension (see **Figure 4-4**). The F6 Extension would connect to the New M5 project at Arncliffe. These extensions were described in the *State Infrastructure Strategy Update 2014* (Infrastructure NSW 2014).

The northern extension would enable:

- A connection to the Sydney CBD via Anzac Bridge, as well as to Victoria Road
- A connection to the proposed future Western Harbour Tunnel and Beaches Link, which together with the M4-M5 Link, would create a western bypass of the Sydney CBD
- Connectivity to The Bays Precinct
- Reduction in surface traffic along Parramatta Road.

In late 2014 the constructability, economic and financial feasibility and traffic impacts of the northern and southern extensions were investigated and a preliminary design put forward for the M4-M5 Link to the NSW Government. The preliminary design work for the project confirmed the viability of the northern extension (ie connections to Victoria Road, Anzac Bridge and the proposed future Western Harbour Tunnel and Beaches Link) and recommended that this future extension be considered in the alignment of the project. The mainline tunnel alignment was amended to divert from the previous Parramatta Road alignment, to instead follow a City West Link alignment to Rozelle (to connect with

Anzac Bridge) before turning south to Camperdown and continuing to St Peters. The alignment through Rozelle was amended to facilitate the connection to a future harbour crossing to the northeast (the proposed future Western Harbour Tunnel and Beaches Link project).

The revised tunnel alignment for the project also required changes to the connection with the M4 East project at Haberfield. These changes relate to the configuration of the entry and exit ramps at the Wattle Street interchange, which is where the project mainline tunnels connect with the M4 East tunnels.

The *State Infrastructure Strategy Update 2014* identified that a completed WestConnex program of works, together with the proposed future Western Harbour Tunnel and Beaches Link project, would provide a western bypass of the Sydney CBD, alleviating pressure on existing north−south corridors including Southern Cross Drive, the A1 (Princes Highway) and A3 (Centenary Drive/Roberts Road/King Georges Road) and the Sydney orbital network, as well as reducing traffic volumes on the Sydney Harbour Bridge and Sydney Harbour Tunnel. These changes would reduce journey times between Sydney's northern and southern suburbs.

Strategic and financial analysis of the new alignment for the M4-M5 Link recommended proceeding with the amended project design. Based on this advice, the NSW Government accepted the change to the mainline tunnel alignment in October 2014.

4.2.4 WestConnex Updated Strategic Business Case 2015

In November 2015, the *WestConnex Updated Strategic Business Case* was released, which consolidated the work undertaken in the 2013 business case with additional modelling, analysis and scope development. The *WestConnex Updated Strategic Business Case* described the development of a modified alignment for the M4-M5 Link with connections at Rozelle and Camperdown. The modified alignment would allow for the inclusion of a northern extension, allowing connections to the proposed future Western Harbour Tunnel and Beaches Link (see **Figure 4-4**).

Source: Sydney Motorway Corporation 2015a

Figure 4-4 WestConnex overview 2015

As part of the development of the *WestConnex Updated Strategic Business Case* a number of options which would facilitate the northern extension, while still delivering the objectives of WestConnex, were identified and evaluated. This strategic analysis evaluated the options based on expected traffic outcomes on Parramatta Road, the broader road network (including the impact on Anzac Bridge), and the impact on the M4-M5 Link itself.

The evaluation identified two designs, with particular sets of network connectivity, for further analysis:

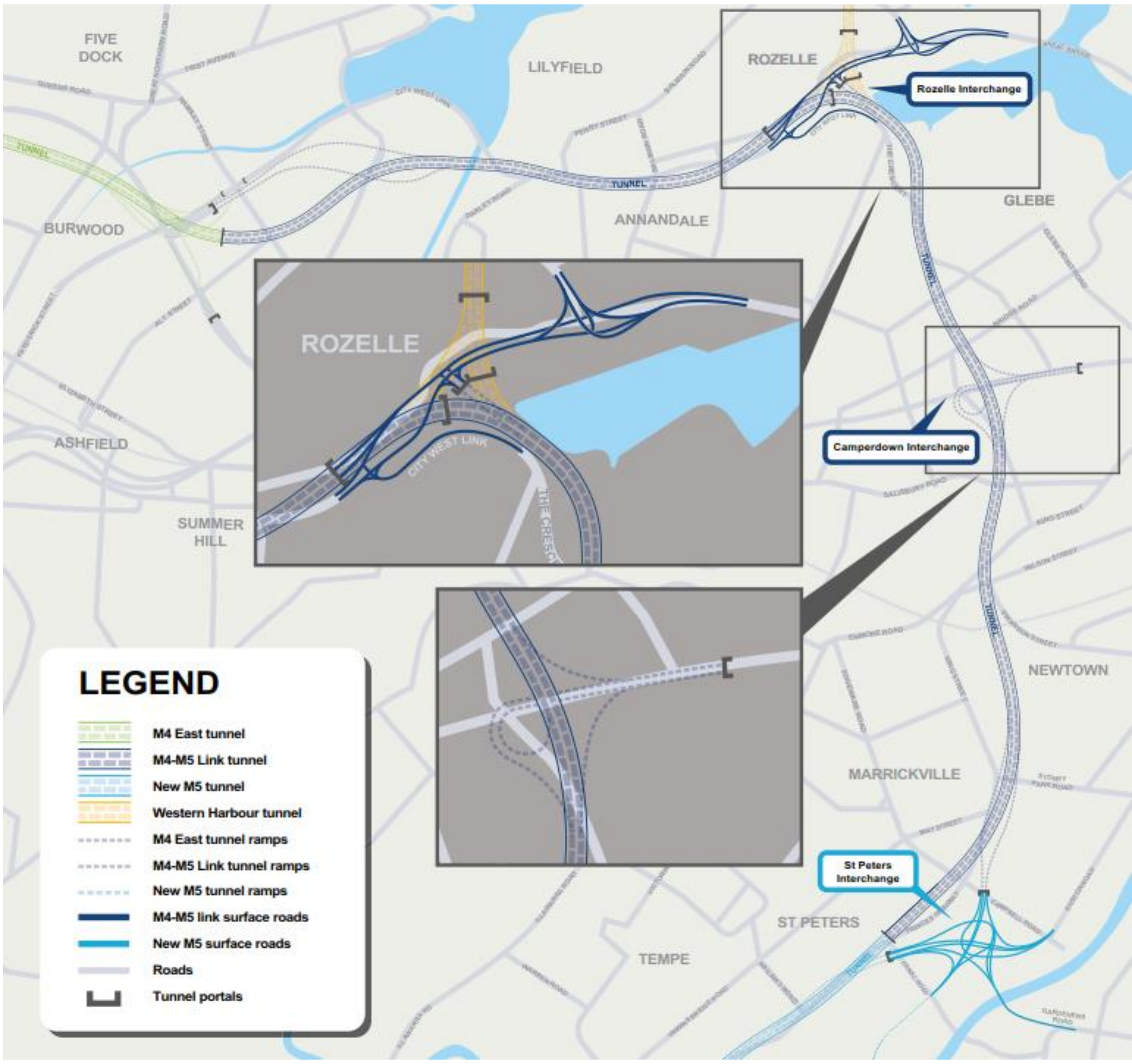
- The WestConnex reference scheme (as identified in the State Infrastructure Strategy 2012-2032), with the M4-M5 Link following the Parramatta Road corridor, and the addition of the northern and southern extensions (see **Figure 4-2**)
- An updated design with the addition of a northern and southern extension (see **Figure 4-4**).

These options for the WestConnex program of works were costed and a preliminary economic and financial evaluation was undertaken, with the original WestConnex reference scheme from the 2013 business case acting as the 'base case' for this analysis.

The analysis recommended proceeding with the updated design, which includes the northern and southern connections. This option would yield the following benefits over the project reference scheme:

- Be more cost effective, as it is a stronger economic case than delivering a northern extension (ie the proposed future Western Harbour Tunnel and Beaches Link) as a separate project to the M4-M5 Link, because the northern extension could be reduced in length if connecting to City West Link instead of to Parramatta Road further to the south
- Accommodate connectivity to the proposed future Western Harbour Tunnel and Beaches Link project without additional infrastructure investment
- Provide similar reductions in surface traffic flows by comparison to the WestConnex alignment that followed the Parramatta Road corridor.

The indicative alignment for the project in the *WestConnex Updated Strategic Business Case*, including proposed interchanges at Rozelle, Camperdown and St Peters, is shown in **Figure 4-5**.



Source: Sydney Motorway Corporation 2015a

Figure 4-5 Indicative preliminary mainline tunnel alignment and interchange locations

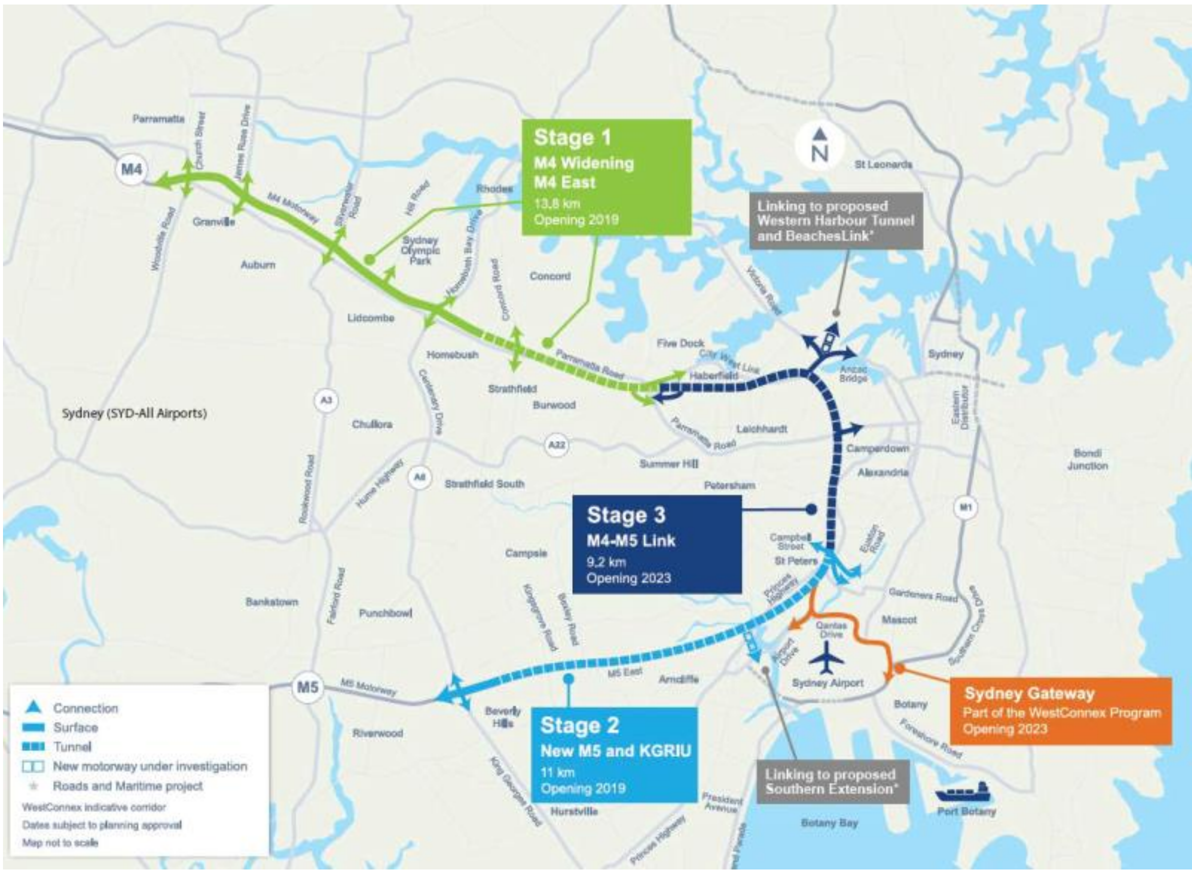
The project has evolved from the initial concept presented in the 2015 *WestConnex Updated Strategic Business Case* (see **section 4.2**), which informed the January 2016 State significant infrastructure application report (SSIAR) (NSW Roads and Maritime Services (Roads and Maritime) 2016) for the project (see **Figure 4-6**). Key design amendments to the project were described in two addenda to the SSIAR, which were subsequently published on the NSW Major Projects website:

http://majorprojects.planning.nsw.gov.au/

These addenda sought to capture the evolution of the project design, which is summarised below and broadly illustrated in **Figure 4-7** and **Figure 4-8**:

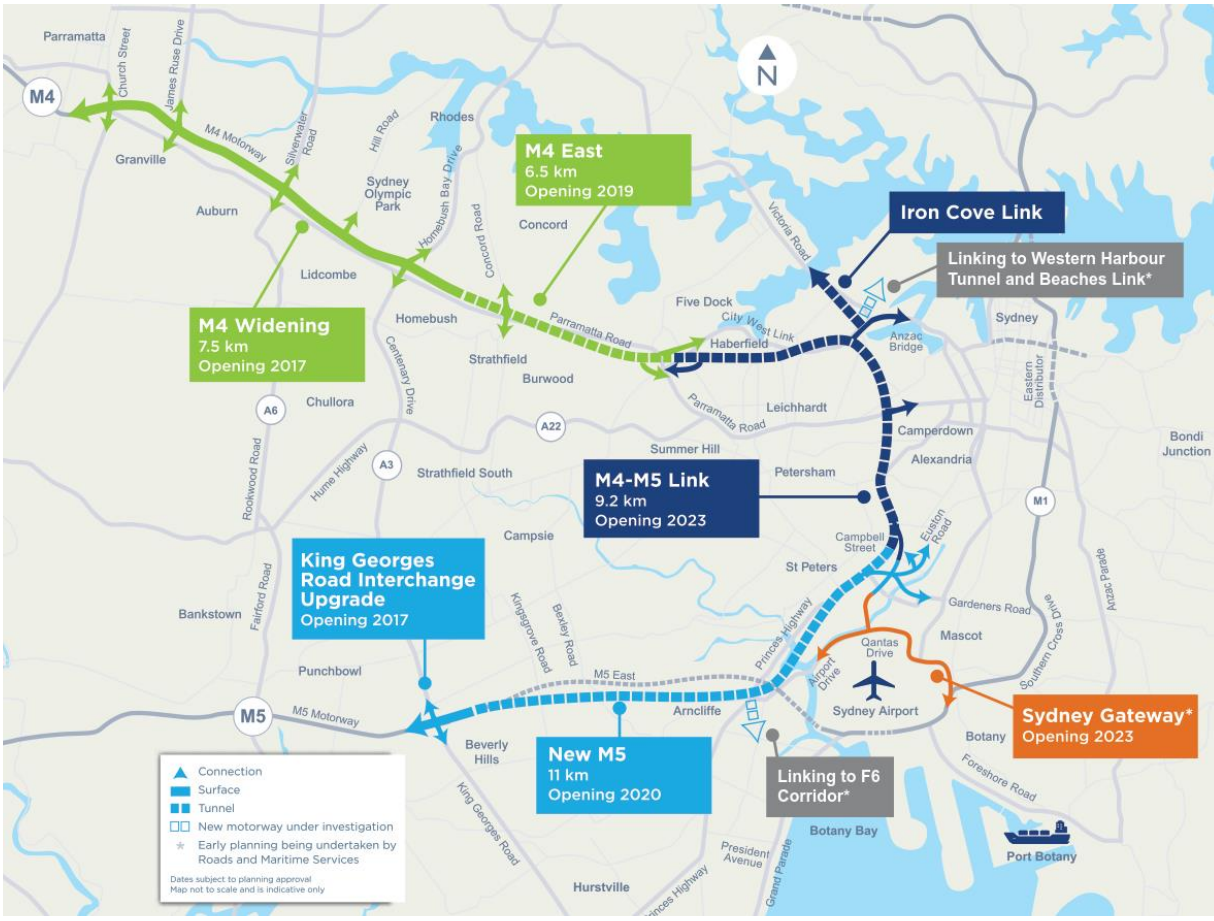
- **Addendum 1** – inclusion of the Iron Cove Link and removal of site management works at the Rozelle Rail Yards from the project scope
- **Addendum 2** – removal of Easton Park from the project footprint, removal of the Camperdown interchange, realignment of the mainline tunnel and increase in the number of traffic lanes, change to the location of the Rozelle interchange, and inclusion of infrastructure for the proposed future Western Harbour Tunnel.

The rationale for these changes to the project design and the various options that were considered are described further in **section 4.5.1** to **section 4.5.3**.



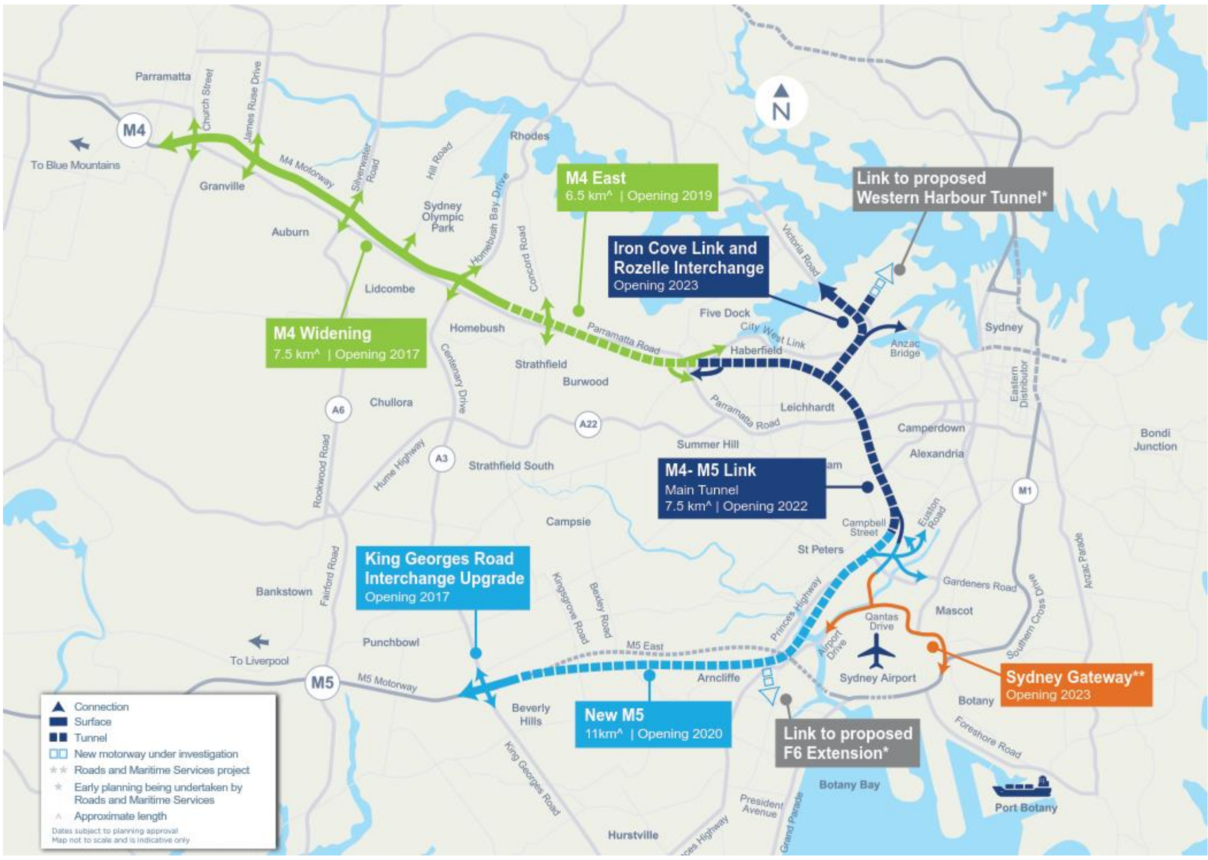
Source: Roads and Maritime 2016a

Figure 4-6 SSIAR, January 2016 – regional project context



Source: Roads and Maritime 2016b

Figure 4-7 SSIAR Addendum 1, September 2016 – regional project context



Source: Roads and Maritime 2017

Figure 4-8 SSIAR Addendum 2, March 2017 – regional project context

4.3 Staging

4.3.1 Staging of the WestConnex program of works

The staging strategy for the WestConnex program of works was outlined in the *WestConnex Updated Strategic Business Case.* An update of the timing for the various component projects is illustrated in **Figure 4-9**. Factors considered in the staging of the WestConnex component projects included:

- Transport benefits and traffic management
- Timing of pre-construction activities
- Government funding requirement
- Infrastructure market capacity.

Once work is completed for the approved WestConnex component projects (M4 Widening, M4 East, King Georges Road Interchange Upgrade and New M5), the remaining WestConnex component project to be completed would be the M4-M5 Link. The M4-M5 Link would provide the critical motorway link between the M4 East Motorway and the New M5 Motorway and would allow many of the benefits of the full WestConnex program of works to be realised. The M4-M5 Link would also provide a strategic connection to the proposed future Western Harbour Tunnel and Beaches Link project which together with WestConnex, would create a western bypass of the Sydney CBD.

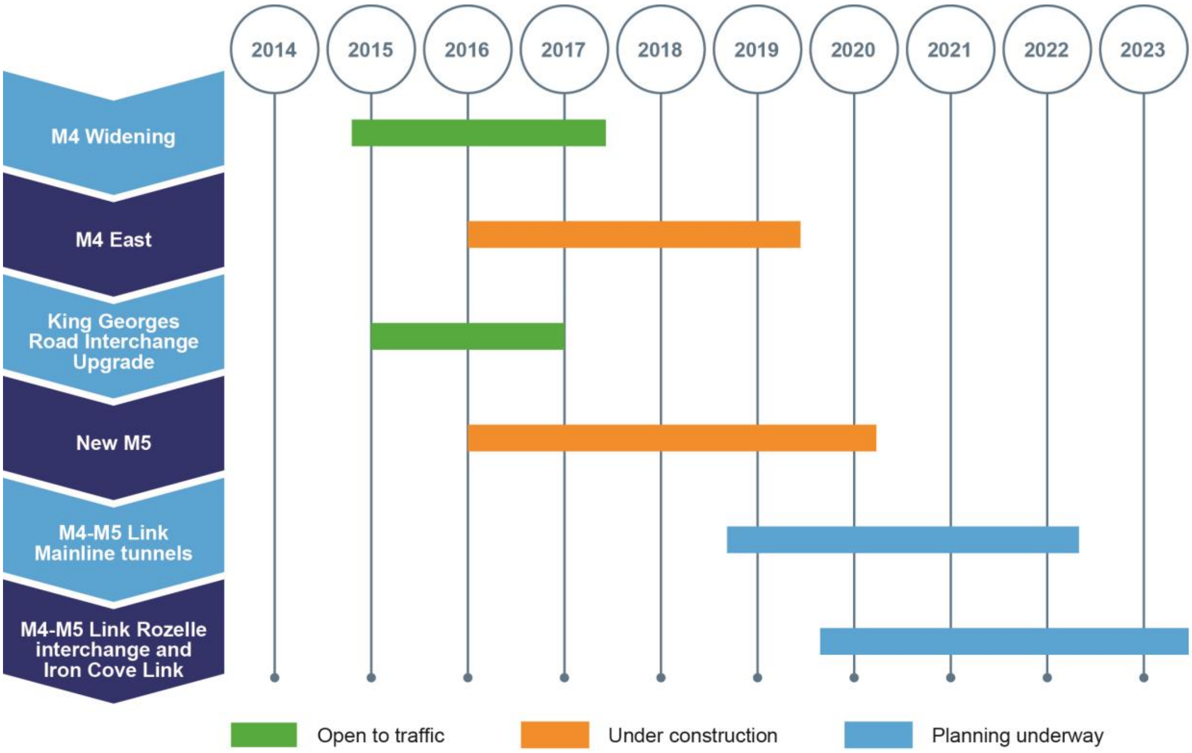


Figure 4-9 WestConnex delivery schedule

4.3.2 Staging of the M4-M5 Link

As the project design has evolved, so has the construction strategy and the proposed delivery mechanism for the project. Various options were considered for the packaging of the project works including packaging the works by major infrastructure components or by geographical location. Criteria that were considered included:

- Timing and critical path items
- Cost and affordability
- Risk allocation and transfer
- Market competition.

Following consideration of options for the construction and delivery of the project, it is anticipated that the project would be constructed in two stages:

- **Stage 1** – construction of the mainline tunnels and stub tunnels to the Rozelle interchange at the Inner West subsurface interchange
- **Stage 2** – construction of the Rozelle interchange and Iron Cove Link including:
  - Connections to the stub tunnels for the mainline tunnels (built during Stage 1)
  - Connections to the surface road network
  - Civil construction of tunnels, entry and exit ramps and infrastructure (a ventilation outlet and ancillary facilities) to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project.

The rationale for this approach was based on the following considerations:

- Easing current congestion issues along Parramatta Road and providing connectivity with the other WestConnex tunnels early
- Allowing more time to resolve the complex design and construction issues associated with the Rozelle interchange
- Making the scope of the project more manageable for delivery by dividing the works into two construction contracts.

It is expected that the mainline tunnels would be constructed and operational in 2022, with the Rozelle interchange and Iron Cove Link completing construction and commencing operations in 2023. Further details on the timing of staging and the description of works to be undertaken in each stage are provided in **Chapter 6** (Construction work). An assessment of the traffic and transport impacts associated with the staged opening of the project is provided in **Chapter 8** (Traffic and transport).

4.4 Strategic alternatives

The merits of the M4-M5 Link were considered in the context of a range of other alternatives, based on the extent to which they could meet the project objectives (refer to **Chapter 3** (Strategic context and project need)) and how well they performed with reference to other transport, environmental, engineering, social and economic factors.

The following strategic alternatives were considered:

- **Alternative 1** – improvements to the existing arterial road network
- **Alternative 2** – investment in alternative transport modes
- **Alternative 3** – demand management
- **Alternative 4** – the ‘do nothing’/’do minimum’ case
- **Alternative 5** – development of the M4-M5 Link.

These alternatives are described in more detail in **section 4.1.1** to **section 4.4.5**.

4.4.1 Alternative 1 – Improvements to the existing arterial road network

An alternative to the project could include maximising the performance of existing infrastructure by undertaking improvements to the arterial road network. Improvements could include improving intersection performance, implementing traffic calming measures, or lane closures and clearways.

Key arterial road connections such as Parramatta Road, City West Link, Victoria Road, and the A3 (Centenary Drive/Roberts Road/King Georges Road) and M1 Motorway (Eastern Distributor/Southern Cross Drive/General Holmes Drive) corridors were, without the project, predicted in the initial traffic modelling to experience increased congestion and to operate near or above their capacities by 2033 during peak periods (refer to the ‘detailed traffic modelling results in **Appendix H** (Technical working paper: Traffic and transport)).

Ongoing improvements to the broader transport network are therefore planned or underway (such as Roads and Maritime's ‘Easing Sydney’s Congestion’ initiatives) including some new infrastructure and intersection improvements to improve capacity and cater for traffic growth. Examples of relevant pinch point projects include Parramatta Road and Great North Road at Five Dock and the Princes Highway and Railway Road at Sydenham. The effect of the implementation of these road improvements has been taken into consideration in the operational traffic modelling for the project. Refer to **Appendix H** (Technical working paper: Traffic and transport) for more information on the projects considered in the modelling.

There are currently no existing arterial roads that would directly link the M4 East Motorway at Haberfield with the New M5 Motorway at St Peters, both of which are currently under construction. In the absence of the project, motorists using these motorway tunnels wishing to travel north or south would be required to travel along local and sub-arterial roads or traverse the Sydney CBD to access existing key north–south corridors such as the M1 Motorway.

Examples of existing routes that would provide connectivity to the north and south (as an alternative to the project) could include Parramatta Road, City Road/Kings Street/Princes Highway, King Georges Road, M1 Motorway/Anzac Bridge/City West Link, Johnston Street/The Crescent, Edgeware Road, Shaw Street and Norton Street, as well as the local road network. The connectivity between the M4 East and the New M5 motorways provided by these routes is indirect and requires motorists to travel through many at-grade intersections and, in some cases, steep grades such as on parts of King Georges Road, or congestion and high pedestrian traffic such as in King Street Newtown, are not appropriate for freight vehicles.

Improvements to the arterial road network (such as improving intersection performance and implementing traffic calming measures, lane closures or clearways) would only provide incremental change in the efficiency of the road network, and would not support the additional capacity required for regional traffic growth, which is associated with the forecast increase in Sydney's population (from 4.3 to 5.9 million between 2011 and 2031 (NSW Government 2014) and subsequent increases in vehicle kilometres travelled.

Continued urban development along the Parramatta Road and Victoria Road corridors has resulted in limited capacity for widening and/or upgrades to these roads. Limited road reserves would mean that any future improvements to the surface road network would not be able to proceed without considerable challenges, including the acquisition of a large number of properties. Even if arterial road upgrades could be achieved at reasonable cost and impacts, the improvements are unlikely to match the capacity that would be provided by the project; hence the potential benefits to motorists would be limited in the longer term. As such, improvements to the arterial road network alone, other than minor improvements such as Easing Sydney's Congestion program, are not a feasible or long-term alternative to the project.

Without the project, passenger and commercial vehicles, trucks and buses travelling from Haberfield to the Sydney CBD would continue to use the already congested east−west arterial road network (ie Parramatta Road and City West Link). According to the *NSW Long Term Transport Master Plan* (Transport for NSW 2012a) (*Transport Master Plan)*, this is one of the most constrained strategic transport corridors in Sydney. Similarly, the north-south arterial road network between Drummoyne and the Sydney CBD via Victoria Road and Anzac Bridge is one of the most congested sections of the Sydney road network.

Improvements to the road network through these corridors as an alternative to the project would require significant upgrades (eg road widening or road closures) and the implementation of traffic controls (eg clearways) to accommodate projected traffic volumes. This would result in potentially significant community and environmental impacts through increased traffic flows within residential areas and potential property acquisition impacts associated with road upgrades. This would also make it difficult to achieve land use regeneration and urban renewal along parts of Parramatta Road or along Victoria Road (east of Iron Cove Bridge), or to upgrade public transport services along these corridors, as proposed by the NSW Government. Improvements to the existing arterial road network would not provide the connectivity to Sydney's international gateways at Sydney Airport and Port Botany through the St Peters interchange and the future proposed Sydney Gateway. Nor would these improvements enable connectivity to the future proposed Western Harbour Tunnel and Beaches Link and F6 Extension to provide an inner western bypass of the Sydney CBD.

Arterial road improvements alone would therefore not meet the project objectives. However, together with the project, these improvements, although limited, would provide more effective solutions to congested parts of the road network.

4.4.2 Alternative 2 – Investment in alternative transport modes

As discussed in **Chapter 3** (Strategic context and project need), WestConnex is identified as important and necessary road infrastructure in the *Transport Master Plan*, the *State Infrastructure Strategy 2012–2032* (Infrastructure NSW 2012), the *State Infrastructure Strategy Update* (Infrastructure NSW 2014) and *A Plan for Growing Sydney* (NSW Government 2014).

As part of a broader integrated transport solution, WestConnex supports a coordinated approach to the management of freight and passenger movements, and is complementary to all modes of transport including road, rail, bus, ferries, light rail, cycling and walking. There is, however, recognition that Sydney's freight, commercial and services tasks require distribution of goods and services across the Sydney basin, which relies on more diverse and dispersed point-to-point transport connections that can only be provided by the road network.

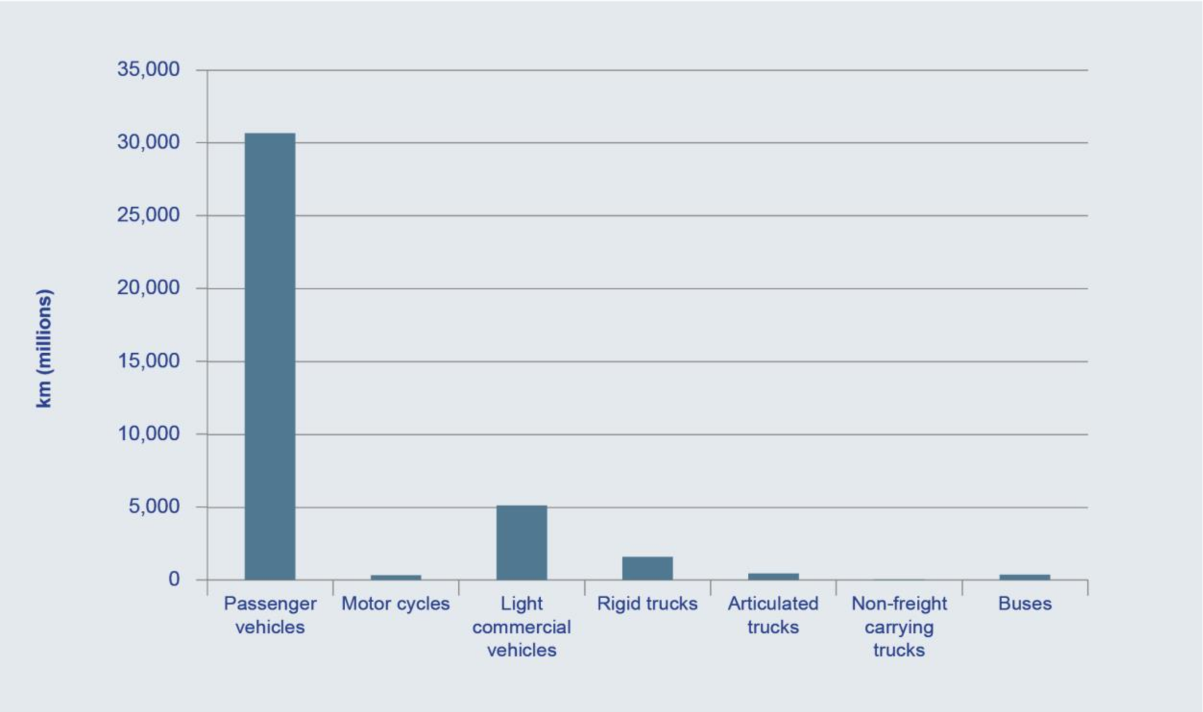
Alternative transport modes to the project, and their effectiveness in meeting the project objectives, are described in the following sections.

Public transport

The *State Infrastructure Strategy* states that, based on the economic and demographic forecasts, public transport is expected to experience strong growth, particularly around the Sydney CBD and other business centres. The Strategy also notes that the key challenges facing urban public transport relate to the following:

- The ability of the existing public transport network to serve a growing population while providing the mobility and connectivity necessary to sustain economic growth and productivity
- Improving access to the Sydney CBD
- Supporting growth in Sydney's emerging centres
- Optimising the performance of the existing public transport network
- Building future network capacity that keeps pace with demand and meets the needs of businesses and households.

Public transport in Sydney is predominantly via passenger trains (heavy rail) and buses and improvements to public transport in Sydney are focused on these two services. **Figure 4-10** illustrates the split in total motorised passenger kilometres (in billions of kilometres) travelled in Sydney in 2013.



Source: Bureau of Infrastructure, Transport and Regional Economics 2014

Figure 4-10 Total motorised passenger task for Sydney – 2013

Improvements to passenger rail services

Key existing rail services in and around the project footprint include the Western Line, Southwest Line, Airport Line and Inner West Light Rail line. The passenger rail system is often congested and demand for rail services is forecast to increase by 37 per cent over the next 20 years (Infrastructure NSW 2012). The *State Infrastructure Strategy Update* (Infrastructure NSW 2014) recognised that capital investment would be required to address projected overcrowding and maintain service reliability on key railway lines. To address these challenges, the NSW 2016-2017 budget includes more than $400 million to plan, develop and deliver enhancements to increase and improve rail services, including more express services to western Sydney. Key rail projects that have been announced, are under assessment or are underway are summarised in **Table 4-2**.

Table 4-2 Key rail projects that are under construction or have been announced

Name	Brief description	Project status	Capital cost
Sydney Metro Northwest	A 36 kilometre rapid transit railway line between Rouse Hill and Epping in Sydney's northwest including eight new metro stations and 4,000 commuter car parking spaces. Services are expected to commence in 2019.	Construction underway	$8.3 billion
Sydney Metro City and Southwest: • Stage 1 - Chatswood to Sydenham • Stage 2 - Sydenham to Bankstown	A 30 kilometre rapid transit railway line between Chatswood (from Sydney Metro Northwest) and Bankstown via the Sydney CBD including seven new metro stations, the upgrade of 11 existing stations and a new twin tunnel rail crossing under Sydney Harbour. Services are expected to commence in 2024.	Stage 1 - Approved in 2016 Stage 2 - Planning assessment underway	$11.5 to $12.5 billion
Sydney Metro West	A rapid transit, largely underground, railway line between the Sydney CBD and Parramatta servicing four key precincts: Parramatta, Sydney Olympic Park, The Bays Precinct and the Sydney CBD with up to 12 stations. Expected to be operational in the second half of the 2020s.	Early planning phase	Unknown
CBD and South East Light Rail	A 12 kilometre light rail line with 19 stops between Circular Quay and the south-eastern suburbs of Randwick and Kingsford via the Sydney CBD. Services are expected to commence in 2019.	Construction underway	$2.1 billion
Parramatta Light Rail	Stage 1 comprises a 12 kilometre light rail line with 16 stops (provisional) between Westmead and Carlingford via the Parramatta CBD. Services are expected to commence in 2023. Planning work for Stage 2 of the project from Camellia to Strathfield via Sydney Olympic Park is being developed in collaboration with Sydney Metro West.	Planning assessment underway	$3.51 billion
Western Sydney Rail Needs Scoping Study	A scoping study to better understand the need, timing and service options for rail investment to support western Sydney and the Western Sydney Airport.	Scoping study underway	N/A

Improvements to the Sydney bus network

Buses play a crucial role in Sydney's public transport system. They can be put into service more quickly, cheaply and to more places than any other type of public transport. Sydney's bus network currently includes more than 600 routes. For more than 90 per cent of residents within Sydney, local bus routes are within 400 metres of home and offer connections to neighbourhood shops and services, major centres and the wider public transport system (Transport for NSW 2013a).

In response to changing passenger needs and an increase in demand, additional services have been added to the bus network. However, without measures to improve journey times, the addition of more buses to the network can contribute to congestion, making bus services less effective at meeting customer needs. *Sydney's Bus Future* acknowledges that improvements to the bus network are essential to meet changing customer needs, including access to major centres outside the Sydney CBD. The *Transport Master Plan* aims to connect seamlessly to other transport modes to deliver the right mix of services.

Sydney's Bus Future (Transport for NSW 2013a) proposes to redesign the Sydney bus network to meet current and future demands by providing rapid service routes to connect major centres along transport routes with mass transit demand. Suburban and local service routes would build on the foundation of the rapid routes to improve access to local, neighbourhood destinations. *Sydney's Bus Future* specifically states that new bus connections would take advantage of WestConnex to improve access east-west along Parramatta Road and north-south across Parramatta Road to the inner west and south-eastern suburbs. These changes would provide better public transport for workers and airport users.

Key bus-related infrastructure opportunities relevant to the project include the potential for bus rapid transit along Victoria Road and the proposed Parramatta Road on-street rapid transit. Other improvements to the bus network along Parramatta Road, such as the introduction of bus 'superstops' and increasing the frequency of some buses were also announced in the *Parramatta Road Corridor Urban Transformation: Infrastructure Schedule* (UrbanGrowth NSW 2016). No information was available at the time of writing this EIS on the timing or scope of the potential Victoria Road bus rapid transit program. While bus rapid transit has been identified as a potential future development, this is only viable if traffic can be diverted from these corridors. The project therefore acts as a catalyst for these potential projects, reducing the surface traffic along these major bus corridors.

Public transport constraints

Public transport is critical to urban productivity, expanding labour market catchments, reducing congestion and increasing economic and social mobility (Infrastructure NSW 2014). Employment growth in the Sydney metropolitan area is expected to increase in keeping with a growing population. While Sydney has an extensive public transport network (with rail being the most popular mode used to access the Sydney CBD), the level of service can vary significantly. With demand for rail travel in particular forecast to grow faster than other modes, the NSW Government is implementing measures (including new projects) to address this demand, especially during peak periods.

A key constraint to the expansion and development of the rail network is Sydney's geography, with large parts of the Sydney metropolitan area, such as outer western Sydney and the Northern Beaches region, being relatively poorly connected by public transport to Sydney's global employment centres. As major rail projects have a long lead time, the focus in the shorter term is to improve public transport services through the bus network, such as bus priority programs and bus rapid transit.

While the use of public transport is expected to grow with the implementation of key public transport initiatives, most growth in transport demand over the next 20 years will continue to be met by roads.

Public transport is best suited to providing concentrated, high volume flows of people to and from established centres. It is less suited to providing dispersed cross-city or local trips. In 2014, around 17.6 million trips were made each average weekday in Sydney, with around 75 per cent of these by road. Even with significant investment and high levels of patronage growth forecast for Sydney's public transport network, about 72 per cent of around 27.5 million journeys in 2031 are expected to be made on the road network each weekday by private vehicles, equal to an additional 4.3 million new trips compared to 2014 (Infrastructure NSW 2014).

With about 60 per cent of employment dispersed across the Sydney metropolitan area, public transport alone cannot viably serve most of these locations. Even under the most ambitious scenarios for land use change and growth in public transport, the absolute number of car journeys will continue to increase (Sydney Motorway Corporation 2015a).

The key customer markets identified for the project include highly dispersed and long distance passenger movements, as well as heavy and light freight and commercial services and businesses whose travel patterns are also highly dispersed and diverse in nature. These customers have highly varied requirements when it comes to the transfer of goods and services. These requirements include the transport of containerised freight by rigid and articulated trucks, light trucks, vans, utility vehicles and cars.

As it is forecast that the demand for mobility by road travel will continue to grow, public transport initiatives would only partially contribute to relieving congestion on arterial roads. The provision of additional public transport services would create opportunities for improved liveability; however, these initiatives alone would not considerably enhance the productivity of commercial and freight generating land uses.

Public transport would only partially address these customer demands. No feasible strategic transport alternatives such as heavy or light rail options or bus corridor enhancements would meet the diverse range of customer needs for travel in this corridor and address the project objectives as effectively as the project and the broader WestConnex program of works. Public transport improvements alone are therefore not a viable alternative to meeting the project objectives. As discussed in **Chapter 3** (Strategic context and project need), investment in integrated transport solutions that involve both roads and public transport is needed to cater for the concentrated population growth forecasts and associated increase in travel movements.

Rail freight

The Sydney freight network facilitates the movement of freight in Sydney and provides a link to the NSW rural and interstate rail network and intermodal network. The two main components of the network are the Southern Sydney Freight Line (SSFL) and a line from Sefton to Enfield and Port Botany. The SSFL is a freight only corridor between Macarthur in Sydney's southwest and Port Botany. South of Macarthur, the line runs to Glenfield via Ingleburn. North of Glenfield, the line crosses to the east of the existing tracks via a flyover, with potential access to the Moorebank Intermodal Terminal. The line then continues to Sefton, passes under the Bankstown Line and joins the Metropolitan Goods Line, which provides access to the Intermodal Logistics Centre at Enfield, the Cooks River Rail Depot and Empty Container Park at St Peters and the Port Botany marshalling yards.

The current situation for freight movements into and out of Port Botany, and potential future scenarios for freight movements in NSW, was considered in assessing improvements to the freight rail network as a viable alternative to the project. The recorded throughput at Port Botany was over 2.3 million 20-foot equivalent units (TEUs) (one TEU is equivalent to the dimensions of a standard shipping container) in the 2015/2016 financial year (NSW Ports 2016). By 2020, the volume of TEUs at Port Botany is forecast to grow to between three and 3.6 million, reaching between 4.9 and seven million by 2030 (Sydney Motorway Corporation 2015a).

The *NSW Freight and Ports Strategy* (Transport for NSW 2013b) (*Freight Strategy*) states that about 63 per cent of NSW's freight in 2011 was transported by road and about 33 per cent by rail. When coal-related freight is removed, road-based freight movements account for nearly 90 per cent of the NSW freight task. The relative share of container freight that was moved by rail (relative to road transport) to and from Port Botany in 2012 was about 14 per cent. To support an increased role for rail based freight movements, the NSW Government and Australian Rail Track Corporation (ARTC) are currently investigating the duplication of the rail line between Port Botany and the Cooks River.

The volumes of all commodities demanding capacity on the freight network are expected to grow as population and economic activity increases across NSW. Port Botany and Sydney Airport are predicted to accommodate much of the rapid growth forecast for containerised cargo and air travel over the next 20 years (Infrastructure NSW 2014). The implications of this growth for the road and rail network are expected to be significant, with capacity across key parts of the network, particularly the Sydney metropolitan area, already under pressure to match demand.

Although opportunities exist to shift more freight from the road network onto the freight heavy rail network, the need to transport freight by road will continue. The *Freight Strategy* notes that dedicated freight rail corridors are being planned to ensure passenger and freight rail demand can be accommodated. However, rail freight transport is more effective for long distance transport of goods to regional centres while Sydney's freight, service and business task relies upon a dispersed point-to-point transport connection to customers within the metropolitan area. *NSW 2021: A Plan to Make NSW Number One* outlines a target set by the NSW Government to double the 2011 share of container freight moved by rail through NSW Ports by 2020 (NSW Department of Premier and Cabinet 2011). Assuming this target is achieved, more than 70 per cent of Port Botany's trade would still be moved by road, requiring investment in an efficient road network to support the Port Botany and Sydney Airport precincts (NSW Department of Premier and Cabinet 2011). One of the actions arising from the *Freight Strategy* includes 'connect and complete Sydney's motorway network'. This includes the widening of the M4 and M5 West motorways, connecting the M2 and M1 motorways and delivering the WestConnex program of works.

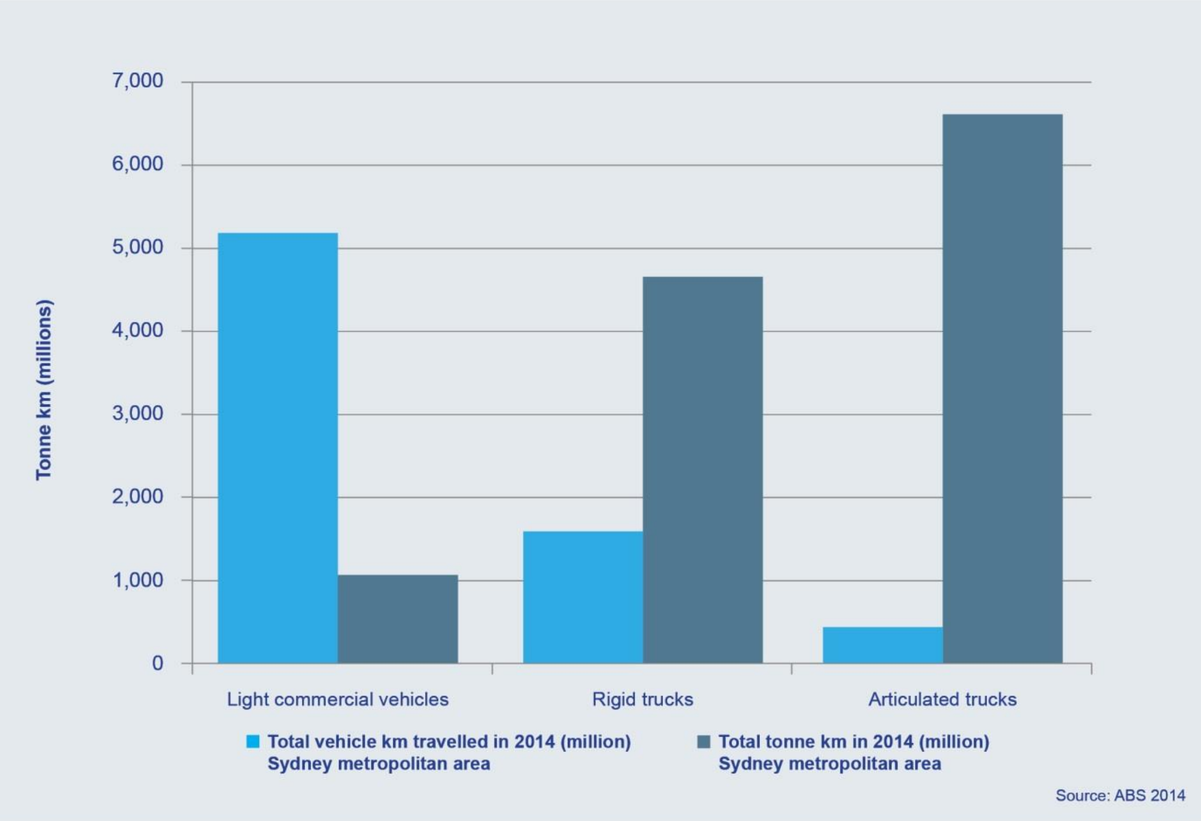
There is a need for the development of additional metropolitan intermodal terminals. Transport for NSW defines an intermodal terminal as 'an area of land used to transfer freight between at least two modes of transport'. It is typically used to describe the transfer of international shipping containers form road to rail and vice versa'. These terminals are critical to increasing rail mode share and managing the rapidly growing import container trade, as well as interstate freight. The primary function of metropolitan intermodal terminals is to facilitate the import container trade, and in this context, to serve as inland satellite ports (Transport for NSW 2013b). This would help to reduce congestion from the Sydney Airport and Port Botany precinct, which would help to increase efficiency on the road network and facilitate the improved transport of the remaining freight by road.

To cater for the growth in the container market, new intermodal terminals have recently been established at Chullora (2015), Enfield (2016) and Moorebank (to open late 2017). Strategic locations for potential future intermodal terminals and/or facilities include Eastern Creek and Western Sydney Airport to provide a connection to the Metropolitan Freight Network. However, even with new intermodal terminals, there remains a significant demand for road freight movements in the Sydney metropolitan area. Rail freight improvements alone are therefore not a viable alternative to meeting the project objectives.

Road freight

Freight rail transport predominantly forms the first leg of the freight journey for imported freight, with containerised freight broken down at distribution nodes and further distributed across Sydney. The management of the freight task from the port to distribution nodes requires a primary network for heavy commercial vehicles with high quality connections between major freight hubs. From the distribution nodes, light commercial vehicles are required, which depend on a multi-layered network with many connections to service more diverse and dispersed markets across Sydney.

This arrangement means that there are around four times as many light commercial vehicle (LCV) trips on Sydney's road network as heavy commercial vehicle (HCV) trips and this trend is forecast to continue. **Figure 4-11** shows freight-related LCVs in NSW travelled a greater distance in 2014 than rigid or articulated trucks (ie HCVs), although the amount of freight carried by LCVs was significantly lower. A key reason for this trend is that heavy freight activity precincts are concentrated in a few key locations near Port Botany and in western Sydney, and this land use pattern is set to continue.



Source: Australian Bureau of Statistics 2015

Figure 4-11 Kilometres travelled in 2014 (million) - Sydney metropolitan area

In NSW, nearly all air cargo (domestic and international) moves through the Sydney Airport. Freight access to and from the airport is exclusively via road, as consignment sizes and time sensitivity of the goods excludes the use of rail as a substitutable mode for providing access to and from the Sydney Airport precinct. Air cargo movements are forecast to grow steadily over the next 20 years to more than one million tonnes per annum. While air cargo only represents a small proportion of the freight task and movements to and from the Sydney Airport and Port Botany precinct, its value to the NSW economy is significant. Failure to address the increasing demand for air freight has the potential to increase industry costs and reduce the reliability and competitiveness of air freight (Transport for NSW 2013b). The WestConnex program of works seeks to help resolve some of these road freight issues by providing a connection between the Sydney Airport and Port Botany precinct (through the connection with the New M5 project) and areas to the north (through the connection with the proposed future Western Harbour Tunnel and Beaches Link project) and to the west of Sydney (through the connection with the M4 East project) that would improve the efficiency of road freight movements. The M4-M5 Link project would play a crucial role in connecting these ‘under construction’ and ‘proposed future’ projects.

Future freight capacity

The *Transport Master Plan* provides a framework to deliver an integrated, modern transport system by identifying NSW’s transport actions and investment priorities over the next 20 years. It identifies the key challenges that the NSW transport system must address to support the state’s economic and social performance, and identifies a planned and coordinated set of actions to address those challenges.

The *Transport Master Plan* notes that the domestic freight task across Australia is set to double by 2031 and triple by 2050, from about 504 billion tonne-kilometres in 2008 to more than 1,504 billion tonne-kilometres in 2050 (Transport for NSW 2012a). In NSW this rate of growth is supported by the *Freight Strategy,* which has identified that the freight task of around 409 million tonnes in 2011 will almost double to an estimated 794 million tonnes by 2031.

The *Freight Strategy* notes that the role of heavy vehicles in moving freight across NSW is substantial, and will continue to be so for the foreseeable future. Typically, bulk commodities such as coal and grain are moved by rail, while commodities transported in smaller quantities are moved by road. The mode share of freight varies significantly based on a range of factors, including: the type and tonnage of commodity being moved, the distance between the origin and destination, and access to other modes of transport.

As mentioned above, the NSW road network carried 63 per cent of the total freight task in 2011, or about 256 million tonnes of freight. Increases to freight are projected to impact the performance of all key NSW road freight corridors over the next 20 years, including the M5 Motorway corridor. By 2031, NSW roads are projected to remain the dominant mode for freight transport, but to carry less of the total freight task at 59 per cent (Transport for NSW 2013b). By 2031, the container trade at Port Botany is forecast by Sydney Ports Corporation to increase from the existing throughput of around two million TEUs to up to seven million TEUs. The target mode share for 2031 is to double the proportion of containers carried by rail in 2020 (NSW Department of Premier and Cabinet 2011).

The *Freight Strategy* acknowledges that even with the targeted increase in rail mode share, WestConnex alone would not be able to accommodate the additional container traffic when combined with background growth from employment and population by 2031, although as part of an integrated transport solution, it at least assists with this. With forecast congestion increasing along the M4 and M5 motorway corridors, accommodating 20 years of growth in container freight will require a package of solutions to meet the needs of road freight and other road users.

The *Freight Strategy* recognises that there are significant economic efficiency implications for NSW if major changes are not made to ports and related road and rail systems in the next 20 years. While dedicated freight rail lines are relatively well served by capacity development plans, there is limited available capacity on the shared rail network in metropolitan areas for freight traffic. One action of the *Transport Master Plan* is to implement rail freight infrastructure enhancements to increase the share of freight carried on the rail network. These enhancements would include new investment in rail pinch points, measures to improve rail competitiveness, and the development of a metropolitan intermodal terminal network.

A number of current and future freight-related projects are proposed to improve the efficiency of, and remove existing bottlenecks from, the existing freight rail network, including:

- **Proposed Port Botany rail duplication project** - about three kilometres of the Port Botany Freight Line between Mascot and the Port Botany Rail Yard to provide improved service reliability and increased capacity
- **The Southern Sydney Freight Line** (rail operations commenced in 2013) - a 36 kilometre length of freight rail track in the south-western suburbs of Sydney, between Macarthur and Sefton. At Sefton Junction, the line passes under the Bankstown Line and joins the Metropolitan Goods Line which provides access to the Enfield and Port Botany marshalling yards. This line would potentially tie in to the Moorebank intermodal terminal. It also links the interstate network between Sydney and Melbourne with the Metropolitan Freight Network and is managed by the Australian Rail Track Corporation (ARTC)
- Development of intermodal terminals:
  - **The Enfield intermodal logistics centre** - this logistics centre is being developed at Enfield as a key logistics hub in central-west Sydney, about 16 kilometres west of the Sydney CBD. The terminal commenced operations in March 2015. Although the intermodal terminal has assisted in mitigating the number of freight truck numbers on Sydney's road, additional rail freight capacity is needed
  - **Moorebank intermodal terminal** - the concept plan for this terminal, around 35 kilometres southwest of the Sydney CBD, was approved by the NSW Minister for Planning in December 2014. Planning approval for Stage 1 was granted in December 2016. The Moorebank intermodal terminal would involve the construction of freight terminal facilities linked to the interstate and freight rail network via a dedicated rail freight line. The project aims to increase Sydney's rail freight mode share by promoting the movement of container freight by rail between Port Botany and western and south-western Sydney. The Moorebank intermodal site is adjacent to the Southern Sydney Freight Line, the East Hills and Airport railway line and the

M5 East Motorway

  - Even with the Enfield and Moorebank intermodal terminals/logistics centres operating, which would increase freight rail capacity substantially, truck movements are still forecast to almost triple, reaching around 8,000 per day by 2031 (Sydney Motorway Corporation 2015a)

- **A proposed Western Sydney Freight Line and intermodal terminal** - a new dedicated freight line connecting the Main West Railway Line and the Southern Sydney Freight Line to a new intermodal precinct at Eastern Creek. It would service growth areas of western Sydney that connect to Port Botany and regional producers that export from Port Kembla, as well as meeting demand from businesses in the Western Sydney Employment Area, for movement of containers by rail. The Western Sydney Freight Line and intermodal terminal is listed as a corridor preservation priority in the *Freight Strategy* and *State Infrastructure Strategy Update*. The *State Infrastructure Strategy Update* anticipates that by 2036, about 4.3 million truck kilometres a year could be saved through the Western Sydney Freight Line and terminal precinct project.

While realising opportunities to shift more freight onto rail remains a priority for the NSW Government, the forecast growth in the freight task will still require investment in an efficient road network to support the Sydney Airport and Port Botany precinct. Rail freight improvements alone are therefore not a viable alternative to meeting the project objectives.

Western Sydney Airport

The Western Sydney Airport at Badgerys Creek would be developed in stages. Stage 1 would comprise a single runway, a terminal and other relevant facilities to accommodate around 10 million passengers annually in addition to freight traffic. These facilities would be developed prior to the commencement of airport operations in the mid-2020s and would be capable of supporting both domestic and international public transport services, in addition to freight.

Over time and as demand grows, the proposed airport would include an expanded terminal, further support and commercial facilities and a second runway, and would serve around 19.5 million passengers annually by around 2050. The proposed airport would also support freight aircraft, with capacity for around 7,000 dedicated freight air traffic movements annually following Stage 1, increasing to 30,000 air traffic movements per year in the longer term.

The development of the Western Sydney Airport at Badgerys Creek has the potential to change the way some freight is moved around Sydney, by providing an alternative entry or exit point for freight. The completed WestConnex program of works would connect the M4 East and New M5 motorways, encouraging efficient movement of road freight to and from Western Sydney Airport and the Sydney metropolitan area. Overall, however, the movement of freight around Sydney in the short to medium-term would not be significantly altered by the introduction of the new airport, for the following reasons:

- The operation of the Western Sydney Airport would be staged, with throughput increasing in stages over time subject to demand. Initial operations are anticipated to commence in the mid-2020s (at least two years after the expected commencement of operations of the M4-M5 Link)
- The proportion of freight transported by air is small compared to transport by road and rail. Freight arriving at the new airport would still have destinations across the wider Sydney metropolitan area, which would most likely be transported by road and therefore reliant on a resilient and efficient motorway network
- Port Botany and Sydney Airport would still be key freight entry and exit points, with the new airport to provide additional capacity, rather than replace the function these terminals currently provide.

Once the Western Sydney Airport is operational, it is expected that longer term benefits to freight movements would be experienced, primarily through providing a new terminal for incoming and outgoing goods.

Active transport improvements

Sydney's Cycling Future (Transport for NSW 2013c) aims to make cycling a safe, convenient and enjoyable transport option for short trips by:

- Investing in separated cycle ways and providing connected bicycle networks to major centres and transport interchanges
- Promoting better use of the existing network
- Engaging with stakeholders across government, councils, developers and bicycle users.

The implementation of the strategy aims to increase the mode share of cycling in the Sydney metropolitan area for short trips that can be an easy 20 to 30-minute ride. The strategy aims to improve access to towns and centres, reduce congestion and increase capacity on the public transport system by investing in connected bike routes within five kilometres of major centres and public transport interchanges. The 'Bike and Ride' initiative will make it convenient for customers to ride to transport hubs, leave their bikes securely locked up and transfer to public transport to continue their journey.

Sydney's Walking Future (Transport for NSW 2013d) is intended to complement *Sydney's Cycling Future*. The actions set out in *Sydney's Walking Future* propose to make walking the transport choice for quick trips under two kilometres and help people access public transport. Encouraging and enabling more people to make walking trips will ease pressure on public transport, reduce congestion on roads and promote a healthier transport alternative.

As outlined in *Sydney's Cycling Future* and *Sydney's Walking Future*, journeys made by cycling and walking are generally for short trips only. Improvements to cyclist and pedestrian infrastructure alone would not cater for the diverse travel demands within the project footprint that are best met by road infrastructure. Further improvements to cyclist and pedestrian infrastructure alone would not support long-term economic growth through improved motorway access or enhance the productivity of commercial and freight generating land uses. The active transport network is therefore complementary to other modes of transport as part of an integrated transport solution.

The project would deliver new and improved active transport links within residual land created by the project such as within the Rozelle Rail Yards and along the south side of Victoria Road. These works would be consistent with other plans for active transport improvements in the area, as outlined in the *Parramatta Road Corridor Urban Transformation Strategy*, *The Bays Precinct Transformation Plan* and various council initiatives such as Greenway, The Green Grid and the Lilyfield Road regional bike route. A brief description of these initiatives and projects is provided in **Table 4-3**.

Table 4-3 Description of active transport initiatives and improvements outside of the project scope

Project/plan title	Brief description
Parramatta Road Corridor Urban Transformation Strategy	As the Parramatta Road corridor undergoes renewal, cycling corridors will provide a viable alternative to private vehicle use, especially for shorter trips. Used in conjunction with public transport, cycling corridors will also present an attractive option for those seeking to make regional travel trips. The Strategy will focus on delivering safe, high-quality cyclist routes such as the regional cycleway between Concord and Iron Cove along Gipps Street, Patterson Street and Queens Road, and the GreenWay from the Cooks River to the Parramatta River. Safe and high-quality pedestrian access is also essential to the successful transformation of the Parramatta Road Corridor, particularly to encourage walking to public transport nodes. Plentiful walking paths and connections mean shorter walking distances and a greater choice of routes. Improving the pedestrian environment in existing areas can be achieved by the creation of quality pedestrian links and short cuts.
The Bays Precinct Transformation Plan	Transport solutions for the precinct would be based on an integrated transport system that would support the ambition of job creation and economic development. Opportunities would be explored to increase walking and cycling and to make active and public transport so efficient that it is a first-choice option would be explored. An initiative would also include working towards re-opening Glebe Island Bridge for active and public transport.

Project/plan title	Brief description
The Green Grid	A network of interlinked multipurpose, open and green spaces across Sydney connecting homes to centres, public transport, jobs and recreational areas. The initiative is aimed at creating a great place to live with communities that are strong, healthy and well-connected. The Green Grid identifies a potential primary open space corridor at Rozelle, Balmain and Annandale around Rozelle Bay and the Parramatta River.
Greenway	A green urban corridor running from the Cook's River to Iron Cove in Sydney's inner west. Currently the corridor is a bush corridor used for a range of community activities including bushcare, walking and cycling. Plans for the Greenway include the provision of an off-road shared path from the Cooks River to Iron Cove. The Greenway would then link with the Lilyfield Road cycle route.
Lilyfield Road Regional Bike Route	A well-established east-west cycle route that provides a direct connection between Anzac Bridge and Hawthorne Canal. The Inner West Council (and former Leichhardt Council) is proposing to improve the bicycle route along Lilyfield Road, which is considered an important regional route which connects people to the Cooks River, the Bay Run, Victoria Road, Anzac Bridge and further, including Newtown and the Sydney CBD.

Active transport improvements are regarded as complementary to other transport modes including roads and public transport. They are an essential component of the integrated transport solution. The project includes the development of new or improved active transport links in a number of locations, generally associated with surface works and/or residual land for the project, such as at the Rozelle Rail Yards and along Victoria Road. These links would improve connectivity between communities, open space areas, public transport modes and the existing active transport network. This is described in further detail in **Chapter 8** (Traffic and transport) and in **Appendix N** (Technical working paper: Active transport strategy).

Summary of alternative transport modes

WestConnex is one of more than 80 projects outlined in the *Transport Master Plan* to address the state's complex transport needs. As part of a broader integrated transport and land use solution, WestConnex supports a coordinated approach to the management of freight and passenger movements, and is complementary to other modes of transport including rail, bus, ferries, light rail, cycling and walking. However, Sydney's freight, commercial and services tasks require distribution of goods and services across the Sydney basin, which relies on diverse and dispersed point-to-point transport connections that are most efficiently provided by the road network.

Not all trips in Sydney can be undertaken by public transport as customer needs are diverse, often requiring travel over long distances or dispersed across multiple destinations. Even though projects are being undertaken to significantly increase the share of freight being moved by rail, the overall growth in the freight task is outgrowing demand for the transport of freight by road. As such, the capacity and reach of the motorway and arterial road network needs to be increased to accommodate this growth. While the NSW Government is investing $41.5 billion (2016–2017 NSW Budget) in transport projects over the next four years (including roads and public transport) there are no feasible strategic public transport or freight alternatives to the project that, on their own, would meet the diverse range of needs for travel in the Sydney metropolitan area.

In addition, by reducing surface road traffic along sections of Parramatta Road and Victoria Road, the project would facilitate potential future developments in public transport and support the expansion of the active transport network to achieve the sustainability and liveability objectives of the WestConnex program (as outlined in **Chapter 3** (Strategic context and project need) and **Chapter 14** (Social and economic)).

4.4.3 Alternative 3 – Travel demand management

Travel demand management relates to minimising or avoiding the need to invest in new motorway infrastructure such as the project, by reducing individual trip lengths and making alternative transport mode options more viable. Travel demand management initiatives include the following:

- Land use planning policies that promote urban consolidation and the establishment of town 'centres' with the aim of incorporating local employment and recreational opportunities in order to reduce the need for travel. For example, the Transport Master Plan aims to prioritise the development of local growth centres to the northwest and southwest the Sydney CBD, to bring jobs closer to homes and to areas of increasing population. This policy approach is replicated in the *Parramatta Road Corridor Urban Transformation Strategy* and *The Bays Precinct Transformation Plan*, which outline proposals for urban generation, including residential development and increasing commercial opportunities
- Augmenting existing public transport and integrating urban regeneration around transport nodes. This approach is being adopted by Transport for NSW and DP&E as part of Stage 2 of the Sydney Metro City and Southwest project (Sydenham to Bankstown) and the corresponding Sydenham to Bankstown Urban Renewal Corridor (DP&E 2017), to provide a coordinated approach to infrastructure delivery and development across the corridor
- Implementing policies to restrict parking provisions in new developments to encourage alternative modes of transport.

According to the 2016 NSW population and household predictions (DP&E 2016), Sydney's population is expected to grow by more than 2.1 million people in the next 20 years, which is about 170,000 more than predicted only two years ago. This forecast growth in Sydney's population is expected to generate the need for another 726,000 new dwellings by 2036. In Parramatta, the population is expected to double from about 200,000 in 2011 to 416,000 in 2036.

While housing is more affordable in western Sydney, there is a greater demand for jobs in the eastern half of the city in areas that are part of or support the Sydney CBD, Port Botany, Sydney Airport and surrounding industrial areas. This creates a disparity in employment opportunities close to people's homes. The *Transport Master Plan* highlights that western Sydney is currently home to 47 per cent of Sydney's residents but only 37 per cent of Sydney's jobs (Transport for NSW 2012a).

As discussed in **section 4.4.2** increasing the capacity of the public transport network to assist in accommodating forecast growth in population is an imperative for the NSW Government. Coupled with urban renewal of areas around new and upgraded metro stations (such as along the Sydney Metro City and Southwest Sydenham to Bankstown corridor), integrated transport and land use planning would relieve congestion through transport upgrades and providing new homes and jobs close to stations. However, these approaches would be needed even without the project to address the demand for housing and the travel needs of Sydney's growing population. For example, around 4,500 new homes are expected to be built within the Sydenham to Bankstown corridor over the next two to three years, and development along this corridor is expected to grow with the introduction of Sydney Metro (Sydenham to Bankstown Urban Renewal Corridor Strategy 2016). Planning for this growth is critical to meeting current and future demand.

To have a major impact on road traffic, travel demand management measures would require considerable changes in social attitudes, travel behaviour and government policy and can take many years to achieve. Therefore, while travel demand management could help reduce demand on the road network during peak times, its effectiveness would be limited by other constraints, such as:

- Land use patterns, in particular the location of new jobs relative to areas of residential growth
- The availability of alternative travel modes at the user's origin and destination such as public transport and active transport
- Flexibility of working arrangements to take advantage of 'time of day' tolling or transport pricing benefits.

Travel demand management changes alone are therefore not a viable alternative to meeting the project objectives. They are, however, viewed as complementary initiatives, together with the project, to reduce the impacts of road traffic on Sydney's road network.

Population growth, combined with the growing road freight task in the Sydney metropolitan area, would result in a continued demand for use of roads providing east-west and north-south connections such as the M4 Motorway, M5 Motorway, M1 Motorway and A3 and A6 corridors (see **Figure 4-12**). Without infrastructure investment or significant changes to how people travel, the continued demand and use of these corridors would result in additional, prolonged congestion.

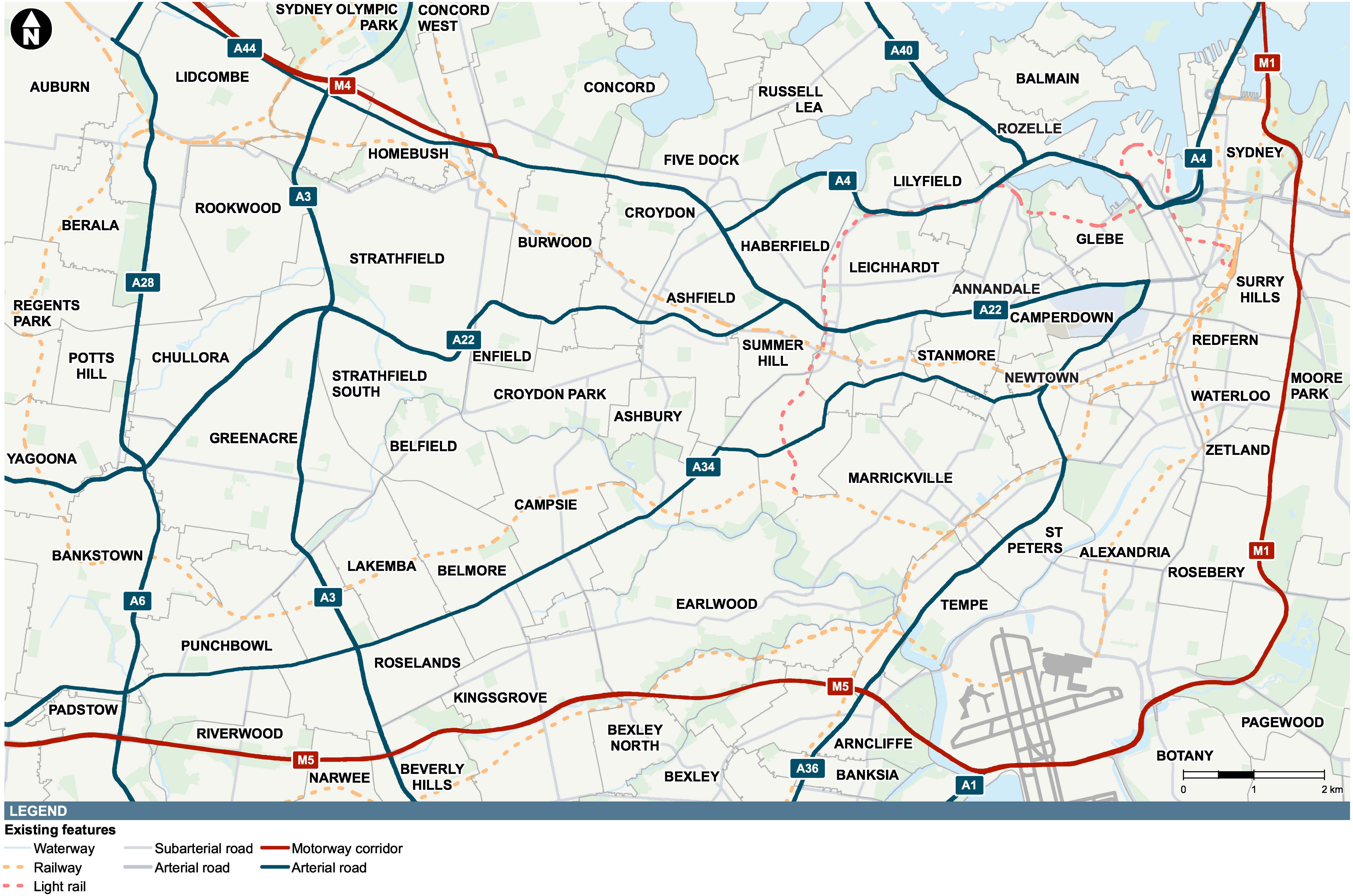


Figure 4-12 Existing motorway and arterial road corridors

4.4.4 Alternative 4 – The ‘do nothing’/’do minimum’ case

The ‘do nothing’/‘do minimum’ alternative assumes that the approved components of WestConnex are completed (ie M4 Widening, M4 East, King Georges Road Interchange Upgrade and New M5) but that the M4-M5 Link does not proceed.

This scenario is referred to as ‘do nothing’/‘do minimum’ because even without the project, it is expected that a number of other road network improvements are already approved, planned or underway to address traffic conditions on key arterial road connections such as Parramatta Road, City West Link, Victoria Road, the M1 corridor (Eastern Distributor/Southern Cross Drive/General Holmes Drive), King Street and the Princes Highway. These traffic improvements are described further in **section 4.4.1**.

As identified in **Chapter 3** (Strategic context and project need), the M4-M5 Link is a key component of the WestConnex program of works. The project would provide a motorway standard, tunnel alternative to the congested surface road network for passenger, commercial and freight traffic traveling between the M4 East and New M5 motorways. Not proceeding with the project would mean that that the full benefits of WestConnex would not be realised, including linking, by road, major employment centres that are critical in supporting the creation of jobs and businesses. These include the ‘global economic corridor’, which encompasses: the Sydney Airport and Port Botany precincts, Sydney CBD, Sydney Olympic Park, Parramatta CBD and Norwest Business Park.

Traffic modelling for the project (refer to **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport)) shows that the overall forecast growth in traffic demand is consistent with the forecast growth in population in the Sydney Metropolitan Area. Importantly, this growth in traffic is not confined to major routes. Increased traffic on many roads in Sydney is forecast without the project in the 2023 and 2033 peak periods, as vehicles seek to avoid the congested arterial road network by travelling along lower order roads.

A reduction in daily traffic is forecast along Parramatta Road (west of the M4 East Parramatta Road ramps) in 2023 and 2033 as a result of the M4 East, and on the M5 East as a result of the New M5. However, increased daily traffic is forecast along Parramatta Road (east of the M4 East Parramatta Road ramps), Southern Cross Drive, Sydney Harbour Tunnel, Sydney Harbour Bridge, Western Distributor and Anzac Bridge, as well as other urban arterial roads, such as Victoria Road, City West Link, Hume Highway, Canterbury Road, Stoney Creek Road, Olympic Drive, Centenary Drive and Anzac Parade approaching the Sydney CBD in both 2023 and 2033.

With forecast traffic growth, the network performance in Haberfield around the Wattle Street interchange, in Rozelle around the Rozelle interchange and in St Peters around the St Peters interchange is forecast to deteriorate over time without the project. These increases in traffic demand would occur on parts of the surface road network that already experience significant congestion, especially during the peak hours.

As a result of an expanding future population, employment and urban growth, Sydney can expect worsening road network and traffic conditions if integrated transport solutions are not implemented. However, while public transport, integrated transport and land use planning is part of the overall transport plan, not all trips across Sydney can be served by public transport, especially trips to dispersed destinations, commercial trips requiring the movement of large or heavy goods/materials, or trade and service-related journeys. In addition, Sydney is home to two-thirds of NSW’s manufacturing sector, with the many of the state’s major aviation, pharmaceuticals, biotechnology, electronics and automotive industries based in western Sydney. These businesses rely on the road network and its connectivity to the port and airport precincts.

The addition of the M4-M5 Link would provide a significant overall improvement to network productivity. A number of key benefits and improvements are forecast as a result of the project (when compared to not proceeding with the project):

- Non-motorway roads in the Inner West LGA are forecast to experience faster trips with the daily average speed increasing by about 10 per cent. Similarly, the vehicle distance travelled on non-motorway roads is forecast to reduce by about 12 per cent. This indicates that on average, these trips are fewer in number and faster

- Improved network productivity on the metropolitan network, with more trips forecast to be made or longer distances travelled on the network in a shorter time. The forecast increase in vehicle kilometres travelled (VKT) and reduction in vehicle hours travelled (VHT) is mainly due to traffic using the new motorway, with reductions in daily VKT and VHT also forecast on non-motorway roads
- Reduced travel times are forecast on key corridors, such as between the M4 Motorway corridor and the Sydney Airport/Port Botany precinct
- Reduced traffic is forecast on sections of major arterial roads including City West Link, Parramatta Road, Victoria Road, King Street, King Georges Road and Sydenham Road
- Almost 2,000 heavy vehicles are forecast to be removed from Parramatta Road, east of the M4 East Parramatta Road ramps, each weekday.

Where the project would connect to the existing road network, increased congestion is forecast in parts of Mascot, along Frederick Street at Haberfield, Victoria Road north of Iron Cove Bridge, Johnston Street at Annandale and on the Western Distributor. A number of these areas are forecast to improve when the WestConnex program of works and the proposed future Western Harbour Tunnel and Beaches Link are completed.

The lost opportunities from not proceeding with the project mean that the ‘do nothing’/‘do minimum’ case is not a feasible or realistic alternative. Notwithstanding this, the M4-M5 Link, as part of the WestConnex program of works, is one part of a broader solution to these pressures. For these reasons, the NSW Government is also investigating and investing in light rail, metro, bus rapid transit and motorways to provide a multi-modal response to the future challenges.

4.4.5 Alternative 5 – Development of the M4-M5 Link

The *State Infrastructure Strategy* notes that investment in Sydney’s strategic road network can be sustainable if complemented by strategies to manage congestion and environmental impacts, and should be undertaken in tandem with investment in public transport and demand management measures.

The WestConnex program of works (including the M4-M5 Link) forms part of a broader integrated transport solution which supports a coordinated approach to the management of freight, commercial and passenger movements, across all modes of transport. As described in **Chapter 3** (Strategic context and project need), the primary objective of the project is to link the other key component projects of WestConnex (which have already been approved and are currently under construction), so that the broader benefits of, and opportunities arising from WestConnex can be realised.

The delivery of freight, commercial and services tasks would continue to rely on more diverse and dispersed point-to-point transport connections that can only be provided by the road network, which also supports private passenger movements. The project is therefore a necessary component of the WestConnex program of works.

The project is forecast to provide:

- More reliable trips, both in terms of travel time and safety, between south-western and western Sydney and the inner west
- Additional motorway capacity through a north-south corridor to support Sydney’s freight and commercial task
- Traffic flow reductions along sections of major arterial roads, including Parramatta Road, Victoria Road (east of the Iron Cove Link portals), City West Link, King Street, Sydenham Road and King Georges Road
- A reduction in heavy vehicles on sections of the surface road network, including around 2,000 heavy vehicles forecast to be removed from Parramatta Road, east of the M4 East Parramatta Road ramps, each weekday.

The need for the project is described in detail in **Chapter 3** (Strategic context and project need). Details of the evolution of the project and the initial design options are described in **section 4.3**. Further detail on the project concept is provided in **Chapter 5** (Project description).

4.5 Project evolution and design refinements

Since the inception of the M4-M5 Link and the WestConnex program of works, various options have been considered in the development of the key components of the project, including:

- Interchanges
- Mainline tunnels (including numbers of lanes)
- The Iron Cove Link.

A comprehensive options identification and evaluation process using multi-criteria analysis (MCA) was carried out in 2016 to define the optimal project concept design for the Rozelle interchange and the Iron Cove Link. The MCA was undertaken for the Rozelle interchange and the Iron Cove Link as these are complex project components with a number of potential concept design options that could meet project objectives (compared to the mainline tunnels, which have fixed endpoints and therefore fewer viable concept design options). The criteria for the MCA, and their performance attributes, are listed in **Table 4-4.**

Table 4-4 MCA criteria and performance attributes for the Rozelle interchange and Iron Cove Link

MCA criteria	Performance attributes
Road network operation and safety	• Route connectivity • Road hierarchy • Network efficiency • Wayfinding • Contingency for growth.
Urban design	• Opportunities for multiple site uses • Clear road hierarchy • Opportunities for increased connectivity to public transport • Opportunities to facilitate improved active transport connectivity/linkages.
Constructability	• Construction complexity • Relocation of significant services • Spoil disposal • Flooding risk and drainage capability.
Environment and heritage	• Impact on state listed non-Aboriginal heritage items • Impact on local listed heritage items and heritage conservation areas • Impact on visual amenity • Impact from noise generation • Air emissions • Direct impact on endangered ecological communities, threatened flora and fauna species or groundwater dependent ecosystems • Area of vegetation removal • Impact on open space.
Programme and cost	• Estimate of construction program • Estimated capital construction cost • Estimated 50-year operation and maintenance cost • Estimate of future capacity enhancement cost.
Community and stakeholders	• Community benefits • Impact on business • Stakeholders impacted.

Various options for the components of the Rozelle interchange and the Iron Cove Link were scored and ranked against the MCA criteria with suitable options taken further for more in-depth technical and engineering investigation and analysis.

The sections below provide further detail on the evolution of the key project components.

4.5.1 Interchanges

Suitable interchange locations were identified for assessment based on the following criteria:

- Optimising the benefits to and minimising the adverse impacts on local communities and businesses, including minimising property acquisitions and impacts on heritage items and/or conservation areas and providing new and improved active transport outcomes
- Reducing impacts on open space/recreation areas and creating opportunities for new open space/recreation areas
- Integrating with existing and proposed public transport services
- Meeting the project objective to reduce traffic on Parramatta Road, between Haberfield and Camperdown
- Maximising connectivity with, and effectively integrating into, the road network and nearby areas of potential urban development
- Facilitating connections to proposed future road projects
- Minimising impacts on the road network during construction.

Rozelle interchange

The SSIAR included the Rozelle interchange within the Rozelle Rail Yards and provided a link between the Sydney CBD and the mainline tunnels via connections to City West Link, Victoria Road and Anzac Bridge.

The Rozelle Rail Yards are part of a disused former rail corridor owned by the NSW Government. Use of this site was considered beneficial to minimise environmental impacts and acquisition requirements while meeting constructability, connectivity and urban design objectives for the project. However, initial designs of the interchange were predominantly aboveground and included significant elevated structures to achieve connectivity.

The design of the interchange considered:

- Using NSW Government owned land and minimising property acquisition
- Maximising positive urban design solutions for residual land including new open space areas and new and improved active transport links
- Minimising impact on public open space and recreational land
- A connection to the proposed future Western Harbour Tunnel and Beaches Link project
- Maximising connectivity to the surrounding road network and The Bays Precinct
- Minimising impacts on surface water and groundwater
- Minimising impacts on utilities.

Three main concept designs have been considered for the Rozelle interchange:

- Predominantly above ground within the Rozelle Rail Yards
- Predominantly below ground within the Rozelle Rail Yards
- Predominantly below ground and extending north of the Rozelle Rail Yards (subject of this EIS).

Each of these options for the Rozelle interchange is shown in **Figure 4-13**.

Predominantly above ground within the Rozelle Rail Yards

The Rozelle Rail Yards are part of a disused former rail corridor owned by the NSW Government. Use of this site was considered beneficial to minimise environmental impacts and acquisition requirements whilst meeting constructability, connectivity and urban design objectives for the project. However, initial designs of the interchange were predominantly aboveground and included significant elevated structures to achieve connectivity. Key features of these above ground design options included:

- A number of roads at or above the existing ground level of the Rozelle Rail Yards
- A number of bridge structures would be required to enable the various roadway movements to occur. These structures were up to 20 metres above existing ground levels
- More natural drainage flow paths from the north and west of the Rozelle Rail Yards with roads above the drainage channels
- Less contiguous open space opportunities with some parks developed beneath road bridges (with associated shadowing and horticultural impacts and challenges)
- Closure of Easton Park (immediately north of the Rozelle Rail Yards) during construction to enable the Iron Cove Link to be constructed
- Full closure of Lilyfield Road for the duration of construction
- Difficulty achieving the urban design connectivity principals for the project
- Difficulties with flooding and drainage management
- Social and economic impacts
- Reduced area, quality and amenity of residual land.

The large number of constraints associated with the above ground options necessitated refinements to the Rozelle interchange design.

Predominantly below ground within the Rozelle Rail Yards

A decision was made to relocate most of the Rozelle interchange underground and minimise the extent of surface infrastructure within the Rozelle Rail Yards, which provided an opportunity at the Rozelle Rail Yards for improved urban design outcomes and community benefits (consistent with the NSW Government announcement in July 2016 for the development of up to 10 hectares of open space at the Rozelle Rail Yards).

Key features of this design option included:

- Around 95 per cent of infrastructure below the existing ground surface
- Complex ground conditions (a palaeochannel traverses the Rozelle Rail Yards site)
- A very deep interchange (up to 22 metres in some places) requiring significant underground barrier walls to exclude groundwater intrusion
- Significant volume of heavy duty (concrete) deck structure required to cover the roads
- Extensive landscaping above the deck structure to achieve suitable parkland/open space
- Constructability impacts on Easton Park
- Full closure of a section of Lilyfield Road at Easton Park during construction
- Complex road connections that would not be easy for motorists to navigate
- Large volumes of stormwater runoff with high flooding risk, and constrained drainage north–south through the Rozelle Rail Yards
- Opportunities for public open space, subject to loss of usable space for open drains
- Improvements to community connectivity
- Poor sustainability outcomes for construction and operational maintenance.

Of these features above, the construction of and landscaping of a concrete deck to cover the roads was associated with a number of major constraints, including constructability, cost and amenity of the final landform. Design refinements for the Rozelle interchange therefore continued to be investigated.

Predominantly below ground and north of the Rozelle Rail Yards

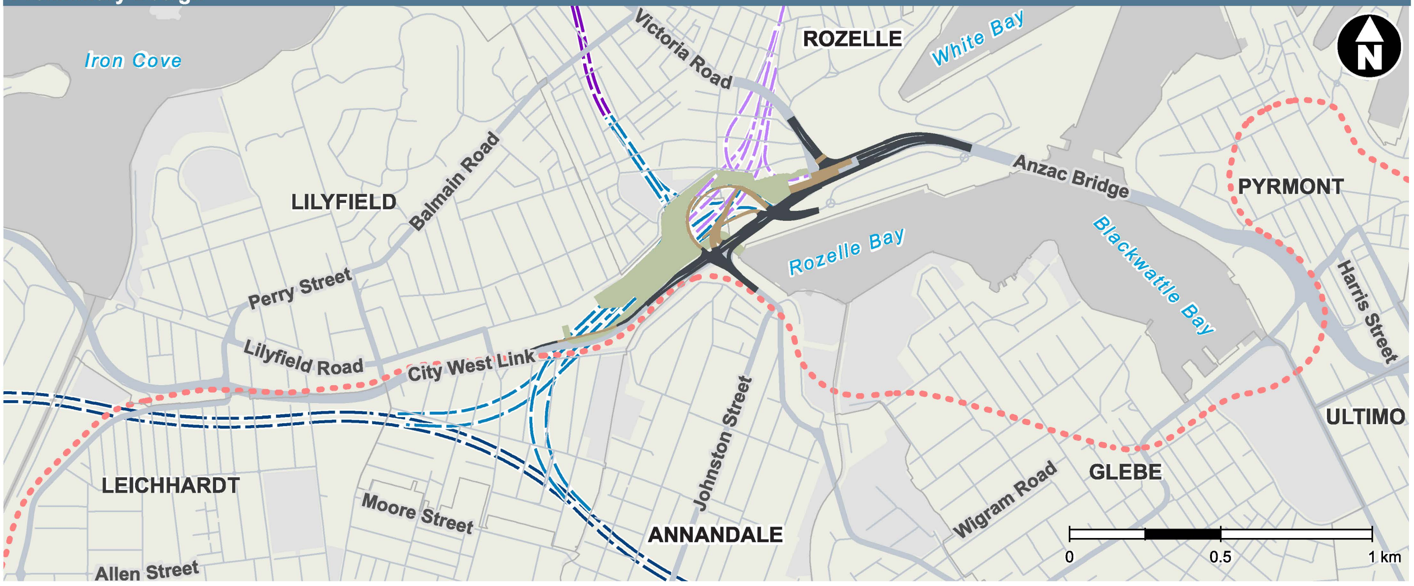
The design of the Rozelle interchange progressed to an option that meets the connectivity requirements and also considers stakeholder and community expectations for the future use of the Rozelle Rail Yards, consistent with the NSW Government announcement in 2016. While the concept design proposes to use part of the Rozelle Rail Yards for surface connections and infrastructure, the tunnel connections as part of the interchange would extend underground beyond the boundaries of the site.

Revising the design in this way takes advantage of favourable ground conditions north of the Rozelle Rail Yards that are more suitable for tunnelling. The concept design of the Rozelle interchange (assessed in this EIS) would provide a safe and easily navigable network of roads, at the surface and below ground. An Urban Design and Landscape Plan (UDLP) would be prepared to facilitate the establishment of landscaping and open space initiatives within the Rozelle Rail Yards. Key features of this design option included:

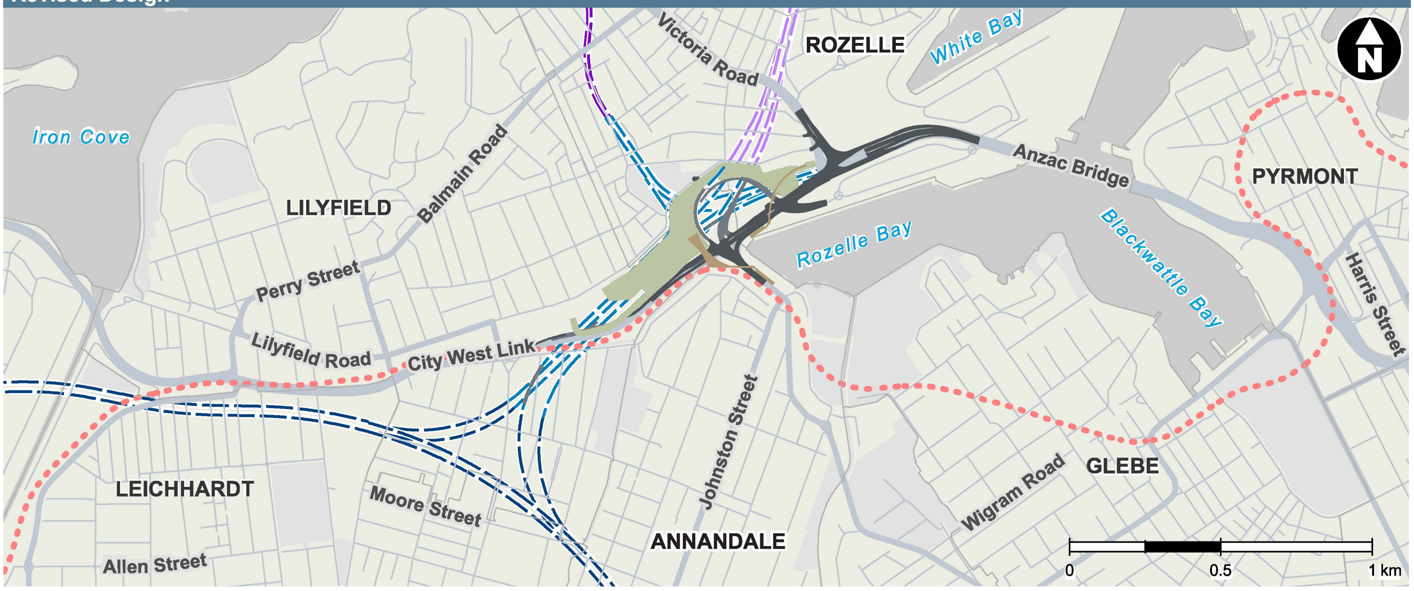
- Predominantly below-ground allows for improved residual land outcomes
- Better open space/recreational land outcome
- Tunnelling in better geotechnical conditions
- A more natural drainage solution that respects existing flow paths
- Constructability activities contained within the Rozelle Rail Yards with no impact on Easton Park
- More easily implemented active transport links
- More extensive tunnelling under residential areas, although at depth.

Other design refinements that were incorporated included the provision of a pedestrian bridge at the western end of the Rozelle Rail Yards. The pedestrian bridge at this location was included to improve active transport connectivity and public access to and across the Rozelle Rail Yards.

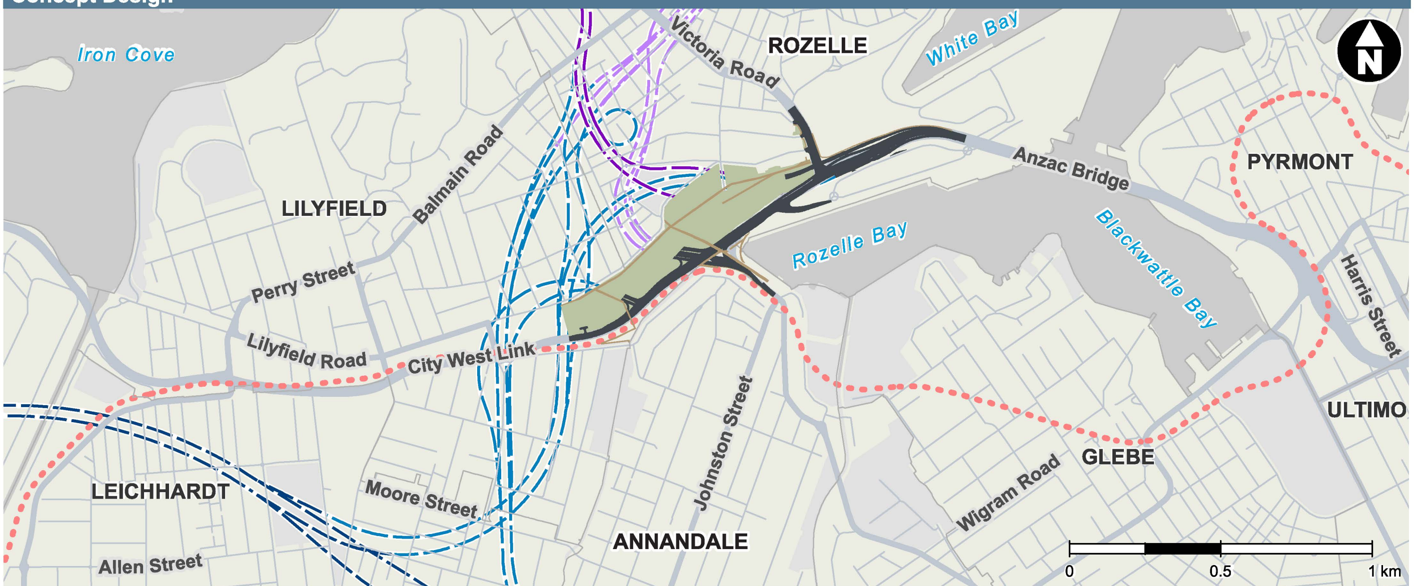
Preliminary Design



Revised Design



Concept Design



LEGEND

M4-M5 Link

- Mainline tunnel
- Iron Cove Link tunnel
- Rozelle interchange tunnel
- Proposed future Western Harbour Tunnel and Beaches Link connections (civil construction only)
- Proposed new open space
- New and upgraded bridge structures
- Surface road upgrade and improvement works
- Potential land bridge and new active transport links

Figure 4-13 Evolution of the Rozelle interchange concept design

Camperdown interchange

The Camperdown interchange is no longer a component of the project. This section provides an outline of the options considered for the interchange and the reasons for removing the interchange from the project.

The preference for a connection at Camperdown was first identified in the WestConnex reference scheme in the *State Infrastructure Strategy*. The Camperdown interchange was intended to provide entry and exit ramps connecting to Parramatta Road for drivers travelling to and from the Sydney CBD. A number of localities were examined for potential ramp locations. Evaluation of alternative locations included potential impacts on open space, heritage items and residential and other sensitive land uses, potential requirements for property acquisition, challenges integrating with the surface road network, constructability and potential impacts on future public transport initiatives and active transport links.

The key difference between the alternative interchange locations related to how future public transport services would be provided for within the road space (including bus rapid transit along Parramatta Road). Following an options evaluation process, the construction of ramps at Arundel Street near the University of Sydney and Royal Prince Alfred (RPA) Hospital was identified in the SSIAR as the preferred outcome.

As the project design progressed, a review of the functionality and potential impacts of the interchange was carried out as part of the design development process and to address feedback received from stakeholders and local communities. The review of the Camperdown interchange identified a number of issues and considerations, including:

- Updated traffic forecasts and land use information reflecting a projected increase in development along Parramatta Road
- Impacts on traffic on other parts of the road network without the Camperdown interchange
- Transport for NSW confirmed its requirements to accommodate current kerb side public transport along Parramatta Road
- Availability of space within the road corridor to avoid property acquisition
- Minimising impacts on heritage items and heritage conservation areas
- Potential impacts from vibration from tunnelling on sensitive equipment at the RPA Hospital and University of Sydney.

Following an assessment of traffic, environmental and community impacts, the Camperdown interchange was removed from the project. The benefits of removing the Camperdown interchange from the project included:

- Avoiding increased traffic demands on Parramatta Road and Broadway (east of the portals) in comparison to an interchange at this location
- By avoiding increasing traffic demand along this section of Parramatta Road, opportunities for future public transport improvements along Parramatta Road would be able to be implemented in a less constrained infrastructure corridor
- Avoiding impacts (direct and indirect) on heritage conservation areas and heritage items such as the University of Sydney and Victoria Park (both nominated for state heritage listing) and a locally listed sandstone retaining wall on the northern side of Parramatta Road
- Avoiding impacts on residential and commercial properties at Camperdown and Forest Lodge from surface works and property acquisition as well as removal of street trees along Arundel Street
- Avoiding potential vibration impacts from tunnelling on sensitive equipment at the University of Sydney and the RPA Hospital
- Avoiding increased traffic demand along Parramatta Road would also support the desired future character of the area along Broadway, including the University of Sydney, Victoria Park and

Broadway Shopping Centre. This area has the potential to be a more public transport and pedestrian-oriented environment.

Traffic that would otherwise have entered or exited the M4-M5 Link via the Camperdown interchange is forecast to redistribute to sections of the surface road network, including on the Anzac Bridge/Western Distributor, sections of Parramatta Road and sections of the St Peters road network. As part of the traffic assessment undertaken for the project, an assessment of the redistribution of traffic and the impact on traffic volumes resulting from the removal of the Camperdown interchange was undertaken (refer to Annexure C of **Appendix H** (Technical working paper: Traffic and transport)).

4.5.2 Mainline Tunnel

Mainline tunnel corridor alignment

The mainline tunnel corridor alignment shown in the *WestConnex Updated Strategic Business Case* and the January 2016 SSIAR for the project was around 9.2 kilometres long (see **Figure 4-6**). The alignment was influenced by underground connections to the Wattle Street interchange at Haberfield and the St Peters interchange at St Peters (fixed locations) and by the location of the proposed Rozelle interchange.

The horizontal and vertical alignment of the tunnel corridor between the fixed points (ie the interchanges) was influenced by the following considerations:

- Investigations into geology, geotechnical (ie ground conditions) and groundwater conditions, especially at tunnel portals and crossings under creeks
- Potential for contamination
- Facilitating drainage
- Avoiding long, steep road gradients that would slow heavy vehicles and increase vehicle emissions
- Location of sensitive receivers above the tunnels (including heritage items, educational institutions, places of worship, hospital and medical facilities) that may be potentially affected during construction of the tunnels
- Location of major underground utilities and services (such as water and sewer mains and fibre optic telecommunications cables) that may be costly to relocate and would substantially extend the duration of construction of the project
- Location of existing or proposed subsurface infrastructure (such as for the Sydney Metro City and Southwest tunnels and the Sydney Water City and Pressure tunnels)
- Future connections to the Sydney motorway network
- Fire and life safety considerations (including emergency egress points from the tunnels).

Geotechnical conditions are a major consideration for tunnelling projects as they determine ground stability to support tunnel infrastructure and the potential for ground movement or settlement at the surface. Geotechnical conditions also affect constructability, including, how difficult, how long and how costly it would be to construct the tunnels.

The decision to remove the Camperdown interchange (see **section 4.5.1**) provided a trigger to review and confirm the suitability of the alignment of the mainline tunnels.

A number of alignment options for the mainline tunnels were considered to achieve optimal connectivity between the M4 East and New M5 as well as with the Rozelle interchange. Issues considered as part of the alignment review included:

- The suitability of geological conditions
- The provision of the shortest travel distance/travel time
- The location of state heritage listed items at Camperdown
- The orientation of the Wattle Street ramps being constructed for the M4 East project

- The proximity of the mainline tunnels to potential construction sites for tunnelling
- Potential vibration and settlement impacts on sensitive equipment at the RPA Hospital and University of Sydney
- The location of the Sydney Metro City and Southwest tunnels
- The location of the Sydney Water Pressure Tunnel and Sydney Water City Tunnel
- The design of the Rozelle interchange.

The alignment review resulted in a shorter mainline tunnel length of around 7.5 kilometres with a more direct connection between the Rozelle interchange and the St Peters interchange. The east–west section of the alignment, between the Wattle Street interchange (being constructed as part of the M4 East project) and the Rozelle interchange, was moved slightly north, while the north–south section between the Rozelle interchange and the St Peters interchange moved further west. These changes to the alignment mean that the mainline tunnels are located around 450 metres and 700 metres west of the RPA Hospital and the University of Sydney at Camperdown respectively.

A detailed description of the mainline tunnel alignment, including connections to the M4 East Motorway at Haberfield, the New M5 Motorway at St Peters, with the Rozelle interchange and the proposed future Western Harbour Tunnel and Beaches Link, is provided in **Chapter 5** (Project description).

Number of tunnel lanes

Three options (two, three or four lanes in each direction, plus merges and tie-ins) were originally considered for the number of traffic lanes within each of the mainline tunnels, and assessed against the project objectives.

The key considerations for selection of the optimal lane configuration are outlined in **Table 4-5**.

Table 4-5 Key considerations for the mainline tunnel lane options

Number of lanes in each direction	Key considerations
Two	• Not sufficient to carry the expected traffic volumes • Costly and disruptive to upgrade to three lanes, which would likely be required not long after project opening.
Three	• Would not allow for long-term capacity for forecast traffic volumes • Would integrate with the M4 East mainline tunnel and New M5 mainline tunnel.
Four	• Would allow for long term capacity for forecast traffic volume • Satisfactory levels of performance in the mainline tunnels • Ensures efficient and safe merging and diverging.

While the initial project concept described in the SSIAR included up to three lanes in each direction, revised traffic modelling, which incorporated updated land use inputs, indicated that amendments to the original three lane configuration were required to maintain acceptable lane functionality and traffic flow within the mainline tunnels in future years. Traffic modelling demonstrated that the mainline tunnels would operate more efficiently under a four-lane configuration, to allow for future demand increases. However, while the majority of the mainline tunnels are designed for four lanes (plus merges and tie-ins, they reduce to three lanes at the M4 East mainline tunnel interface and to two lanes at the New M5 mainline tunnel interface. Where the mainline tunnels connect to the Inner West subsurface interchange, they would be two lanes.

Refer to **Chapter 8** (Traffic and transport) for further details on lane functionality. Further details on lane configurations and the direction of traffic flow within the tunnels, is provided in **Chapter 5** (Project description).

Connection to the Wattle Street interchange

The initial project concept described in the SSIAR did not specify the nature of the entry ramps to the Wattle Street interchange. The initial design comprised one entry ramp consisting of two traffic lanes. During the project development the design was refined to divide the entry ramp into two one-lane entry ramps.

The Wattle Street interchange entry ramp would divide into two, one-lane entry ramps about midway along the entry ramp around Alt Street at Haberfield. These tunnels would then join with the southbound mainline tunnel before the Inner West subsurface interchange. Motorists traveling to the Rozelle interchange would join on the left side of the southbound mainline tunnel, while motorists traveling to the New M5 Motorway would join on the right side of the southbound mainline tunnel.

By giving motorists the ability to choose a merge location dependent on their destination, this arrangement would make driving in the tunnel safer by reducing the amount of lane changes that motorists may need to carry out on the approach to the Inner West subsurface interchange. Further detail on operational traffic is provided in **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).

4.5.3 Iron Cove Link

During the design development process for the Rozelle interchange, a tunnel connection of about one kilometre in length between the Rozelle interchange and Victoria Road, at the eastern abutment of Iron Cove Bridge (the 'Iron Cove Link'), was identified. This link would direct surface traffic travelling from northwest of Rozelle or from the Sydney CBD (via Anzac Bridge) to the Rozelle interchange, allowing vehicles to by-pass Victoria Road (between Iron Cove Bridge and City West Link), which is a corridor that experiences high traffic volumes and congestion.

The inclusion of the Iron Cove Link to the project has the following benefits:

- Reducing traffic along sections of Victoria Road through Rozelle
- Bypassing six sets of traffic lights at intersections along Victoria Road
- Facilitating future urban renewal opportunities and amenity benefits for properties along Victoria Road, east of Iron Cove Bridge
- Enabling an opportunity for improved public transport reliability and future public transport improvements along Victoria Road, east of Iron Cove Bridge
- Creating a motorway standard link for regional traffic from the northwest, including heavy vehicles, to access the New M5 Motorway (once operational) and the Sydney Airport and Port Botany precinct via the project and the future proposed Sydney Gateway
- Assisting with constructability and staging of works for the Rozelle interchange
- Indirectly creating a number of potential opportunities for the local surface road network including public transport, amenity and active transport improvements along Victoria Road as well as improving east-west connectivity across Victoria Road.

During community consultation for the project in August 2016, the possibility was raised of extending the link further to the north to the south side of the Gladesville Bridge at Drummoyne, rather than to Iron Cove Bridge at Rozelle. The rationale for this extension of around 2.5 kilometres was to reduce surface traffic along Victoria Road at Drummoyne and facilitate additional opportunities for urban renewal and public transport improvements in the future. This extension was not further considered as part of the M4-M5 Link project as it:

- Could not be delivered within the existing project budget
- Is not currently identified as a policy priority of the NSW Government
- Would likely require additional property acquisition
- Would require further investigation, including a cost/benefit analysis.

Although this option is outside the scope of the project and was not considered further, the development of the Iron Cove Link does not preclude a further tunnel connection to the north at some stage in the future. Such a proposal would be subject to further investigation, business case and design development, community/stakeholder consultation and environmental assessment.

Tunnel portal locations

Options for the alignment of the Iron Cove Link were determined by the two terminal points, namely the Rozelle interchange and Victoria Road. Potential portal locations along Victoria Road included:

- Between Crystal Lane and Wellington Street, near the site of the current United Petroleum service station
- In the vicinity of Terry Street.

Of the two options, tunnel portals at Crystal Lane were considered to be less desirable as this option would:

- Be in potential conflict with future infrastructure in the reserved CBD Metro corridor. The corridor includes an underground metro station between Darling Street and Wellington Street, immediately to the east of Crystal Street
- Require relocation of a local utilities substation
- Be located within a mixed residential and light industrial zone which, given the nature of existing and historical land uses, is likely to represent a contamination risk
- Compromise the right turn from Victoria Road into Terry Street, which is a significant local traffic movement
- Result in portals further south along Victoria Road which would reduce the desirability of the Iron Cove Link as an alternative route option for motorists and potentially impact traffic flow.

The preferred portal location to the east of Terry Street would maintain the right turn access to Terry Street, allow for a pedestrian crossing across Victoria Road and avoid an additional set of traffic lights on Terry Street.

A more detailed description of the Iron Cove Link is provided in **Chapter 5** (Project description).

4.5.4 Construction of connections to the proposed future Western Harbour Tunnel and Beaches Link at Rozelle

The WestConnex program of works objectives includes providing the ability to connect an additional harbour road crossing and northern beaches motorway, the proposed future Western Harbour Tunnel and Beaches Link, to the WestConnex motorway. This objective builds on the recommendation of the *State Infrastructure Strategy Update 2014* (Infrastructure NSW 2014) to prioritise the proposed future Western Harbour Tunnel and Beaches Link in tandem with, or immediately after, the M4-M5 Link. The location and design of the Rozelle interchange have been selected in consideration of this objective (see **section 4.2**).

To further support this objective and the policy setting from which this objective has been derived, the construction of tunnels, ramps and associated infrastructure at the Rozelle interchange would be carried out to provide connections to the proposed future Western Harbour Tunnel and Beaches Link.

Constructing tunnels, ramps and associated infrastructure as part of the M4-M5 Link project would allow for orderly planning of these respective projects, and would minimise cumulative construction impacts on the community around the Rozelle interchange. This approach would also avoid or minimise potential delays to the delivery of the urban design and landscaping outcome at the Rozelle Rail Yards proposed as part of the project, which may otherwise be delayed and/or staged due to extended use of a portion of this land for construction activities associated with the proposed future Western Harbour Tunnel and Beaches Link.

The proposed future Western Harbour Tunnel and Beaches Link project would be delivered by Roads and Maritime and is currently in the early stages of environmental investigations and design development to support a separate consultation, assessment and approvals process in the future.

4.6 Other project options considered

The following section outlines options considered within the project including:

- Ventilation facilities
- Construction ancillary facility locations
- Construction methodologies
- Spoil transport and disposal.

4.6.1 Ventilation facilities

Ventilation system design

Most tunnels in NSW are unidirectional, meaning that traffic travels in one direction only within the tunnel. Usually two tunnels are constructed side by side (for example, the Lane Cove Tunnel), or one on top of the other (for example, the Eastern Distributor), to enable traffic to travel in both directions.

On an open roadway, vehicle emissions are diluted and dispersed by natural surface air flows. However, in a tunnel, mechanical ventilation is required to ensure that air quality standards are maintained. This is achieved by providing fresh air to, and removing exhaust air from, the tunnel. The requirements for tunnel ventilation are determined by the vehicle emissions in the tunnel and the limits of pollutant levels set by regulatory authorities. Air quality is managed by ensuring that the volume of fresh air coming into the tunnel adequately dilutes emissions.

The movement of vehicles through a tunnel drives air flow, called the 'piston-effect', drawing fresh air in through the tunnel entrance, diluting the vehicle exhaust emissions. In short tunnels up to around one-kilometre-long, air flow resulting from the piston effect of the vehicles is adequate to manage in-tunnel air quality. Emission levels increase as vehicles travel through the tunnel. As a result, in longer tunnels, the flow of fresh air can be supplemented by ventilation facilities which remove exhaust air and/or supply additional fresh air. The need for these features is dependent on tunnel size and length and the number and mix of vehicles using the tunnel. Fans may also be required when the piston effect is insufficient to maintain adequate air flow, such as during periods of low traffic or congested traffic conditions.

Elevated ventilation outlets are used for longer tunnels in urban areas in Australia to disperse tunnel air at a height that ensures dispersion of emissions complies with ambient air quality criteria. A number of options for the design of the ventilation system were considered. These systems are described below and illustrated in **Figure 4-14**.

Natural ventilation

Road tunnels with natural ventilation rely on vehicle movements, prevailing winds and differences in air pressure between the tunnel portals to move air through the tunnels without the assistance of mechanical ventilation (for example, through the use of fans). In the case of unidirectional naturally ventilated tunnels, the piston effect generated by traffic using the tunnels also assists in the movement of air. Because naturally ventilated tunnels do not have mechanical ventilation outlets, all air from within the tunnels is emitted via the tunnel portals.

Natural ventilation is only acceptable for use in relatively short tunnels (ie less than one kilometre). This is because without the assistance of mechanical ventilation, vehicle emissions can build up within the tunnels leading to unacceptable in-tunnel air quality under some traffic scenarios. Emergency smoke management considerations may also dictate a mechanical solution. For these reasons natural ventilation is not practical for longer road tunnels such as those proposed for the project. Natural ventilation would not achieve acceptable in-tunnel air quality under low vehicle speed conditions or during emergencies, and is therefore not a viable ventilation design for the project.

Longitudinal ventilation

The simplest form of ventilation for road tunnels is longitudinal ventilation, in which fresh air is drawn in at the entry portal and passes out through the exit portal with the flow of traffic. For longer tunnels, the air flow is supplemented by fans that are used when traffic is moving too slowly to maintain adequate air flow, or to draw air back from the exit portals against the flow of exiting traffic. This air is then exhausted through an elevated ventilation outlet to maximise dispersion. All road tunnels longer than one kilometre built in Australia in the last 20 years have been designed and operated with longitudinal ventilation systems. This includes the NorthConnex, M4 East and New M5 tunnels, which are all approved and under construction.

Transverse ventilation

Another way to ensure adequate dilution of emissions is to provide fresh air inlets along the length of the tunnel along one side, with outlets on the opposite side. This system requires two ducts to be constructed along the length of the tunnel: one for the fresh air supply and one for the exhaust air. Transverse ventilation has been used in the past when vehicle emissions produced greater levels of pollutants than they do today. A transverse ventilation system is more expensive to construct because of the additional ducts that need to be excavated for each tunnel. This type of system is less effective than a longitudinal system for controlling smoke in the tunnel in case of a fire. It is also more energy intensive as more power is consumed to manage air flows.

Semi-transverse ventilation

Semi-transverse ventilation combines both longitudinal and transverse ventilation. Fresh air can be supplied through the portals and be continuously exhausted through a duct along the length of the tunnel. Alternatively, fresh air can be supplied through a duct and exhausted through the portals.

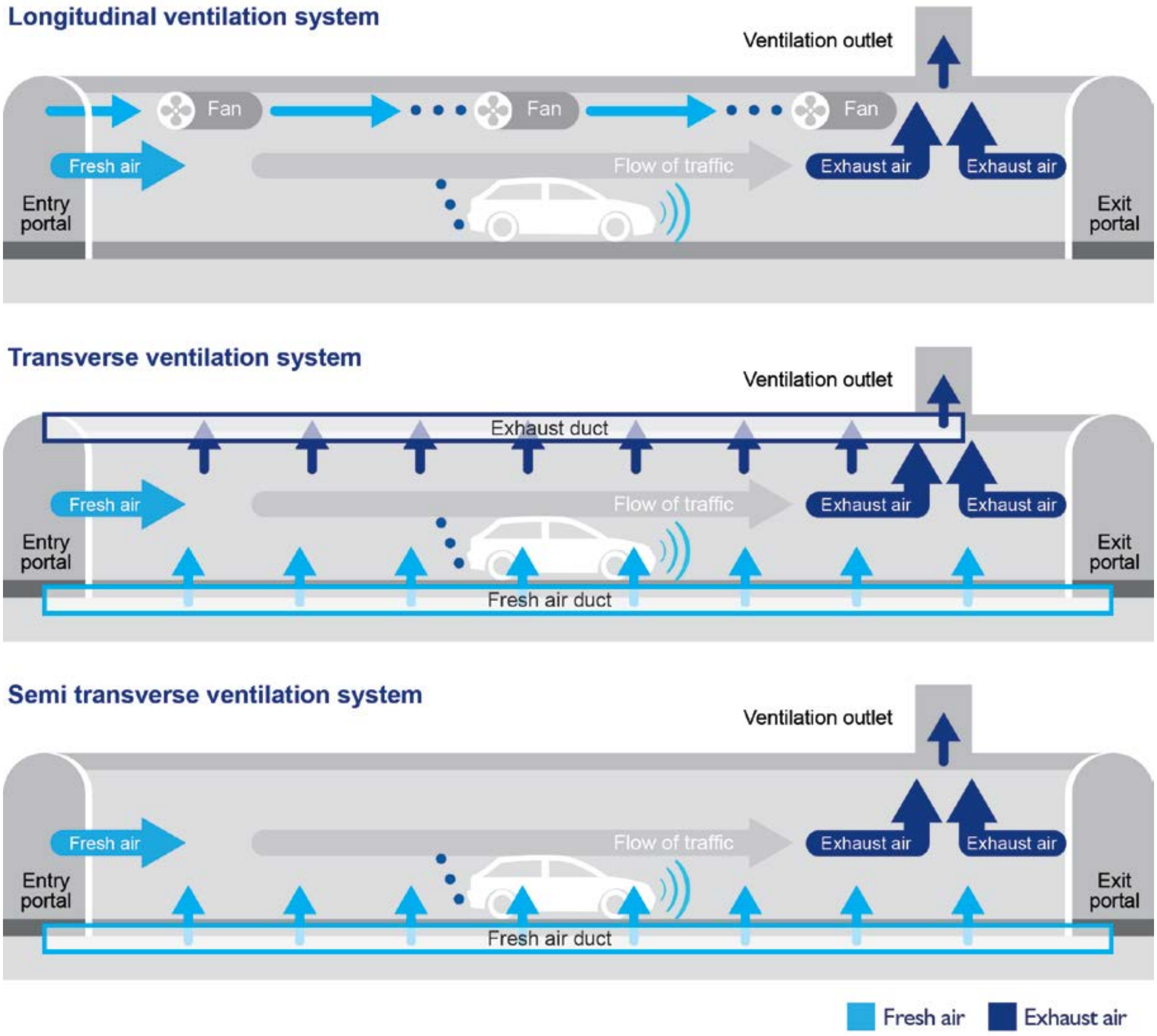


Figure 4-14 Mechanical ventilation system design options

Preferred option

The development of cleaner vehicles in response to cleaner fuel and emissions standards has led to a significant reduction in vehicle emissions over the past 20 years. Where longitudinal ventilation was once not suitable for long tunnels, due to the need to supply large volumes of fresh air to dilute vehicle emissions, a well-designed longitudinal ventilation system can maintain acceptable air quality in long tunnels and is considered the most efficient and effective tunnel ventilation system (Advisory Committee on Tunnel Air Quality (ACTAQ) 2014).

Although all three mechanical ventilation systems described above could be designed to meet in-tunnel air quality criteria, a longitudinal system with elevated ventilation outlets has been selected as the preferred option for the project, and the other tunnel projects forming part of the WestConnex program of works, for the following reasons:

- It is less costly to construct and operate than transverse systems
- It is able to ensure emissions are dispersed and diluted so that there is minimal or no effect on ambient air quality
- It is more effective for the management of smoke in a tunnel in the event of a fire
- It is able to meet the requirement to minimise portal emissions as far as practicable.

The effectiveness of elevated ventilation outlets in dispersing emissions is well established. **Chapter 9** (Air quality) presents the air quality assessments for both in-tunnel and external air quality. An overview of the ventilation system design and operation is provided in **Chapter 5** (Project description).

Ventilation outlets and portal emissions

Since 1998, a key operating requirement for road tunnels longer than one kilometre in Sydney has been to minimise emissions through the portals, or tunnel exits. Essentially, this means that the ventilation systems are designed to have zero portal emissions, with all air being drawn in from the exit portals against the flow of traffic, and expelled through an elevated ventilation outlet. The ventilation system needed to achieve this requires more fans than it would if portal emissions were permitted, with higher capital and operational costs.

Drawing air from the exit portal increases the quantity of ventilation air to be discharged through the ventilation outlet and can increase the diameter of the outlet required, or require an additional outlet close to the exit portal. The need for zero portal emissions also means that the ventilation fans in the exit ramps need to operate all the time, regardless of whether in-tunnel or ambient air quality warrants this operation. This incurs higher energy usage than if portal emissions were permitted.

The feasibility of allowing portal emissions for the Iron Cove Link was investigated on the basis that it is a short tunnel (about one kilometre) with only two traffic lanes in each direction and therefore it would generate lower pollution concentrations than the larger and longer mainline tunnels. If portal emissions were acceptable, then the construction of at least one and potentially two outlets (ie one at each end of the tunnel), and associated infrastructure including ventilation tunnels, could be avoided. Health impact risk factors applied to the change in concentration of fine particles with a diameter less than 2.5 micrometres (ie $PM_{2.5}$) were used as the criterion for acceptability of portal emissions. This initial screening assessment demonstrated that the criterion would be exceeded and there was therefore no further consideration of portal emissions for the Iron Cove Link.

Air filtration at the ventilation outlet

Only a small proportion of road tunnels around the world are fitted with air treatment systems. It has been shown that control of pollutants at the source is significantly more effective in improving local and regional air quality (ACTAQ 2014; National Health and Medical Research Council 2008). Control measures include minimising road gradients, increasing tunnel height and providing a large tunnel cross-sectional area. The tunnel ventilation system for the project would be designed with appropriate levels of conservatism and redundancy to ensure compliance with air quality goals and limits.

No in-tunnel filtration system is proposed for the project because the modelling undertaken demonstrates that the ventilation system would be effective in ensuring compliance with the in-tunnel air quality criteria. If in-tunnel air quality levels could not be achieved with the ventilation system proposed, the most effective solution would be the introduction of additional ventilation outlets and additional locations for fresh air supply. The inclusion of tunnel filtration was evaluated and found not to provide any material benefit to air quality or community health, and is discussed in the air quality impact assessment in **Appendix I** (Technical working paper: Air quality).

The inclusion of filtration would result in no material change in air quality in the surrounding community when compared to the current project ventilation system and outlet design. Any predicted changes in the concentration of pollutants would be driven by changes in the surface road traffic.

Ventilation facility locations

The main considerations in relation to ventilation facilities include minimising local air quality impacts on nearby receptors and maximising the operational efficiency of the tunnel ventilation system. Minimising local air quality impacts is primarily achieved through the design and operation of the ventilation outlet. However, the location of road tunnel ventilation outlets is very important for the efficiency of the tunnel ventilation system. The project includes ventilation outlets at Haberfield, St Peters (Campbell Road) and Rozelle (in two locations). More detail on the location of the ventilation facilities is provided below and in **Chapter 5** (Project description).

Background and design considerations that affect location of ventilation facilities

As described above, a longitudinal ventilation system is proposed for the project. A longitudinal system relies on single directional traffic flow; therefore, separate tunnels for northbound and southbound traffic would be required. This also results in the need for a ventilation outlet at each end of the mainline tunnels, with at least one outlet for each tunnel. The location of the project ventilation facilities is shown in **Figure 4-15**.

The ventilation outlets ideally need to be located close to the end of the tunnels, before the exit portals. This allows some air to be drawn into the portals against the traffic flow. This forced reverse flow is achieved by jet fans within the exit ramp and tunnel. Minimising the use of these fans increases the performance of the tunnels and reduces operational power consumption and cost, while providing environmental benefits, by reducing greenhouse gas emissions associated with energy generation.

The locations of ventilation facilities for the project were influenced by the design of the approved M4 East and New M5 projects. Both of these projects take into account the development of ventilation facilities for the M4-M5 Link by providing space in their respective project footprints for the development of these facilities. The construction of the ventilation facility at Haberfield (the Parramatta Road ventilation facility) that would be shared by the M4 East and M4-M5 Link projects was approved and is being constructed as part of the M4 East project, however the fitout and use of the M4-M5 Link section of the ventilation facility is subject to assessment and approval through the M4-M5 Link project. At St Peters, the ventilation facility would be located at the northern end of the project footprint of the New M5 project at the St Peters interchange, however the approval for the construction, fitout and operation of a new ventilation facility for the M4-M5 Link is subject to assessment and approval through the M4-M5 Link project. Locating ventilation facilities within the project footprints of the previous WestConnex projects minimises land acquisition requirements and streamlines the design and construction process for the M4-M5 Link.

The project also includes construction of a ventilation outlet for the proposed future Western Harbour Tunnel and Beaches Link project, as part of the Rozelle ventilation facility at the Rozelle Rail Yards (further detail is provided in **Chapter 6** (Construction work)).

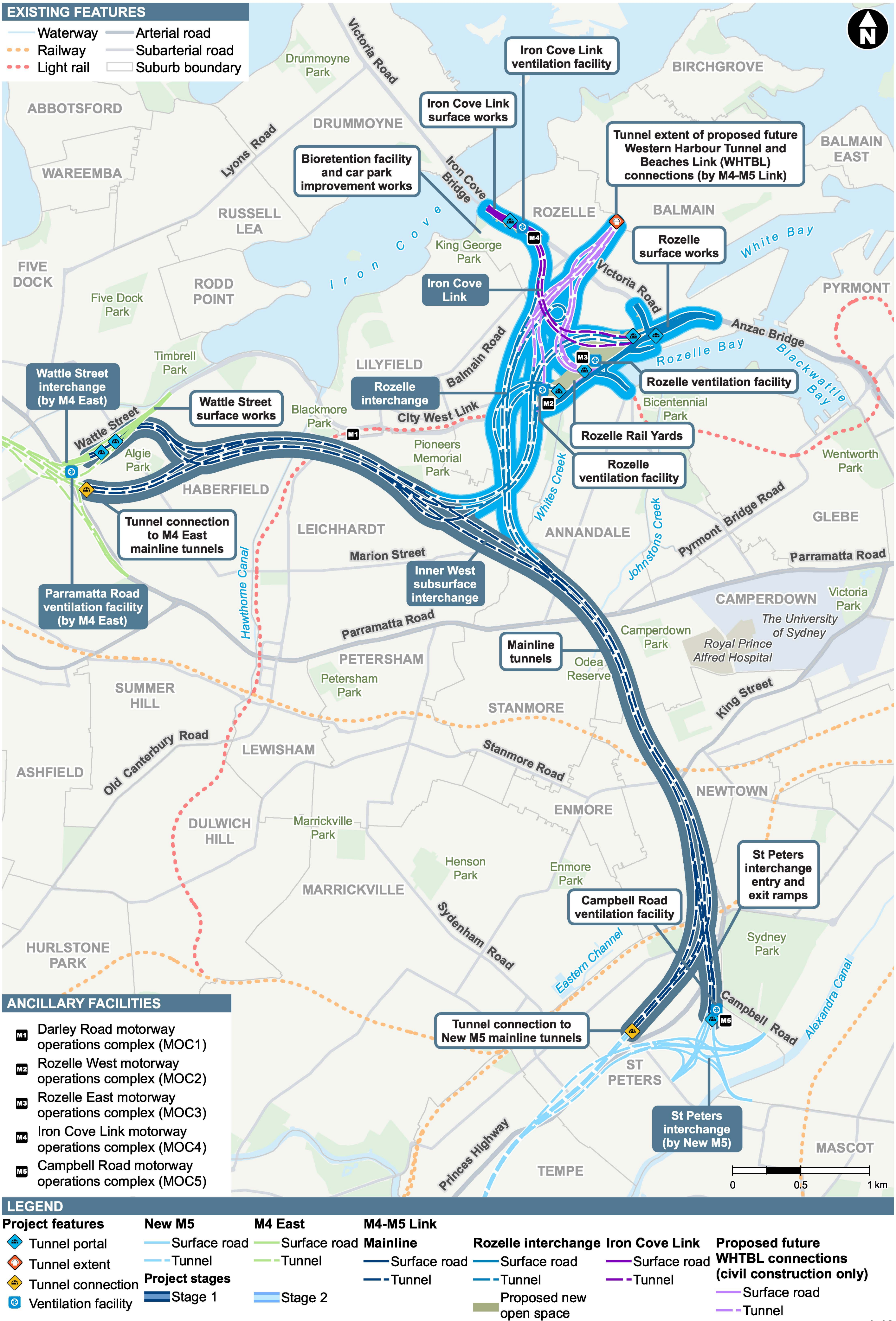


Figure 4-15 Ventilation facility locations

Campbell Road ventilation facility at the St Peters interchange

Suitable options for a ventilation facility at the St Peters interchange were investigated to inform the EIS and ongoing design development of the project. A number of options were identified and subject to a screening assessment against a number of criteria, including:

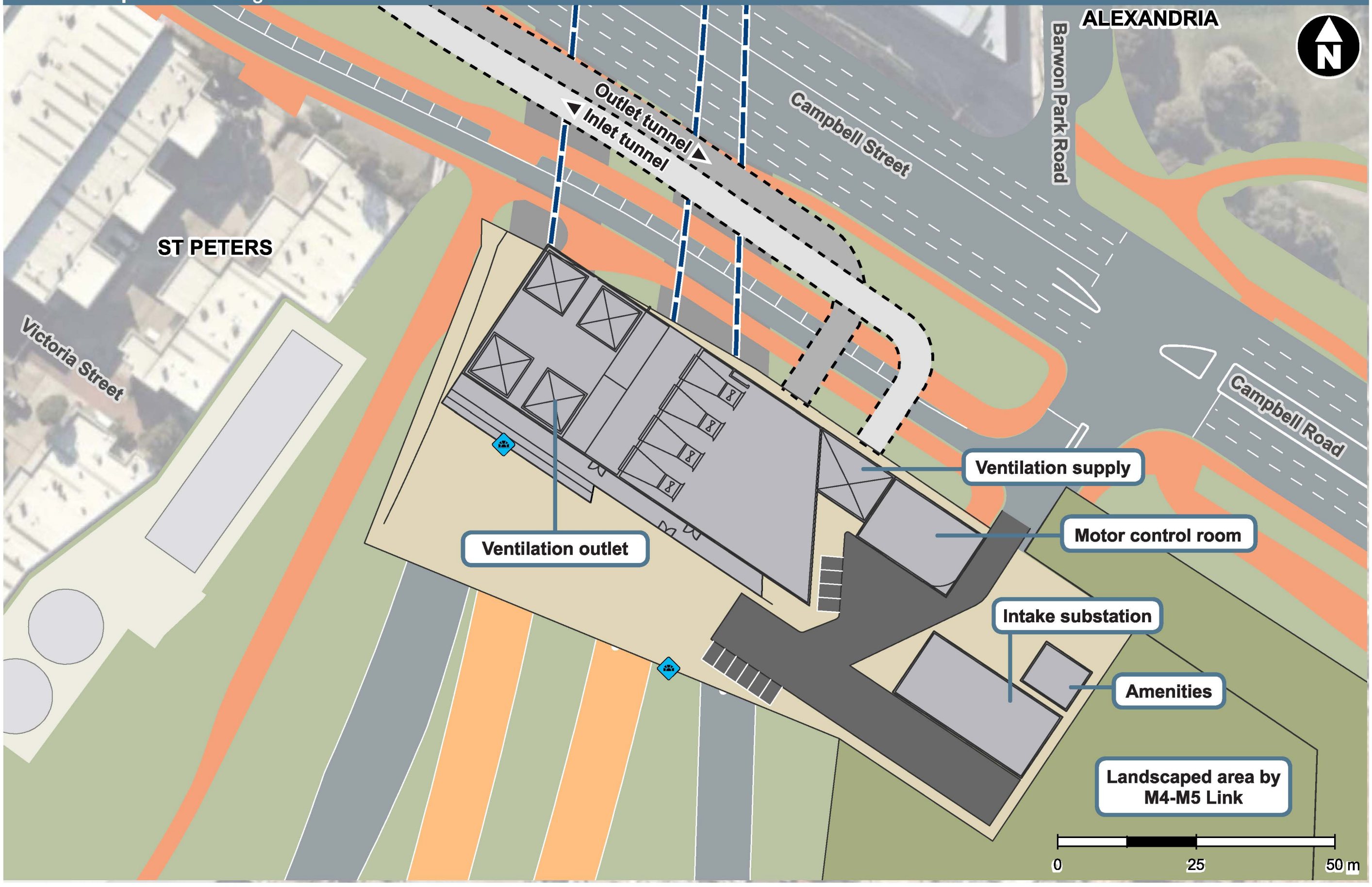
- Proximity to mainline tunnel and entry and exit ramps
- Ventilation facility functional requirements such as proximity to the mainline tunnels and entry and exit ramps
- Future open space and landscaping requirements at the site (as detailed by conditions of approval for the New M5 project)
- Civil Aviation Safety Authority requirements
- Maintenance and operation requirements
- Proximity to the Alexandria Landfill
- Constructability and construction program
- Access for maintenance
- Meeting relevant ambient air quality criteria at closest sensitive receivers.

Two suitable options were identified, as illustrated in **Figure 4-16**, including:

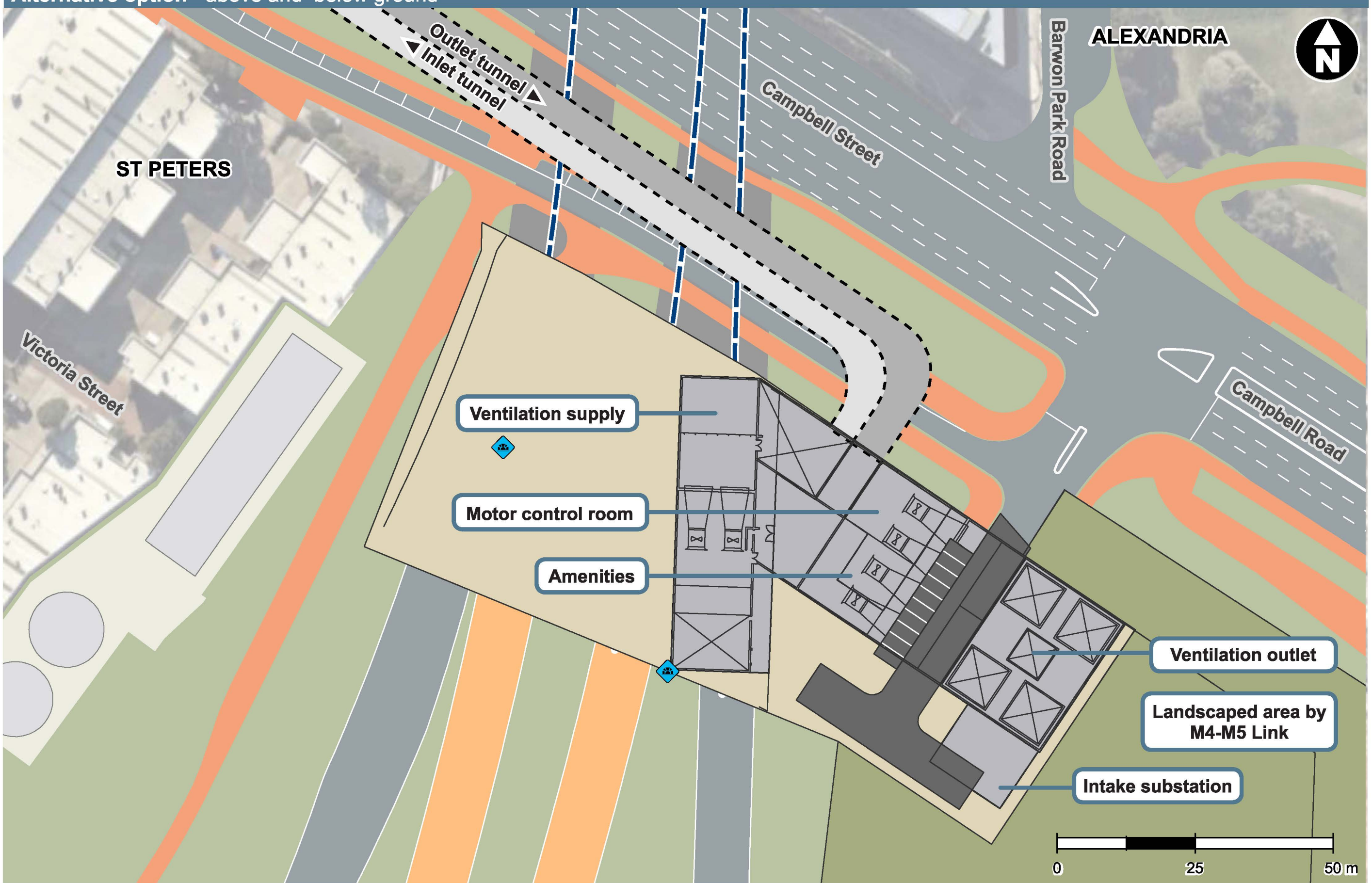
- **A combined underground and surface facility** – this option includes an underground ventilation exhaust facility with an above ground ventilation outlet and ventilation supply building. The ventilation outlet would be around 22 metres high above existing ground level and is located at the north-eastern end of the St Peters interchange
- **An above ground facility** – in this option the ventilation exhaust facilities are on top of the southbound St Peters interchange tunnel portal cover along with the ventilation supply structure. The ventilation outlet would have a height of around 22 metres above existing ground level and is located slightly west of the combined facility location.

The preferred option assessed in this EIS is the above ground facility; however, both options are subject to further engineering investigation and design.

Preferred option - above ground



Alternative option - above and below ground



LEGEND

New M5
- Building
- Surface road
- Shared path
- Landscaping
- Proposed future Sydney Gateway connections (non-operational as part of M4-M5 Link)

M4-M5 Link

Mainline tunnel
- Tunnel

Project features
- Tunnel portal

Ventilation facility
- Building
- Car parking
- Ventilation site
- Landscaping
- Ventilation supply tunnel
- Ventilation exhaust tunnel

Figure 4-16 Feasible Campbell Road ventilation facility options

Rozelle ventilation facility at the Rozelle interchange

The Rozelle ventilation facility would be located within the Rozelle interchange at the Rozelle Rail Yards. Locating the ventilation facility within the Rozelle Rail Yards provides a ventilation facility location that would be suitable for both northbound and southbound tunnels. The facility includes three outlets in one location at a height of around 35 metres above existing ground level. The ventilation outlet was initially designed to be a height of around 20–22 metres (as for the Iron Cove Link and Campbell Road ventilation outlets), however in order to meet project air quality objectives in this location while minimising aviation risks, the design was refined to increase the height of the ventilation outlets to around 35 metres above existing ground level.

A number of locations within the Rozelle Rail Yards were considered, having regard to a range of criteria, including:

- The location relative to the mainline tunnels, entry and exit ramps and surface connections including those for the Western Harbour Tunnel and Beaches Link project
- Location of residential receivers to the north along Lilyfield Road (which sit at a higher elevation than the rail yards) and to the south across City West Link
- Location of other infrastructure including water treatment plants, wetlands, drainage channels, and active transport links
- The urban design principles for the project including the provision of open space
- Potential impacts on air quality.

The exact location of the ventilation facility would be determined during the detailed design of the project.

Iron Cove Link ventilation facility at Victoria Road

Two locations have been identified for the Iron Cove Link ventilation facility including:

- **On the southern side of Victoria Road** – this location at Springside Street is within the footprint of residual land created by the project. It is also close to residences and both the outlet (around 20 metres above existing ground level) and the ventilation building (around 12 metres above ground level) would be visible from Victoria Road and from a number of local roads at Rozelle
- **In the centre of Victoria Road** – this location was identified to increase the distance of the ventilation outlet from residences and to provide a more optimal urban design solution by creating a feature in the Victoria Road corridor and the local landscape. The outlet is expected to be around 20 metres above existing ground level. The ventilation building is the same size and in the same location as for the option on the southern side of Springside Street. This is the preferred option assessed in the EIS and described in more detail in **Chapter 5** (Project description).

4.6.2 Construction ancillary facility locations

Twelve construction ancillary facilities have been identified to support the construction of the project. These are sites that would be used during construction of the project for a mix of civil surface works, tunnelling support and administrative purposes. The locations identified for the construction ancillary facilities also give consideration to the following criteria:

- **The locations of key project infrastructure** – where feasible, the construction ancillary facilities would be located within or adjacent to land which would be used for permanent operational infrastructure
- **Co-locating sites with other WestConnex projects where possible** – the project would use construction ancillary facilities approved for use by the M4 East and New M5 projects at Haberfield and St Peters respectively
- **Land is suitable for use** – this included consideration of surrounding land uses, biodiversity and heritage values and minimising disruption to communities
- **Accessibility** – sites would be located close to arterial routes for spoil haulage and would minimise use of local roads through residential areas

- **Minimising private property acquisition** – the aim is to utilise government owned properties where possible
- **Construction program implications** – site selection that would enable construction works to be completed as efficiently as possible.

Twelve construction ancillary facilities are described and assessed in this EIS. The number, location and layout of construction ancillary facilities would be finalised as part of detailed construction planning during detailed design and would meet the environmental performance outcomes stated in the EIS and the Submissions and Preferred Infrastructure Report and satisfy criteria identified in any relevant conditions of approval.

To assist in informing the development of a construction methodology that would manage constructability constraints and the need for construction to occur in a safe and efficient manner, while minimising impacts on local communities, the environment, and users of the surrounding road and other transport networks, two possible combinations of construction ancillary facilities at Haberfield and Ashfield have been assessed in this EIS (see **Table 4-6**). The construction ancillary facilities that comprise these options have been grouped together in this EIS and are denoted by the suffix *a* (for Option A) or *b* (for Option B) eg C1a Wattle Street civil and tunnel site.

Table 4-6 Possible construction ancillary facility combinations at Haberfield and Ashfield assessed in this EIS

Option A	Option B
Wattle Street civil and tunnel site (C1a)	Parramatta Road West civil and tunnel site (C1b)
Haberfield civil and tunnel site (C2a)	Haberfield civil site (C2b)
Northcote Street civil site (C3a)	Parramatta Road East civil site (C3b)

While the Option A sites were identified to minimise the project footprint of the M4-M5 Link and to maximise the use of facilities and infrastructure to be constructed by the M4 East project, the Option B sites provide a number of benefits over the Option A sites including:

- Avoid or minimise impacts to the timing of delivery of the M4 East Urban Design and Landscape Plan and the M4 East Legacy Project around Walker Avenue at Haberfield, by minimising the amount of land at the surface that would be used for construction of the M4-M5 Link project
- Avoid construction fatigue for receivers adjacent to the Option A sites such as along Wattle Street, Walker Avenue and Northcote Street due to concurrent project construction for the M4 East and M4-M5 Link projects. Notwithstanding this, the Parramatta Road West civil and tunnel site (C2b) would be adjacent to a construction site for the M4 East project, which would mean nearby receivers, particularly around Bland Street at Ashfield, would be subject to cumulative construction impacts (such as construction fatigue)
- Safeguard the project program by limiting dependence on the completion of M4 East works at the Option A sites before these sites can be made available for use for construction of the project.

Throughout the development of the project, a number of potential construction ancillary facility sites were investigated but were excluded from the project for various reasons. These sites and the reasons they do not form part of the project are outlined in **Table 4-7**. The location of these sites is shown in **Figure 4-17**. Other design refinements related to construction ancillary facilities included limiting construction activities at Darley Road civil and tunnel site (C4) to standard construction hours only, where out-of-hours works were initially proposed. The refinement was included to minimise noise impacts on surrounding receivers and minimise heavy vehicle movements on local roads outside standard construction hours. This refinement was made following consultation with relevant stakeholders and the community.

Chapter 5 (Project description) includes details of the locations of the construction ancillary facilities that do form part of the project. Refer to **Chapter 6** (Construction work) for further information on the anticipated works planned at each site and the indicative timing for these works. The potential impacts associated with the construction ancillary facility sites are presented in the relevant technical impact assessment chapters in this EIS.

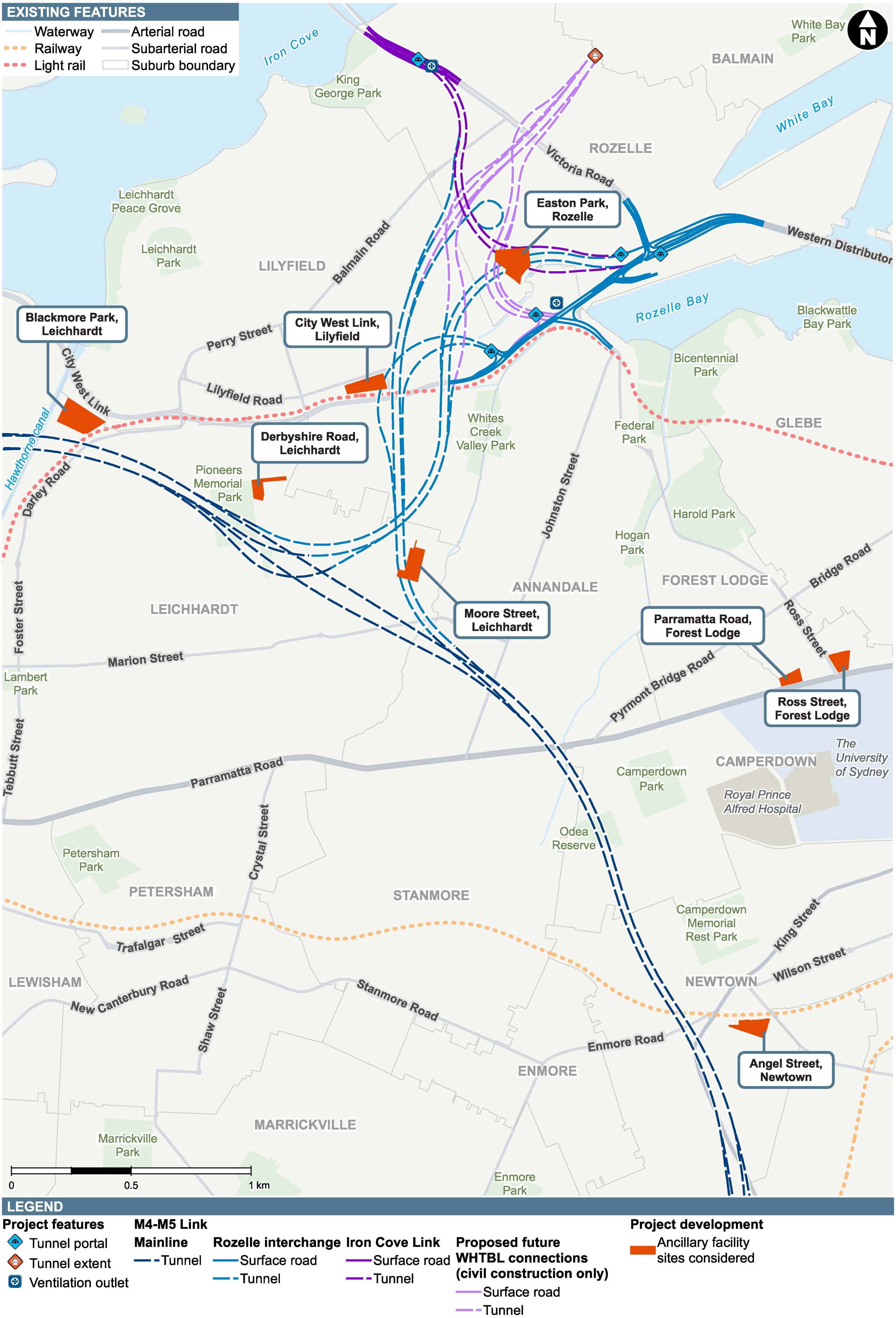


Figure 4-17 Construction ancillary facility sites that were investigated but do not form part of the project

Table 4-7 Construction ancillary facility options that were investigated but do not form part of the project

Site name	Works proposed	Reasons for excluding this site	Project function provided by
Blackmore Park, Leichhardt	Tunnel and civil site – support tunnelling of the mainline tunnels including launching road headers and spoil management and haulage	Would require temporary loss of passive and active open space and vegetation removal. Community and stakeholder feedback requesting that impacts on public open space be avoided was also taken into consideration during relocation of the ancillary facility site. Access to the site was constrained by a narrow road (Canal Road) and the restricted height clearance under the light rail bridge.	Darley Road civil and tunnel site (C4)
Easton Park, Rozelle	Tunnel and civil site - construct the dive and cut and cover tunnel portals to connect the surface roads at the Rozelle interchange to the Iron Cove Link tunnel	Would require temporary loss of passive and active open space, vegetation removal and impacts on heritage items (Easton Park and Sydney Water sewage pumping station). Community and stakeholder feedback requesting that impacts on public open space be avoided was also taken into consideration during relocation of the ancillary facility site. Design optimisation led to the relocation of cut-and-cover tunnel structures to within the Rozelle Rail Yards, therefore this site could be avoided. Community and stakeholder feedback requesting that impacts on public open space be avoided were also taken into consideration during relocation of the ancillary facility site. Use of this site also required closure of part of Lilyfield Road.	Rozelle civil and tunnel site (C5)
Moore Street, Leichhardt	Tunnel and civil site – support tunnelling of the mainline tunnels including launching road headers and spoil management and haulage	There is the potential for the site to be contaminated given current and previous land uses. Alternative sites in the vicinity that would result in less property impacts were identified. Potential access constraints for heavy vehicles between the site and the arterial road network, and the associated amenity impacts on nearby receivers along the haulage route, were also taken into consideration.	Darley Road civil and tunnel site (C4)
Ross Street, Forest Lodge	Tunnel and civil site – support tunnelling of the mainline tunnels including launching road headers and spoil management and haulage	Removal of the Camperdown interchange and subsequent change to the mainline tunnel alignment meant that the length of the temporary construction access tunnel from this site increased, which would have resulted in significant delays to the construction program. Limitations on access for heavy vehicles between this site and the arterial road network were also taken into consideration during relocation of the	Pyrmont Bridge Road tunnel site (C9)

Site name	Works proposed	Reasons for excluding this site	Project function provided by
		construction ancillary facility. Proximity to heritage items and the education precinct of University of Sydney were raised as concerns by stakeholders.	
Parramatta Road, Forest Lodge	Tunnel and civil site – support tunnelling of the mainline tunnels including launching road headers and spoil management and haulage	Removal of the Camperdown interchange and subsequent change to the mainline tunnel alignment meant that the length of the temporary construction access tunnel from this site increased, which would have resulted in significant delays to the construction program. Limitations on access for heavy vehicles between this site and the arterial road network were also taken into consideration during relocation of the construction ancillary facility. Proximity to heritage items and the education precinct of University of Sydney were raised as concerns by stakeholders.	Pyrmont Bridge Road tunnel site (C9)
City West Link, Lilyfield	Tunnel and civil site – support tunnelling of the mainline tunnels including launching road headers and spoil management and haulage	The temporary access tunnel between the site and the mainline tunnels would be around 750 metres in length. Constructing this temporary access tunnel before tunnelling of the mainline could begin from this site would have resulted in substantial construction program delays. There is the potential for the site to be contaminated given current and previous land uses. The site is in proximity to active light rail corridor facilities and would require tunnelling under the light rail line. There are level differences between the site and surrounding roads which would constrain access.	Rozelle civil and tunnel site (C5)
Angel Street/ Railway Lane, Newtown	Tunnel and civil site – support tunnelling of the mainline tunnels including launching road headers and spoil management and haulage	The site, including the buildings associated with the former Newtown Tram Depot, is listed on the state heritage register. There is the potential for the site to be contaminated given current and previous land uses. Heavy vehicles would need to use narrow, one-way local roads to access the site, which would have resulted in amenity impacts on nearby receivers. There was a high potential for the site to be contamination, given its previous land uses. The site was in close proximity to an active rail corridor and residential areas. Distance of this site to the arterial	Campbell Road civil and tunnel site (C10)

Site name	Works proposed	Reasons for excluding this site	Project function provided by
		road network posed constraints for spoil haulage.	
Derbyshire Road, Leichhardt	Tunnel and civil site – support tunnelling of the mainline tunnels including launching road headers and spoil management and haulage Subsequently, construction workforce parking	The site was immediately adjacent to Sydney Secondary College Leichhardt Campus, a sports oval, the State Transit – Leichhardt Depot and Pioneers Memorial Park. Heavy vehicles would have to utilise Derbyshire Road. A locally listed heritage item (Former State Rail Authority cable store and traffic office, including interiors, which includes two buildings) would be required to be demolished. Community and stakeholder feedback requested that consideration be given to relocating this site.	Darley Road civil and tunnel site (C4)

4.6.3 Tunnel construction methodologies

A number of tunnel construction methods were considered and are described in the following sections.

Tunnel boring machine

A tunnel boring machine (TBM) is a specialist machine that excavates a circular bore of fixed diameter by rotary action. The machine comprises a rotating head fitted with disc cutters, drag bits and clay spade. Soft ground TBMs include a facility for the fixing of fabricated permanent wall lining panels (generally precast concrete) immediately behind the cutting face. Hard ground (rock) TBMs include a gripper facility that allows the TBM to push off the wall of the excavation. TBMs are normally custom made to suit the particular requirements of the project and require considerable time to deliver and mobilise for full operation. They also require a large open area on site to assemble and align in position for driving.

Drill and blast

The drill and blast excavation method involves a sequence of drilling holes, charging the holes with explosive, blasting, mucking out, and installing roof and wall ground support. The method is an efficient and cost effective way of excavating in rock, and provides an effective tunnel excavation method which assists in achieving an overall shorter project delivery. This method offers the shortest exposure to noise and vibration for residents and businesses above the tunnels, compared to other methods of tunnel excavation.

Roadheader excavation

Roadheaders are commonly used for excavation in sandstone and have been successfully used in other tunnel projects in Sydney, including other WestConnex projects. A roadheader is specialised tunnelling equipment that excavates with picks mounted on a rotary cutter head attached to a hydraulically operated boom. In areas of very hard rock, ripper dozers and rock breakers would also be used to assist with the excavation. The excavated material would be continually removed by conveyors onto dump trucks designed to operate underground. The excavated material would then be stockpiled near the tunnel entrance, from where it would be removed via truck for disposal or reuse. As the excavation advances, temporary or permanent ground support would be installed behind the excavation face. The support could be permanent or temporary and would normally include rock bolts, steel mesh and sprayed concrete.

Roadheaders offer advantages over tunnel boring machines for:

- The excavation of varying cross sections, caverns and niches

- The excavation of cross passages
- The ease by which roadheaders can be moved to different parts of the tunnel alignment.

Preferred tunnel construction method

It is anticipated that a combination of the roadheader excavation and drill and blast methods would be used for the project, for the following reasons:

- The combination of methods speeds up excavation compared to work being undertaken solely with roadheaders
- It is more economic because it takes less time and generates less spoil than a tunnel boring machine
- The road geometry and cross-sectional dimensions of the project tunnels precludes the use of TBMs for excavation
- It reduces the noise and vibration impacts on residential and commercial properties due to the shorter duration impacts associated with blasting compared to other tunnel construction methods
- Geological conditions along the alignment are suitable for both roadheader excavation and drill and blast methods.

Further detail on the tunnelling construction approach is provided in **Chapter 6** (Construction work).

4.6.4 Spoil storage, transport and disposal options

Construction of the project would generate around 4.5 million cubic metres of spoil, which allows for numerous spoil reuse and disposal options. Consideration has been given to the various modes available to store and transport spoil, as outlined below.

Spoil storage options

The development of the project identified and incorporated the opportunity to store spoil within the M4 East project tunnels at Haberfield. The refinement was included to reduce heavy vehicle movements on surface roads (and associated traffic congestion and noise impacts on adjacent receivers) and minimise potential for dust mobilisation and associated air quality impacts.

Spoil transport options

Rail

The benefit of rail as a spoil transport option is the ability to move large volumes, while reducing the number of heavy vehicle movements on the wider road network. However, this method presents the following issues:

- There are very few spare train paths on the Sydney rail network, which presents logistical challenges
- The material would need to be double (or possibly triple) handled, as trucks would be required to move material to the train loading facility, and potentially from the rail facility to its final location, if this does not have rail access
- Infrastructure upgrades would potentially be required at rail yards which are part of the Sydney Metropolitan Freight Network (at Port Botany or Enfield) to allow the train loading facility to receive the material.

Barge

As with rail, the main benefit of barge transport is the ability to move large volumes of spoil, while reducing the number of heavy vehicle movements on the wider road network. However, this option presents a number of issues including:

- The material would need to be double (or possibly triple) handled, as trucks would be required to move material to the barge loading facility, and potentially from the barge to its final location, if this does not have barge access

- Infrastructure upgrades would potentially be required to allow the barge loading facility to receive the material.

Notwithstanding this, further investigations would be undertaken of spoil transport options, including the potential barging of spoil, during detailed design.

Heavy vehicle

Spoil removal using heavy vehicles (ie trucks) would involve transporting material from the construction sites directly to its final destination and would occur primarily via the arterial road network. However, as trucks would be limited to transporting relatively small volumes of spoil (around 25–30 cubic metres per truck), a large number of truck movements would be required. The use of trucks would therefore streamline the handling of spoil as no double or triple handling would be required, but would result in a higher number of trucks on the road. This increase is considered acceptable given trucks are the most appropriate transport option for the location of the spoil disposal sites. Transport by other transport options (rail and barging) would still require trucks to initially move material to the loading facility and, potentially, to the final destination.

Heavy vehicles are the preferred spoil transport option for the project. **Chapter 8** (Traffic and transport) provides a summary of heavy vehicle movements, including spoil related haulage. A summary of spoil haulage routes from the various construction sites is provided in **Chapter 23** (Resource use and waste minimisation). Use of local roads would be avoided where possible, with the main haulage routes being via major arterial roads such as City West Link, Parramatta Road, the M4 Motorway, the Princes Highway and the M5 Motorway. There may be an opportunity for spoil generated at the Haberfield and St Peters ends of the mainline tunnel to be transported via the completed M4 East and New M5 tunnels rather than via surface roads, where practicable. This option would be investigated further by the construction contractor.

Spoil reuse and disposal options

As described in **Chapter 23** (Resource use and waste minimisation), spoil would be beneficially reused as part of the project before alternative spoil disposal options, such as other infrastructure or development projects, were pursued. Residual spoil waste which cannot be reused or recycled would be disposed of to a suitably licensed landfill or waste management facility. Potential opportunities for reuse of spoil within the project include use for the formation of embankments and earth mound noise barriers, site rehabilitation and landscaping, road upgrades, and infill for temporary tunnel access shafts and declines. At least 95 per cent of usable (eg uncontaminated) construction and demolition waste is anticipated to be reused and/or recycled as part of the project.

Six potential spoil management sites, ranging from between 25 to 50 kilometres from the project footprint, have been identified as possible receiving sites for excess spoil from the project. During the development of the project, the proposed Western Sydney Airport was also identified as a potential spoil management site. Determination of the final destination(s) for spoil from construction of the project would be made during the detailed design stage, and may include more than one disposal site.

Alternative and/or additional spoil reuse options may be identified by the construction contractor as the project progresses.

5 Project description

This chapter describes the M4-M5 Link project (the project), including the project tunnels, interchanges and associated infrastructure, and ancillary facilities. It also describes the design standards and construction activities required to deliver the project.

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued environmental assessment requirements for the project. These are referred to as the Secretary's Environmental Assessment Requirements (SEARs). **Table 5-1** sets out certain SEARs alongside the desired performance outcomes of the project, and identifies where the requirements have been addressed in this environmental impact statement (EIS).

Table 5-1 SEARs – project description

Desired Performance Outcome	SEARs	Where addressed in the EIS
2. Environmental Impact Statement The project is described in sufficient detail to enable a clear understanding that the project has been developed through an iterative process of impact identification and assessment and project refinement to avoid, minimise or offset impacts so that the project, on balance, has the least adverse environmental, social and economic impact, including its cumulative impacts.	1. The EIS must include, but not necessarily be limited to, the following: (b) a description of the project and all components and activities (including ancillary components and activities) required to construct and operate it, including:	
	The proposed route	The proposed route is described in **section 5.3.1** for the mainline tunnels, **section 5.3.2** for the Rozelle interchange and Iron Cove Link tunnels, in **section 5.6** for the Rozelle surface works and **section 5.7** for the Iron Cove Link surface works.
	Design of the tunnels, interchanges (inclusive of tunnel portals and entry and exit ramps), and connections to Stage 1 and Stage 2 of WestConnex and other proposals(such as the Western Harbour Tunnel) and road user, pedestrian and cyclist facilities, and lighting	The design of the tunnels is described in **section 5.3.1** for the mainline tunnels, **section 5.3.2** for the Rozelle interchange and Iron Cove Link tunnels, in **section 5.6** for the Rozelle surface works and **section 5.7** for the Iron Cove Link surface works. The design of the Rozelle interchange is described in **section 5.5**. Civil construction of tunnels and entry and exit ramps to enable connections to the proposed future Western Harbour Tunnel and Beaches Link project is outlined in **section 5.3.4.** Integration with other WestConnex projects is described in **section 5.4.** Pedestrian and cyclist facilities are described throughout **section 5.6** for the Rozelle interchange and in **section 5.7.4** for the Iron Cove Link. Lighting, roadside furniture and

Desired Performance Outcome	SEARs	Where addressed in the EIS
		signage for the project is described in **section 5.8.9.** A description of the iterative process of impact identification and assessment and project refinement relating to the construction of the project is included in **Chapter 4** (Project development and alternatives).
	Surface road upgrade works, including road widening, intersection treatment and grade separation works, property access, parking, pedestrian and cyclist facilities (including appropriate locations for overbridges) and public transport facilities	Surface road upgrade works are described in **section 5.6** for the Rozelle surface works and **section 5.7** for the Iron Cove Link surface works. Property access is discussed in **section 5.11** and **Chapter 12** (Land use and property). Pedestrian and cyclist facilities are described throughout **section 5.6** for the Rozelle interchange and in **section 5.7.4** for the Iron Cove Link. Changes to bus infrastructure are described in **section 5.6.8** for the Rozelle interchange and in **section 5.7.6** for the Iron Cove Link.
	Ancillary infrastructure and operational facilities, such as operational and maintenance facilities, ventilation structures and systems, and fire and emergency services and infrastructure for the proposal, including (if required) additional infrastructure (such as tolling and ventilation infrastructure) for the M4 East, M5 Motorway and future Western Harbour Tunnel	Ventilation systems and facilities are described in **section 5.8.2**. Fire and life safety systems are discussed in **section 5.8.3**. Traffic monitoring and management systems are described in **section 5.8.6**. Air quality monitoring and management systems are described in **section 5.8.7**. Motorway tolling infrastructure is described in **section 5.8.8**. Integration with other WestConnex projects is outlined in **section 5.4**.
	Location and operational requirements of construction ancillary facilities and access	Location and operational requirements of construction ancillary facilities and access are described in **Chapter 6** (Construction work).
	Land use changes as a result of the proposal and the acquisition of	Land use changes and property acquisition are discussed in

Desired Performance Outcome	SEARs	Where addressed in the EIS
	privately owned, Council and Crown lands, and impacts to Council and Crown lands	**section 5.11** and **Chapter 12** (Land use and property).
	The relationship and/or integration of the project with existing public and freight transport services	The relationship and/or integration of the project with existing public and freight transport services is discussed in **Chapter 3** (Strategic context and project need) and **Chapter 8** (Traffic and transport).

This chapter describes the key elements of the project, based on the concept design. The concept design defines a constructible concept that provides:

- A definition of property acquisition requirements sufficient to allow construction to proceed
- A general project footprint, including for construction and operation
- A clear description of the design principles, extent of impacts and impact management requirements
- A sound and clear basis for later development of the detailed design to a standard required to support project delivery.

The concept design would continue to be refined where relevant to improve road network and safety performance, minimise impacts on receivers and the environment, and in response to feedback from stakeholders.

5.1 The project

The project would comprise a new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange.

Together with the other components of the WestConnex program of works and the proposed future Sydney Gateway, the project would facilitate improved connections between western Sydney, Sydney Airport and Port Botany and south and south-western Sydney, as well as better connectivity between the important economic centres along Sydney’s Global Economic Corridor and local communities.

The M4-M5 Link is part of the WestConnex program of works. Separate planning applications and assessments have been completed for each of the approved WestConnex projects. Roads and Maritime has commissioned Sydney Motorway Corporation (SMC) to deliver WestConnex, on behalf of the NSW Government. However, Roads and Maritime is the proponent for the project.

In addition to linking to other WestConnex projects, the M4-M5 Link would provide connections to the proposed future Western Harbour Tunnel and Beaches Link, the Sydney Gateway (via the St Peters interchange) and the F6 Extension (via the New M5).

The WestConnex program of works, as well as related projects, are described in **Table 5-2**.

Table 5-2 WestConnex component projects

Project	Description	Status
WestConnex program of works		
M4 Widening	Widening of the existing M4 Motorway from Parramatta to Homebush.	Planning approval under the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) granted on 21 December 2014. Open to traffic.
M4 East	Extension of the M4 Motorway in tunnels between Homebush and Haberfield via Concord. Includes provision for a future connection to the M4-M5 Link at the Wattle Street interchange.	Planning approval under the EP&A Act granted on 11 February 2016. Under construction.
King Georges Road Interchange Upgrade	Upgrade of the King Georges Road interchange between the M5 West and the M5 East at Beverly Hills, in preparation for the New M5 project.	Planning approval under the EP&A Act granted on 3 March 2015. Open to traffic.
New M5	Duplication of the M5 East from King Georges Road in Beverly Hills with tunnels from Kingsgrove to a new interchange at St Peters. The St Peters interchange allows for connections to the proposed future Sydney Gateway project and an underground connection to the M4-M5 Link. The New M5 tunnels also include provision for a future connection to the proposed future F6 Extension.	Planning approval under the EP&A Act granted on 20 April 2016. Commonwealth approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) granted on 11 July 2016. Under construction.
M4-M5 Link (the project)	Tunnels connecting to the M4 East at Haberfield (via the Wattle Street interchange) and the New M5 at St Peters (via the St Peters interchange), a new interchange at Rozelle and a link to Victoria Road (the Iron Cove Link). The Rozelle interchange also includes ramps and tunnels for connections to the proposed future Western Harbour Tunnel and Beaches Link project.	The subject of this EIS.
Related projects		
Sydney Gateway	A high-capacity connection between the new St Peters interchange (under construction as part of the New M5 project) and the Sydney Airport and Port Botany precinct.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval.
Western Harbour Tunnel and Beaches Link	The Western Harbour Tunnel component would connect to the M4-M5 Link at the Rozelle interchange, cross underneath Sydney Harbour between the Birchgrove and Waverton areas, and connect with the Warringah Freeway at North Sydney. The Beaches Link component would comprise a tunnel that would connect to the Warringah Freeway, cross underneath Middle Harbour and connect with the Burnt Bridge Creek Deviation at Balgowlah and Wakehurst Parkway at Seaforth. It would also involve the duplication of the Wakehurst Parkway between Seaforth and Frenchs Forest.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval.

Project	Description	Status
F6 Extension	A proposed motorway link between the New M5 at Arncliffe and the existing M1 Princes Highway at Loftus, generally along the alignment known as the F6 corridor.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval.

5.1.1 The completed project

An overview of the completed project is shown in **Figure 5-1**. More detailed illustrations of completed project components are provided in **Figure 5-2** to **Figure 5-9** with corresponding descriptions provided in the following sections.

Key components of the project would include:

- Twin mainline motorway tunnels between the M4 East at Haberfield and the New M5 at St Peters. Each tunnel would be around 7.5 kilometres long and sized to accommodate up to four lanes of traffic in each direction
- Connections of the mainline tunnels to the M4 East project, comprising:
  - A tunnel-to-tunnel connection to the M4 East mainline stub tunnels east of Parramatta Road near Alt Street at Haberfield
  - Entry and exit ramp connections between the mainline tunnels and the Wattle Street interchange at Haberfield (which is currently being constructed as part of the M4 East project)
  - Minor physical integration works with the surface road network at the Wattle Street interchange including road pavement and line marking
- Connections of the mainline tunnels to the New M5 project, comprising:
  - A tunnel-to-tunnel connection to the New M5 mainline stub tunnels north of the Princes Highway, near the intersection of Mary Street and Bakers Lane at St Peters
  - Entry and exit ramp connections between the mainline tunnels and the St Peters interchange at St Peters (which is currently being constructed as part of the New M5 project)
  - Minor physical integration works with the surface road network at the St Peters interchange including road pavement and linemarking
- An underground interchange at Leichhardt and Annandale (the Inner West subsurface interchange) that would link the mainline tunnels with the Rozelle interchange and the Iron Cove Link (see below)
- A new interchange at Lilyfield and Rozelle (the Rozelle interchange) that would connect the M4-M5 Link mainline tunnels with:
  - City West Link
  - Anzac Bridge
  - The Iron Cove Link (see below)
  - The proposed future Western Harbour Tunnel and Beaches Link
- Construction of connections to the proposed future Western Harbour Tunnel and Beaches Link project as part of the Rozelle interchange, including:
  - Tunnels that would allow for underground mainline connections between the M4 East and New M5 motorways and the proposed future Western Harbour Tunnel and Beaches Link (via the M4-M5 Link mainline tunnels)
  - A dive structure and tunnel portals within the Rozelle Rail Yards, north of the City West Link/The Crescent intersection

- Entry and exit ramps that would extend north underground from the tunnel portals in the Rozelle Rail Yards to join the mainline connections to the proposed future Western Harbour Tunnel and Beaches Link
- A ventilation outlet and ancillary facilities as part of the Rozelle ventilation facility (see below)

- Twin tunnels that would connect Victoria Road near the eastern abutment of Iron Cove Bridge and Anzac Bridge (the Iron Cove Link). Underground entry and exit ramps would also provide a tunnel connection between the Iron Cove Link and the New M5/St Peters interchange (via the M4-M5 Link mainline tunnels)
- The Rozelle surface works, including:
  - Realigning The Crescent at Annandale, including a new bridge over Whites Creek and modifications to the intersection with City West Link
  - A new intersection on City West Link around 300 metres west of the realigned position of The Crescent, which would provide a connection to and from the New M5/St Peters interchange (via the M4-M5 Link mainline tunnels)
  - Widening and improvement works to the channel and bank of Whites Creek between the light rail bridge and Rozelle Bay at Annandale, to manage flooding and drainage for the surface road network
  - Reconstructing the intersection of The Crescent and Victoria Road at Rozelle, including construction of a new bridge at Victoria Road
  - New and upgraded pedestrian and cyclist infrastructure
  - Landscaping, including the provision of new open space within the Rozelle Rail Yards
- The Iron Cove Link surface works, including:
  - Dive structures and tunnel portals between the westbound and eastbound Victoria Road carriageways, to connect Victoria Road east of Iron Cove Bridge with the Iron Cove Link
  - Realignment of the westbound (southern) carriageway of Victoria Road between Springside Street and the eastern abutment of Iron Cove Bridge
  - Modifications to the existing intersections between Victoria Road and Terry, Clubb, Toelle and Callan streets
  - Landscaping and the establishment of pedestrian and cyclist infrastructure
- Five motorway operations complexes; one at Leichhardt (MOC1), three at Rozelle (Rozelle West (MOC2), Rozelle East (MOC3) and Iron Cove Link (MOC4) and one at St Peters (MOC5). The types of facilities that would be contained within the motorway operations complexes would include substations, water treatment plants, ventilation facilities, offices, on-site storage and parking for employees
- Tunnel ventilation systems, including ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels
- Three new ventilation facilities, including:
  - The Rozelle ventilation facility at Rozelle
  - The Iron Cove Link ventilation facility at Rozelle
  - The Campbell Road ventilation facility at St Peters
- Fitout (mechanical and electrical) of part of the Parramatta Road ventilation facility at Haberfield (which is currently being constructed as part of the M4 East project) for use by the M4-M5 Link project

- Drainage infrastructure to collect surface and groundwater for treatment at dedicated facilities. Water treatment would occur at:
  - Two operational water treatment facilities (at Leichhardt and Rozelle)
  - The constructed wetland within the Rozelle Rail Yards
  - A bioretention facility for stormwater runoff within the informal car park within King George Park at Rozelle (adjacent to Manning Street). A section of the existing informal car park would also be upgraded, including sealing the car park surface and landscaping Treated water would flow back to existing watercourses via new, upgraded and existing infrastructure
- Ancillary infrastructure and operational facilities for electronic tolling and traffic control and signage (including electronic signage)
- Emergency access and evacuation facilities, including pedestrian and vehicular cross and long passages and fire and life safety systems
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities. A Utilities Management Strategy has been prepared for the project that identifies management options for utilities, including relocation or adjustment (**Appendix F** (Utilities Management Strategy)) of the EIS as discussed in **section 5.10**.

The project does not include:

- Site management works at the Rozelle Rail Yards. These works were separately assessed and determined by Roads and Maritime through a review of environmental factors under Part 5 of the EP&A Act (refer to **Chapter 2** (Assessment process))
- Ongoing motorway maintenance activities during operation
- Operation of the components of the Rozelle interchange which are the tunnels, ramps and associated infrastructure being constructed to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project.

5.1.2 Project footprint

The project footprint would include the land above and below ground required to construct the project, as well as for temporary ancillary construction facilities, and the land required above and below ground to accommodate permanent infrastructure and areas of new public open space. An overview of the area required for construction is provided in **Chapter 6** (Construction work). The land required for permanent operational infrastructure is shown in **Figure 5-1** and shown in detail in **Figure 5-2** to **Figure 5-9**.

5.1.3 Staged construction and opening of the project

It is anticipated the project would be constructed and opened to traffic in two stages (as shown in **Figure 5-1**).

Stage 1 would include:

- Construction of the mainline tunnels between the M4 East at Haberfield and the New M5 at St Peters, stub tunnels to the Rozelle interchange (at the Inner West subsurface interchange) and ancillary infrastructure at the Darley Road motorway operations complex (MOC1) and Campbell Road motorway operations complex (MOC5)
- These works are anticipated to commence in 2018 with the mainline tunnels open to traffic in 2022. At the completion of Stage 1, the mainline tunnels would operate with two traffic lanes in each direction. This would increase to generally four lanes at the completion of Stage 2, when the full project is operational.

Stage 2 would include:

- Construction of the Rozelle interchange and Iron Cove Link including:
  - Connections to the stub tunnels at the Inner West subsurface interchange (built during Stage 1)
  - Ancillary infrastructure at the Rozelle West motorway operations complex (MOC2), Rozelle East motorway operations complex (MOC3) and Iron Cove Link motorway operations complex (MOC4)
  - Connections to the surface road network at Lilyfield and Rozelle
  - Construction of tunnels, ramps and associated infrastructure as part of the Rozelle interchange to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project
- Stage 2 works are expected to commence in 2019 with these components of the project open to traffic in 2023.

The total construction period for both stages of the project is expected to be around five years, which includes commissioning that would occur concurrently with the final stages of construction. Further staging details would be confirmed when construction contractors have been engaged.

The potential benefits of a staged opening of the project are detailed in **Chapter 4** (Project development and alternatives). A more detailed description of how the project would be constructed in stages is provided in **Chapter 6** (Construction work). An assessment of the traffic and transport impacts of opening the project in stages is included in **Chapter 8** (Traffic and transport).

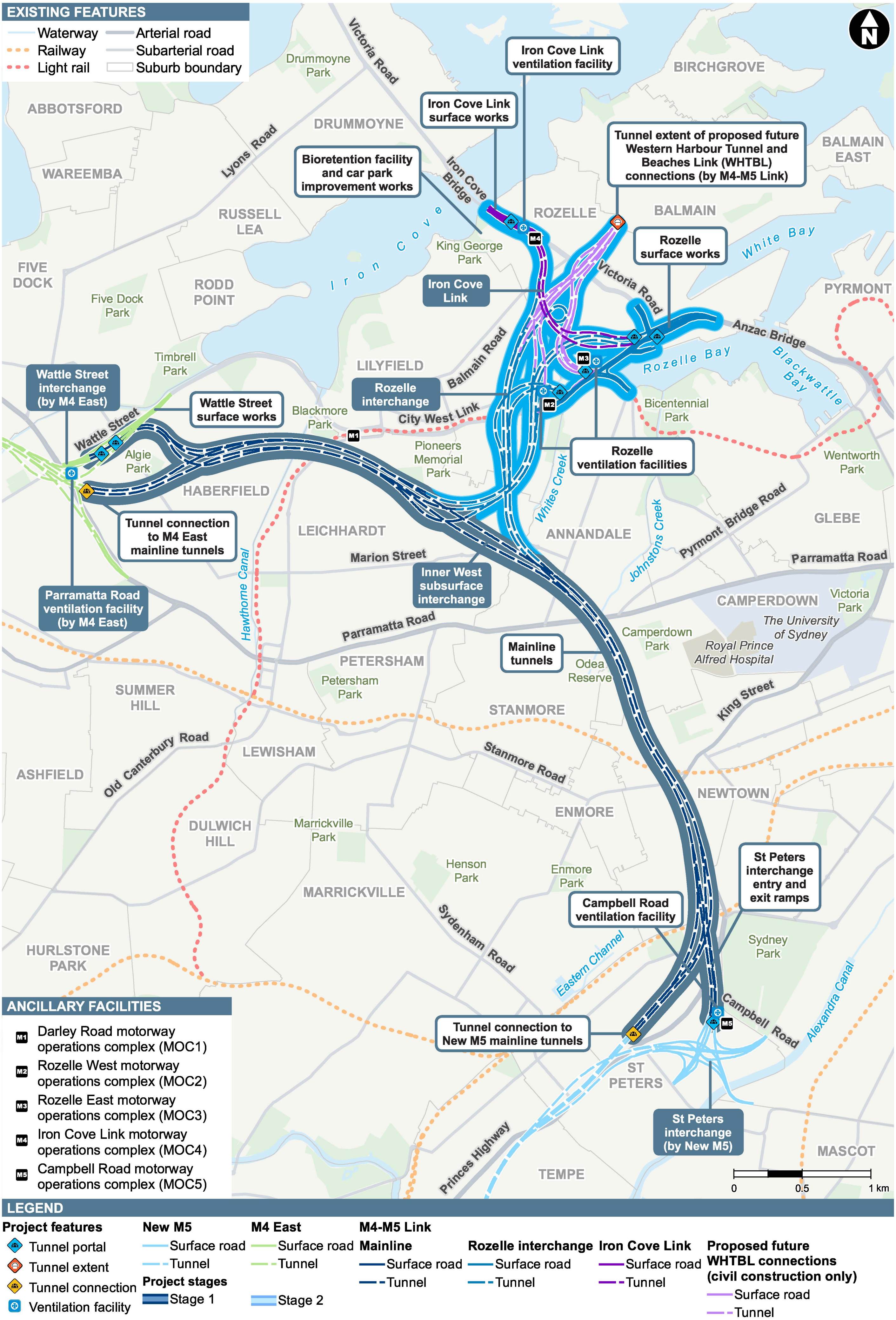


Figure 5-1 Overview of the project

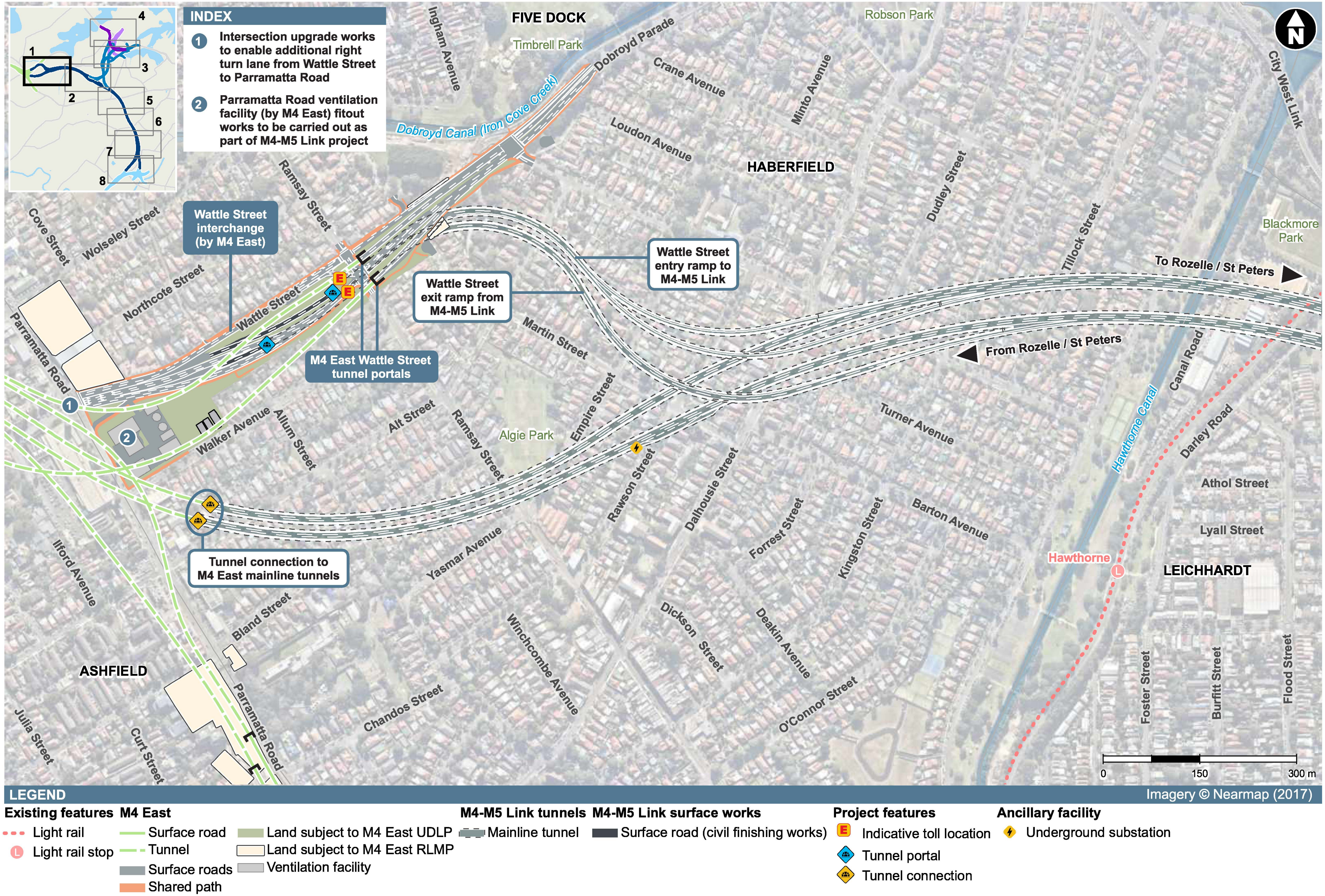


Figure 5-2 Project operational layout – Map 1

Figure 5-3 Project operational layout – Map 2

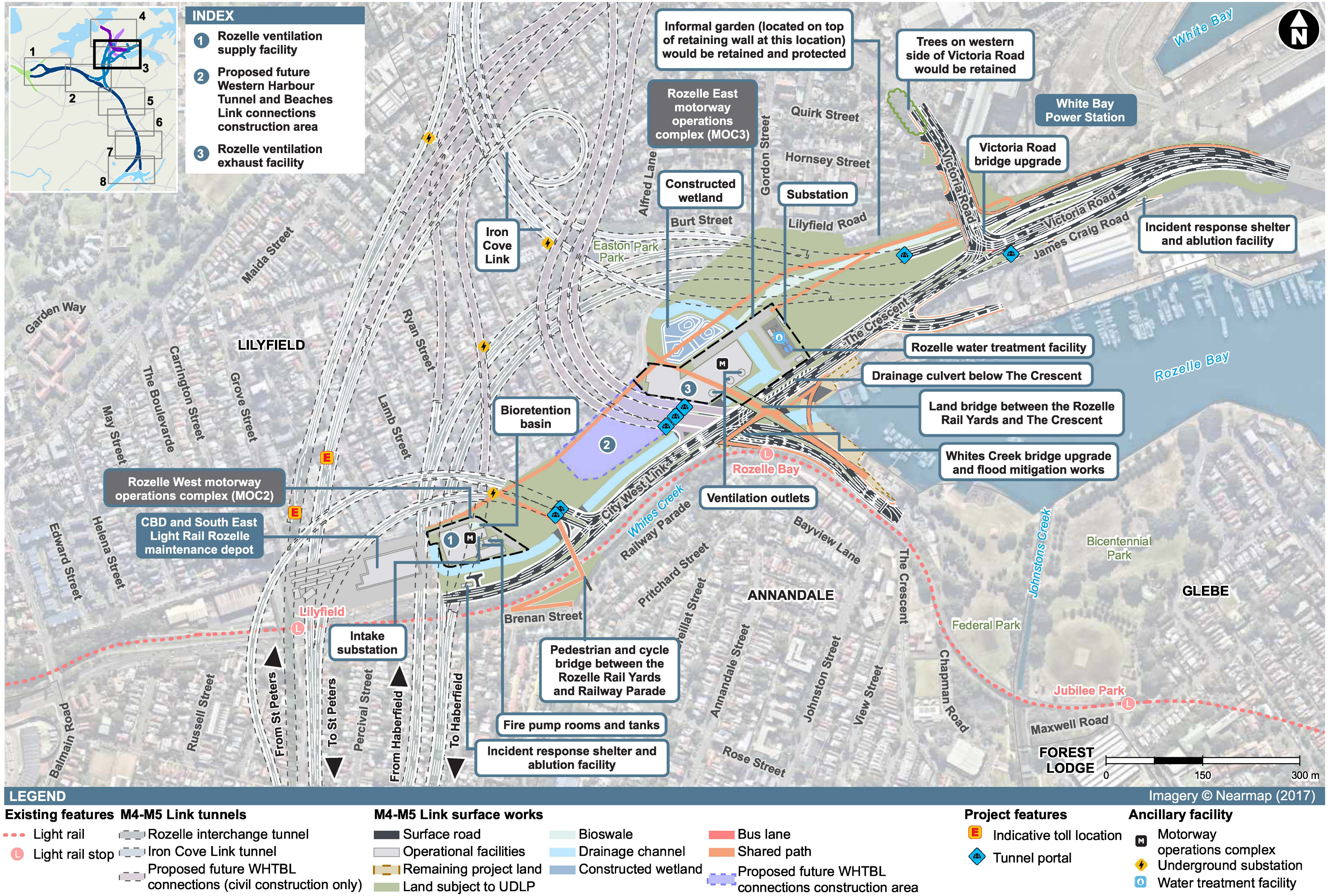


Figure 5-4 Project operational layout – Map 3

Figure 5-5 Project operational layout – Map 4

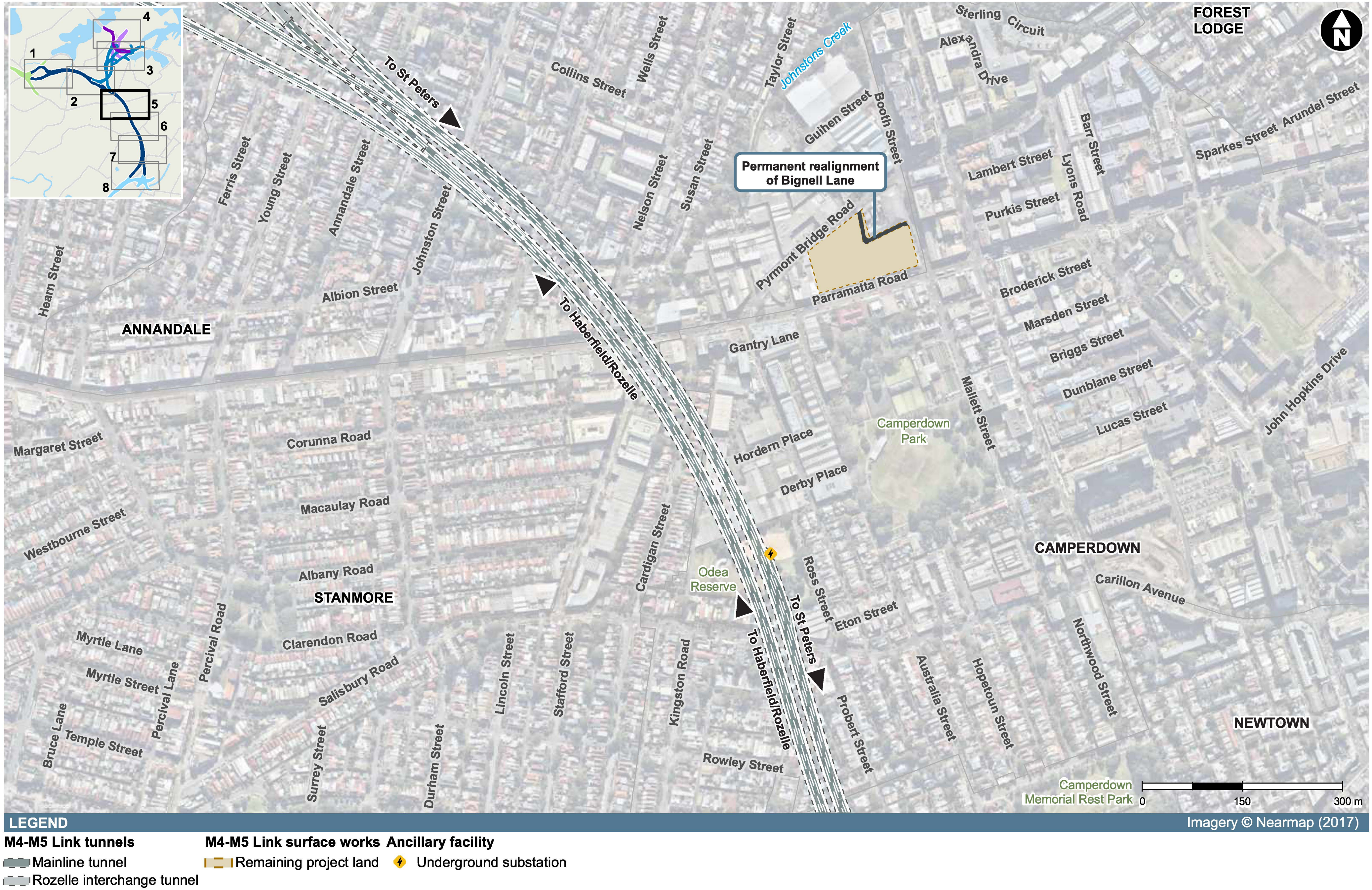
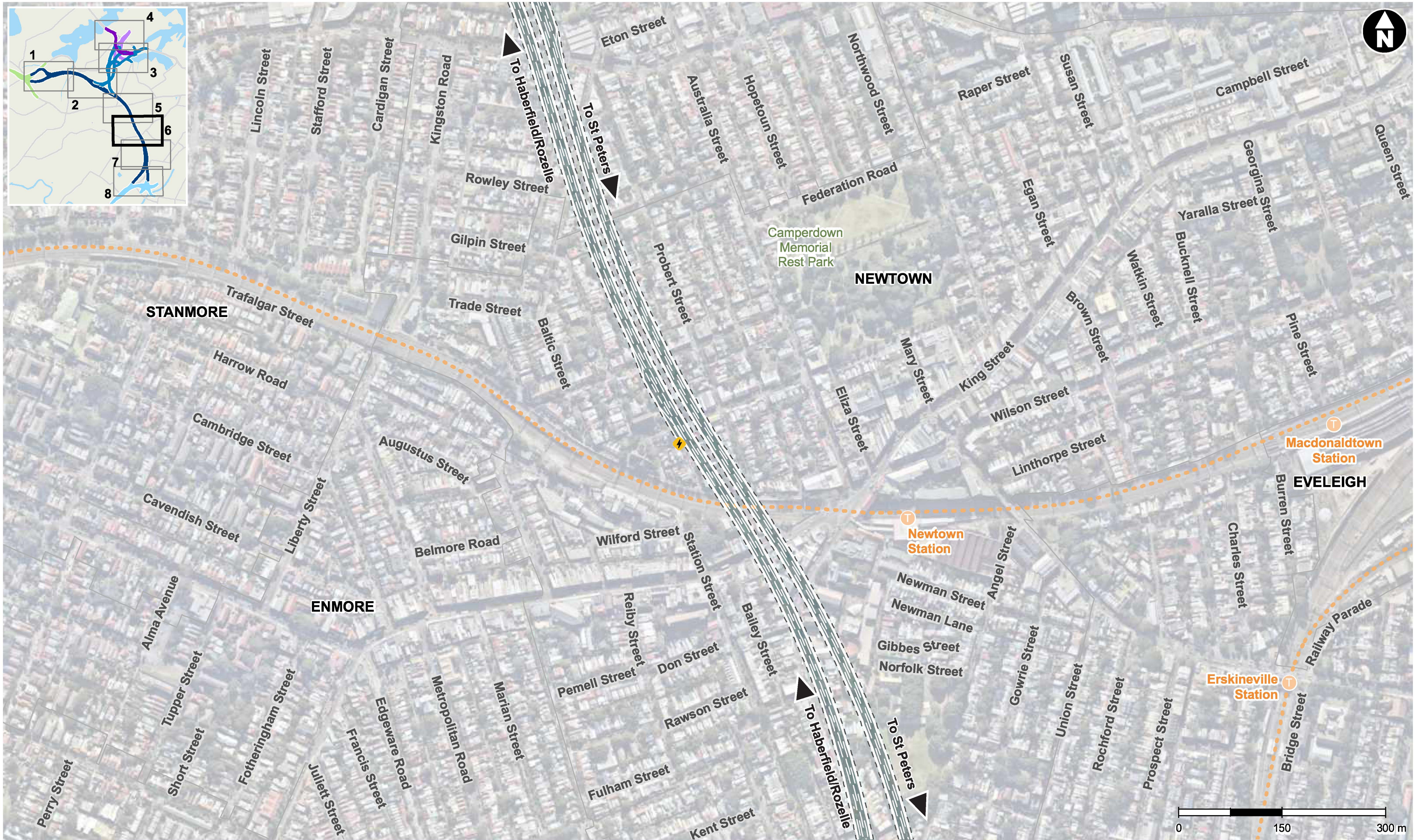


Figure 5-6 Project operational layout – Map 5



LEGEND

Imagery © Nearmap (2017)

Existing features	M4-M5 Link tunnels	Ancillary facility
Railway	Mainline tunnel	Underground substation
Railway station		

Figure 5-7 Project operational layout – Map 6

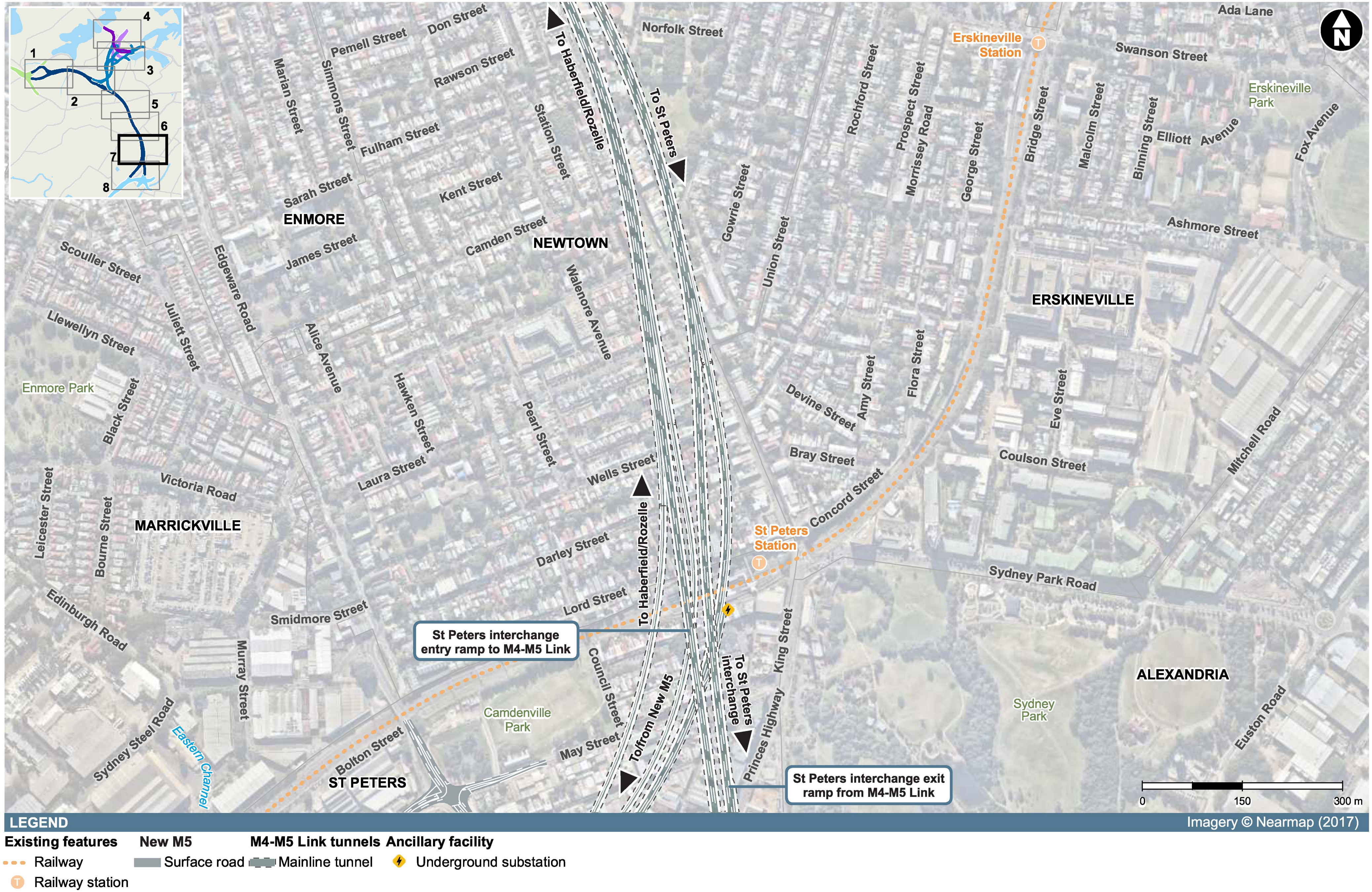


Figure 5-8 Project operational layout – Map 7

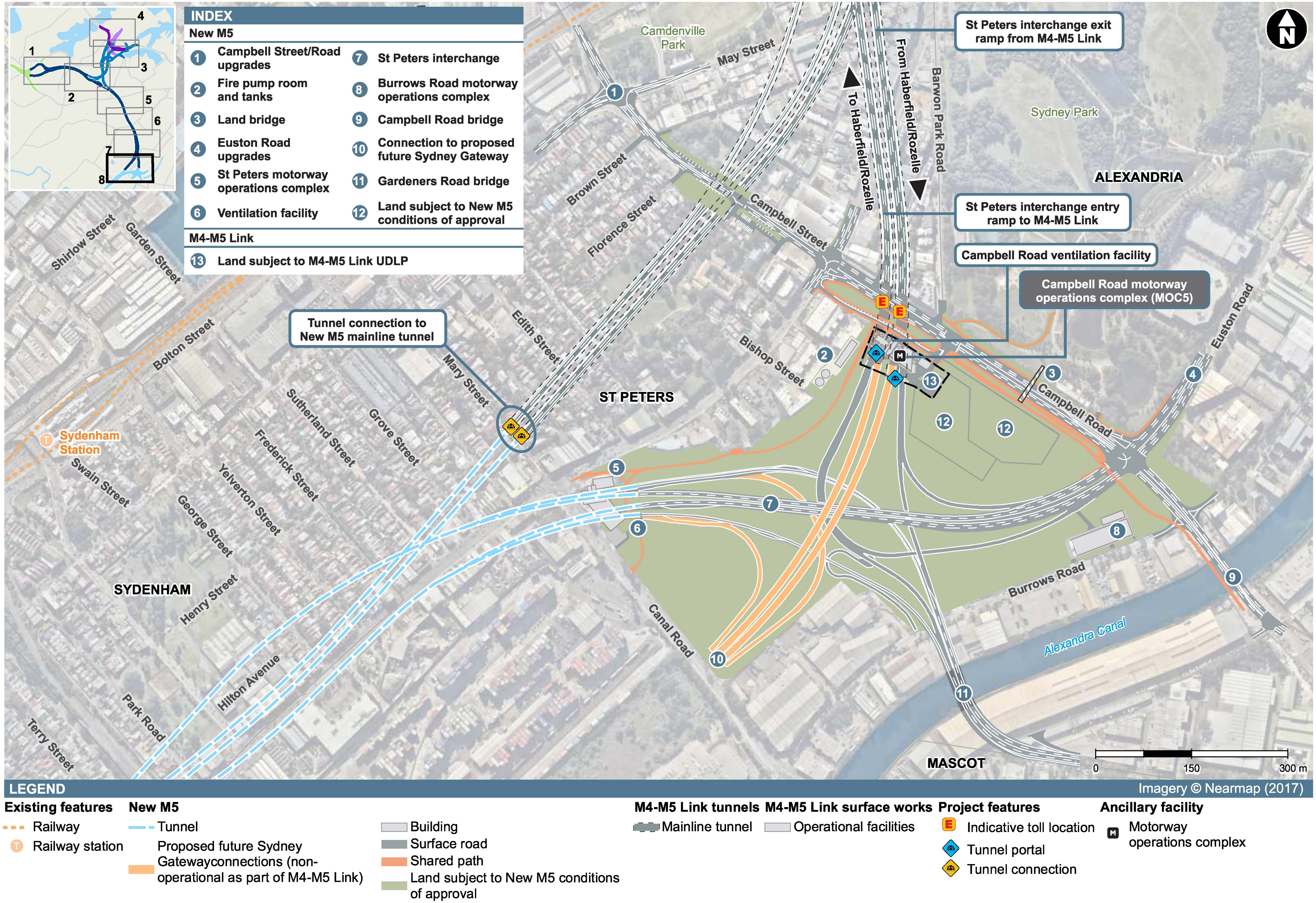


Figure 5-9 Project operational layout – Map 8

5.2 Urban design objectives and principles

Urban design principles have been developed for the project, consistent with the key urban design guidelines and policies including *Beyond the Pavement: Urban Design Procedures and Design Principles* (Roads and Maritime 2014a). The urban design principles applied to the design of the project and the rationale for their use is provided in **Table 5-3.** Further detail is provided in **Chapter 13** (Urban design and visual amenity) and **Appendix L** (Technical working paper: Urban design).

Table 5-3 Urban design objectives and the proposed methodology to achieve these objectives

Urban design objectives	Proposed methodology to achieve the urban design objectives
Integrated and collective approach Create holistic and integrated design solutions generated by collaboration across disciplines, the community, stakeholders and government bodies.	• Working across disciplines • Holding regular stakeholder workshops contributing to design outcomes • Prioritising comprehensive community input and consultation • Working with government agencies and considering future plans • Considering all relevant regulatory frameworks.
Environmental vision Create a sustainable and enduring design response which enhances and connects local ecologies and green spaces.	• Enhancing waterways, creeks and rivers • Utilising water-sensitive urban design where possible • Connecting fractured green spaces • Enhancing local ecology and vegetation • Utilising durable, sustainable and long lasting materials and robust design.
Cross-scale connection of spaces Prioritise both locally and regionally significant connections that respond to the broader issues of the local neighbourhoods and city.	• Enhancing connectivity between streets, facilities, neighbourhoods, green spaces, cyclist and pedestrian connections across the project footprint and city • Integrating and connecting transport modes • Connecting local and regional road, cyclist, public transport and pedestrian links.
A motorway integrated within its context Understand the existing landscape and respond in a respectful manner that seeks to enhance and/or contribute back to its context.	• Responding to natural patterns in the landscape • Respecting and working with the local landform • Enhancing the interface between existing open spaces and the proposed motorway.
Place sensitive design Celebrate and work with the character of each place and destination, responding to their unique histories, materiality, architecture, built fabric, cultural context, landform and topography.	• Incorporating heritage into the urban design • Respecting and responding to cultural contexts • Complementing the existing built fabric • Increasing the legibility of places, buildings, streets and landmarks.
Multi-dimensional user force Consider holistically how a diversity of users experience space including all ages, abilities and transport modes for a truly inclusive, universally accessible and safe outcome.	• Consider Crime Prevention Through Environmental Design (CPTED) principles in the urban design • Creating safe, legible connections with wayfinding for all user types • Ensuring universal design outcomes • Considering the user experience for all modes including drivers, pedestrians, cyclists and public transport users.

Urban design objectives	Proposed methodology to achieve the urban design objectives
Revitalisation, opportunity and economics Establish opportunities for development that supports and connects existing neighbourhoods, complements and stimulates local economies and provides opportunity for growth across existing and future local industries.	• Contributing to urban structure and revitalisation • Connecting existing and fragmented spaces through property acquisition • Capitalising on traffic reduction to enhance local streets and increase neighbourhood liveability • Creating opportunities for urban renewal.

A detailed review and finalisation of the architectural treatment of the motorway operational ancillary facilities, including ventilation facilities (see **section 5.8**), portals and all permanent infrastructure, would be carried out during detailed design. The architectural treatment of these facilities would be guided by ventilation facility performance requirements, the outcomes of community consultation and the urban design principles identified in **Appendix L** (Technical working paper: Urban design). Landscaping works would be carried out adjacent to disturbed areas, around operational infrastructure (such as ventilation facilities), and in areas of new open space that would be provided at the Rozelle Rail Yards and adjacent to Victoria Road at Rozelle.

Further details about urban design for the project are provided in **Chapter 13** (Urban design and visual amenity) and **Appendix L** (Technical working paper: Urban design). Urban design concept plans have also been prepared for the Rozelle Rail Yards and the Iron Cove Link surface works in consideration of the urban design objectives described in **Table 5-3**. These would inform the Urban Design and Landscape Plan (UDLP) that would be prepared for the project and are discussed further in **section 5.6.7** and **section 5.7.5**.

In addition, UDLPs have been prepared for the M4 East and New M5 projects. This includes land around the Wattle Street interchange at Haberfield, including the draft concept plans for the M4 East Legacy Project, and the St Peters interchange at St Peters. The project would not impact on the implementation of these plans, but may impact the timing in which they are carried out.

5.3 Tunnels

This section describes the design of the tunnel components of the project, including:

- The mainline tunnels, including the number and width of traffic lanes
- The Rozelle interchange and the Iron Cove Link tunnels, including tunnels to enable connections to the proposed future Western Harbour Tunnel and Beaches Link project
- The location and configuration of tunnel portals
- The tunnel vertical alignments.

5.3.1 Mainline tunnels

The mainline tunnels would be about 7.5 kilometres long and would extend from the underground connection with the M4 East tunnels at Haberfield to the underground connection with the New M5 tunnels at St Peters. The mainline tunnels would connect to the surface road network at four locations:

- The Wattle Street interchange at Haberfield via tunnel portals being built by the M4 East project
- The St Peters interchange at St Peters via tunnel portals being built by the New M5 project
- City West Link and Victoria Road at Rozelle via the Inner West subsurface interchange and the Rozelle interchange
- Victoria Road at Rozelle, east of Iron Cove Bridge, via the Inner West subsurface interchange, the Rozelle interchange and the Iron Cove Link.

Lane configuration in the mainline tunnels

The mainline tunnels would generally be four traffic lanes in each direction in addition to merging lanes and tie-ins (where required). Under the concept design described in this EIS, the configuration of traffic lanes within the mainline tunnels would be provided in five distinct sections as described in **Table 5-4** and shown in **Figure 5-10**. Indicative cross-sections of the mainline tunnels and the entry and exit ramps are shown in **Figure 5-11** and **Figure 5-12**.

Table 5-4 Typical lane configuration and widths for the mainline tunnels

Mainline tunnel section	No. of lanes	Width of lanes (metres)	Width of nearside shoulder (metres)	Width of offside shoulder (metres)	Carriageway width kerb to kerb (min.) (metres)	Design speed (km/h)	Posted speed (km/h)
M4 East mainline connection to merge/diverge of the Wattle Street interchange entry and exit ramps with the mainline tunnels	3	3.5	1.0	1.0	12.5	90	80
Wattle Street interchange entry and exit ramps	2[1]	3.5	1.0	1.0	9.0	70	60
Merge/diverge of the Wattle Street interchange entry and exit ramps to the M4 East Inner West subsurface interchange connection below Leichhardt	4	3.5	1.0	1.0	16.0	90	80
Between the M4 East and the New M5 connections at the Inner West subsurface interchange	2	3.5	2.5	1.0	10.5	90	80
New M5 Inner West subsurface interchange connection to the merge/diverge of the St Peters interchange entry and exit ramps	4	3.5	1.0	1.0	16.0	90	80
Merge/diverge of the St Peters interchange entry and exit ramps to the New M5 mainline connection	2[2]	3.5	2.5	1.0	10.5	90	80
St Peters interchange entry and exit ramps	3[3]	3.5	1.0	1.0	12.5	70	60

Notes:

[1] The Wattle Street interchange entry ramp would divide into two, one-lane tunnels before joining the southbound mainline tunnel (see **section 5.4.1**).

[2] The northbound mainline tunnel would divide into two, one-lane tunnels before joining the northbound St Peters interchange entry ramp (see **section 5.4.3**).

[3] The St Peters interchange exit ramp would increase to four lanes before surfacing at the St Peters interchange tunnel portal (see **section 5.4.4**).

Inner West subsurface interchange

The Inner West subsurface interchange would be located underground at Leichhardt/Annandale and would link with the mainline tunnels at two locations, enabling free-flow of traffic between the M4 East and New M5 motorways and the Rozelle interchange. The layout of the Inner West subsurface interchange is shown in **Figure 5-3**. The connectivity that would be provided by the Inner West subsurface interchange and the Rozelle interchange is shown in **Figure 5-24**.

For motorists traveling westbound from the Rozelle interchange towards the M4 East Motorway, the three-lane tunnel would divide into two on the approach to the Inner West subsurface interchange. One tunnel with two lanes would travel towards the M4 East mainline tunnels and one tunnel with one lane would travel towards the Wattle Street interchange. These separate tunnels would extend south and southwest for a distance of around one kilometre, joining with the northbound mainline tunnel generally at a point below Norton Street at Leichhardt. Motorists traveling to the M4 East Motorway would join on the right side, and motorists traveling to the Wattle Street interchange would join on the left side. Motorists travelling to the Wattle Street interchange would then be on the correct side of the northbound mainline tunnel on the approach to the Wattle Street interchange exit ramp.

By giving motorists the ability to choose a merge location dependent on their destination, this arrangement would make driving in the tunnel safer by reducing the number of lane changes that motorists may need to carry out. This would also reduce the potential impact on vehicle speeds associated with merging. Further detail on operational traffic is provided in **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).

The mainline tunnels at the Inner West subsurface interchange would be built to accommodate up to three lanes in each direction. When the project opens, this section of the mainline tunnels would be marked for two lanes in each direction, with the capacity to increase to three lanes in each direction subject to future traffic demands. The width of the caverns for the mainline tunnels has been designed to allow for this capacity increase without the need for further excavations.

Figure 5-10 Lane configuration - mainline tunnels

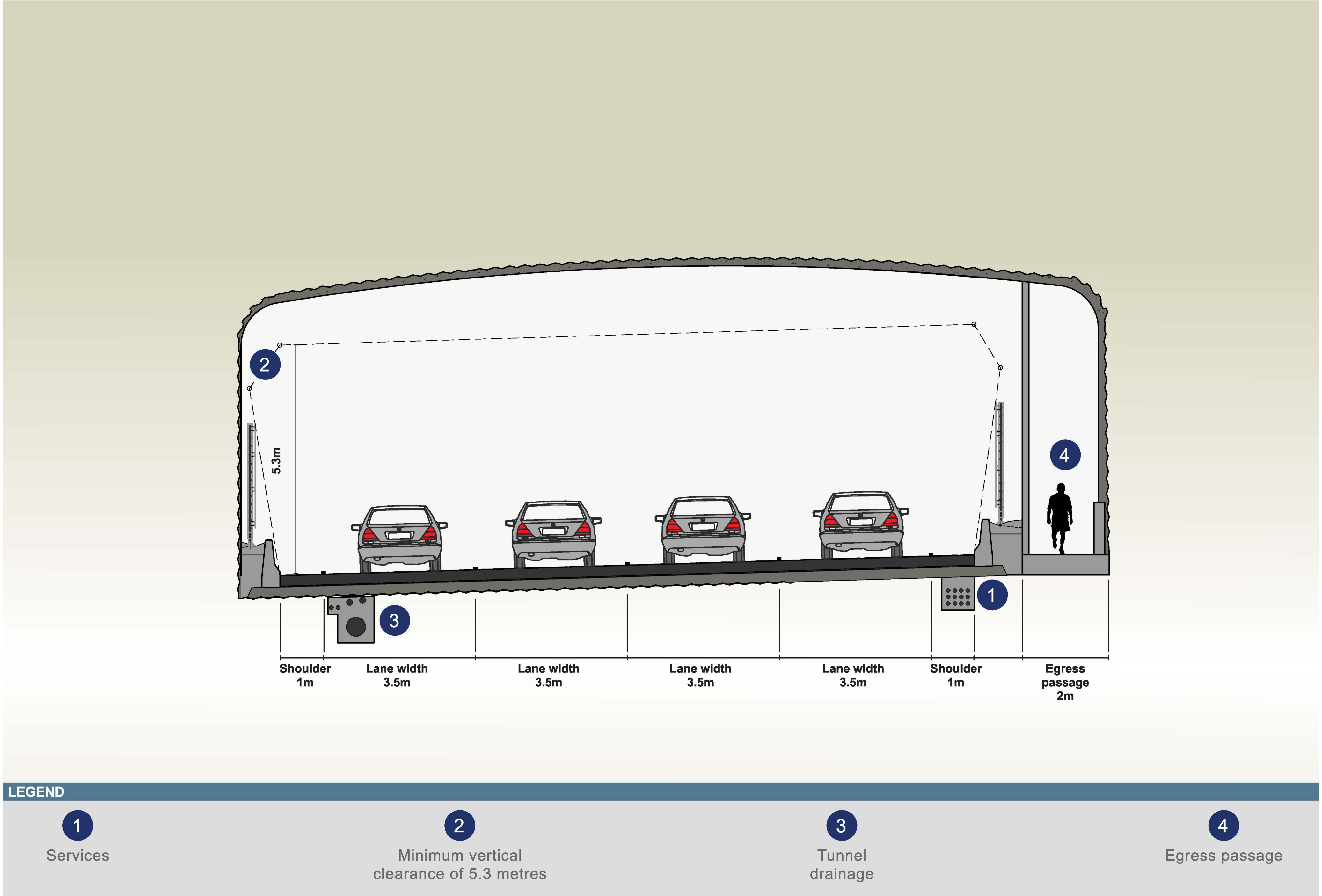


Figure 5-11 Indicative cross-section - mainline tunnels

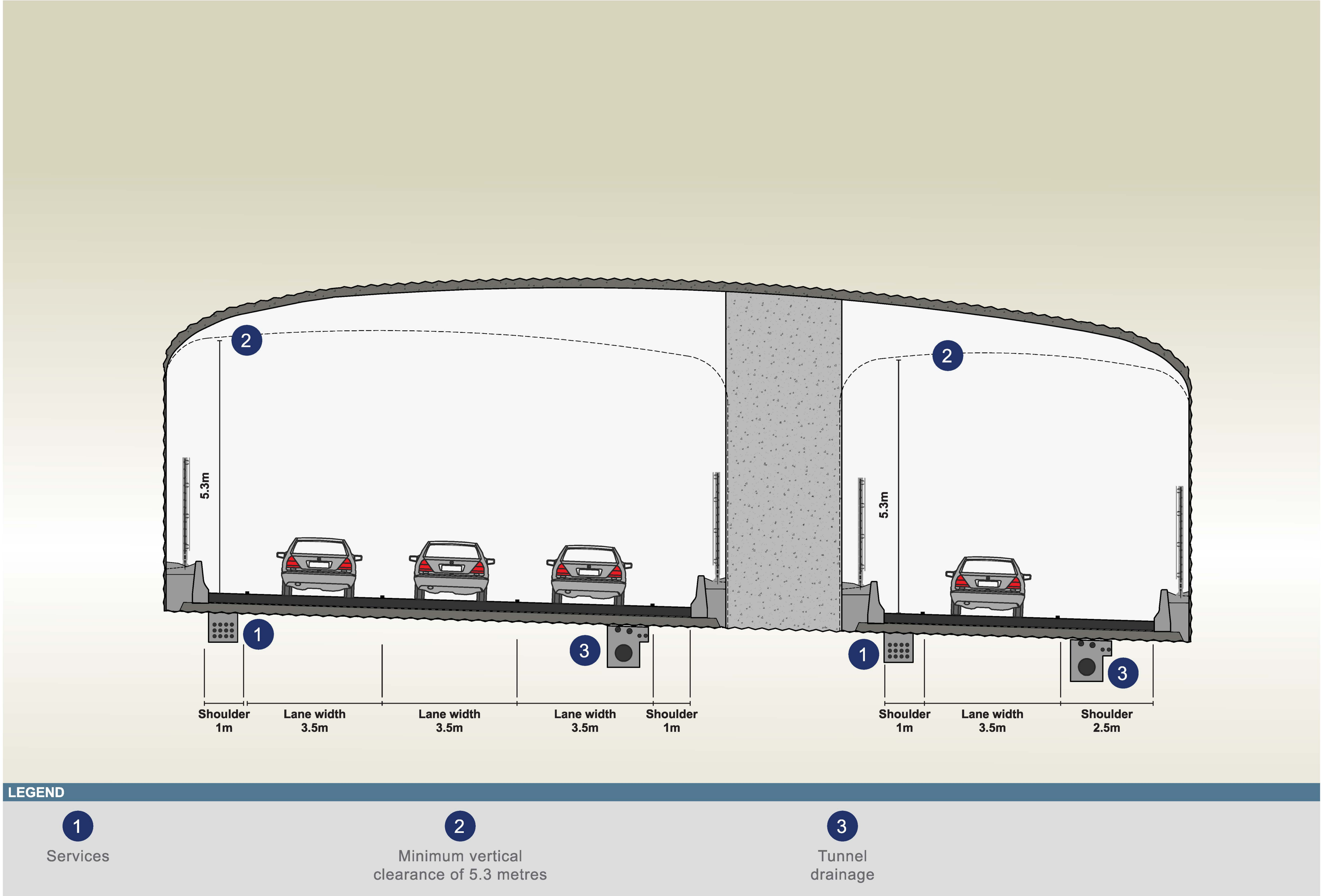


Figure 5-12 Indicative cross-section - mainline tunnel entry and exit ramps

5.3.2 Rozelle interchange and Iron Cove Link tunnels

Rozelle interchange tunnels

The Rozelle interchange tunnels would connect the mainline tunnels (via the Inner West subsurface interchange) with:

- The existing surface road network at City West Link, The Crescent and Victoria Road
- The Iron Cove Link, which would connect to the existing surface road network at Victoria Road near the eastern abutment of Iron Cove Bridge (see below)
- The proposed future Western Harbour Tunnel and Beaches Link.

A detailed description of project connectivity is provided in **section 5.5**. The layout of the Rozelle interchange is shown in **Figure 5-23**.

Iron Cove Link tunnels

The Iron Cove Link would comprise twin tunnels linking Victoria Road, near the eastern abutment of Iron Cove Bridge, with the Anzac Bridge. The Iron Cove Link tunnels would be two-lanes wide in each direction, with a small section of the eastbound tunnel decreasing to one lane before merging with the M4 East to Anzac Bridge exit ramp. An exit ramp would also diverge from the eastbound tunnel to connect motorists to the New M5 Motorway via the Rozelle interchange. The layout of the Iron Cove Link is shown in **Figure 5-4** and **Figure 5-5**.

5.3.3 Emergency and breakdown facilities

The tunnels would include vehicular cross-passages to allow for emergency traffic switching, as well as pedestrian cross-passages spaced at a maximum of 120 metres that provide emergency pedestrian egress between tunnels in the event of an emergency. An indicative cross-passage layout is shown in **Figure 5-16**. Additional details about fire and life safety provisions for the project are provided in **section 5.8.3**.

Breakdown bays would be spaced around 2.5 kilometres apart and would be large enough to allow a B-double vehicle to pull over into the bay and safely park outside of the nominal tunnel shoulder width away from operational traffic lanes and without blocking traffic flow. The Rozelle interchange tunnels would be widened at this location to accommodate the breakdown bay outside of the shoulders. Breakdown bays would not be required in the Iron Cove Link tunnels due to the short distance of these tunnels. An indicative layout of a mainline tunnel maintenance and breakdown bay is shown in **Figure 5-13**.

Lane configurations in the Rozelle interchange and Iron Cove Link tunnels

A summary of the lane configuration and typical widths of the sections of the Rozelle interchange and Iron Cove Link tunnels is provided in **Table 5-5** and shown in **Figure 5-13**. Indicative cross-sections of the Rozelle interchange and Iron Cove Link tunnels and the entry and exit ramps are shown in **Figure 5-14** and **Figure 5-15**.

Table 5-5 Typical lane configurations and widths for the Rozelle interchange and Iron Cove Link

Rozelle interchange tunnel section	No. of lanes	Width of lanes (metres)	Width of nearside shoulder (metres)	Width of offside shoulder (metres)	In-tunnel barrier to barrier width (metres)	Design speed (km/h)	Posted speed (km/h)
New M5 Inner West subsurface interchange to proposed future Western Harbour Tunnel and Beaches Link	3	3.5	1.0	1.0	12.5	90	80
M4 East from proposed future Western Harbour Tunnel and Beaches Link ramp to Victoria Road/Anzac Bridge Portal	2[1]	3.5	2.5	1.0	10.5	80	70
The New M5 Inner West subsurface interchange connection to Rozelle	3	3.5	1.0	1.0	12.5	90	80
Proposed future Western Harbour Tunnel and Beaches Link tunnels	3	3.5	1.0	1.0	12.5	90	80
One-lane entry and exit ramps at the Rozelle interchange	1	3.5	2.5	1.0	7.0	70	60
Two-lane entry and exit ramps at the Rozelle interchange	2	3.5	1.0	1.0	9.0	70	60
Iron Cove Link	2[2]	3.5	1.0	1.0	9.0	70	60

Notes:

[1] The three-lane southbound tunnel would divide into two on the approach to the Inner West subsurface interchange, extending south and southwest and joining with the northbound mainline tunnel at a point below around Norton Street at Leichhardt (refer to the description of the Inner West subsurface interchange in **section 5.3.1**).

[2] A section of the eastbound Iron Cove Link tunnel is one lane.

5.3.4 Connections to the proposed future Western Harbour Tunnel and Beaches Link

The project also includes the civil construction of entry and exit ramps, tunnel portals, tunnels and civil infrastructure for connecting to the proposed future Western Harbour Tunnel and Beaches Link. Tunnel sections include:

- Mainline connection tunnels that would extend north from the Inner West subsurface interchange, below Leichhardt, Lilyfield and Rozelle, to a point below Rozelle. These would provide a mainline connection between the New M5/St Peters interchange and the proposed future Western Harbour Tunnel and Beaches Link (via the mainline tunnels and the Inner West subsurface interchange)
- Connections between the Rozelle interchange and the mainline connection tunnels described above. These would connect the M4 East/Wattle Street interchange with the proposed future Western Harbour Tunnel and Beaches Link (via the mainline tunnels and the Inner West subsurface interchange)
- Underground entry and exit ramps extending north from the Rozelle Rail Yards, joining the mainline connection tunnels described above at a point below around Victoria Road at Rozelle. These entry and exit ramps would enable future surface connections between the realigned City West Link/The Crescent intersection and the proposed future Western Harbour Tunnel and Beaches Link.

The construction activities for these works are described in **Chapter 6** (Construction work). The construction of the remainder, and operation of, the proposed future Western Harbour Tunnel and Beaches Link does not form part of the M4-M5 Link project, and would be subject to future environmental assessment and planning approval.

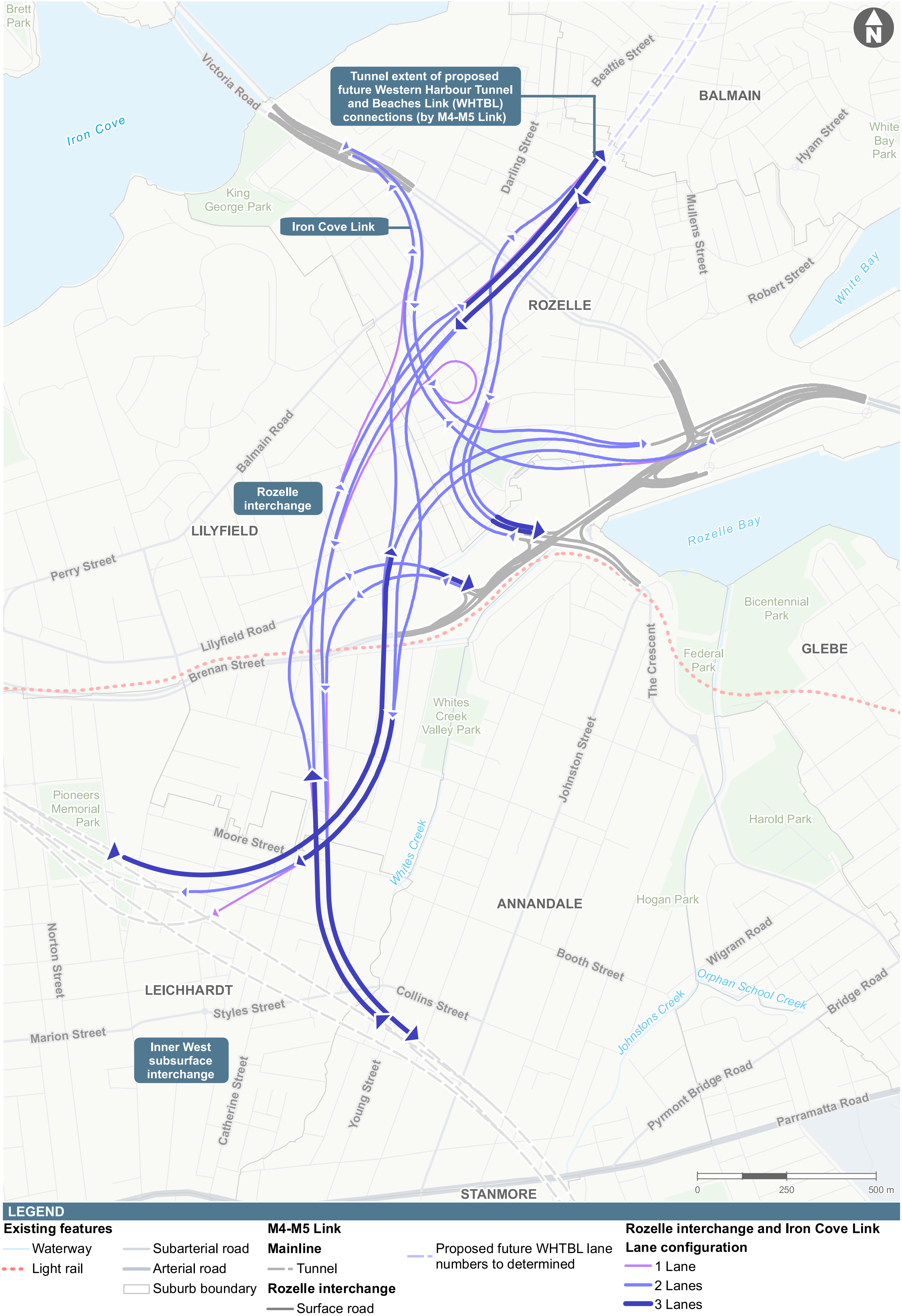
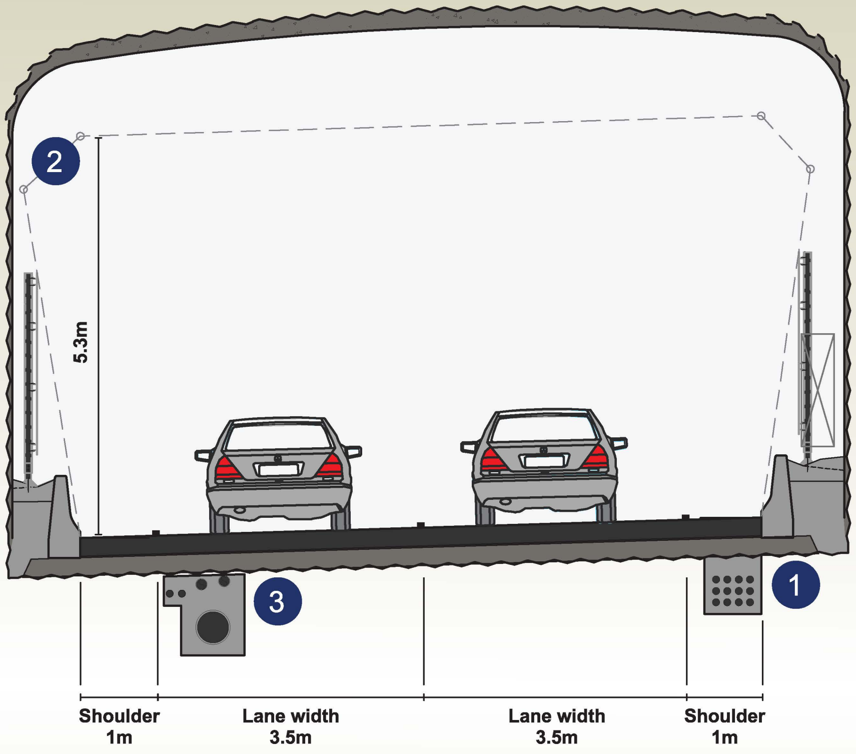


Figure 5-13 Lane configuration in the Rozelle interchange and Iron Cove Link tunnels



LEGEND

1 Services

2 Minimum vertical clearance of 5.3 metres

3 Tunnel drainage

Figure 5-14 Indicative cross-section - Rozelle interchange and Iron Cove Link tunnels

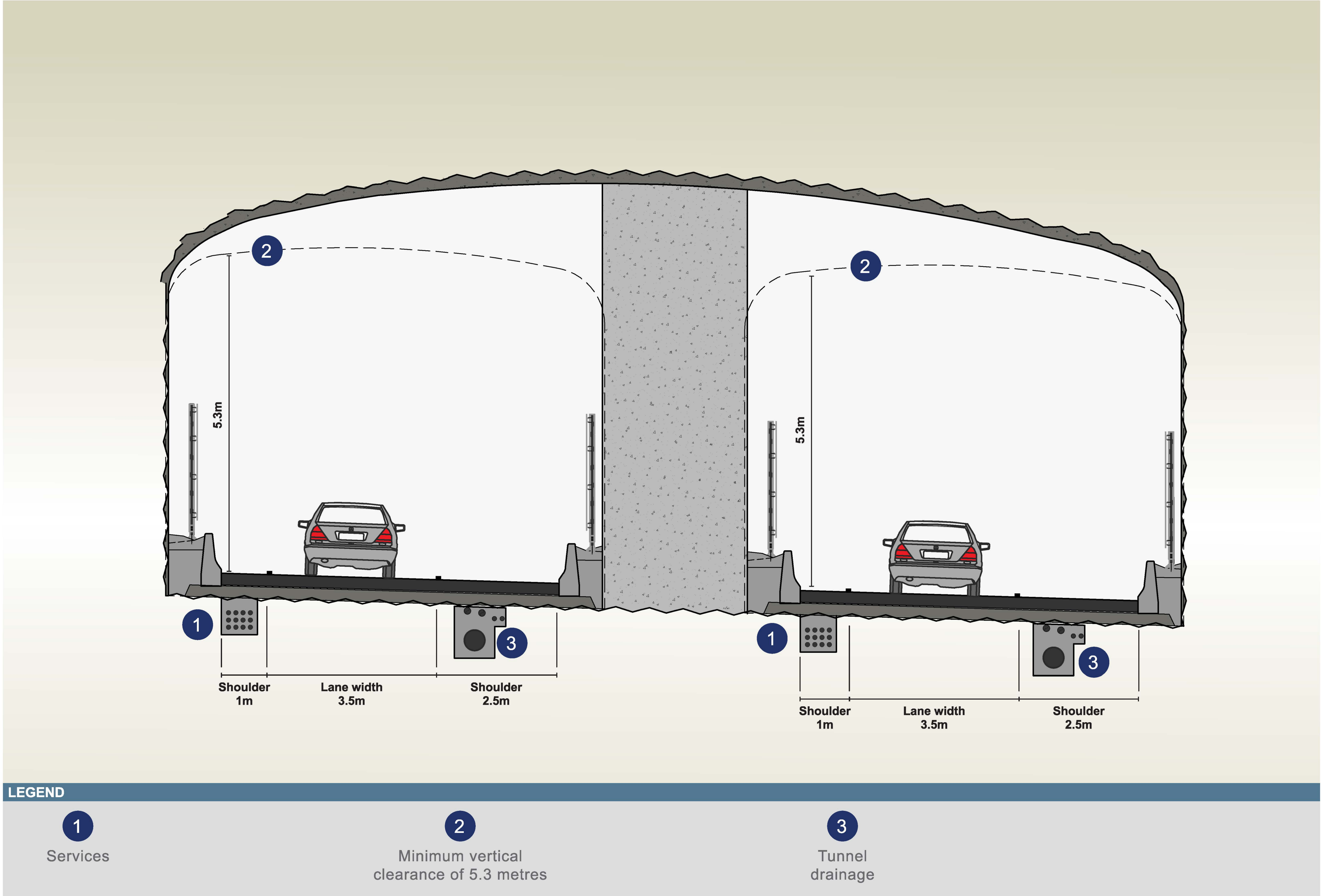
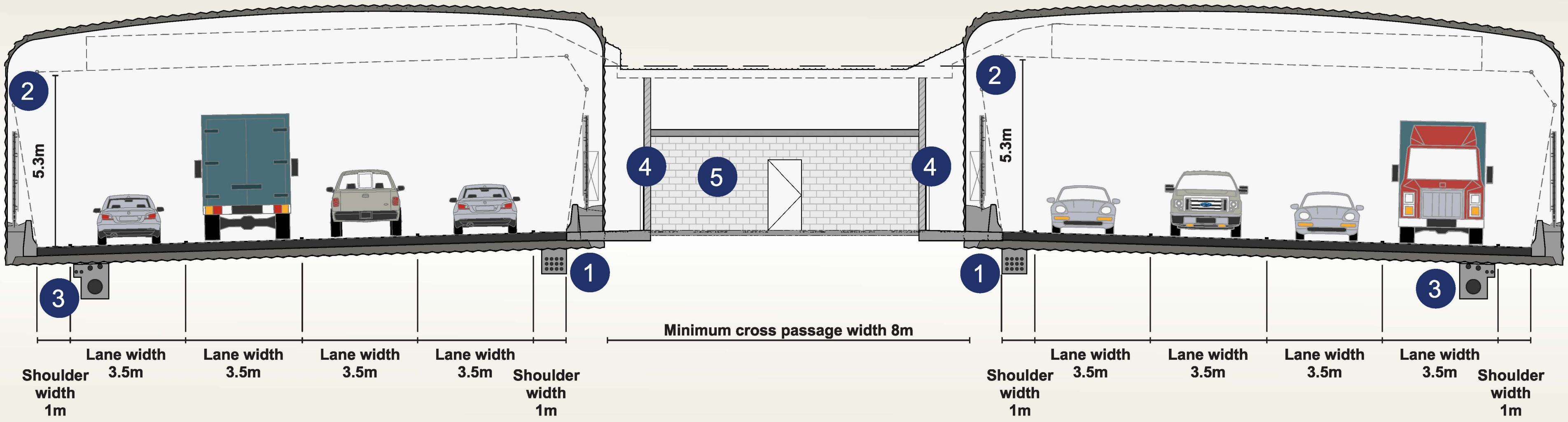


Figure 5-15 Indicative entry and exit ramp tunnel cross-section - Rozelle interchange and Iron Cove Link tunnels



LEGEND

1 Services

2 Minimum vertical clearance of 5.3 metres

3 Tunnel drainage

4 Fire - Rated sliding door

5 Pedestrian cross passage

Figure 5-16 Indicative cross-passage layout

5.3.5 Tunnel portals

Portals would provide connections between the tunnels and the surface road network. Tunnel portals at the Wattle Street interchange and the St Peters interchange will be built as part of the M4 East and New M5 projects respectively and are shown in **Figure 5-17** and **Figure 5-18**.

The Rozelle interchange and Iron Cove Link tunnel portals are shown in **Figure 5-19** to **Figure 5-22** and would include:

- Rozelle interchange tunnel portals:
  - City West Link to New M5/St Peters interchange portals (via the M4-M5 Link mainline tunnels), via a new intersection along City West Link between Catherine Street and The Crescent
  - Victoria Road/Anzac Bridge to M4 East/Wattle Street interchange/Iron Cove Link portals. These portals would be staggered, with the eastbound portal meeting the surface within the Rozelle Rail Yards and the westbound portal meeting the surface south of the Victoria Road/The Crescent intersection
  - Civil construction only of the proposed future Western Harbour Tunnel and Beaches Link portals. These portals would be located within the Rozelle Rail Yards north of the realigned intersection of City West Link and The Crescent
- Iron Cove Link tunnel portals:
  - Between the eastbound and westbound Victoria Road carriageways, in the vicinity of Terry Street at Rozelle.

Dive and cut-and-cover structures would be constructed at the tunnel portals to create entry and exit ramps to join the surface roads with the tunnels (refer to **Chapter 6** (Construction work) for more detail about the construction of these structures). Entry and exit ramps would vary in size and shape in response to local conditions and would require a number of cuttings and embankments. The portals have been designed to provide for a 5.3 metre vertical clearance.

5.3.6 Tunnel vertical alignments

The tunnels would generally have grades of less than four per cent. However, isolated locations connecting to the surface road network may require short lengths of steeper grades of up to eight per cent. These grades would generally match with existing conditions on local surface roads or are required to ensure appropriate ground conditions with no direct property impacts.

The lowest point of the mainline tunnels would be in the vicinity of Darley Road at Leichhardt, and the lowest points of the Rozelle interchange and the Iron Cove Link would be in the vicinity of the Rozelle Rail Yards. Tunnel drainage would connect to surface water treatment facilities within the Darley Road motorway operations complex (MOC1) and the Rozelle East motorway operations complex (MOC3) (see **section 5.9.2**). In addition, tunnel drainage from about one kilometre of the northbound mainline tunnel and 600 metres of the southbound mainline tunnel would be captured by the New M5 drainage system and conveyed to the New M5 operational water treatment plant at Arncliffe.

The cross-fall of the carriageway in each of the tunnels would generally be around two per cent. This would allow water to drain to the low side of each mainline tunnel for collection and management as part of the tunnel water management system (see **section 5.9**).

Geotechnical long-sections of the mainline tunnels and the Rozelle interchange and Iron Cove Link tunnels are provided in **Appendix E** (Geological long-sections).

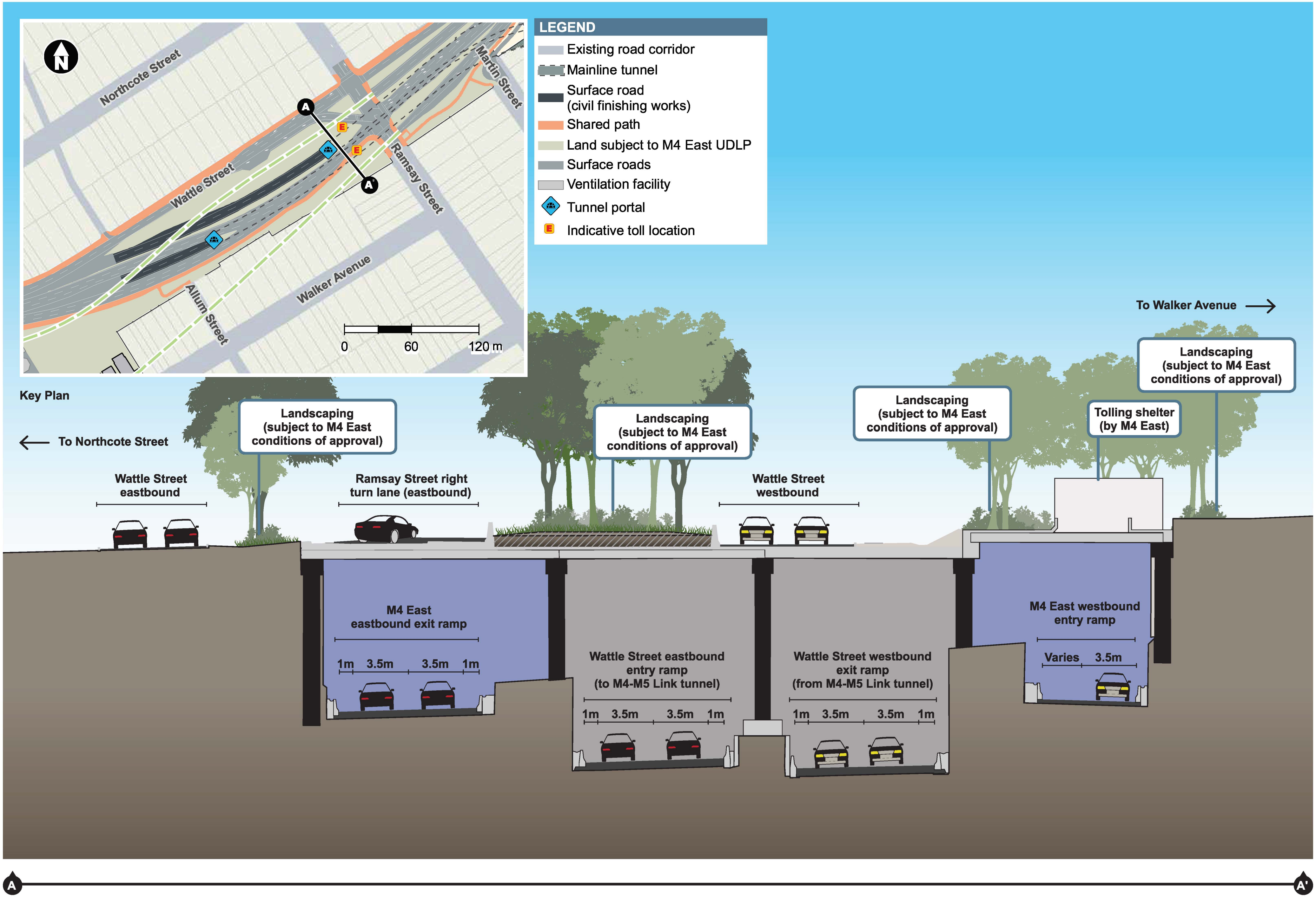


Figure 5-17 Indicative cross-section - Wattle Street interchange tunnel portals

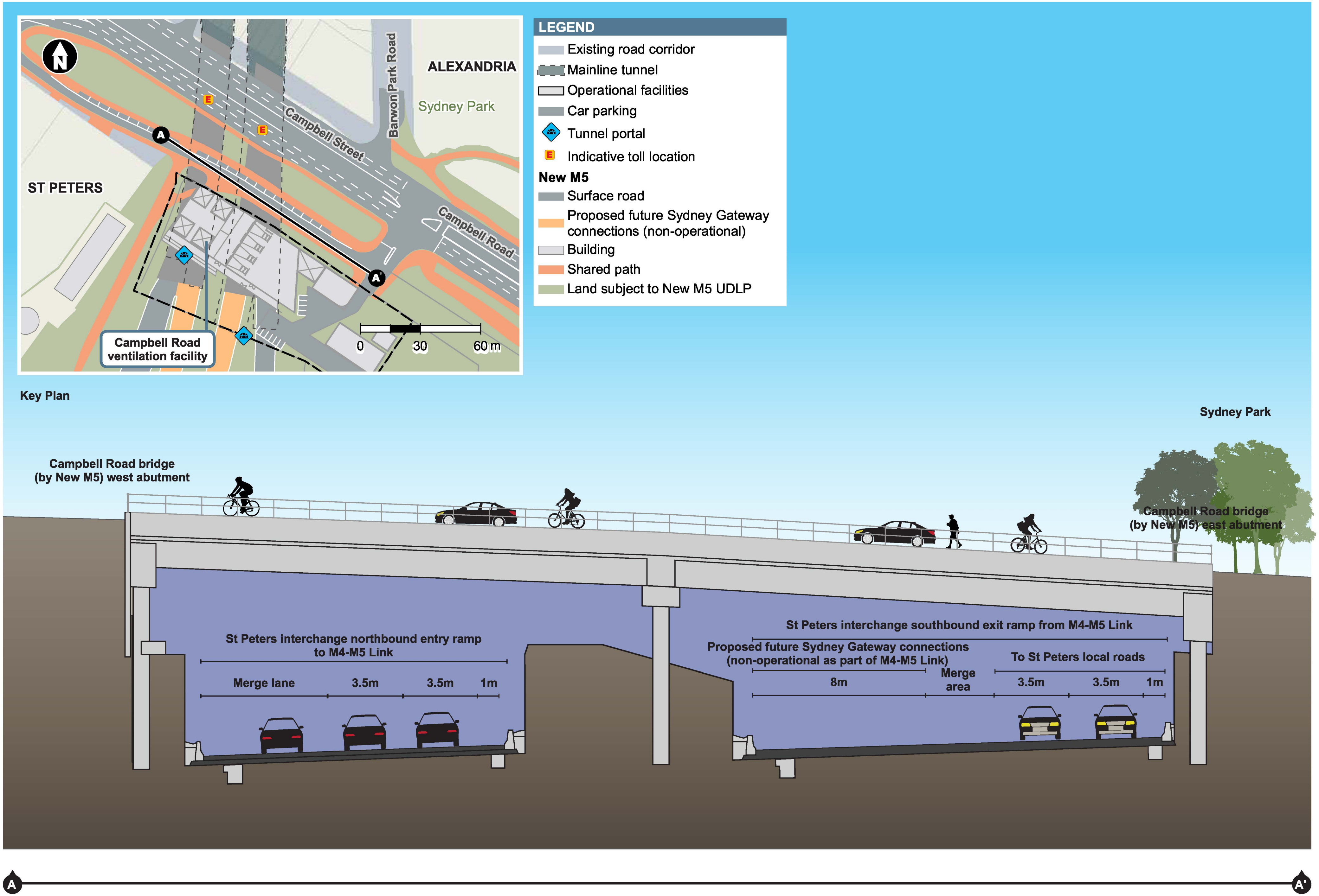
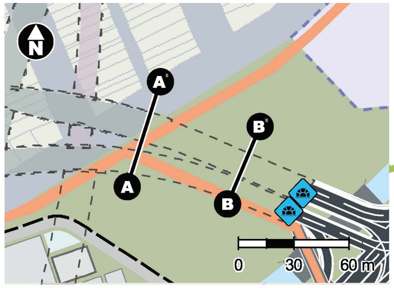


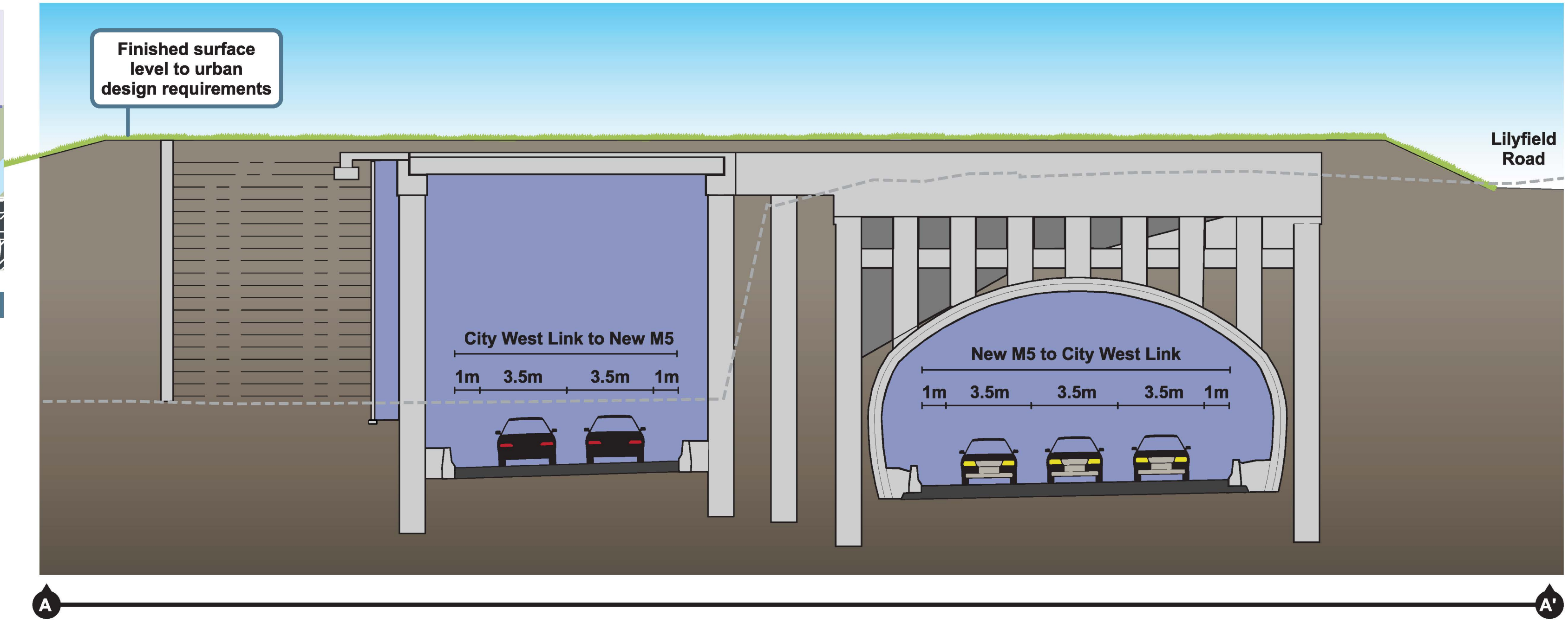
Figure 5-18 Indicative cross-section - St Peters interchange tunnel portals



Key Plan

LEGEND

- Existing road corridor
- Proposed future WHTBL (civil construction only)
- Rozelle interchange tunnel
- Surface road
- Operational facilities
- Bioretention basin
- Land subject to UDLP
- Shared path
- Proposed future WHTBL connections construction area
- Tunnel portal



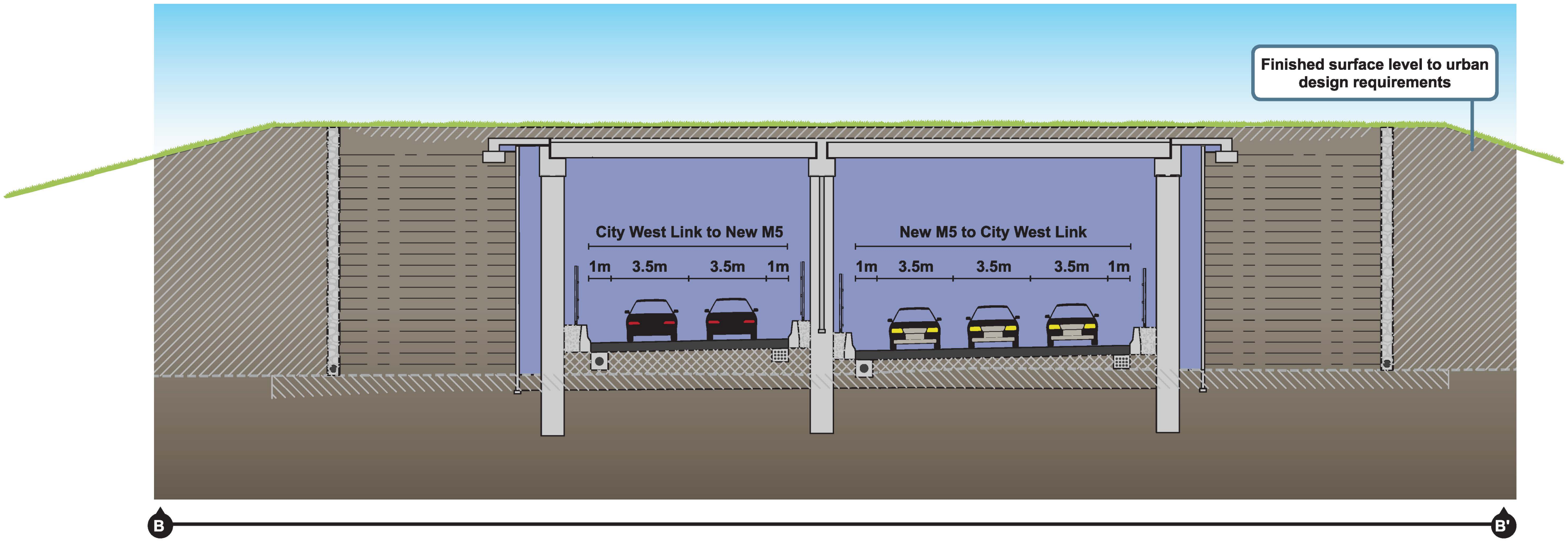


Figure 5-19 Indicative cross-section - City West Link to New M5 / St Peters interchange tunnel portals

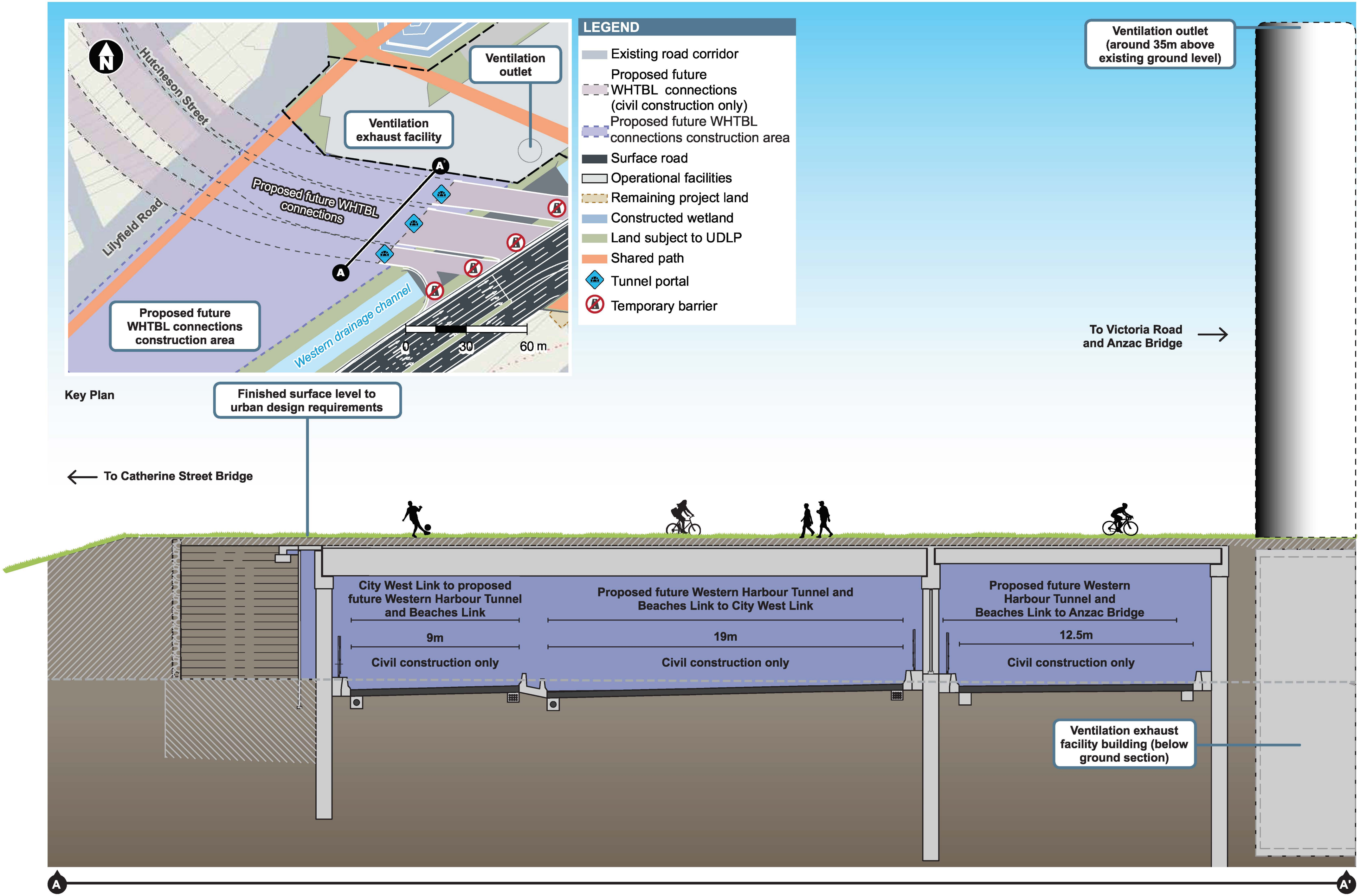
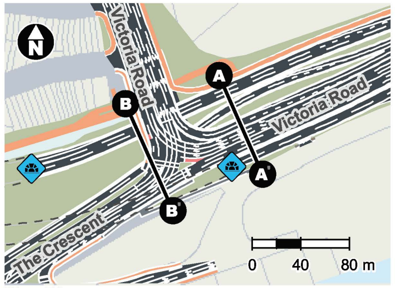


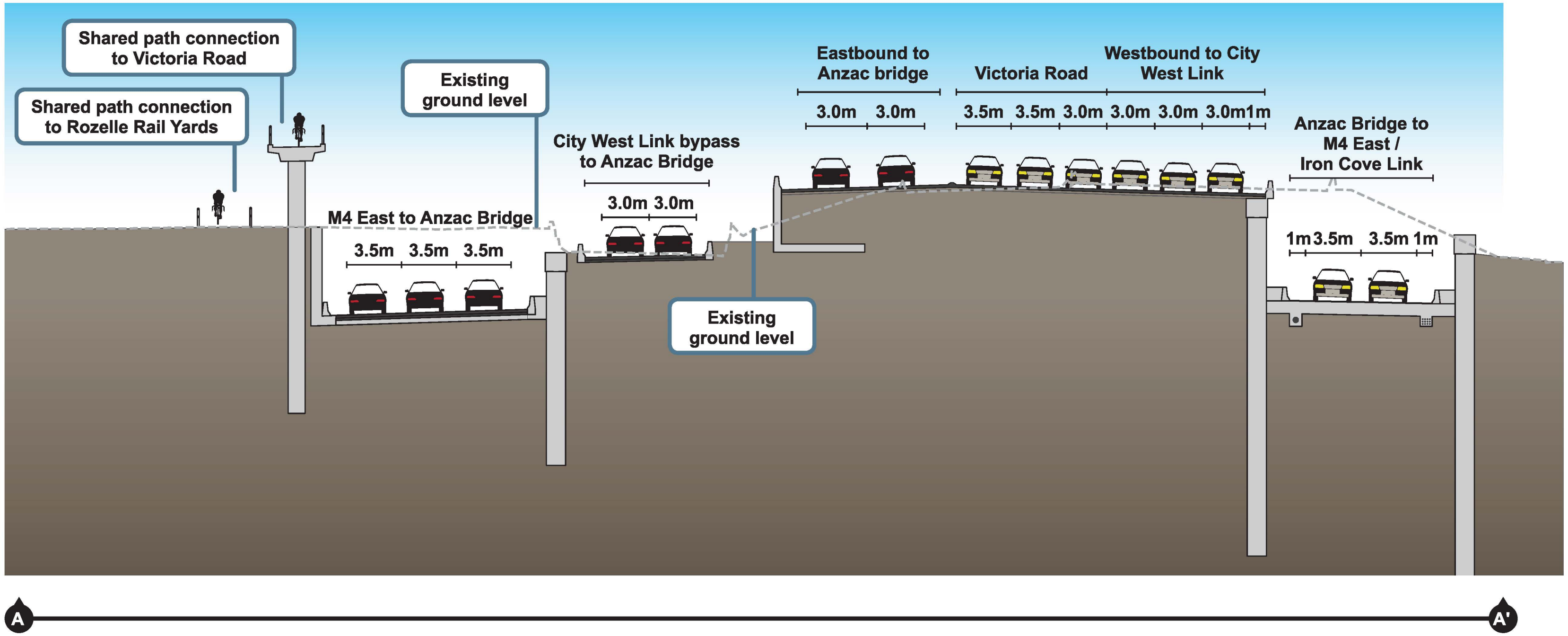
Figure 5-20 Indicative cross-section - City West Link / The Crescent to proposed future Western Harbour Tunnel and Beaches Link portals (civil contruction only)



Key Plan

LEGEND

- Existing road corridor
- Rozelle interchange tunnel
- Surface road
- Bus lane
- Land subject to UDLP
- Drainage channel
- Shared path
- Tunnel portal



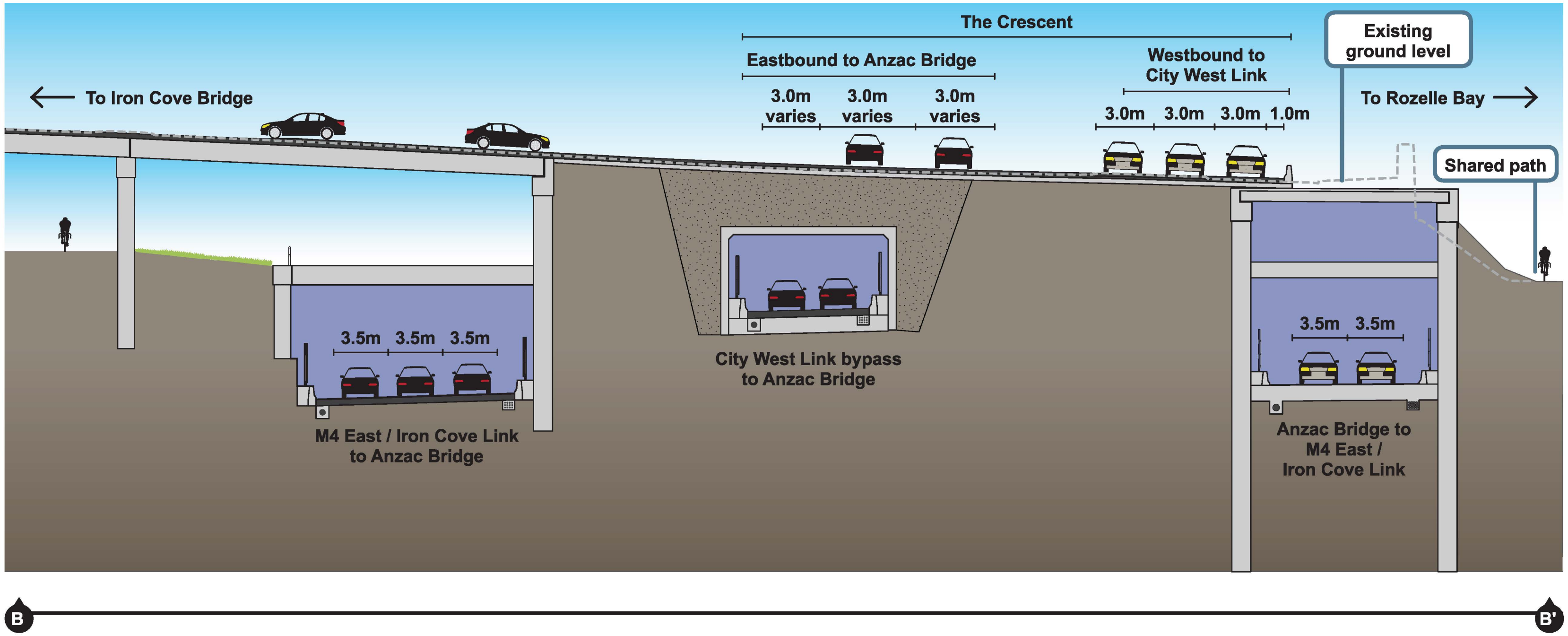


Figure 5-21 Indicative cross-section - Victoria Road / Anzac Bridge to M4 East / Wattle Street interchange portals

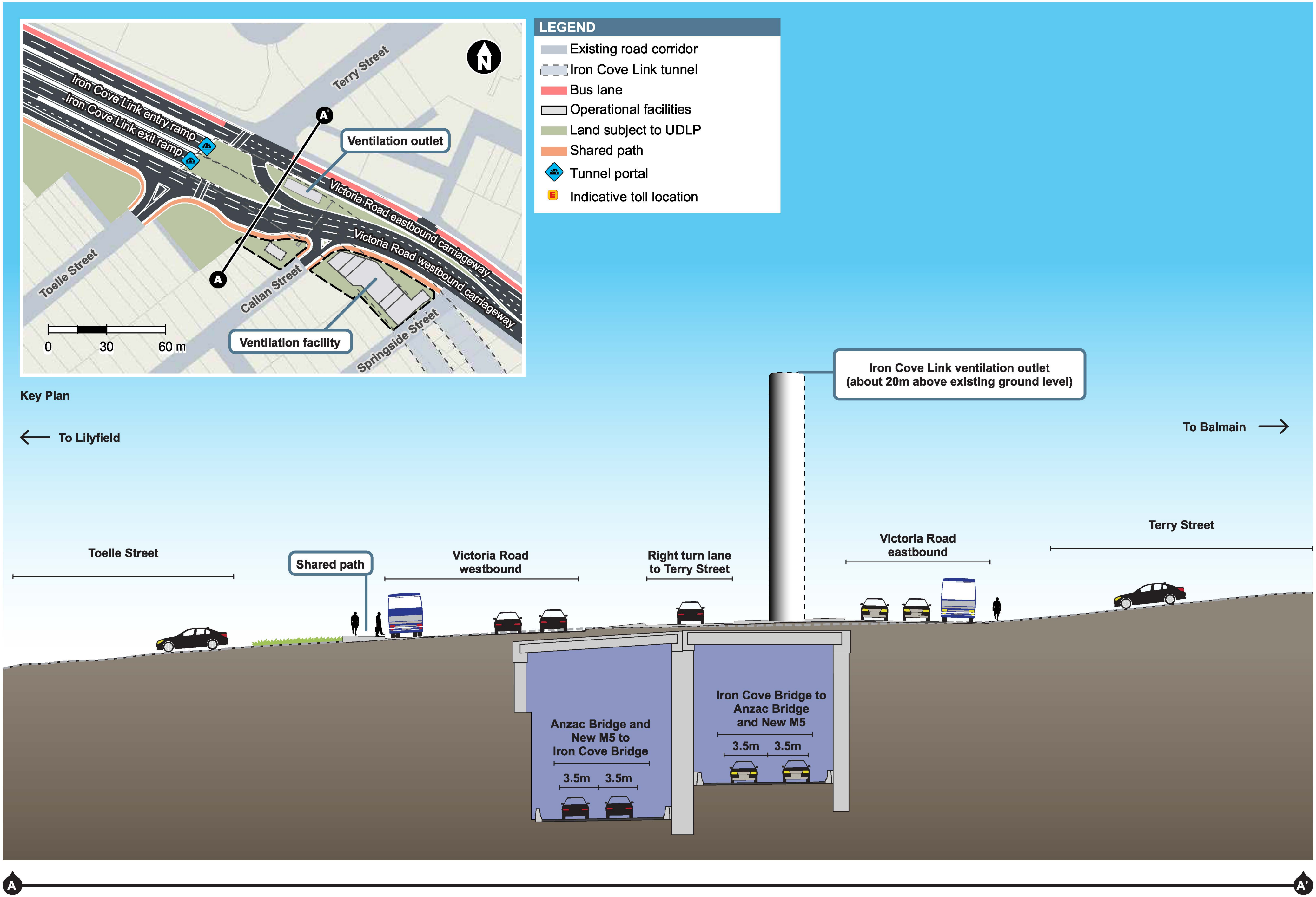


Figure 5-22 Indicative cross-section - Iron Cove Link portals

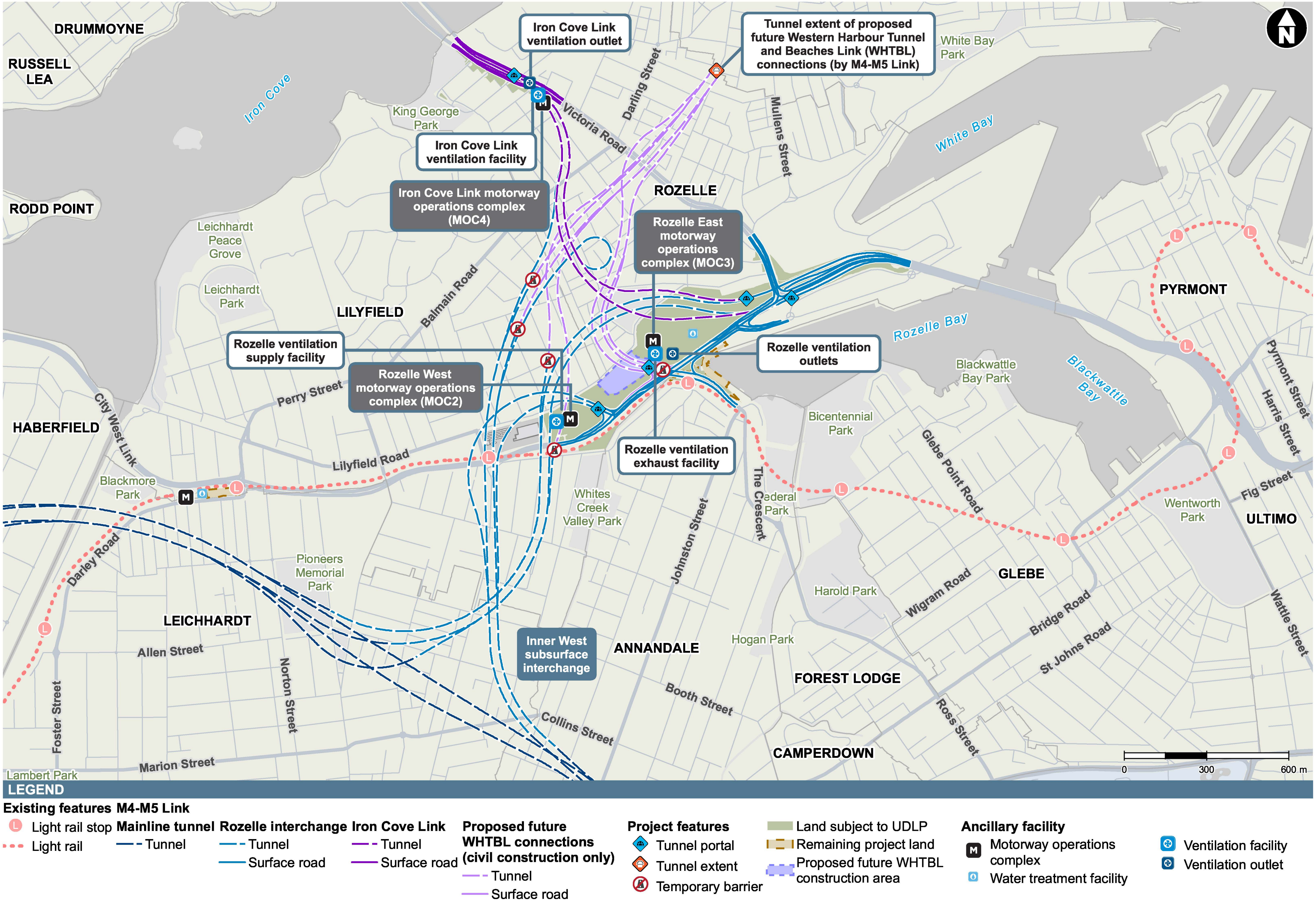


Figure 5-23 Rozelle interchange - M4-M5 Link project operational layout

5.4 Integration with other WestConnex projects

5.4.1 Connection to the M4 East mainline tunnel

The mainline tunnels would connect with the M4 East mainline tunnels underground around Alt Street at Haberfield (see **Figure 5-2**). This would be a tunnel-to-tunnel connection facilitated by stub tunnels that are being constructed as part of the M4 East project, and would provide for travel between the M4-M5 Link and M4 East mainline tunnels. The mainline tunnels would be three-lanes wide in each direction at this connection.

5.4.2 Connection to the Wattle Street interchange

Entry and exit ramps would connect the mainline tunnels with the Wattle Street interchange at Haberfield via tunnel portals and twin, two-lane cut-and-cover tunnels and dive structures being built between the divided Wattle Street carriageways. These ramps are being built as part of the M4 East project. This connection is shown in **Figure 5-2** and an indicative cross-section of these tunnel portals is shown in **Figure 5-17**.

To efficiently manage the merge between the Wattle Street interchange entry ramp and the mainline tunnels and the approach to the Inner West subsurface interchange, the Wattle Street interchange entry ramp would divide into two, one-lane entry ramps about midway along the entry ramp (around Alt Street at Haberfield). These single lane tunnels would then join with the southbound mainline tunnel before the Inner West subsurface interchange. Motorists traveling to the Rozelle interchange would join on the left (northern) side of the southbound mainline tunnel, and motorists traveling to the New M5 Motorway would join on the right (southern) side of the southbound mainline tunnel.

By giving motorists the ability to choose a merge location dependent on their destination, this arrangement would make driving in the tunnel safer by reducing the amount of lane changes that motorists may need to carry out on the approach to the Inner West subsurface interchange. Further detail on operational traffic is provided in **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).

5.4.3 Connection to the New M5 mainline tunnel

The M4-M5 Link and New M5 mainline tunnels would connect underground north of the Princes Highway at about the intersection of Mary Street and Bakers Lane (see **Figure 5-9**). This would be a direct tunnel-to-tunnel connection facilitated by stub tunnels that are being constructed as part of the New M5 project. The mainline tunnels would be two lanes wide in each direction at this connection with provision to be increased to three lanes in the future (if required).

The northbound mainline tunnel would divide into two, one-lane tunnels generally below Campbell Road at St Peters, separating Rozelle interchange bound motorists from M4 East Motorway bound motorists. These separate tunnels would extend north before joining the northbound St Peters interchange entry ramp. Motorists traveling to the Rozelle interchange would merge on the right (eastern) side, and motorists traveling to the M4 East Motorway would merge on the left (western) side.

By giving motorists the ability to choose a merge location dependent on their destination, this arrangement would make driving in the tunnel safer by reducing the number of lane changes that motorists may need to carry out on the approach to the Inner West subsurface interchange. Further detail on operational traffic is provided in **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).

5.4.4 Connection to the St Peters interchange

Entry and exit ramps would provide a connection between the M4-M5 Link mainline tunnels and the interchange at St Peters, which is being delivered as part of the New M5 project. The ramps would be three to four lanes in each direction and would provide for connections between the M4-M5 Link mainline tunnels, the proposed future Sydney Gateway project and the surface road network at St Peters (Gardeners Road and Campbell Road via the St Peters interchange). This connection is shown in **Figure 5-9**.

The St Peters interchange exit ramp would increase from three to four lanes around 350 metres north of the St Peters interchange tunnel portal (below ground). As the exit ramp approaches the surface at the St Peters interchange, three lanes on the western side would continue straight ahead, forming the connection to the proposed future Sydney Gateway project (via the St Peters interchange). The left lane would divide away on the approach to the surface and would increase to two lanes, forming the exit ramp that would connect the M4-M5 Link with local roads at St Peters (via the St Peters interchange).

To enable the connection between the M4-M5 Link entry and exit ramps and the St Peters interchange, tunnel portals and twin, three-lane cut-and-cover tunnels are being built below a fully-enclosed bridge that extends from around the property line on the north side of Campbell Street to the property line on the south side of Albert Street. These works are being carried out as part of the New M5 project. The M4-M5 Link project would extend the cut-and-cover tunnel of the southbound exit ramp for around 100 metres south of Albert Street (at the St Peters interchange) to support a section of the Campbell Road ventilation facility (see **section 5.8.2** for details about this facility).

Works to complete the entry and exit ramps would be carried out as part of the M4-M5 Link project and would include stabilisation and civil works, including installation of pavement and line marking, drainage, barriers, wall panels and mechanical and electrical works.

Connections between the M4-M5 Link and the proposed future Sydney Gateway at the St Peters interchange would not be open to motorists as part of the M4-M5 Link project. The proposed future Sydney Gateway would be subject to separate environmental assessment and approval and does not form part of this project.

5.5 Connectivity

The project has been designed to provide essential connections between the M4 East and New M5 motorways and the surface road network at Haberfield, Lilyfield, Rozelle and St Peters. The project would also facilitate expansion of a connected motorway network for western and south-western Sydney by enabling future connections to the proposed future Western Harbour Tunnel at Rozelle, and the proposed future Sydney Gateway via the St Peters interchange.

The connectivity that would be provided by the project comprises:

- Free-flow connection (that is, a connection that does not require motorists to travel through or stop at an intersection) between:
  - The M4 East and the New M5, via the mainline tunnels
  - The M4 East and Anzac Bridge, via the Rozelle interchange
  - The M4 East and the proposed future Western Harbour Tunnel and Beaches Link, via the Rozelle interchange (this connection would not be operational as part of the project)
  - The New M5 and the Iron Cove Link, via the Rozelle interchange
  - The New M5 and the proposed future Western Harbour Tunnel and Beaches Link (this connection would not be operational as part of the project)
  - Anzac Bridge and Victoria Road at Rozelle, near the eastern abutment of Iron Cove Bridge (via the Iron Cove Link)
- A connection between the New M5 and the surface road network at Lilyfield and Rozelle, via a new intersection with City West Link between Catherine Street and The Crescent (see **section 5.6.2**)
- A connection between the surface road network and the proposed future Western Harbour Tunnel and Beaches Link, via the realigned intersection of City West Link and The Crescent (see **section 5.6.3**).

The mainline tunnel connection between the M4 East at Haberfield and the New M5 at St Peters is shown in **Figure 5-1**. The connectivity that would be provided by the Rozelle interchange and the Iron Cove Link is shown in **Figure 5-24**.

These planned and proposed connections have been determined based on the strategic road network requirements of the region. Further detail is provided in **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).

LEGEND

M4-M5 Link	Rozelle interchange	
Surface road	M4 East to/from Anzac Bridge	New M5 to/from proposed future WHTBL
Tunnel	City West Link to/from Anzac Bridge	Proposed future WHTBL connections (civil construction only)
	Iron Cove Bridge to/from Anzac Bridge	

Figure 5-24 Rozelle interchange connectivity

5.6 Rozelle surface works

The surface road network around the Rozelle interchange would be upgraded and modified to ensure safe and efficient connections with the road infrastructure proposed as part of the project, and to cater for additional traffic demands in the future. A detailed analysis of the traffic and transport impacts of the Rozelle surface works is provided in **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).

The Rozelle surface works would include:

- Realigning and upgrading City West Link and The Crescent between around 300 metres east of Catherine Street at Lilyfield, and The Crescent/Victoria Road intersection
- A new intersection on City West Link between Catherine Street and The Crescent to connect the surface road network to the New M5 St Peters interchange (via the M4-M5 Link mainline tunnels)
- Realigning The Crescent at Annandale, including a new bridge over Whites Creek and modifications to the intersection with City West Link and Johnston Street
- Upgrades to the intersection of City West Link and The Crescent
- Reconstructing the intersection of The Crescent and Victoria Road at Rozelle, including construction of a new bridge at Victoria Road and minor adjustments to Victoria Road north of this intersection
- Widening and adjustments of Victoria Road between The Crescent and Anzac Bridge
- The Rozelle West motorway operations complex (MOC2) including the Rozelle ventilation supply facility and an electrical substation (see **section 5.8** for further detail)
- The Rozelle East motorway operations complex (MOC3) including the Rozelle ventilation exhaust facility, ventilation outlets and the permanent water treatment facility (see **section 5.8** for further detail)
- Drainage infrastructure to collect surface and groundwater for treatment at dedicated facilities (see **section 5.9** for further detail)
- Widening and improvement works to the channel and bank of Whites Creek at Annandale, between around the light rail bridge and Rozelle Bay. These works would be carried out to manage flooding and drainage for the surface road network
- Landscaping adjacent to disturbed areas, and the provision of new open space within the Rozelle Rail Yards
- Two new pedestrian and cyclist bridges over City West Link to connect Lilyfield Road and Victoria Road with Brenan Street at Lilyfield and The Crescent at Annandale, and a new pedestrian and cyclist underpass below Victoria Road to connect Lilyfield Road with Anzac Bridge
- Pedestrian and cyclist paths
- Other minor local road changes (such as tie-in works)
- New and upgraded bridges (see **section 5.6.6**)
- Upgrades and minor changes to public transport infrastructure (see **section 5.6.8**).

An overview of these works is shown in **Figure 5-25** to **Figure 5-28**. Details of the Rozelle surface works are provided in **section 5.6.1** to **section 5.6.9**.

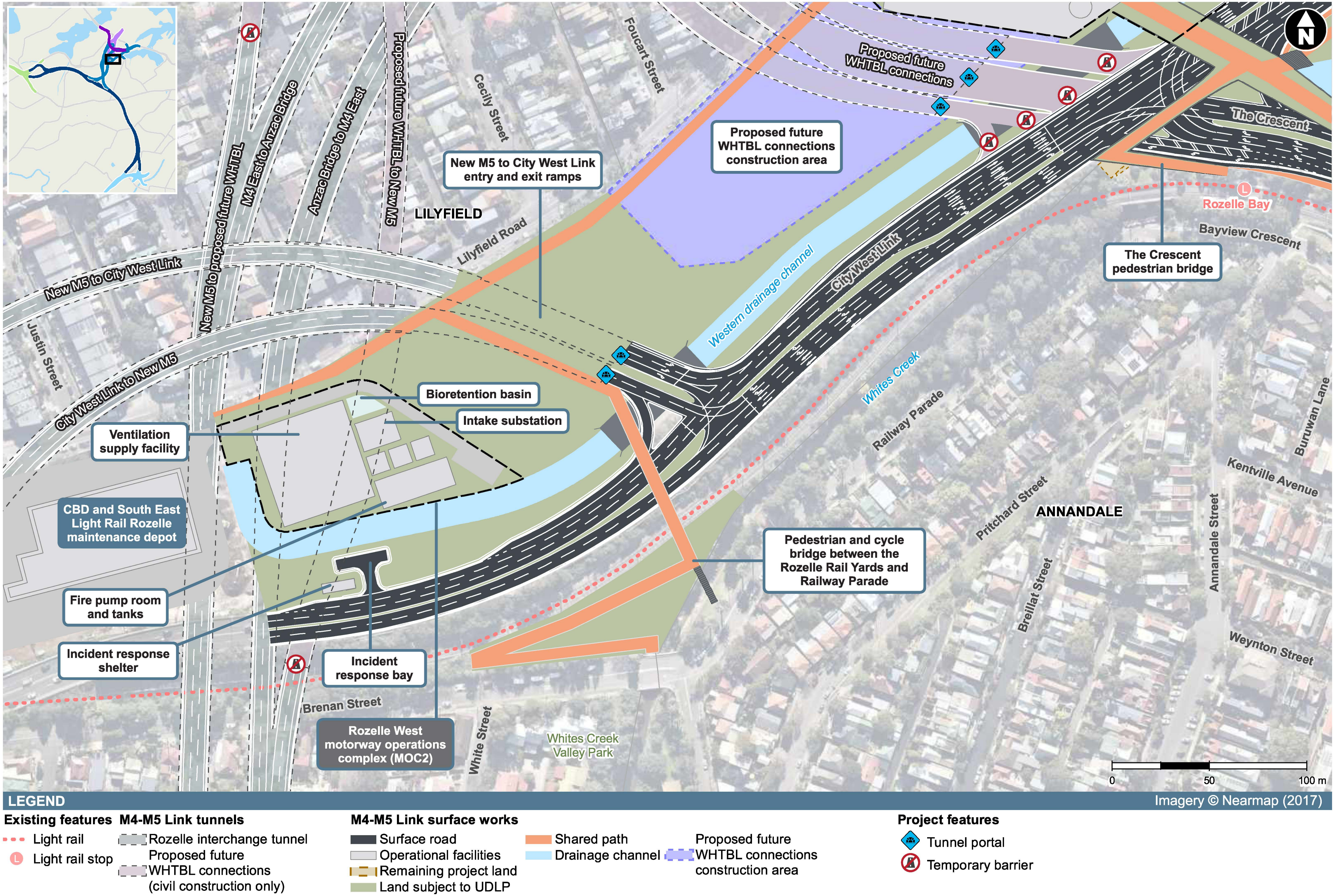


Figure 5-25 Rozelle interchange surface works overview - Map 1

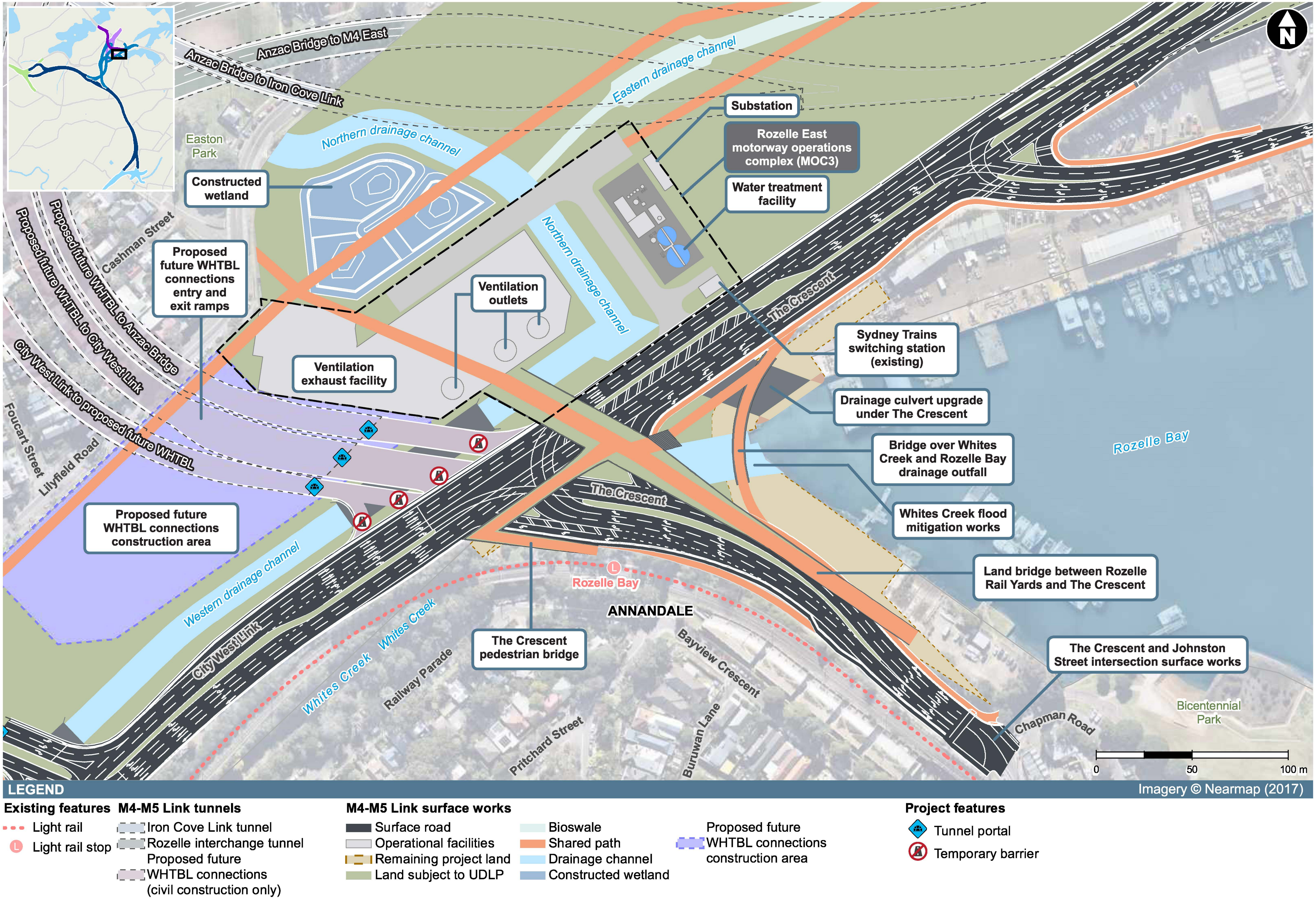
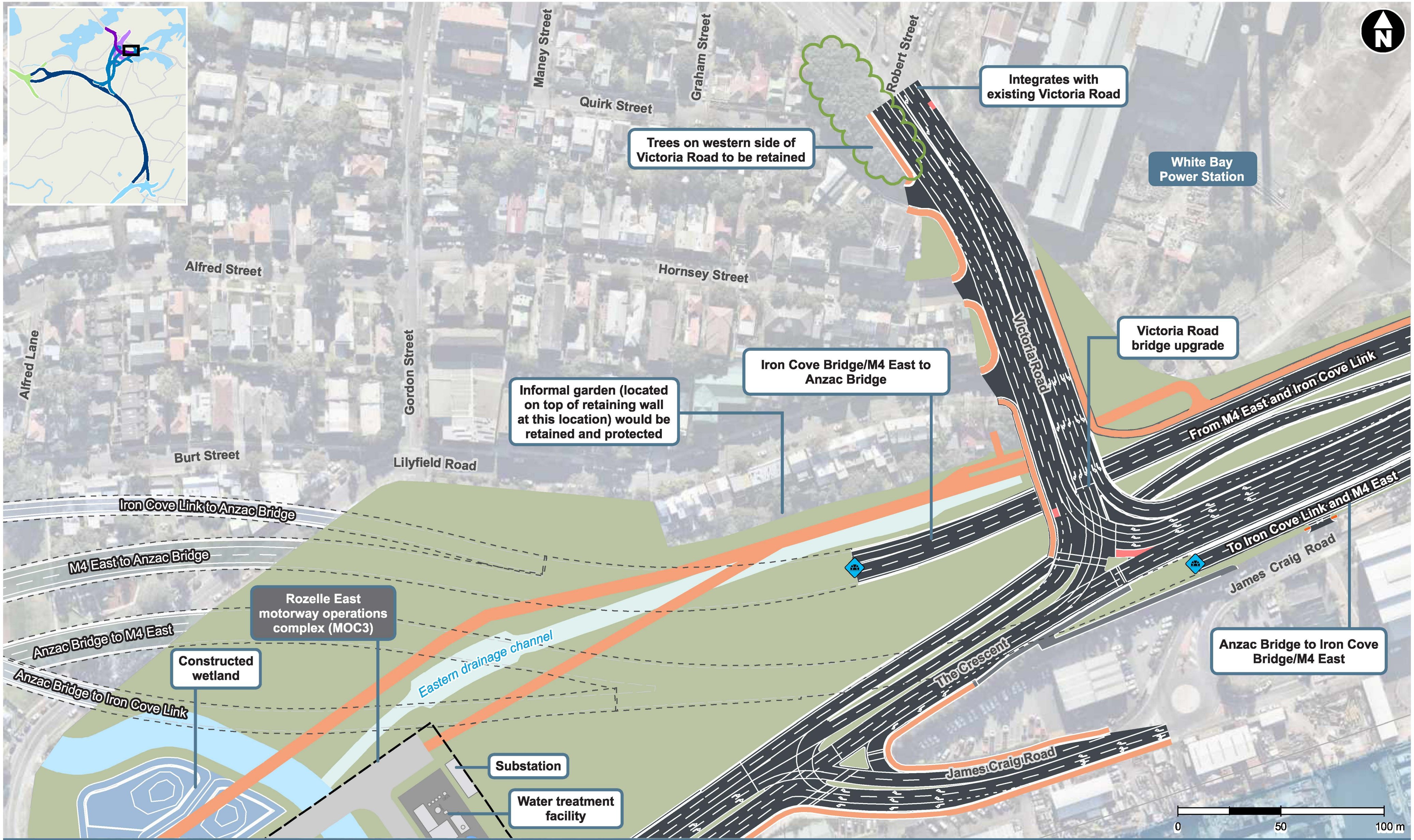


Figure 5-26 Rozelle interchange surface works overview - Map 2



LEGEND

Imagery © Nearmap (2017)

M4-M5 Link tunnels
- Iron Cove Link tunnel
- Rozelle interchange tunnel

M4-M5 Link surface works
- Surface road
- Operational facilities
- Land subject to UDLP
- Bioswale
- Shared path
- Drainage channel
- Constructed wetland
- Bus lane

Project features
- Tunnel portal

Figure 5-27 Rozelle interchange surface works overview - Map 3

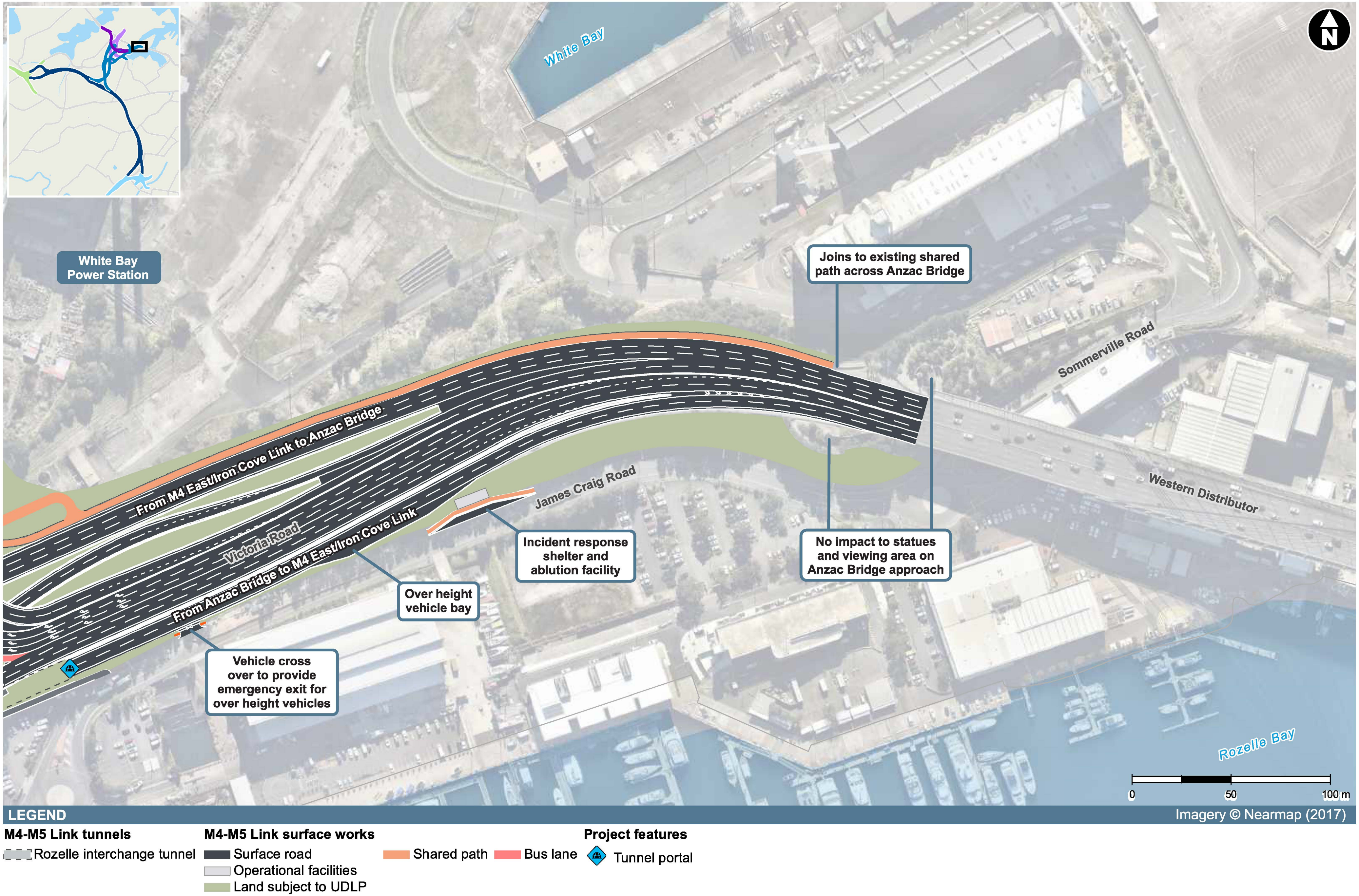


Figure 5-28 Rozelle interchange surface works overview - Map 4

5.6.1 Upgrade, widening and intersection works along City West Link and The Crescent

City West Link and The Crescent would be realigned and upgraded between around 300 metres east of Catherine Street and The Crescent/Victoria Road intersection (shown in **Figure 5-25** and **Figure 5-26**). The majority of widening works along City West Link would occur north of the eastbound carriageways within the existing road reserve and the adjacent Rozelle Rail Yards. This would allow the existing vegetation and noise wall between City West Link and the Inner West Light Rail line to be retained.

Traffic lanes would be between three and 3.5 metres wide. The eastbound and westbound traffic lanes would be separated by a median, which would vary in width to accommodate turning lanes at intersections.

A section of The Crescent between the upgraded City West Link/The Crescent intersection and James Craig Road would be raised about 0.2 metres (compared to the current level) to provide clearance over a new drainage channel that would direct stormwater from the Rozelle Rail Yards to Rozelle Bay. Further details about this culvert are provided in **section 5.6.6** and **section 5.9.2**.

The realignment of City West Link and The Crescent would require minor upgrade works to the intersection of The Crescent and James Craig Road. All turning movements at this intersection would be retained and the works would occur predominantly within the existing road reserve, and within adjacent Roads and Maritime owned land.

5.6.2 New intersection to connect City West Link to the New M5 and the St Peters interchange

A new intersection would be built on City West Link between Catherine Street and The Crescent to connect City West Link to the New M5 and the St Peters interchange (via the M4-M5 Link mainline tunnels). The layout and configuration of this proposed intersection is shown in **Figure 5-25**.

The new intersection would include traffic signals and would allow motorists to:

- Exit the northbound M4-M5 Link mainline tunnels from St Peters, travel along the exit ramp and either turn left or right onto City West Link
- Enter the southbound M4-M5 Link mainline tunnels to St Peters by turning left or right from City West Link to connect to the entry ramp
- Continue to travel along City West Link.

Additional lanes would be added along City West Link to accommodate right and left turn and slip lanes, comprising:

- One additional lane on the eastbound carriageway that would enable motorists to enter the southbound entry ramp via a slip lane, and exit the northbound exit ramp via traffic signals
- Two additional lanes on the westbound carriageway that would become right turn lanes, to enable motorists to enter the southbound entry ramp. This right turn movement would be via traffic signals.

The works to construct the new intersection between City West Link and the Rozelle interchange would occur within land designated as road reserve and within the Rozelle Rail Yards to the north of City West Link.

5.6.3 Realignment of The Crescent at Annandale

The Crescent at Annandale between City West Link and Johnston Street would be realigned westwards by up to around 75 metres. This section of The Crescent would comprise two northbound lanes, three southbound lanes and a median. Traffic lanes in both directions would be around 3.5 metres wide. A new bridge would be built to allow The Crescent to span Whites Creek (see **section 5.6.6**). The layout and configuration of these works are shown in **Figure 5-26**.

A shared pedestrian and cyclist path would be provided on both sides of The Crescent (southbound and northbound carriageways). A pedestrian and cyclist bridge would also be provided to connect the eastern and western sides of The Crescent and the Rozelle Bay light rail stop. This bridge would also extend over City West Link and into the Rozelle Rail Yards to connect with the pedestrian and cyclist path network to be provided (see **section 5.7.4**).

The majority of works to realign The Crescent would be conducted in land designated as:

- Road reserve
- Open space along the western side of The Crescent (Buruwan Park). Buruwan Park would be replaced by operational road infrastructure
- Land owned by Roads and Maritime between The Crescent and Rozelle Bay.

Widening and improvement works to the channel and bank of Whites Creek at Annandale would also be carried out to manage flooding and drainage for the surface road network. These works are described in **section 5.9.2** and shown in **Figure 5-30**. Land use and property impacts are considered further in **Chapter 12** (Land use and property). Socio-economic impacts associated with changes to land use and property are considered in **Chapter 14** (Social and economic).

The Crescent/City West Link intersection upgrades and modifications

The intersection of The Crescent and City West Link would be upgraded to safely and efficiently manage traffic entering and leaving the surface road network and the Rozelle interchange. The layout and configuration of this intersection is shown in **Figure 5-26**. The upgraded intersection would be integrated with other surface road works at Lilyfield and Rozelle and would allow motorists to:

- Turn left from the northbound carriageway of The Crescent at Annandale onto City West Link
- Turn right from the northbound carriageway of The Crescent at Annandale, to continue along The Crescent eastbound towards Victoria Road/Anzac Bridge
- Turn right from the eastbound carriageway of City West Link to head south along The Crescent at Annandale
- Turn left from the westbound carriageway of City West Link, to continue south along The Crescent at Annandale.

Modification works at this intersection would include:

- Realignment of the intersection to the west of its current location
- Dedicated right and left turn lanes.

The upgraded intersection would also include new lanes that would allow motorists to enter and exit the proposed future Western Harbour Tunnel and Beaches Link to and from The Crescent and City West Link. These road connections would only become operational when connected to the proposed future Western Harbour Tunnel and Beaches Link if approved (which would be the subject of separate future assessment and approval process).

5.6.4 Reconstruction of Victoria Road at Rozelle

Victoria Road surface works

The southbound and northbound carriageways of Victoria Road at Rozelle would be reconstructed between Robert Street at Rozelle and the intersection with The Crescent in generally the same alignment as the existing arrangement, with minor widening to the western side. The works would be conducted on land designated as road reserve and on adjacent land that would be acquired for the project. The buildings on the adjacent land would be demolished as part of the project.

Reconstruction of this section of Victoria Road would be carried out to tie-in with the upgraded intersection with The Crescent and is shown in **Figure 5-27**. The remaining land to the east of Victoria Road would be landscaped to be consistent with the UDLP for the project.

Traffic lanes in both directions would be about 3.5 metres wide. A shared pedestrian and cyclist path would be provided on the eastern and western side of Victoria Road. The northbound carriageway of Victoria Road would include two 80-metre long right-turn lanes to allow motorists to turn right into Robert Street. No changes to the intersection of Victoria Road and Robert Street are proposed as part of the project.

Victoria Road/The Crescent intersection modifications

The intersection of Victoria Road and The Crescent would be reconstructed in generally the same alignment as the existing arrangement. The existing Victoria Road bridge would be replaced to enable the M4 East/Iron Cove Link to Anzac Bridge exit ramp and the new east–west pedestrian and cyclist connection to be accommodated beneath (see **section 5.6.5**). The intersection would be integrated with surface road works along Victoria Road and The Crescent and is shown in **Figure 5-27**.

For motorists travelling eastbound along The Crescent towards Anzac Bridge, two lanes would diverge from the eastbound carriageway before the intersection with Victoria Road, continue east below Victoria Road, and merge with the eastbound carriageway of Victoria Road on the approach to Anzac Bridge.

5.6.5 Victoria Road/Anzac Bridge approaches

The eastbound and westbound Victoria Road carriageways would be modified on the approach to and from Anzac Bridge to incorporate the M4 East/Iron Cove Link entry and exit ramps and tunnel portals. The configuration and layout of these modifications are shown in **Figure 5-27** and **Figure 5-28** and described below:

- The M4 East/Iron Cove Link to Anzac Bridge exit ramp would surface at the tunnel portal west of Victoria Road within the Rozelle Rail Yards, travel below the Victoria Road bridge and merge with the northern (eastbound) carriageway on the approach to Anzac Bridge
- Anzac Bridge to M4 East/Iron Cove Link entry ramp would diverge from the southern (westbound) carriageway of Victoria Road on the approach from Anzac Bridge, extend west adjacent to the westbound carriageway of Victoria Road and enter the tunnel portal south of the intersection of The Crescent and Victoria Road.

5.6.6 Bridges and cut-and-cover structures at the Rozelle interchange

This section describes the replacement of existing bridges and the provision of new bridges and structures as part of the Rozelle surface works. The locations of these are shown in **Figure 5-25** to **Figure 5-28**. Indicative cross-sections are shown in **Figure 5-29**. Bridges and structures at the Rozelle interchange are described in the following sections, and would include:

- Replacement of the bridge at the intersection of Victoria Road and The Crescent. The existing bridge would be demolished
- Replacement of the bridge over Whites Creek along the new alignment of The Crescent. The existing bridge would be demolished
- Two new bridges over the western drainage channel along the southern boundary of the Rozelle Rail Yards at the following locations:
  - City West Link to New M5/St Peters interchange entry and exit ramps
  - The proposed future Western Harbour Tunnel and Beaches Link entry and exit ramps
- A new low-level bridge over a new culvert below City West Link. The culvert would direct water flows from the northern drainage channel within the Rozelle Rail Yards to Rozelle Bay. See **section 5.9.2** for drainage infrastructure detail
- Three new pedestrian and cyclist bridges comprising:
  - A bridge over City West Link linking Lilyfield Road and the Rozelle Rail Yards with Brenan Street and Whites Creek at Lilyfield
  - A bridge over City West Link and The Crescent that would connect Lilyfield Road and the Rozelle Rail Yards with The Crescent, Rozelle Bay light rail stop and Annandale and Glebe

- A bridge over Whites Creek and the Rozelle Bay drainage outfall. Utilities would also be located on the underside of this bridge

- Cut-and-cover tunnels and tunnel portal structures in the Rozelle Rail Yards.

Replacement of the Victoria Road bridge

The bridge at the intersection of Victoria Road and The Crescent would be replaced. During construction, traffic would be switched to a temporary bridge to minimise disruptions to motorists. When construction is complete, traffic would be switched on to the new bridge and the temporary bridge would be removed. Below the new bridge, redundant rail infrastructure (including rail tracks) would be removed.

The location of the Victoria Road bridge is shown in **Figure 5-27** and an indicative cross-section is shown in **Figure 5-29**.

New bridge over Whites Creek at The Crescent

A new bridge would be constructed over Whites Creek at Annandale along the new alignment of The Crescent, which would also facilitate the widening and improvement works to Whites Creek. The bridge would be constructed off-line (that is, next to the existing bridge), which would mean that traffic would continue to use this section of The Crescent during construction). When construction of the new bridge is complete, traffic would be switched onto the new bridge and the existing bridge would be demolished.

The design of the bridge would consider water forces resulting from a major flooding event and account for scour, buoyancy and tie down requirements. Existing retaining walls along City West Link would need to be partially demolished and modified to accommodate the northern abutment of the new bridge.

The location of the new bridge over Whites Creek is shown in **Figure 5-26** and an indicative cross-section is shown in **Figure 5-30**.

New bridge over the drainage channel below City West Link

A new low-level bridge structure would support a section of The Crescent carriageways between the intersection with City West Link and the intersection with James Craig Road. This low-level bridge would span over the northern drainage channel that would convey flows from the Rozelle Rail Yards to Rozelle Bay. A series of box culverts would continue from the culvert structures to facilitate drainage from Rozelle Rail Yards to Rozelle Bay. During construction, a temporary diversion of this section of The Crescent would be established to allow for these works on The Crescent to be carried out while minimising disruption to the surface road network.

The location of this bridge and the associated culvert structure is shown in **Figure 5-26** and an indicative cross-section is shown in **Figure 5-31**.

New bridges over the drainage channels within the Rozelle Rail Yards

New bridges would be built over the western drainage channel within the Rozelle Rail Yards to support the City West Link to New M5 and City West Link to the proposed future Western Harbour Tunnel and Beaches Link entry and exit ramps. The design of these bridges would consider water forces resulting from a major flooding event and account for scour, buoyancy and tiedown requirements.

The locations of drainage channel bridges within the Rozelle Rail Yards are shown in **Figure 5-25** to **Figure 5-27**. An indicative cross-section is shown in **Figure 5-32**.

Pedestrian and cyclist bridges

The project would deliver new pedestrian and cyclist infrastructure at Lilyfield and Rozelle. This infrastructure has been designed to maintain and enhance pedestrian and cyclist accessibility and connectivity, providing new and upgraded east–west connections linking Lilyfield and Rozelle with Anzac Bridge, the future Bays Precinct and Balmain, and north–south connections linking Lilyfield and Rozelle with Annandale and Glebe.

Pedestrian and cyclist bridges are described in the following sections and shown in **Figure 5-25** to **Figure 5-27**. Detailed descriptions of the active transport connections to be provided or enabled by the M4-M5 Link project are also provided in **Appendix N** (Technical working paper: Active transport strategy).

New bridge over City West Link linking Lilyfield Road and Brenan Street

A new bridge would be constructed at the western end of the Rozelle interchange to provide pedestrian and cyclist connectivity between Lilyfield and Annandale, by connecting Lilyfield Road to Brenan Street and the Whites Creek shared path. The bridge would provide a direct and safe grade-separated link over City West Link and the existing light rail tracks near the Lilyfield light rail stop.

At the northern end, the approach ramp of the bridge would connect to the new shared path at the elevated platform above the New M5/City West Link dive structures, and link to the new shared path along Lilyfield Road. At the southern end, it is proposed to locate the approach ramps within the area between the light rail corridor, the existing Whites Creek channel and Brenan Street.

New bridge over City West Link and The Crescent

A new pedestrian and cyclist bridge would extend across City West Link and The Crescent to provide a direct link for pedestrians and cyclists between Lilyfield Road, the Rozelle Rail Yards, City West Link, The Crescent and the Rozelle Bay light rail stop, linking Anzac Bridge, Balmain, Rozelle and Lilyfield with Annandale and Glebe.

The main span of the bridge over City West Link would be a smooth and slender structure with distinctive architectural features. The second span of the bridge would extend over The Crescent and provide a connection to the Rozelle Bay light rail stop. A ramp would continue down to connect to the bus stop on The Crescent.

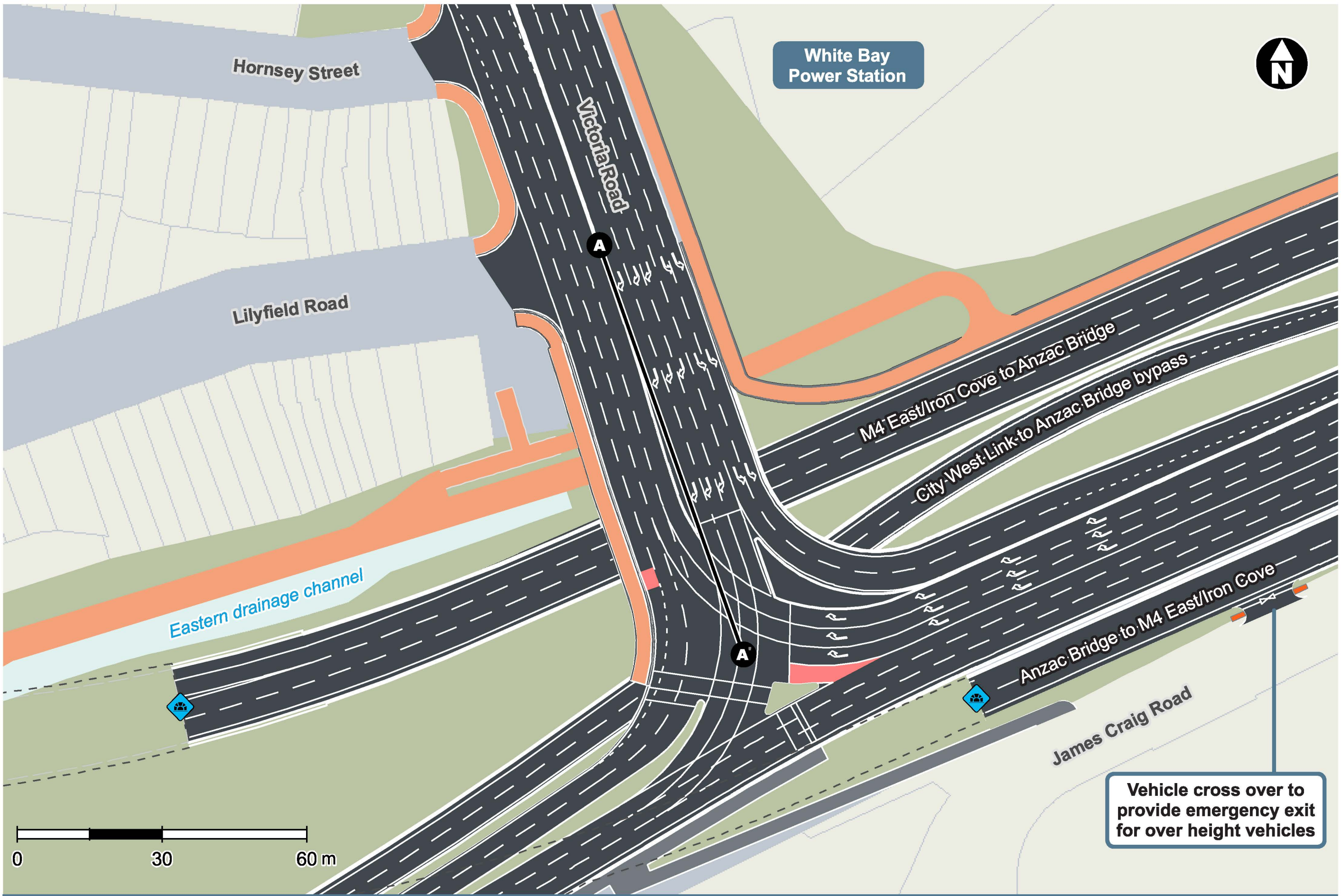
Pedestrian bridge over Whites Creek and the Rozelle Bay drainage outfall

A new bridge would be constructed over the widened Whites Creek channel and the Rozelle Bay drainage outfall to provide a pedestrian connection along The Crescent. This bridge would also incorporate a new utility service corridor for multiple existing utilities running along The Crescent. An indicative alignment of this bridge is shown in **Figure 5-26**.

Cut-and-cover structures within the Rozelle Rail Yards

Cut-and-cover structures would be constructed for the City West Link to New M5/St Peters interchange entry and exit ramps, M4 East/Iron Cove Link to Anzac Bridge entry and exit ramps and proposed future Western Harbour Tunnel and Beaches Link entry and exit ramps, where these ramps approach the surface.

The location of the cut-and-cover structures are shown in **Figure 5-25** to **Figure 5-28.** A description of the construction methodology for cut-and-cover structures is included in **Chapter 6** (Construction work).



LEGEND

Project features
- Tunnel portal

M4-M5 Link tunnels
- Rozelle interchange tunnel

M4-M5 Link surface works
- Surface road
- Land subject to UDLP
- Bioswale
- Bus lane
- Shared path

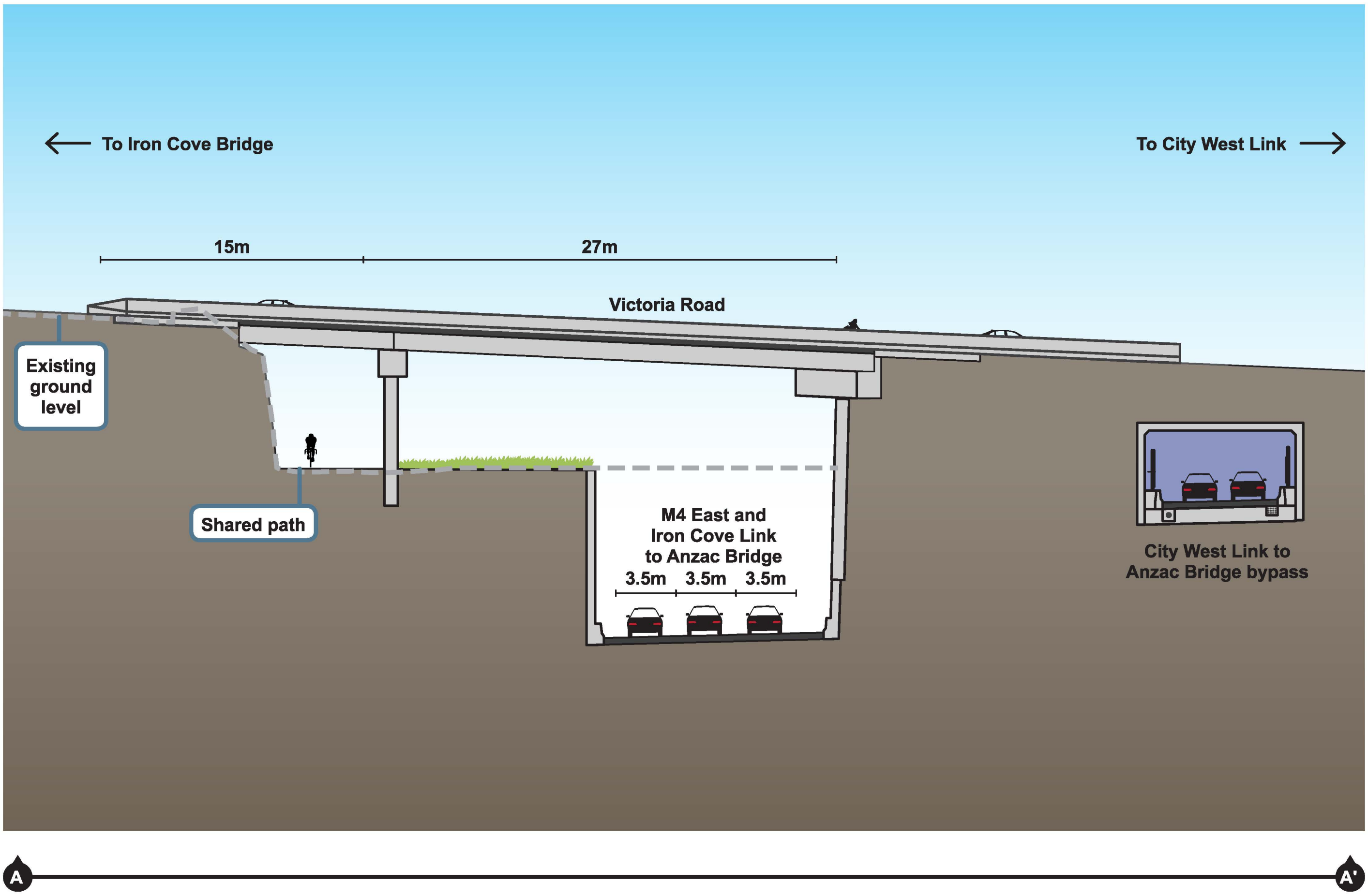


Figure 5-29 Indicative cross-section - replacement of the Victoria Road bridge

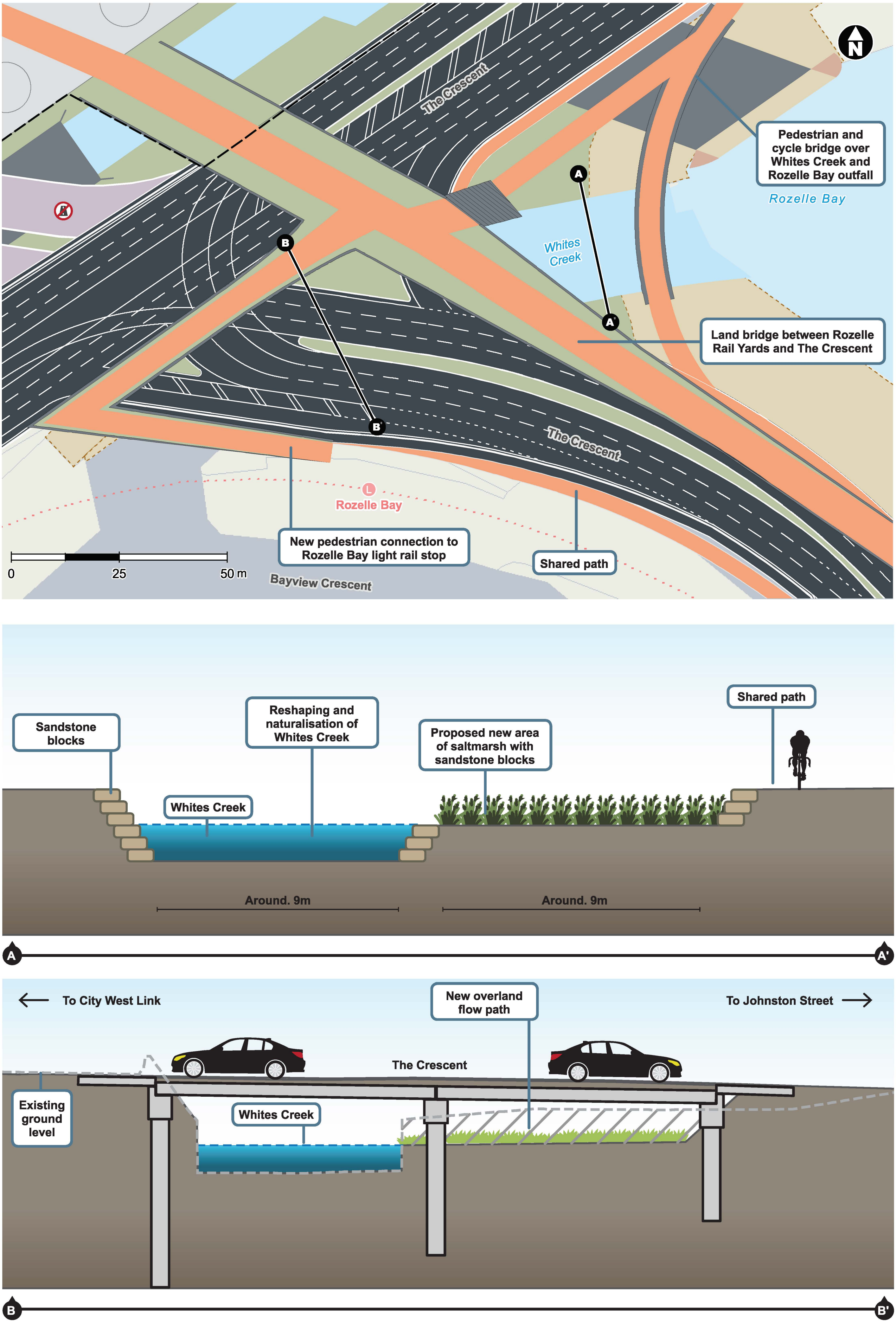


Figure 5-30 Indicative cross-section – new bridge over Whites Creek at The Crescent

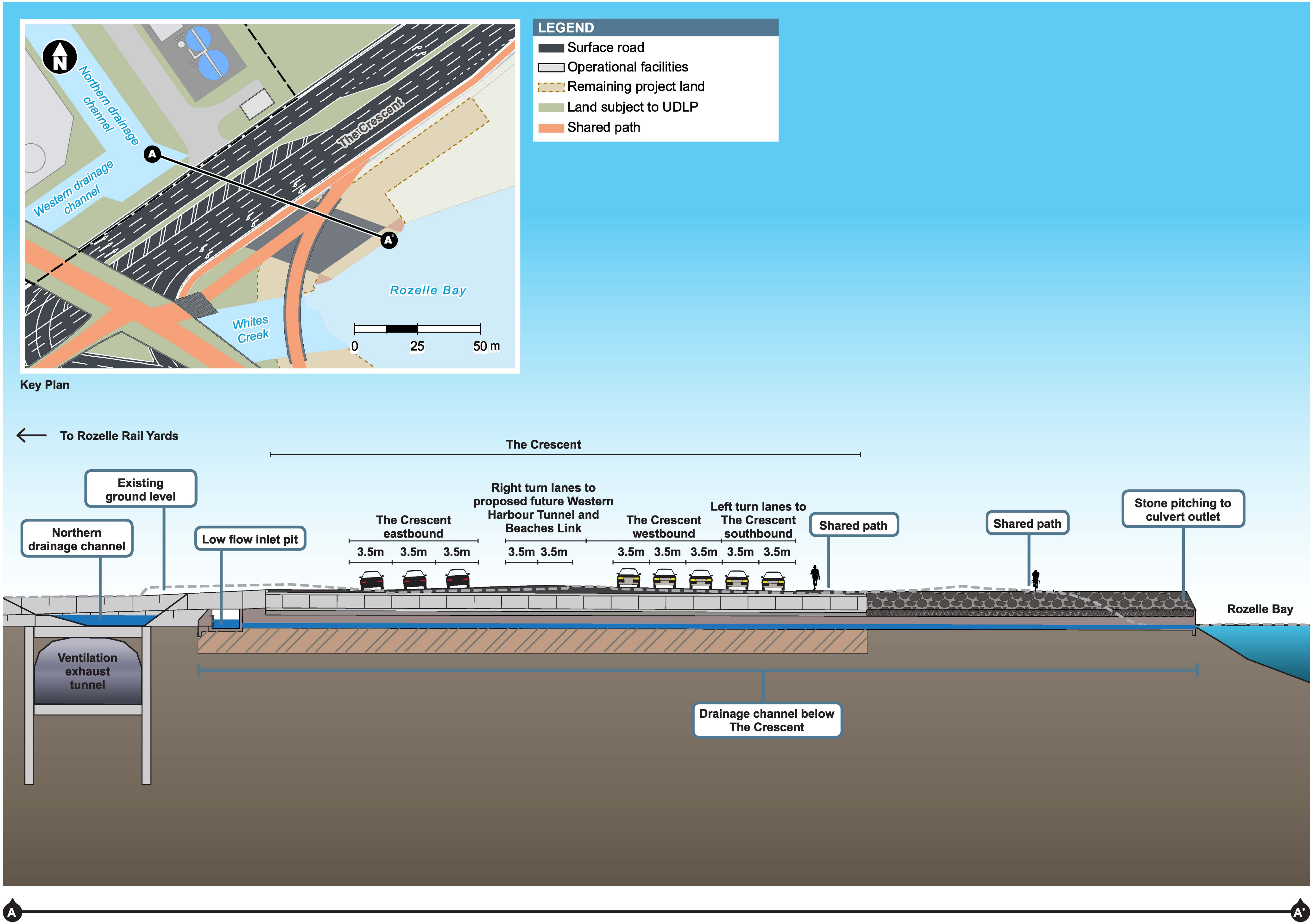


Figure 5-31 Indicative cross-section – new bridge over the northern drainage channel below The Crescent

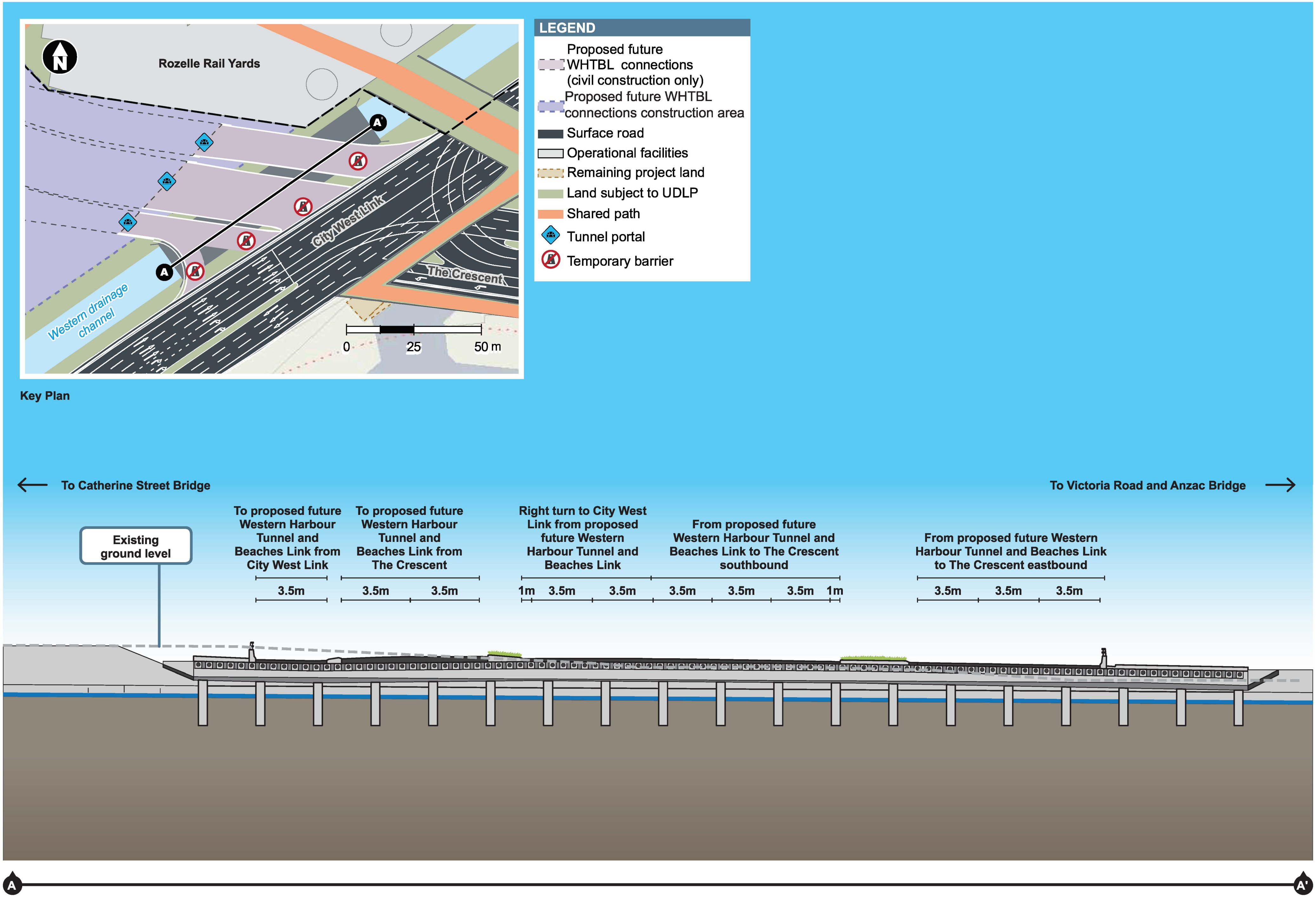


Figure 5-32 Indicative cross-section – new bridge over the western drainage channel within the Rozelle Rail Yards

5.6.7 Urban design and landscape

As part of the project, urban design and landscaping works would be carried out adjacent to disturbed areas associated with the Rozelle surface works, and would include the provision of new open space within the Rozelle Rail Yards. The urban design and landscaping works that would be carried out as part of the Rozelle surface works are shown in **Figure 5-33** and would include (but not be limited to):

- Detailed review and finalisation of the architectural treatment of the operational motorway infrastructure
- Earthworks to reshape the site around the motorway operational infrastructure. Long-sections showing the indicative landform following the construction of the Rozelle interchange are included in **Figure 5-34** to **Figure 5-38**)
- Provision of pedestrian and cyclist paths and bridges
- Provision of new open space within the Rozelle Rail Yards, including landscaping
- Revegetation, including tree planting, at key locations including:
  - Around motorway operational infrastructure such as the ventilation facility
  - Around the constructed wetland, bioretention swale and the drainage channels
  - Adjacent to pedestrian and cyclist paths
  - Around the perimeter of the Rozelle Rail Yards.

Tree planting within the Rozelle Rail Yards would be integrated with street tree planting that would be carried out by the project.

A concept design for these urban design and landscaping works has been prepared having regard to the urban design objectives and principles in **section 5.2**. The concept design is included in **Appendix L** (Technical working paper: Urban design), **Appendix N** (Technical working paper: Active transport strategy) and **Chapter 13** (Urban design and visual amenity). The concept design would be refined during the development of a UDLP, which would be prepared based on the detailed design and in accordance with relevant commitments in this EIS. The UDLP would be prepared in consultation with relevant councils, stakeholders and the community.

A section of the Rozelle Rail Yards around the proposed future Western Harbour Tunnel and Beaches Link entry and exit ramps would be kept as an area of hardstand, in anticipation of it being used to support construction of the proposed future Western Harbour Tunnel and Beaches Link project (if it is approved). Following handover from the project, this area would be physically separated from the remainder of the interchange to restrict access. The possible future use of this area for construction of the proposed future Western Harbour Tunnel and Beaches Link project may mean that landscaping and revegetation works at the Rozelle Rail Yards would need to be staged. Staging of future urban and landscape design works would be outlined in the UDLP.

5.6.8 Integration with public transport

This section describes how the project would integrate with the existing public transport network around the Rozelle interchange, including the Inner West Light Rail line and the bus routes that run along Victoria Road and The Crescent.

Connections to the Inner West Light Rail line

The section of the Inner West Light Rail line around the Rozelle surface works runs north-south between The Crescent and Bayview Crescent at Annandale, and east-west between City West Link and Railway Parade at Annandale. The Rozelle Bay light rail stop is located near the intersection of The Crescent and City West Link and is accessible from Bayview Crescent and The Crescent (via Buruwan Park).

The realignment of The Crescent would include a new pedestrian connection to the Rozelle Bay light rail stop. During construction, a temporary connection for pedestrians would be provided to ensure continued access; cyclists would be diverted via The Crescent/Johnston Street/Bayview Crescent (refer to **Chapter 6** (Construction work) for details on this temporary connection).

The new pedestrian and cyclist bridge that would span City West Link and that would connect The Crescent with the Rozelle Rail Yards would also include a new pedestrian and cyclist connection to the Rozelle Bay light rail stop. Further details on this bridge connection are provided in **section 5.6.6**. The project would not affect the existing connection to the Rozelle Bay light rail stop from Bayview Crescent at Annandale.

Changes to bus infrastructure

The project would require temporary and permanent changes to bus infrastructure around the Rozelle surface works. One bus stop on The Crescent on the western (northbound) side between City West Link and Johnston Street would be relocated during the realignment and upgrade of The Crescent. The northbound bus stop would be permanently relocated around 80 metres south of the existing location. Bus lanes and clearways along Victoria Road would be retained in generally the same configuration as existing.

The project offers a flexible design which does not preclude bus priority measures being included in the future, including along Victoria Road and Anzac Bridge. Roads and Maritime and Transport for NSW will continue to work together to deliver Sydney's Bus Future, which may be extended to the area around the Rozelle interchange in due course, at which point the surface road network can be adapted to include measures identified at a future date.

Temporary changes to bus infrastructure would also be required during construction. These are outlined in **Chapter 6** (Construction work).

5.6.9 Potential future uses of remaining project land around the Rozelle surface works

In most cases, at the completion of construction, land around the Rozelle surface works would be landscaped to be consistent with the UDLP to be prepared for the project.

Land required for construction but not required for operation that does not form part of the UDLP would be rehabilitated at the end of the construction period and made suitable for either return to the previous owner or lessee, or potential development for permissible uses under land use zoning provisions. Where this is the case, potential future development would be subject to separate development assessment and approval and the restrictions of the relevant consent authority. The project would not rezone or consolidate remaining project land and therefore there would be no changes to land use zoning for future development around the Rozelle surface works.

Remaining project land would be subject to the provisions of a Residual Land Management Plan that would be prepared for the project. The Residual Land Management Plan would be prepared in consultation with the relevant council and would identify (and consider), but not be limited to:

- Identification and illustration of all remaining project land, including the location, land use characteristics, size and adjacent land uses
- Identification of feasible uses for remaining project land including justification for the selected use
- Timeframes for implementation of the actions in relation to the identified feasible uses.

Further details about the remaining project land and the Residual Land Management Plan are provided in **Chapter 12** (Land use and property).

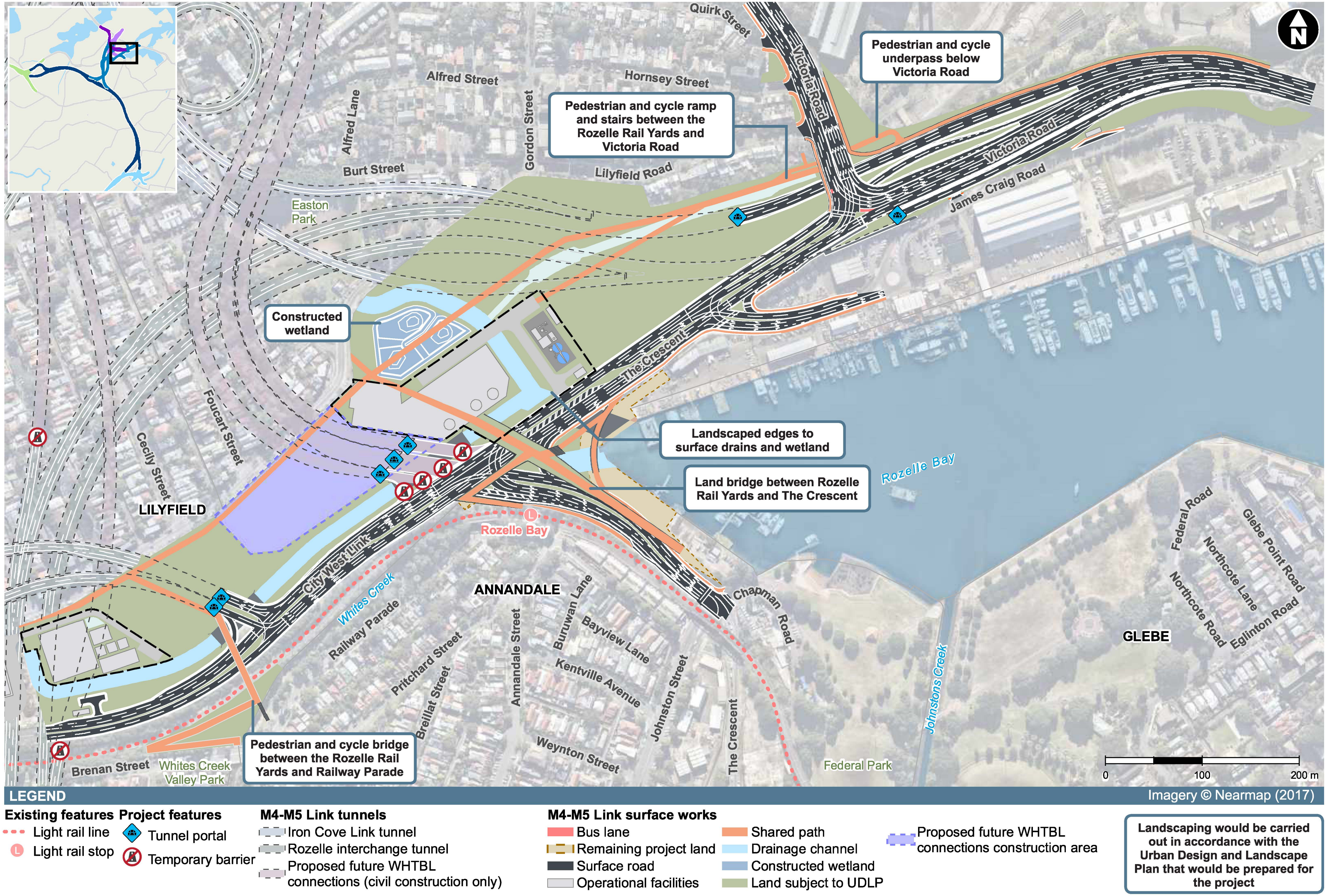


Figure 5-33 Urban design and landscaping works to be carried out by the project – Rozelle Rail Yards

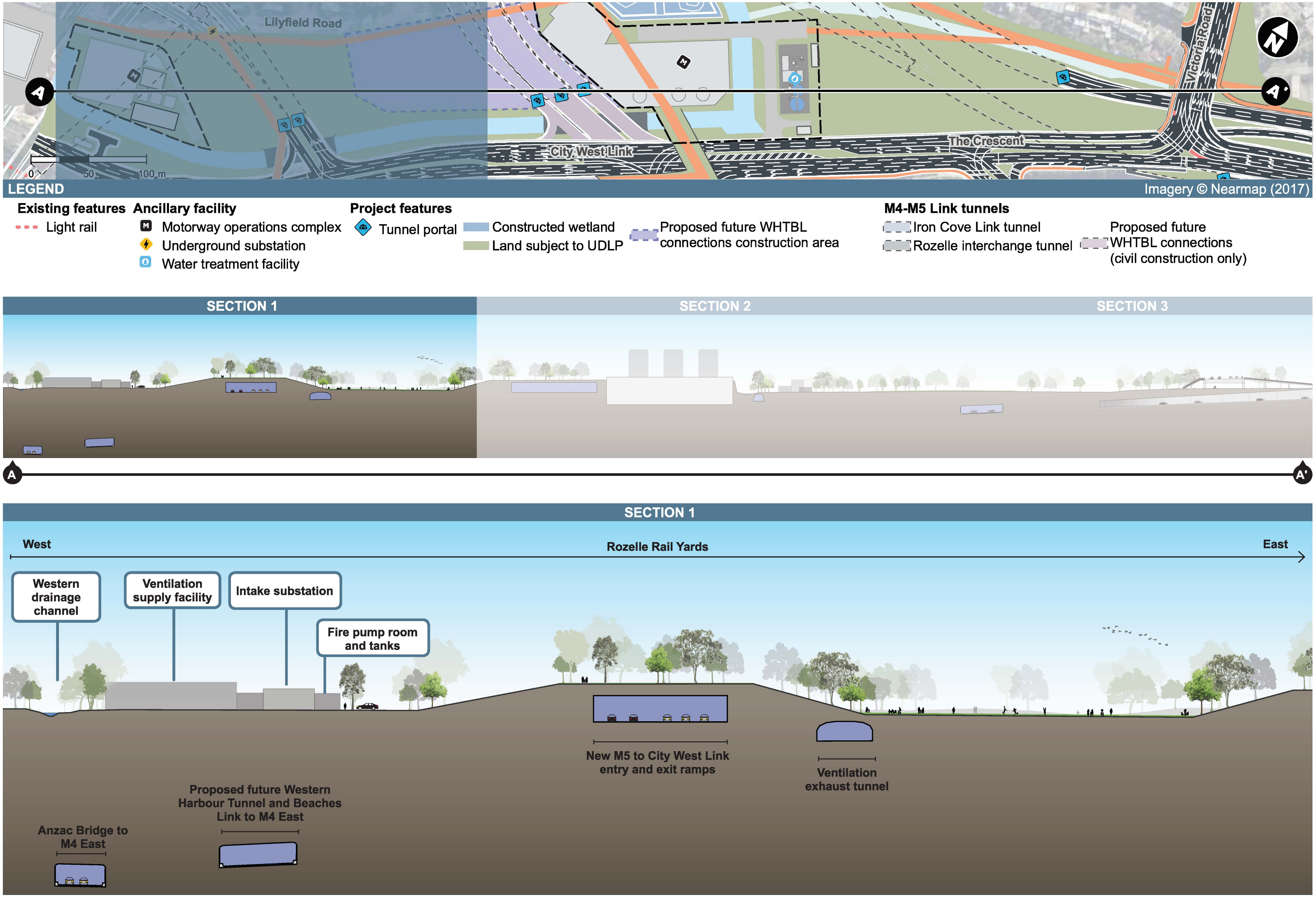


Figure 5-34 Long-section of the Rozelle Rail Yards - east-west - section 1

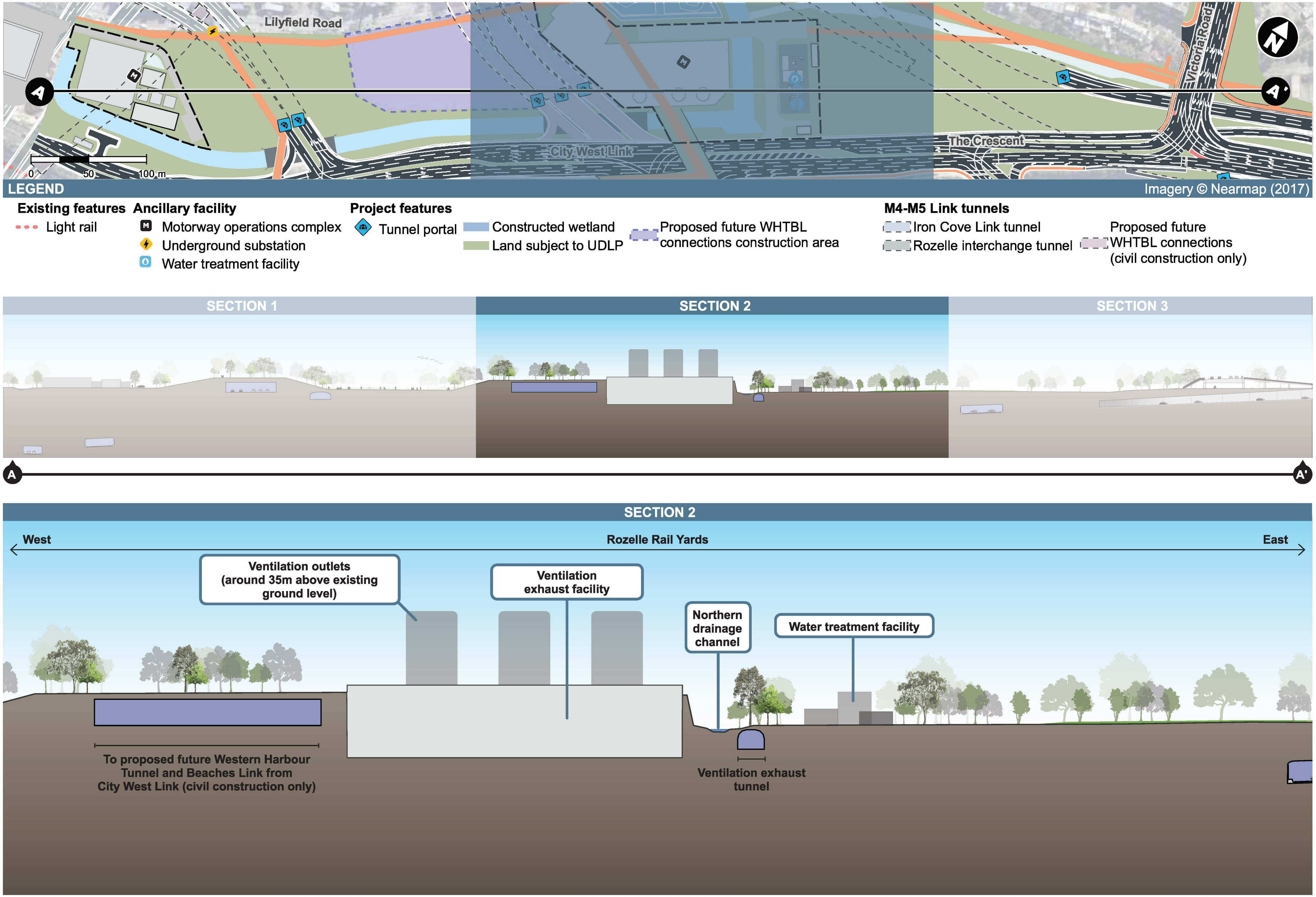


Figure 5-35 Long-section of the Rozelle Rail Yards - east-west - section 2

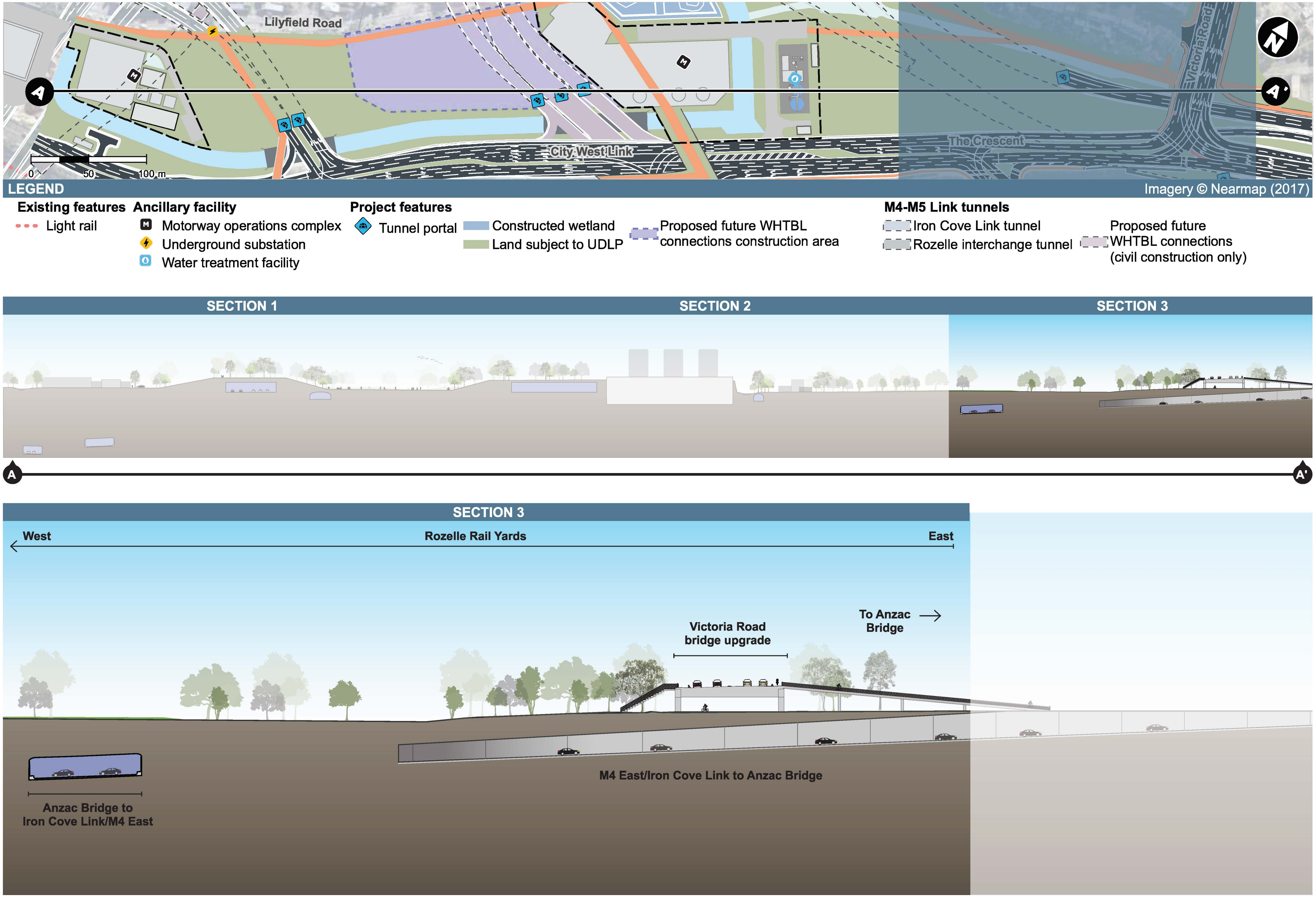
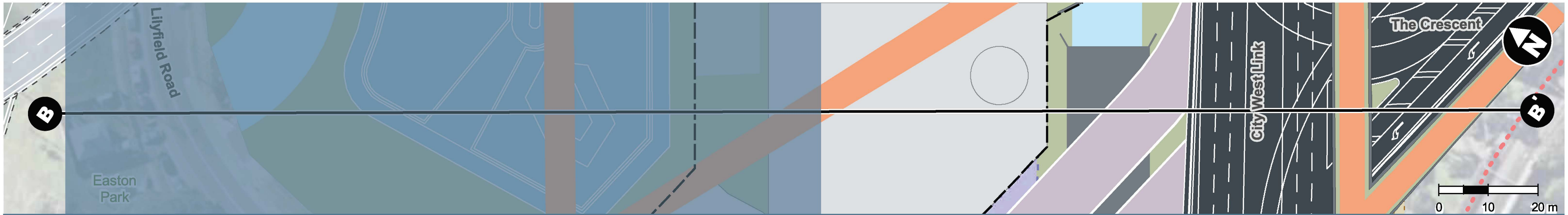


Figure 5-36 Long-section of the Rozelle Rail Yards - east-west - section 3



LEGEND Imagery © Nearmap (2017)

Existing features
- Light rail
- Proposed future WHTBL construction area

M4-M5 Link tunnels
- Rozelle interchange tunnel
- Iron Cove Link tunnel
- Shared path

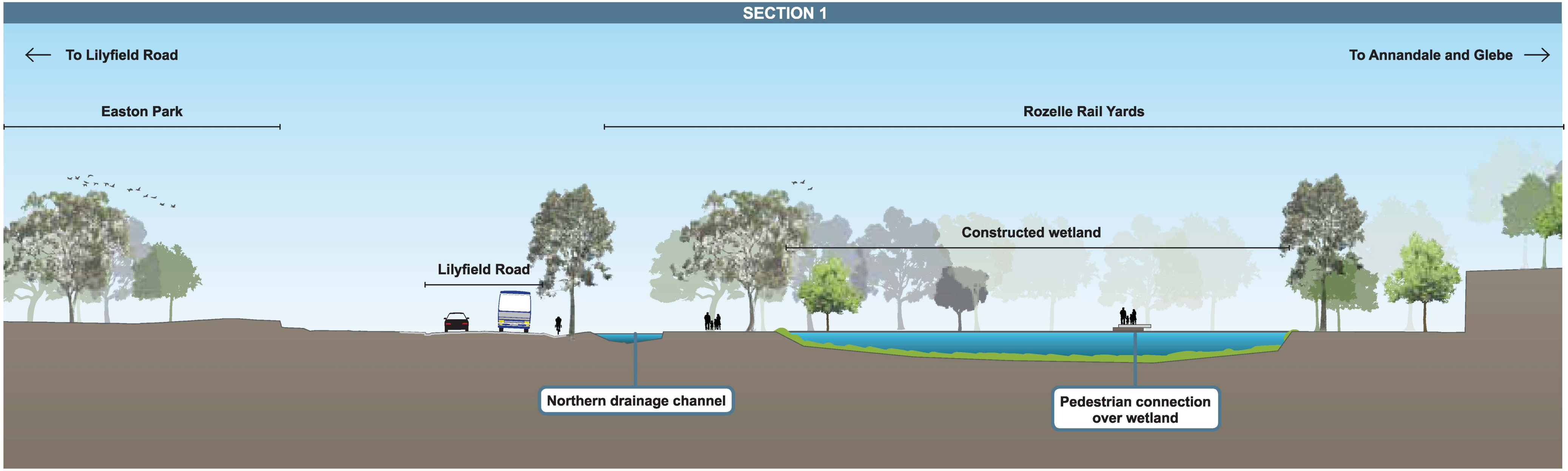


Figure 5-37 Long-section of the Rozelle Rail Yards - north-south - section 1

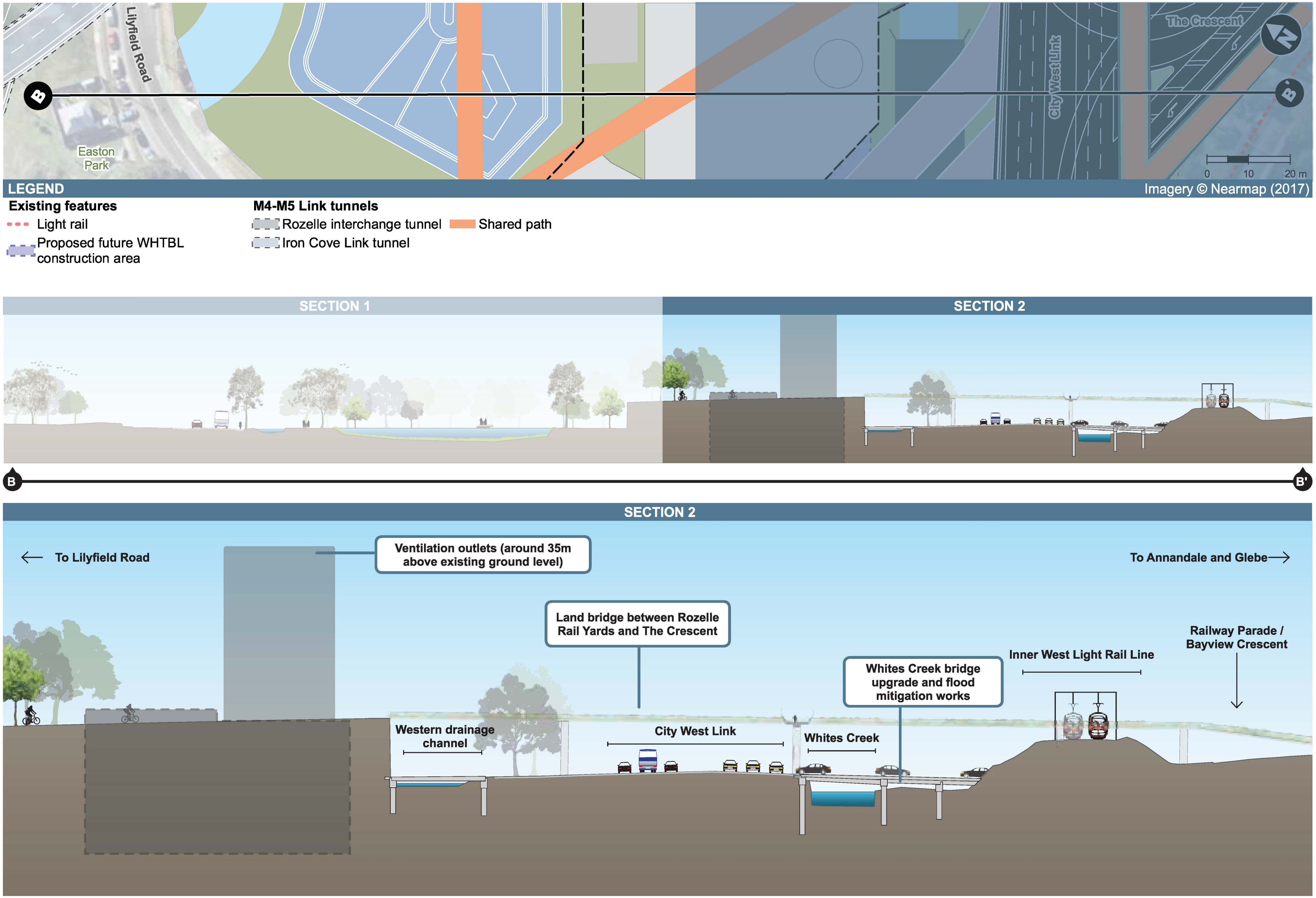


Figure 5-38 Long-section of the Rozelle Rail Yards - north-south - section 2

5.7 Iron Cove Link surface works

5.7.1 Overview

The Iron Cove Link surface works would connect the Iron Cove Link tunnels with Victoria Road around the eastern abutment of Iron Cove Bridge and would include:

- Four new lanes (two eastbound and two westbound) to connect Victoria Road to the Iron Cove Link including dive structure and tunnel portals
- Realignment and modifications to the Victoria Road eastbound and westbound carriageways between the eastern abutment of Iron Cove Bridge and around Springside Street at Rozelle. The Victoria Road surface lanes would travel on the northern and southern sides of the Iron Cove Link lanes
- Construction and installation of the Iron Cove Link ventilation facility on the southern side of the Victoria Road carriageway between Springside Street and Callan Street at Rozelle
- A ventilation outlet in the middle of the widened Victoria Road carriageway connected to the ventilation exhaust facility
- Modifications to the right turn from Victoria Road into Terry Street. This right-turn lane would extend across the cut-and-cover structures for the Iron Cove Link between the eastbound and westbound Victoria Road carriageways
- Closing Clubb Street at Victoria Road, creating a permanent cul-de-sac
- Tie-in works to connect the realigned westbound carriageway of Victoria Road with Toelle and Callan streets
- Landscaping on the southern side of Victoria Road between around Springside and Byrnes streets
- Realignment and improvements to the shared pedestrian and cyclist path that runs along the footpath on the southern side of the westbound carriageway of Victoria Road, including reinstatement of the Bay Run connection to Iron Cove Bridge
- A new stormwater bioretention facility and upgrades to the existing car park within King George Park (adjacent to Manning Street) at Rozelle, to treat stormwater runoff generated by the surface road works associated with the Iron Cove Link. Around 30 car-parking spaces would be formalised as part of these works.

The configuration and layout of the Iron Cove Link surface works are shown in **Figure 5-39** and **Figure 5-40**. An indicative cross-section of the Victoria Road carriageways and the Iron Cove Link entry and exit ramps is shown in **Figure 5-41**. An indicative layout of the bioretention facility at Manning Street at Rozelle, within King George Park, is shown in **Figure 5-43**.

The Iron Cove Link would provide motorists with an underground alternative to Victoria Road. A traffic analysis shows the Iron Cove Link would result in reductions in traffic demand along Victoria Road between Iron Cove Bridge and the intersection with The Crescent. The traffic analysis carried out for this section of Victoria Road is provided in **Chapter 8** (Traffic and transport) and in **Appendix H** (Technical working paper: Traffic and transport).

By reducing traffic demand along sections of Victoria Road, the Iron Cove Link could enable potential future revitalisation opportunities along Victoria Road, including the provision of better active transport and public transport facilities. These suggested active transport and public transport facilities do not form part of the project and would be subject to separate environmental assessment as appropriate.

Further detail on surface road upgrades at Victoria Road to accommodate the tunnel entry and exit ramps and tunnel portals is provided in the following section. The Iron Cove Link motorway operations complex (MOC4) is described in **section 5.8.1**.

5.7.2 Bridges and structures at the Iron Cove Link surface works

The Iron Cove Link surface works would include construction of tunnel dive and cut-and-cover structures between the eastbound and westbound Victoria Road carriageways for the Iron Cove Link entry and exit ramps.

The cut and cover structures would extend from the tunnel portals near Callan Street to around Toelle Street. The dive structures for each tunnel portal would be located within the cut-and-cover tunnel sections. The cut-and-cover structures would support the right-turn lane from Victoria Road to Terry Street, and a pedestrian path connecting Toelle and Terry streets (via a signalised pedestrian crossing).

A typical cross-section of the structural arrangement of the cut-and-cover tunnel and dive structures is shown in **Figure 5-22**. The location of the cut-and-cover structures is shown in **Figure 5-39** and a cross-section is shown in **Figure 5-41**.

5.7.3 Victoria Road intersection modifications

Works to intersections would be carried out to integrate adjoining local roads with the new alignment of Victoria Road. These works are described in **Table 5-6** and shown in **Figure 5-39** and **Figure 5-40**. Access to properties would be maintained during these works.

Table 5-6 Victoria Road near Iron Cove Bridge - intersection modifications

Intersection	Modifications
Victoria Road/Byrnes Street	· Existing cul-de-sac at the northern end of Byrnes Street at Rozelle would be retained but moved south.
Victoria Road/Clubb Street	· Closure of Clubb Street to the south of Victoria Road and establishment of a cul-de-sac and a pedestrian connection to Victoria Road.
Victoria Road/Toelle Street	· Tie-in works to connect with the realigned westbound carriageway of Victoria Road.
Victoria Road/Callan Street	· Tie-in works to connect with the realigned westbound carriageway of Victoria Road.
Victoria Road/Terry Street	· Realignment of the signalised right turn lane from the westbound Victoria Road carriageway into Terry Street · Tie-in works to connect Terry Street with the eastbound carriageway of Victoria Road.

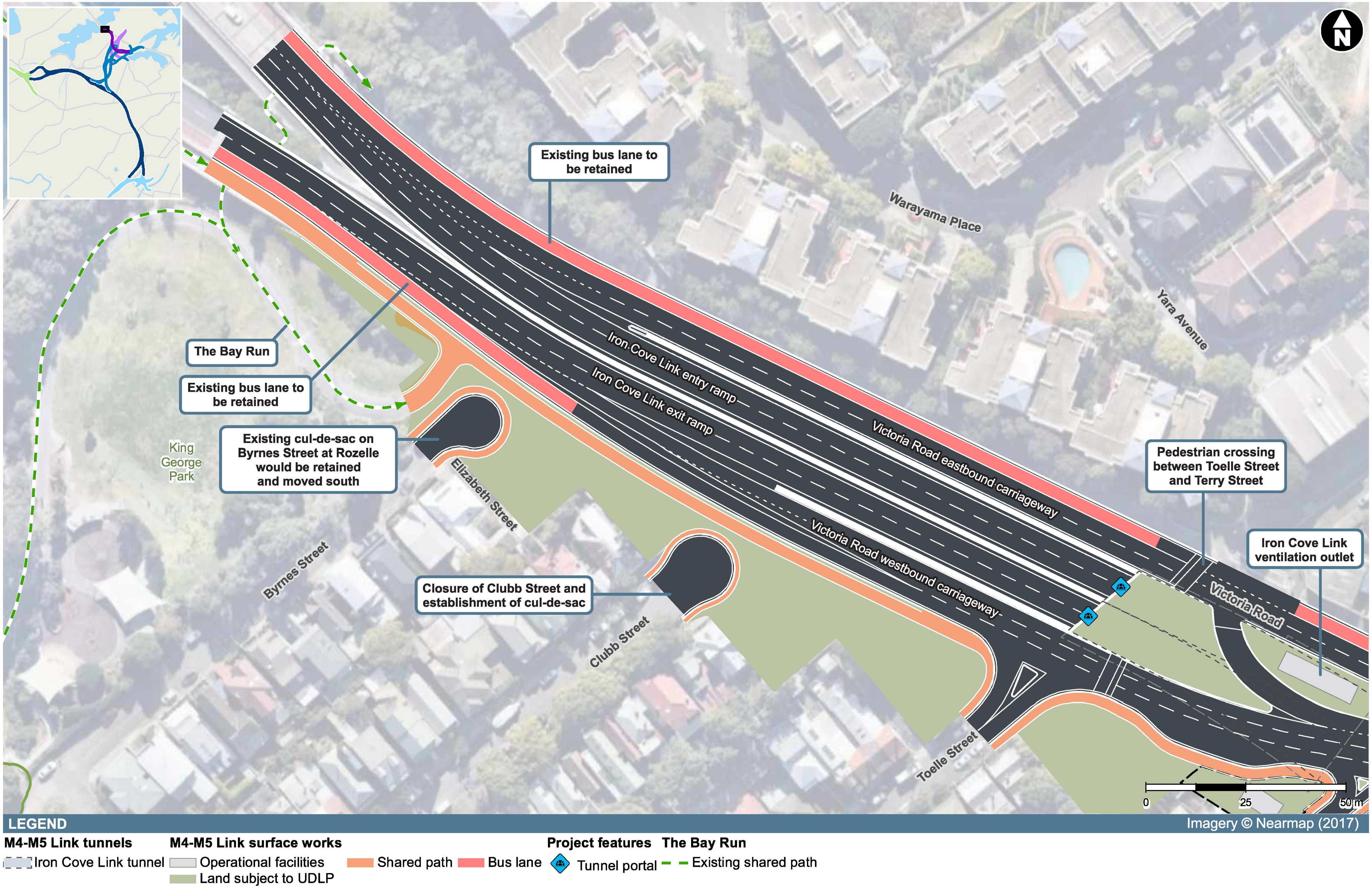
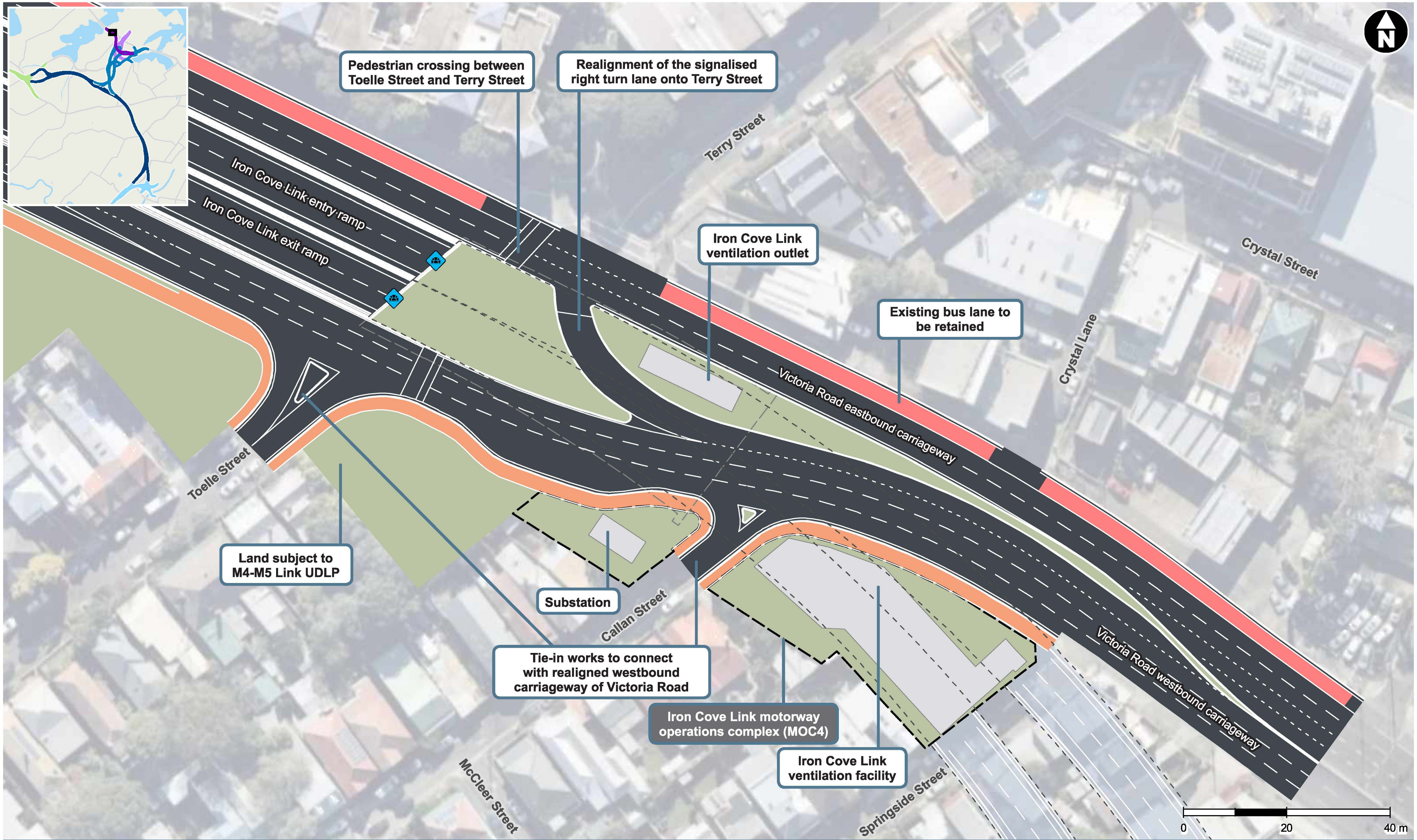


Figure 5-39 Iron Cove Link surface works - Map 1



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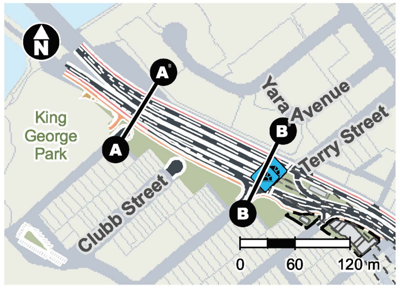
Imagery © Nearmap (2017)

M4-M5 Link tunnels
Iron Cove Link tunnel

M4-M5 Link surface works
Operational facilities
Land subject to UDLP
Shared path
Bus lane

Project features
Tunnel portal

Figure 5-40 Iron Cove Link surface works - Map 2



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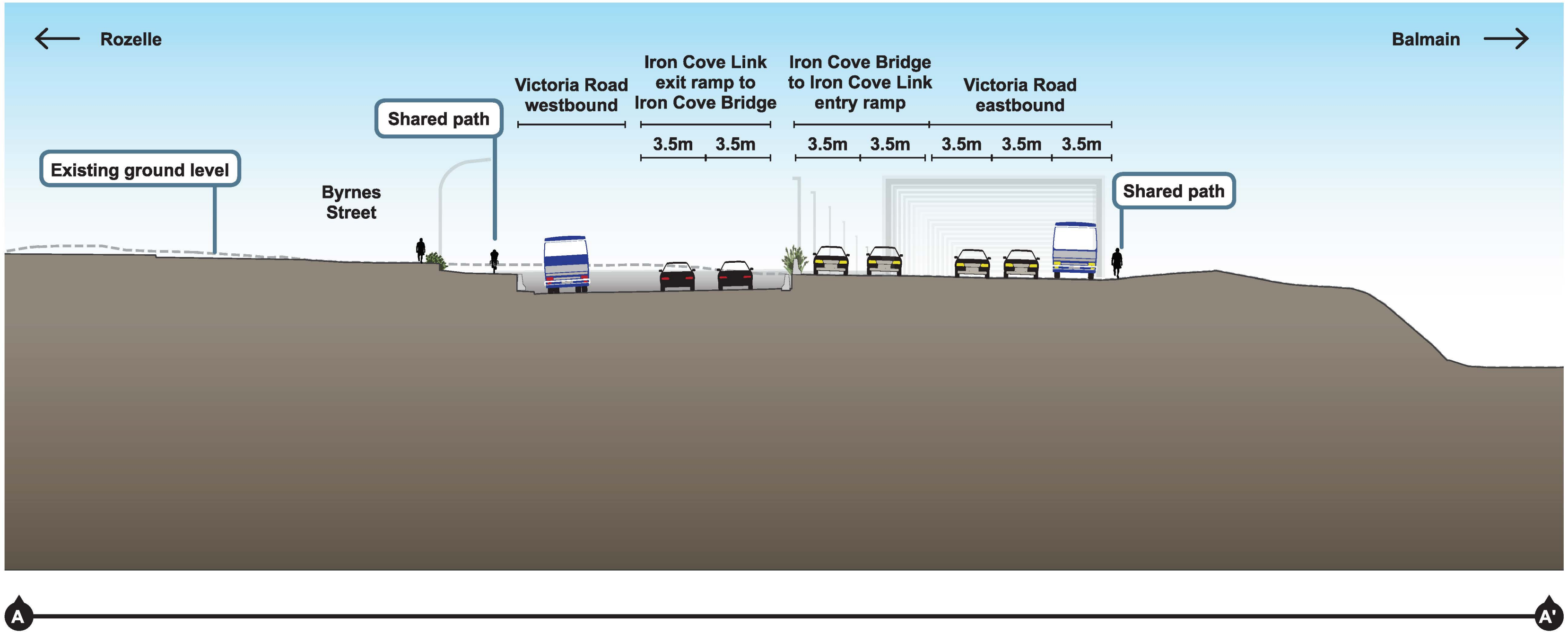
- Existing road corridor
- Iron Cove Link tunnel
- Surface road
- Bus lane
- Operational facilities
- Land subject to UDLP
- Shared path
- Tunnel portal



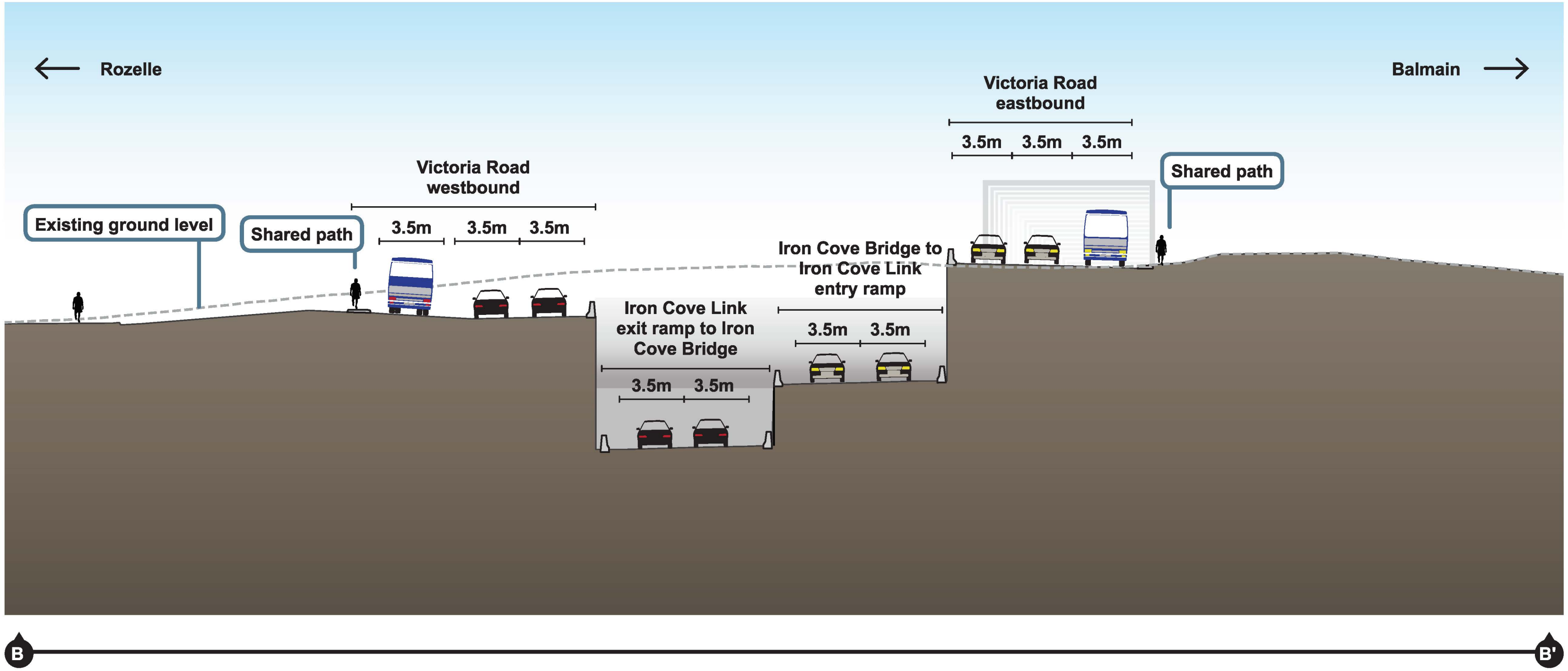


Figure 5-41 Indicative cross-section - Victoria Road carriageways and Iron Cove Link entry and exit ramps

5.7.4 Pedestrian and cyclist facilities

An upgraded shared pedestrian and cyclist path on the southern side of the westbound carriageway of Victoria Road would be provided as part of the Iron Cove Link surface works (see **Figure 5-39** and **Figure 5-40**). This infrastructure has been designed to maintain and enhance pedestrian and cyclist connectivity to local and regional destinations including King George Park, the Bay Run and the new public open space and active transport links to be provided at the Rozelle Rail Yards.

Detailed descriptions of the active transport connections to be provided and potentially enabled along Victoria Road at Rozelle as part of the Iron Cove Link are provided in **Appendix N** (Technical working paper: Active transport strategy).

5.7.5 Urban design and landscape

As part of the project, urban design and landscaping works would be carried out adjacent to disturbed areas associated with the Iron Cove Link surface works. The urban design and landscaping works that would be carried out as part of the Iron Cove Link surface works are shown in **Figure 5-42** and would include (but not be limited to):

- Detailed review and finalisation of the architectural treatment of the motorway operational infrastructure
- Earthworks to reshape the land around the motorway operational infrastructure
- Reinstatement of an improved pedestrian and cyclist path along the southern side of Victoria Road, that would connect to The Bay Run and Iron Cove Bridge
- Provision of new open space, including landscaping
- Revegetation, including tree planting, at key locations including:
  - Around permanent operational infrastructure such as the ventilation facility
  - Adjacent to pedestrian and cyclist paths
  - Along the southern boundary.

A concept design for these urban design and landscaping works has been prepared having regard to the urban design objectives and principles in **section 5.2**. The concept design is included in **Appendix L** (Technical working paper: Urban design) and **Chapter 13** (Urban design and visual amenity) and includes identification of potential future uses of land around the Iron Cove Link surface works that could be delivered as part of the urban design and landscaping works, including the provision of social and community facilities.

The concept design would be refined during the development of a UDLP, which would be prepared based on the detailed design and in accordance with relevant commitments in this EIS, and in consultation with relevant councils, stakeholders and the community.

5.7.6 Integration with public transport

Changes to bus infrastructure

The project would not require permanent changes to bus infrastructure around the Iron Cove Link. Bus lanes and AM and PM peak hour restrictions would be retained in generally the same configuration as the existing arrangement. Temporary changes to bus infrastructure are outlined in **Chapter 6** (Construction work).

The project offers a flexible design which does not preclude bus priority measures being included in the future, including along Victoria Road. Roads and Maritime and Transport for NSW will continue to work together to deliver Sydney's Bus Future, which may be extended to the area along Victoria Road around the Iron Cove Link tunnel portals in due course, at which point the surface road network can be adapted to include such measures.

5.7.7 Potential future uses for remaining land around the Iron Cove Link surface works

In most cases, at the end of construction, land around the Iron Cove Link surface works would be landscaped to be consistent with the UDLP to be prepared for the project.

Remaining project land (land required for construction but not required for operation) that does not form part of the UDLP would be rehabilitated at the end of the construction period and made suitable for either return to the previous owner or lessee, or potential development for permissible uses under land use zoning provisions.

Where this is the case, future development would be subject to separate development assessment and approval and the restrictions of the relevant consent authority. The project would not rezone or consolidate remaining project land and therefore there would be no changes to land use zoning for future development around the Iron Cove Link surface works.

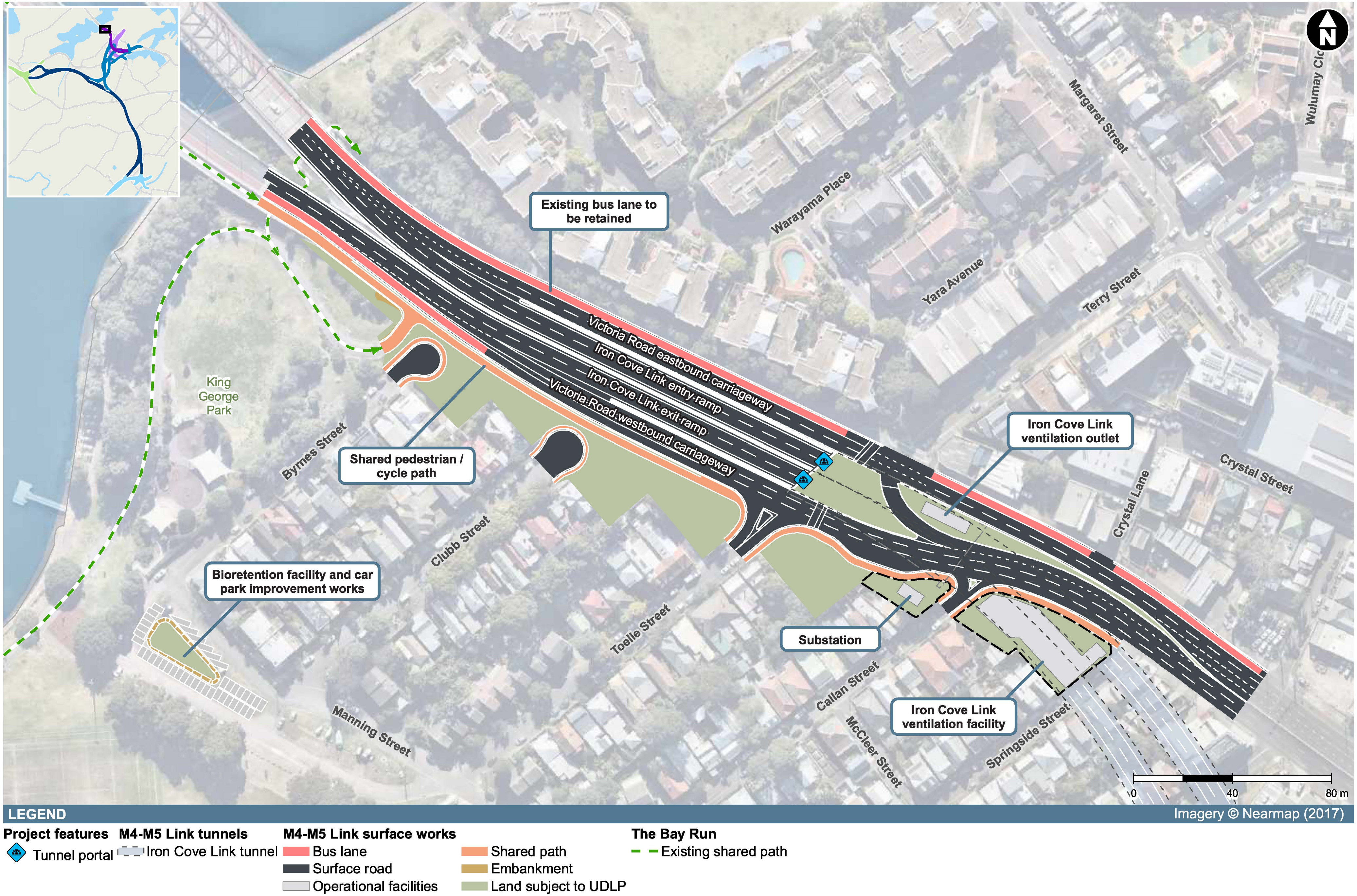
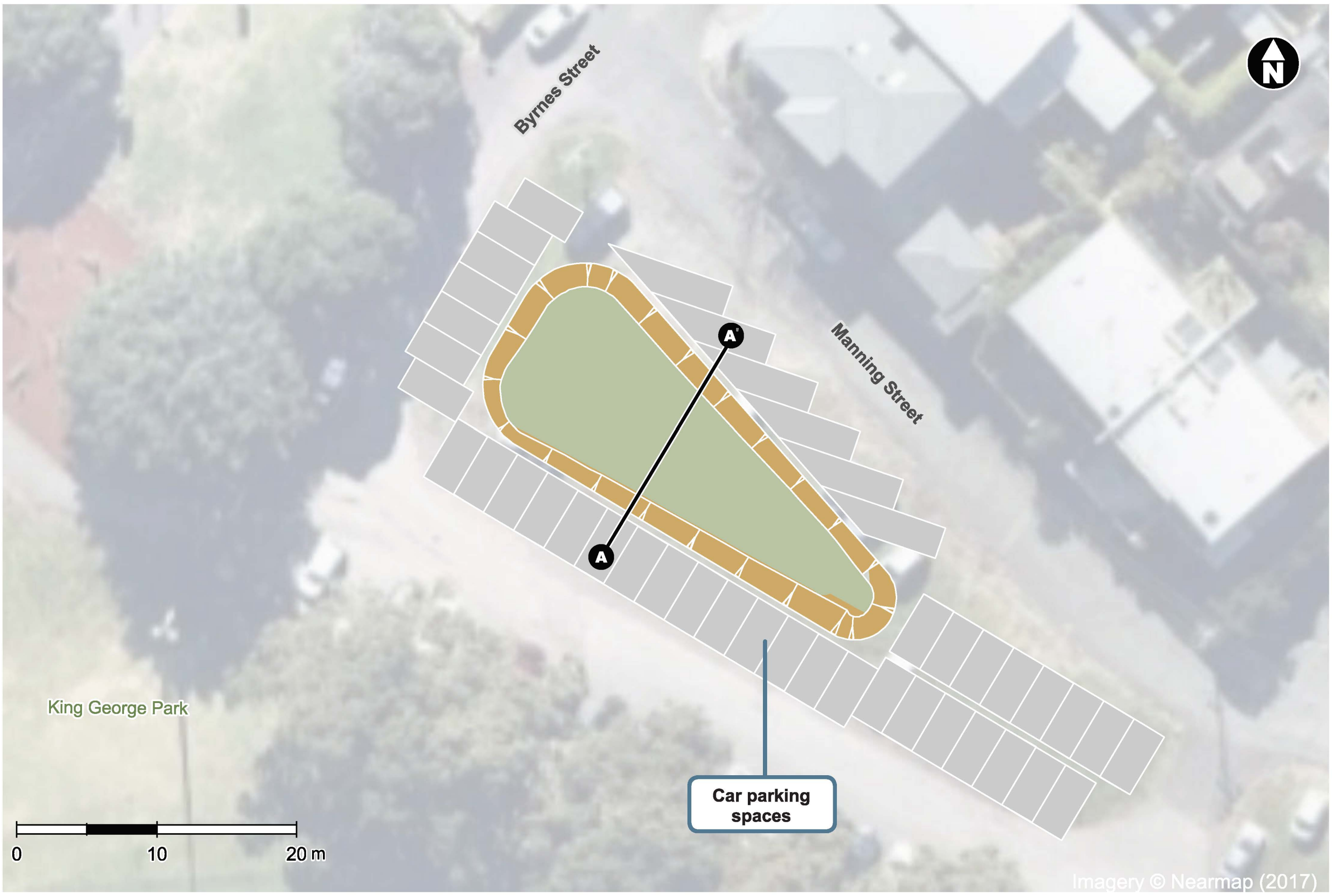


Figure 5-42 Urban design and landscaping works to be carried out by the project – Iron Cove Link



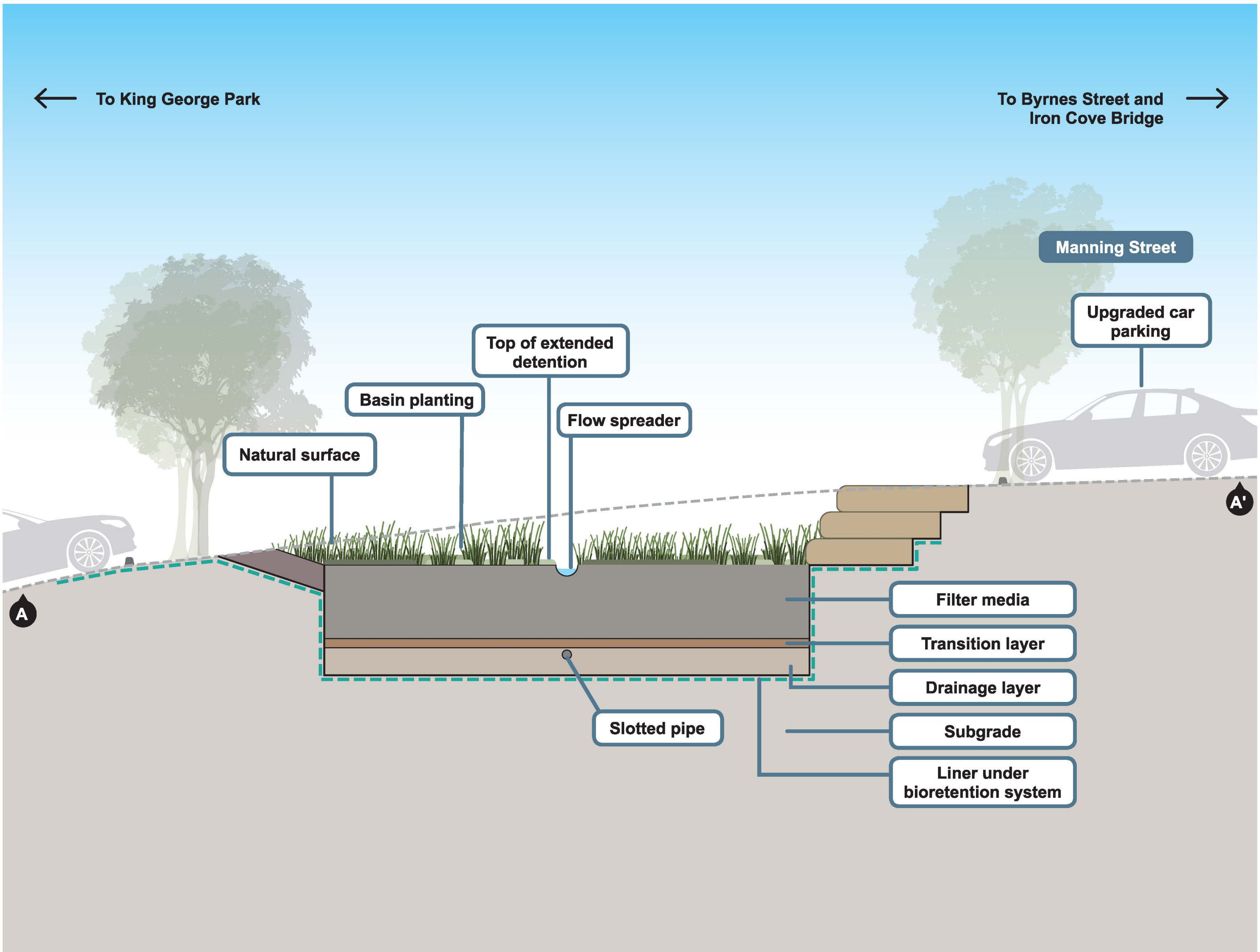


Figure 5-43 Indicative layout of the bioretention facility at Manning Street at Rozelle

5.8 Motorway operational ancillary infrastructure

The project would require permanent operational ancillary infrastructure including:

- Five motorway operations complexes (MOCs)
- Operational management control systems and incident and emergency response infrastructure
- Tunnel ventilation systems and facilities
- Drainage and water treatment facilities
- Noise attenuation measures
- Utilities
- Roadside furniture and lighting.

5.8.1 Motorway operations complexes

Most operational ancillary infrastructure would be established in five main motorway operations complexes (MOCs). The locations of these motorway operations complexes are shown in **Figure 5-44** to **Figure 5-48**. Operational infrastructure outside of the motorway operations complexes is also described in this section, and in **section 5.9** and **section 5.10**.

Motorway operations complexes for the project would comprise:

- The Darley Road motorway operations complex (MOC1) at Leichhardt, located south of City West Link and the Inner West Light Rail line on land occupied during construction by the Darley Road civil and tunnel site (C4)
- The Rozelle West motorway operations complex (MOC2) at Rozelle, located at the western end of the Rozelle Rail Yards on land occupied during construction by the Rozelle civil and tunnel site (C5)
- The Rozelle East motorway operations complex (MOC3) at Rozelle, located at the central/eastern end of the Rozelle Rail Yards, on land occupied during construction by the Rozelle civil and tunnel site (C5)
- The Iron Cove Link motorway operations complex (MOC4) at Rozelle, located south of the realigned Victoria Road carriageway between Callan Street and Springside Street at Rozelle, on land occupied during construction by the Iron Cove Link civil site (C7)
- The Campbell Road motorway operations complex (MOC5) at St Peters, located within the St Peters interchange, south of Campbell Road at St Peters, on land occupied during construction by the Campbell Road civil and tunnel site (C10).

The Rozelle West motorway operations complex (MOC2) and the Rozelle East motorway operations complex (MOC3) would both be located within the Rozelle Rail Yards. The need for two separate motorway operations complexes within the Rozelle Rail Yards is due to the requirement to co-locate facilities (ie the water treatment plant next to the constructed wetland) and to locate the ventilation supply and exhaust facilities as close to the associated ventilation supply and exhaust tunnels as possible. Opportunities to co-locate the motorway operations complexes within the Rozelle Rail Yards would be investigated during detailed design.

Operational ancillary infrastructure that would be located within each motorway operations complex is summarised in **Table 5-7** and detailed in the following sections.

Table 5-7 Summary of motorway operations complexes and operational ancillary infrastructure

Operational ancillary facilities	Motorway operations complex				
	Darley Road (MOC1)	Rozelle West (MOC2)	Rozelle East (MOC3)	Iron Cove Link (MOC4)	Campbell Road (MOC5)
Ventilation facility		ü[1]	ü[2]	ü	ü
Emergency smoke extraction facility					ü
Deluge water tanks[3, 4]		ü			
Car parking	ü	ü	ü	ü	ü
Substation/power supply	ü[5]	ü	ü	ü	ü
Workshop/offices	ü	ü	ü	ü	ü
Storage	ü	ü	ü	ü	ü
Water treatment plant/infrastructure	ü		ü		

Notes:

1 Rozelle ventilation supply facility

2 Rozelle ventilation exhaust facility

3 Deluge water tanks at the Parramatta Road ventilation facility (being built as part of the M4 East project) would be used for the M4-M5 Link project

4 Deluge water tanks at the at the north-western perimeter of the St Peters interchange (being built as part of the New M5 project) would also be used for the M4-M5 Link. The location of these is shown in **Figure 5-9**

5 The need for a substation at the Darley Road motorway operations complex (MOC1) is being investigated and would be confirmed during detailed design

LEGEND

Imagery © Nearmap (2017)

Light rail stop

Existing features

Light rail

M4-M5 Link tunnels

Mainline tunnel

M4-M5 Link surface works

Operational facilities

Remaining project land

Land subject to UDLP

Figure 5-44 Darley Road motorway operations complex (MOC1)

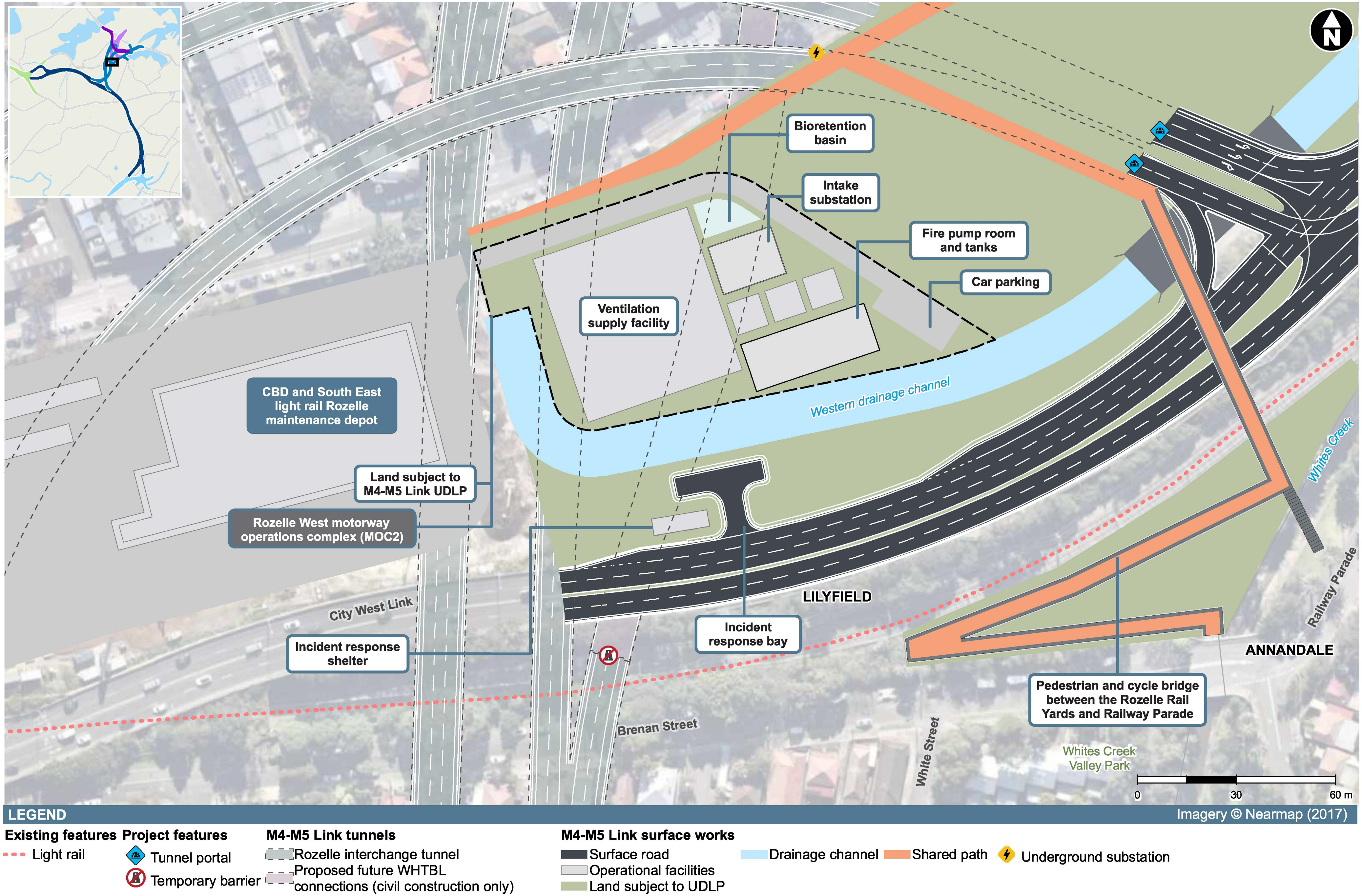


Figure 5-45 Rozelle West motorway operations complex (MOC2)

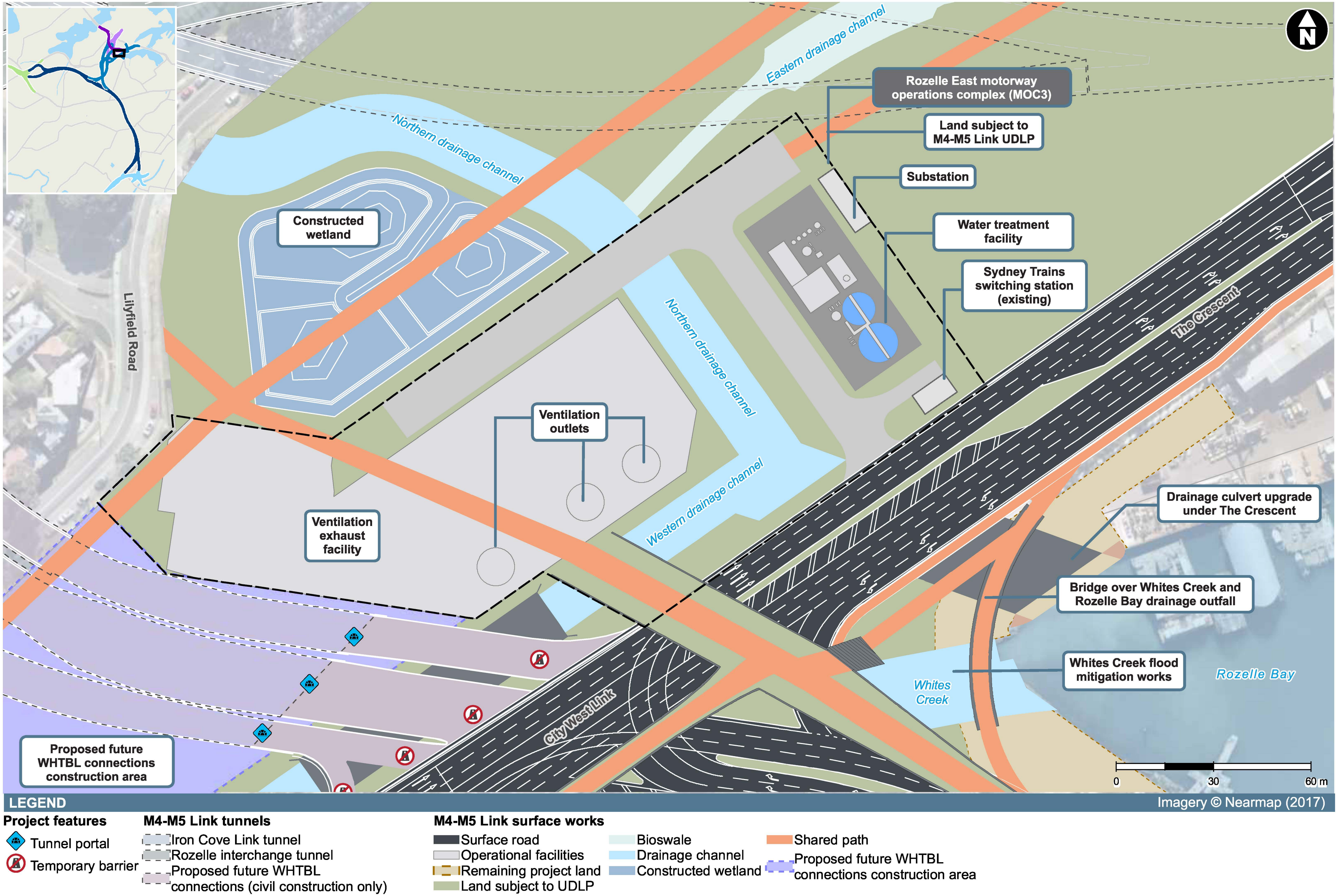


Figure 5-46 Rozelle East motorway operations complex (MOC3)

Figure 5-47 Iron Cove Link motorway operations complex (MOC4)

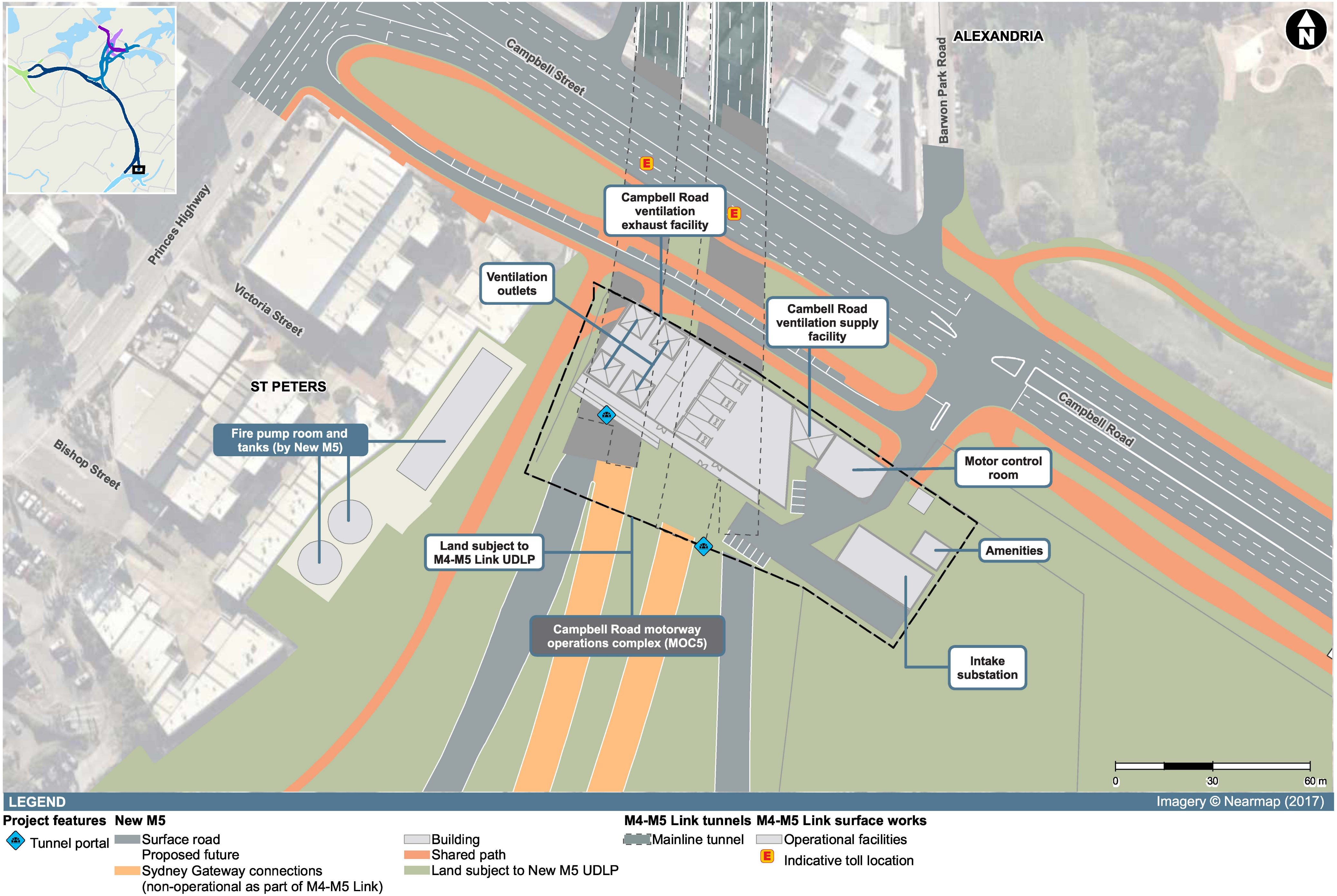


Figure 5-48 Campbell Road motorway operations complex (MOC5)

5.8.2 Ventilation system and facilities

The project's ventilation system has been designed to:

- Ensure the safety and health of motorists using the tunnels during normal operation, heavy traffic conditions and emergency conditions
- Ensure that air inside and outside the tunnels meets the air quality criteria relevant to the project as described in **Chapter 9** (Air quality)
- Operate in a safe, effectively controlled and managed manner, including during major and minor incidents
- Meet the requirements of the Australian Government's Civil Aviation Safety Authority (CASA) noting the limitations on the velocity and height of plume rise as well as limitations on the height of buildings and structures around Sydney Airport as described in **Chapter 25** (Hazard and risk)
- Minimise the consumption of energy and other resources, where doing so would not jeopardise the health and amenity of motorists using the tunnels or the achievement of applicable air quality criteria inside and outside the tunnels
- Integrate with the adjoining M4 East and New M5 tunnels, and the proposed future Western Harbour Tunnel and Beaches Link.

In-tunnel air quality design criteria

The tunnel ventilation system has been designed to achieve acceptable in-tunnel air quality outcomes for carbon monoxide (CO), nitrogen dioxide (NO_2) and visibility (as a measure of in-tunnel particulate matter concentrations) for traffic volumes up to and including the maximum traffic throughput capacity of the tunnels.

In-tunnel air quality criteria for the engineering design of the ventilation system have been based on:

- For CO, a tunnel average of 87 parts per million as a 15-minute average and 50 parts per million as a 30-minute average exposure based on the *World Health Organisation Guidelines for Indoor Air Quality* (World Health Organisation 2010) (WHO Guidelines). These averages are to be applied for all possible journeys through the tunnel, including entry and exit ramps. The WHO Guidelines recommend a maximum short-term exposure (15-minute exposure) of 100 mg/m^3 (equivalent to 87 parts per million at 25ºC) and long-term exposure (30-minute exposure) of 60 mg/m^3 (equivalent to 50 parts per million at 25ºC)
- For NO_2, an average concentration of 0.5 parts per million for the length of all possible travel routes through the tunnel, including entry and exit ramps (M4-M5 Link) measured as a 15-minute rolling average, based on the conditions of approval for the M4 East and New M5 projects
- For measurements of visibility or in-tunnel haze, an extinction coefficient[1] of 0.005m^{-1} based on the recommendations of the Permanent International Association of Road Congresses (PIARC) for free-flowing peak traffic travelling speeds of 50 to 100 kilometres per hour.

Overview of the ventilation system design and operation

The project would include longitudinally ventilated tunnels, which rely on the movement of air through the tunnels in the same direction as the flow of traffic. This air moves from the tunnel entry portals towards ventilation facilities located near the tunnel exit portals, before it is emitted through elevated outlets. Other tunnel ventilation configurations considered as alternatives to this method of tunnel ventilation are discussed in **Chapter 4** (Project development and alternatives).

With longitudinal ventilation, air would move through the project tunnels using two mechanisms, namely:

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[1]Visibility is reduced by the scattering and absorption of light by particles suspended in the air. The measurement of visibility in a tunnel (using an opacity meter) is based on the concept that a light beam 'decays' (reduces in intensity) as it passes through air. The level of decay can therefore be used to determine the opacity of the air. For tunnel ventilation, visibility is expressed by the extinction coefficient K.

- The 'piston effect', caused by the movement of vehicles through the project tunnels. The piston effect is an aerodynamic effect caused by the movement of vehicles as they enter and pass through the project tunnels, pushing air in front of them, and pulling fresh air in behind them
- Jet fans would be installed in the ceiling of the project tunnels and would be orientated along the tunnels. The fans would operate to assist the piston effect if for any reason it is not sufficient to keep enough air moving through the tunnels.

Through a combination of the piston effect and the operation of jet fans, air would be moved from the entry portals of the mainline tunnels and on-ramps in a single forward direction (the direction of traffic flow) through the tunnels. Before the tunnel air reaches the exit portals, the air would be drawn from the tunnels into the ventilation outlets using large exhaust fans (referred to as axial fans).

The project has been designed to avoid the emission of tunnel air from the exit portals. This is achieved by the inclusion of the axial fans, which create a difference in air pressure between the ventilation exhaust facility offtake point and the tunnel exit portals. This pressure difference is used to draw air back into the tunnels from the exit portals against the flow of traffic, preventing tunnel air from escaping from the exit portals. Air drawn from the tunnels using axial fans would be mixed with fresh air and expelled from the elevated ventilation outlets. Ventilation outlets provide an effective means of dispersing air drawn from the tunnels. Further detail regarding ventilation outlets and potential air quality impacts associated with ventilation outlet emissions is provided in **Chapter 9** (Air quality).

In the unlikely event of a fire within the tunnels, the jet fans in the ceiling of the tunnels would be operated to prevent smoke spreading upstream of the fire where traffic is likely to be stopped behind an incident. Smoke would be forced in the direction of vehicle travel as vehicles in front of the fire would potentially be able to safely drive out of the tunnel ahead of the smoke. The fire and life safety systems (see **section 5.8.3**) would operate to bring the fire under control, and to remove smoke from the tunnels.

Depending on the location of a fire, smoke would be contained and removed from the tunnels from the nearest practical and safe point, which may be:

- The ventilation facilities located at Haberfield, Rozelle, Iron Cove or St Peters
- The tunnel portals, if the fire is close to a portal.

Further details of tunnel fire hazards and their management are provided in **Chapter 25** (Hazard and risk).

Ventilation facilities

Ventilation facilities include ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels.

Three new ventilation facilities would be provided as part of the project, including:

- The Rozelle ventilation facility at the Rozelle Rail Yards, which would include a ventilation supply facility at the Rozelle West motorway operations complex (MOC2) and a ventilation exhaust facility at the Rozelle East motorway operations complex (MOC3)
- The Iron Cove Link ventilation facility at Rozelle
- The Campbell Road ventilation facility at St Peters, within the St Peters interchange site.

In addition, part of the Parramatta Road ventilation facility at Haberfield, being built as part of the M4 East project, would be fitted out and used by the M4-M5 Link project.

Key components of the project's ventilation systems are provided in **Table 5-8**. The locations of ventilation facilities for the project are shown in **Figure 5-45** to **Figure 5-48**. The layouts of the ventilation tunnels at Rozelle and St Peters are shown in **Figure 5-49** and **Figure 5-50**. The indicative cross-section for the ventilation facility at St Peters is shown in **Figure 5-51**. Further details regarding external and in-tunnel air quality are provided in **Chapter 9** (Air quality).

Table 5-8 Key component of the project's ventilation systems

Ventilation system component	Description
Jet fans	· Jet fans would be mounted throughout the tunnels and would operate as required to maintain in-tunnel air quality · About 440 jet fans would be installed as part of the project. Of these around 120 would be installed in the northbound mainline tunnel, around 120 in the southbound mainline tunnel and around 200 in the Rozelle interchange and the Iron Cove Link tunnels. The final numbers of jet fans would be determined during the detailed design phase.
Parramatta Road ventilation facility	· A ventilation facility at Haberfield being built as part of the M4 East project would also be used for the M4-M5 Link project. This facility would consist of both a ventilation exhaust facility and a ventilation supply facility. Fitout works would be carried out within part of this structure as part of the project (refer to **Chapter 6** (Construction work) for a description of these fitout works).
Rozelle ventilation facility (comprising a ventilation supply facility at the Rozelle West motorway operations complex (MOC2) and a ventilation exhaust facility at the Rozelle East motorway operations complex (MOC3)	· The facility would service the M4-M5 Link project and the proposed future Western Harbour Tunnel and Beaches Link · The ventilation supply facility would provide fresh air to the southbound mainline tunnels, and to the northbound mainline tunnels (in the event the proposed future Western Harbour Tunnel and Beaches Link project is approved) · The ventilation exhaust facility would consist of one building, with two outlets for the M4-M5 Link and a separate outlet for the proposed future Western Harbour Tunnel and Beaches Link · The M4-M5 Link ventilation exhaust facility at Rozelle would extract exhaust from the mainline northbound tunnels, the Rozelle interchange tunnels and from the Iron Cove Link · The ventilation outlet for the proposed future Western Harbour Tunnel and Beaches Link would be constructed as part of the Rozelle ventilation facility and would comprise the structure only. Fitout of the outlet would occur as part of construction of the proposed future Western Harbour Tunnel and Beaches Link (if approved). These fitout works do not form part of the project · The ventilation exhaust facility for the proposed future Western Harbour Tunnel and Beaches Link at Rozelle would extract exhaust from the southbound Western Harbour Tunnel and Beaches Link mainline and portals · The ventilation outlets would have a height of around 35 metres above existing ground level. The ventilation outlets have been designed at this height to meet project air quality criteria, urban design and visual amenity objectives, and to avoid impacts on civil air operations · An electrical substation would be provided at the ventilation supply facility and the ventilation exhaust facility to supply power for the operation of the ventilation facilities.
Iron Cove Link motorway operations complex (including the Iron Cove Link ventilation facility and an intake substation)	· The Iron Cove Link ventilation facility would extract exhaust from the westbound Iron Cove Link tunnel and would consist of a ventilation exhaust facility located on the south side of Victoria Road and a separate ventilation outlet located between the eastbound and westbound carriageways of Victoria Road · The ventilation outlet would have a height of around 20 metres above existing ground level and would be designed to meet project air quality criteria, urban design and visual amenity objectives, and to avoid impacts on civil air operations · An electrical substation would be provided at the ventilation facility to provide power for its operation.

Ventilation system component	Description
Campbell Road motorway operations complex (including the Campbell Road ventilation facility and an intake substation)	· The ventilation exhaust facility would consist of one building, with four outlets for the M4-M5 Link · The M4-M5 Link ventilation exhaust facility at St Peters would extract exhaust from the southbound M4-M5 Link mainline tunnel and the southbound St Peters exit-ramp · The ventilation outlets would have a height of around 22 metres above existing ground level. The ventilation outlets have been designed at this height to meet project air quality criteria, urban design and visual amenity objectives, and to avoid impacts on civil air operations · A ventilation supply facility would also be provided that would supply fresh air to the southbound M4-M5 Link mainline tunnel · The facility would also include a substation.
Ventilation tunnels	· Ventilation tunnels would connect the road tunnels with the ventilation facilities (including the ventilation supply and exhaust facilities) at Rozelle and St Peters. Ventilation tunnels that connect to the Parramatta Road ventilation facility will be built by the M4 East project. Indicative ventilation tunnel layouts for Rozelle and St Peters shown in **Figure 5-49** and **Figure 5-50**. An indicative cross-section of the Campbell Road ventilation facility is shown in **Figure 5-51**.

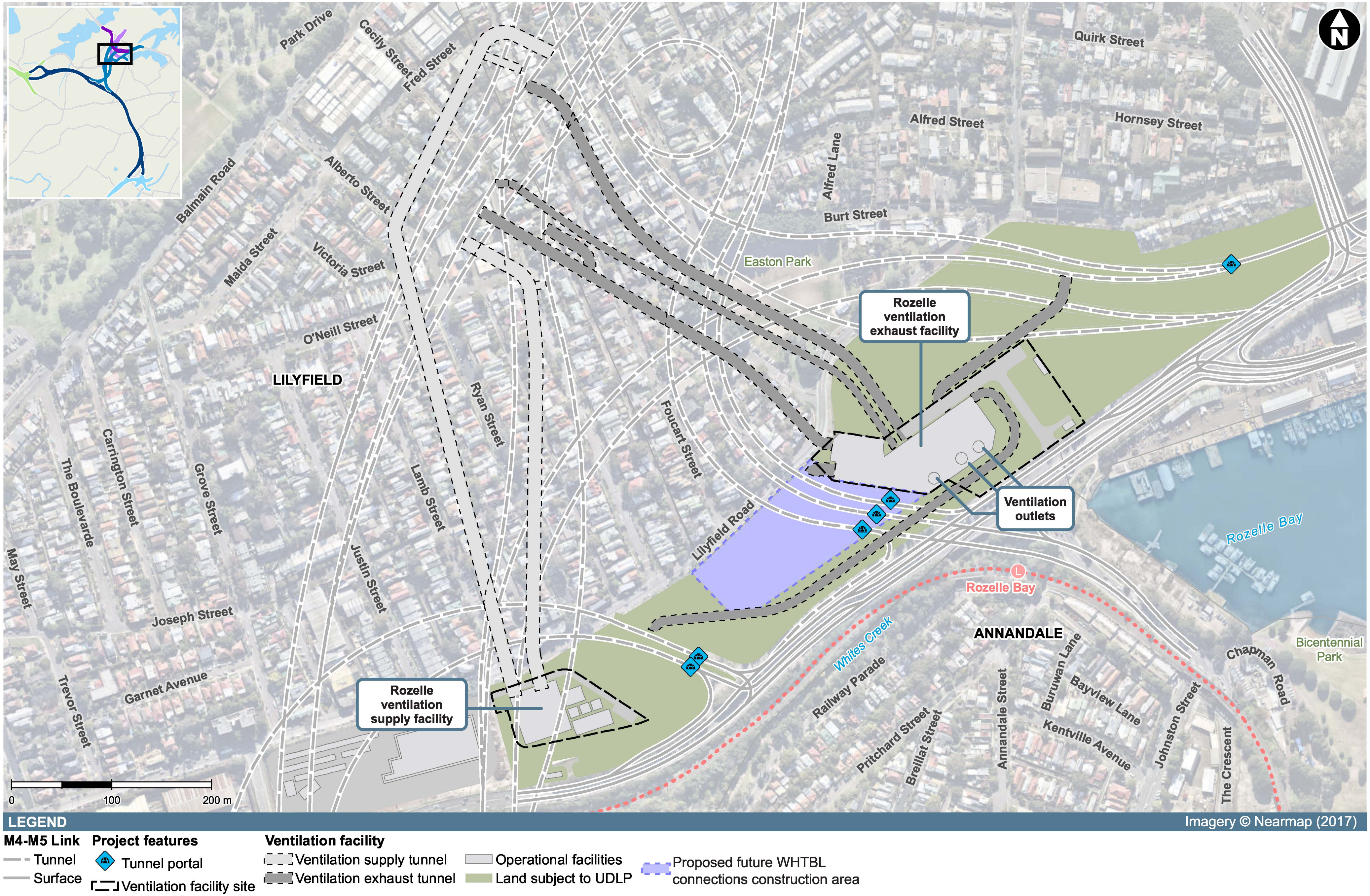
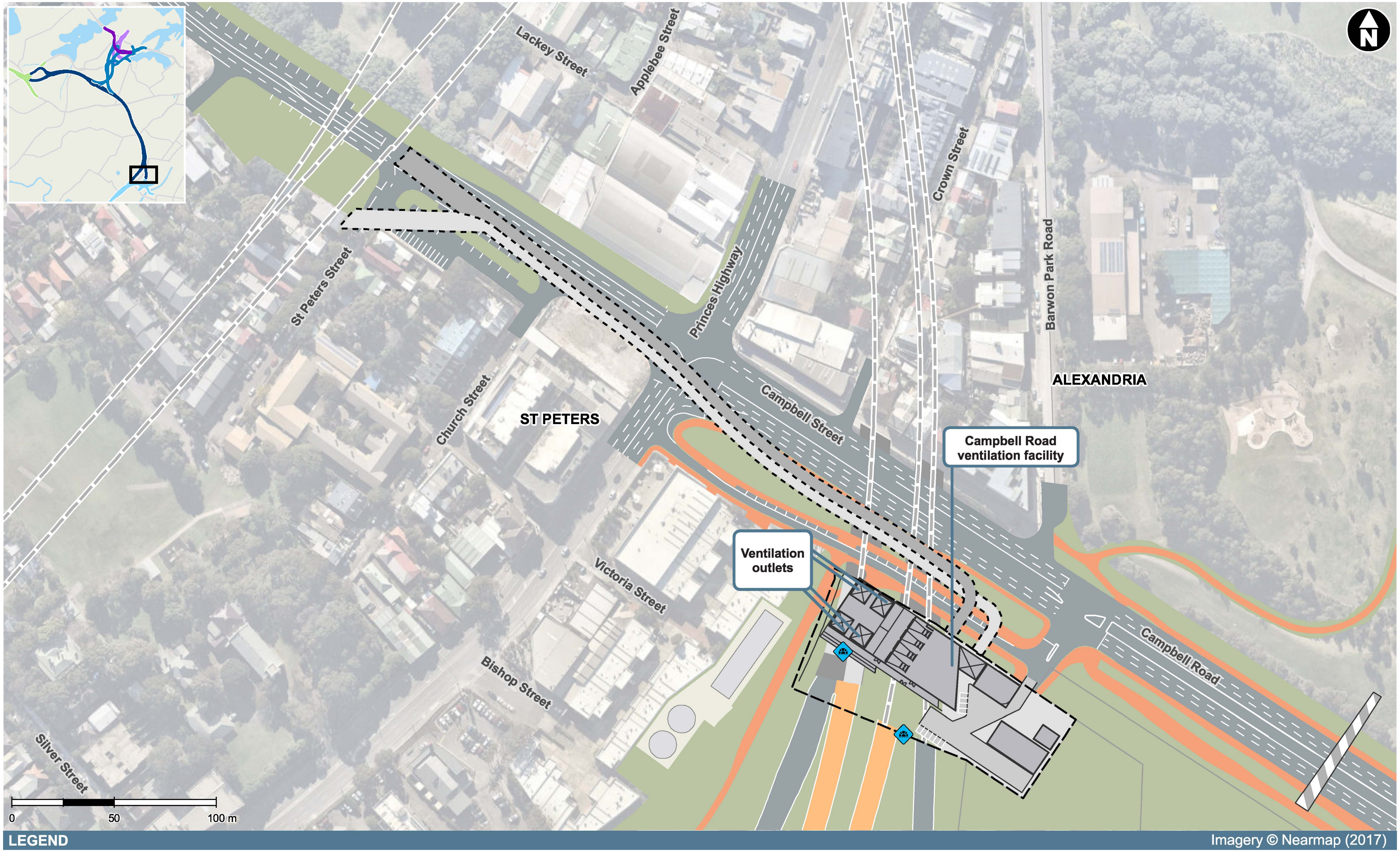


Figure 5-49 Indicative ventilation tunnel layout at Rozelle



New M5
- Land subject to New M5 UDLP
- Proposed future Sydney Gateway connections (non-operational as part of M4-M5 Link)
- Building
- Surface road
- Shared path

M4-M5 Link
- Tunnel

Project features
- Tunnel portal

Ventilation facility
- Car parking
- Ventilation facility site
- Ventilation supply tunnel
- Ventilation exhaust tunnel
- Operational facilities

Figure 5-50 Indicative ventilation tunnel layout at St Peters

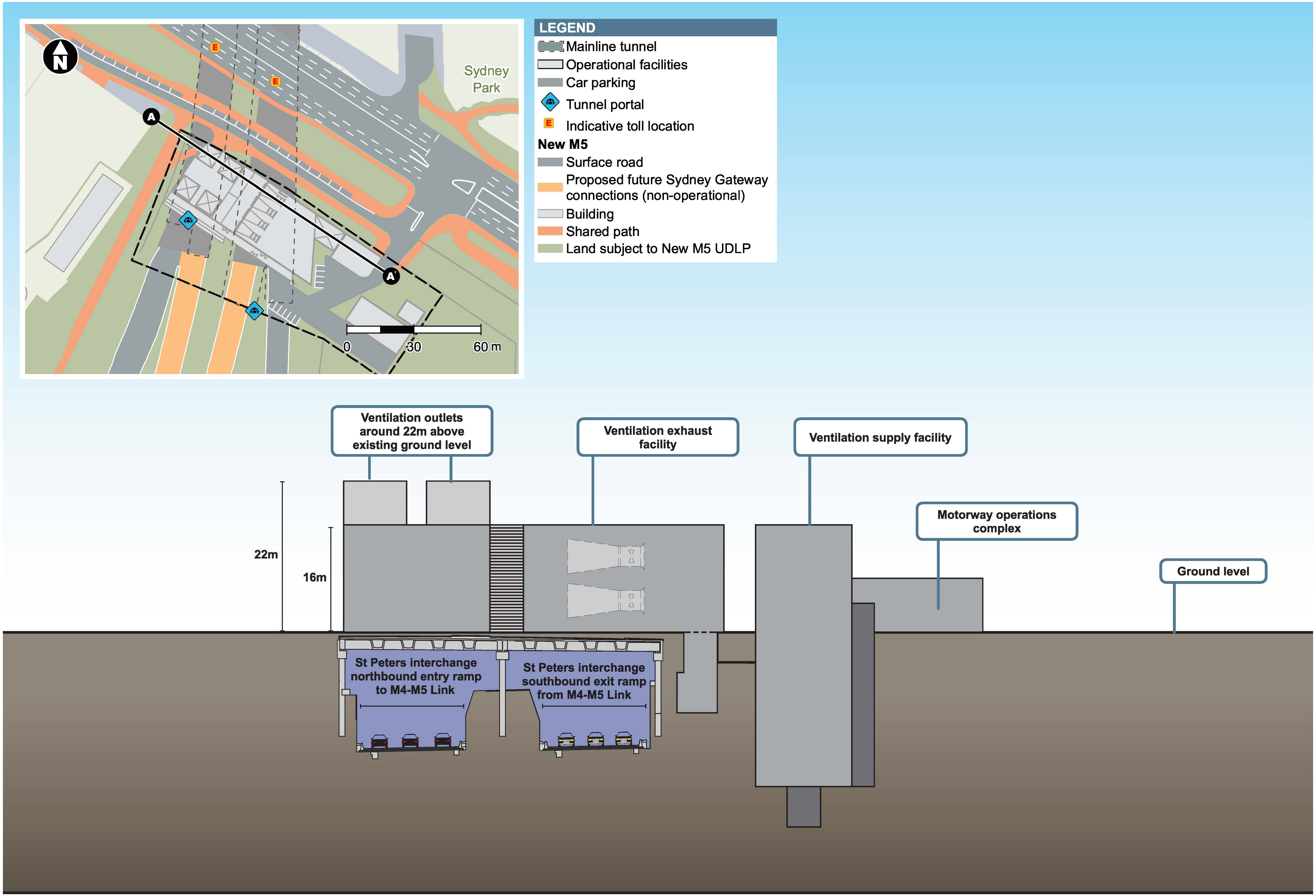


Figure 5-51 Indicative cross-section of the Campbell Road ventilation facility and outlets

Operating modes

The tunnel ventilation system would operate in three modes:

- Normal (expected) traffic conditions
- Maximum capacity traffic, used to assess the highest likely in-tunnel pollution levels
- Emergency conditions.

Operation of the ventilation system under these three conditions is detailed in the following sections.

Normal traffic conditions

Normal traffic conditions are considered to be when traffic flow within the tunnel is at capacity and travelling at posted speed limits (as outlined in **Table 5-9**).

Table 5-9 Posted speeds within the tunnel

Road element	Posted speed (km/h)
Mainline tunnels	
Main carriageways	80
St Peters interchange ramps	80
Rozelle interchange connections	80
Wattle Street interchange ramps	60
Rozelle interchange	
Inner West subsurface interchange to future Western Harbour Tunnel (approaching from the St Peters interchange)	80
Inner West subsurface interchange to future Western Harbour Tunnel (approaching from Wattle Street interchange)	70
Inner West subsurface interchange to Rozelle	80
Rozelle interchange to Anzac Bridge	60
Iron Cove Link	60
Rozelle interchange ramps from tunnel to surface	60
City West Link/The Crescent/James Craig Road	60
Victoria Road	60

Under normal traffic conditions, ventilation would occur due to the piston effect, where fresh air is drawn into the tunnels at entry portals by the aerodynamic drag of vehicles entering the tunnel or supplied at dedicated air supply stations. This fresh air would move along the tunnel with the traffic and be extracted at the ventilation outlets.

Under these conditions, the volume of air moving along the tunnel would be sufficient to satisfy the fresh air demand inside the tunnels. Further details regarding in-tunnel air quality are provided in **Chapter 9** (Air quality).

Maximum traffic flow conditions

Where traffic flow within the tunnel is travelling at low speeds (ie around 40 kilometres per hour or less), typically as a result of a traffic incident or congestion, the piston effect associated with traffic movement would be reduced. Under these conditions, longitudinal ventilation may require mechanical support to maintain air movement through the tunnels. Jet fans, which would be directly controlled by operators in the WestConnex Motorway Control Centre (see **section 5.8.4**), would increase tunnel airflows in the same direction as the traffic flow, when traffic speeds are low. This would ensure sufficient fresh air to dilute vehicle emissions to meet the relevant air quality criteria. Under these traffic conditions, additional fresh air may also be required to ensure that acceptable air quality is maintained. Additional air may be injected into the mainline tunnels via ventilation supply facilities located at Rozelle and St Peters. Air quality monitoring and management is described in **section 5.8.7**. Further details regarding external and in-tunnel air quality are provided in **Chapter 9** (Air quality).

Emergency conditions

During a major incident, when traffic is stopped in the tunnel, the jet fans would be used to increase the air flow to protect vehicle occupants and emergency services personnel from a build-up of emissions. Drivers would be requested, via the public address system, to turn off vehicle engines if there is an extended delay, while the incident is cleared. This would assist in reducing emissions inside the tunnel.

In the case of a fire, the carriageway on which the incident occurred would be closed to incoming traffic and traffic downstream of the fire (ie between the fire and a tunnel portal) would exit the tunnel. Jet fans would be used to propel the smoke downstream to the nearest ventilation outlet, or tunnel portal(s), depending on the location of the fire. This would prevent smoke flowing backwards from the fire source over any vehicles that are stationary behind the fire. See **section 5.8.3** for further detail of the smoke control system.

5.8.3 Fire and life safety

Fire safety in Australian road tunnels follows a defined fire safety engineering process outlined in Australian Standard AS4825 – *Tunnel fire safety*, which also provides a 'Trial Concept Design' when developing road tunnel fire safety systems. As the M4-M5 Link mainline tunnels would connect directly to the New M5 tunnels and M4 East tunnels below ground, the fire safety systems would be coordinated between the projects to ensure safety during an incident. A single Motorway Control Centre at St Peters interchange would provide for coordinated normal and emergency operations for the entire WestConnex program of works (including the M4-M5 Link, the New M5 Motorway, the King Georges Road interchange, the widened M4 Motorway and the M4 East Motorway).

Fire and life safety objectives

The following fire safety objectives would form the basis of the fire safety design for the M4-M5 Link tunnels:

- Occupant life safety - this includes providing all necessary fire safety systems and measures to minimise the impact of fire on occupants of the tunnels
- Facilitate fire services intervention - this includes the provision of fire safety measures and systems, which allow fire service personnel to access the tunnel
- Protection of adjoining property and third parties - the potential for fire spread and tunnel collapse due to fire requires appropriate structural fire resistance
- Asset protection - the level of asset protection is dependent on the road authority requirements and the importance of the asset. M4-M5 Link would provide an important link within the road network, and therefore fire protection and resilience of structures and systems would be critical
- Operational continuity - once operational, the network would become dependent on the M4-M5 Link and therefore systems would be provided to minimise any disruption to service
- Return to service - fire events would require tunnel closure and in some cases repair and clean-up. Appropriate systems and measures would be provided to minimise the time taken to make the M4-M5 Link operational again after an event
- Environmental protection - this includes aspects such as minimising fire size through suppression and therefore minimising smoke production during a fire by use of a deluge system, and managing runoff from water suppression.

Fire and life safety measures

Key components of the project's fire and life safety measures are described in the following sections.

Twin tunnels

The tunnels would be separated by fire-rated materials to provide for one-way, fire-separated carriageways. This arrangement would allow motorists to move to a safe place underground into a non-incident fire-separated carriageway.

For the entry and exit ramps, the principle of access and egress to a fire-separated tunnel is the same, but would not necessarily need to be to an adjoining ramp.

Emergency egress and access for emergency response teams

The tunnels would include vehicular cross-passages to allow for traffic to be moved from one tunnel into another in the case of an emergency. Around three vehicular cross-passages would be provided in both the mainline tunnels and the Rozelle interchange tunnels and would be designed to accommodate a 14.5 metre long bus; so that general traffic could be evacuated during incidents that required tunnel closure. In the event that a vehicle over this size is in a closed tunnel during an incident, vehicle occupants would be evacuated and the vehicle would remain in the closed tunnel until the tunnel reopens.

Cross-passages would be located within the tunnel, around every 120 metres. Cross-passages would connect to the adjoining tunnel, providing access to a non-incident zone during an emergency. Connections between the tunnels would cater for egress for people with disabilities by minimising stairs or ramps with steep grades and providing alternative safe holding zones.

For the entry and exit ramps, connection to an adjoining tunnel is in some cases impractical and therefore the use of longitudinal egress passages would be required. Longitudinal egress passages are generally required where the adjoining entry and exit ramps are separated by long distances, are at significantly different elevations or are on either side of the mainline tunnels, which prevents the use of a level cross-passage. Where the ramps begin to move closer to each other, both in separation distance and elevation, the longitudinal egress passages would end and cross-passages would be provided. The use of cross-passages is preferred because the access travel distance to the incident site is minimised when compared with longitudinal egress passages. Longitudinal egress passages would also be required where the northbound and southbound mainline tunnels are at different depths.

With the use of longitudinal egress passages, additional Fire & Rescue NSW (FRNSW) access passages are required such that the maximum walking distance for FRNSW from its vehicle to an incident site, approaching from the upstream side, does not exceed 250 metres.

The alignments of the twin tunnels between the mainline tunnels and the Rozelle interchange are vertically separated, requiring long longitudinal egress-passages. Longitudinal egress-passages are also required at the Wattle Street and the St Peters interchange ramps. Emergency egress at Rozelle would be provided through a combination of cross-passages and longitudinal egress-passages.

The tunnels would also include emergency stopping bays spaced around 2.5 kilometres apart. Breakdown bays would potentially be combined with maintenance bays and would be large enough to allow a B-double vehicle to pullover into the bay and safely park away from operational traffic lanes, without blocking traffic flow. An indicative layout of a mainline tunnel maintenance and breakdown bay is shown in **Figure 5-52**.

Smoke control system

Longitudinal smoke control is proposed as the primary means of smoke management for the M4-M5 Link project. This would involve blowing smoke along the tunnel in the direction of vehicle travel to ensure that vehicles stopped upstream of (or before) an incident are safe and vehicles downstream of (or after) an incident keep driving out of the tunnel or into the next ventilation section. Smoke would then be removed from the tunnel at portals or via the ventilation outlets.

The M4-M5 Link would also be separated into ventilation sections defined by the location of the ventilation outlets and portals. The ventilation outlets and portals would be used to remove smoke and prevent smoke spreading to adjoining tunnel sections. This is particularly important at the M4-M5 Link interfaces with New M5 and M4 East, where the ventilation system would be designed to prevent smoke spreading between the different tunnel ventilation sections.

Water suppression system

Water suppression (deluge) would be used to manage fire and ensure occupant safety, operational continuity and asset protection. A deluge suppression system would minimise the fire size, reduce fire spread and heat generation and assist the fire brigade in managing a fire event. These factors allow for efficient incident management and minimise the time it takes for the tunnels to be able to be used again.

Water supply for the M4-M5 Link suppression system would be provided from water tanks located at:

- Parramatta Road ventilation facility at Haberfield (being constructed as part of the M4 East project). As part of the project, additional pumps and associated pipework would be installed
- St Peters interchange (being constructed as part of the New M5 project). As part of the project, additional pumps and associated pipework would be installed
- Rozelle West motorway operations complex (MOC2).

Transport of Dangerous Goods

Vehicles transporting dangerous goods as defined by the *Australian Dangerous Goods Code* (National Transport Commission 2015) would be prohibited within the M4-M5 Link tunnels.

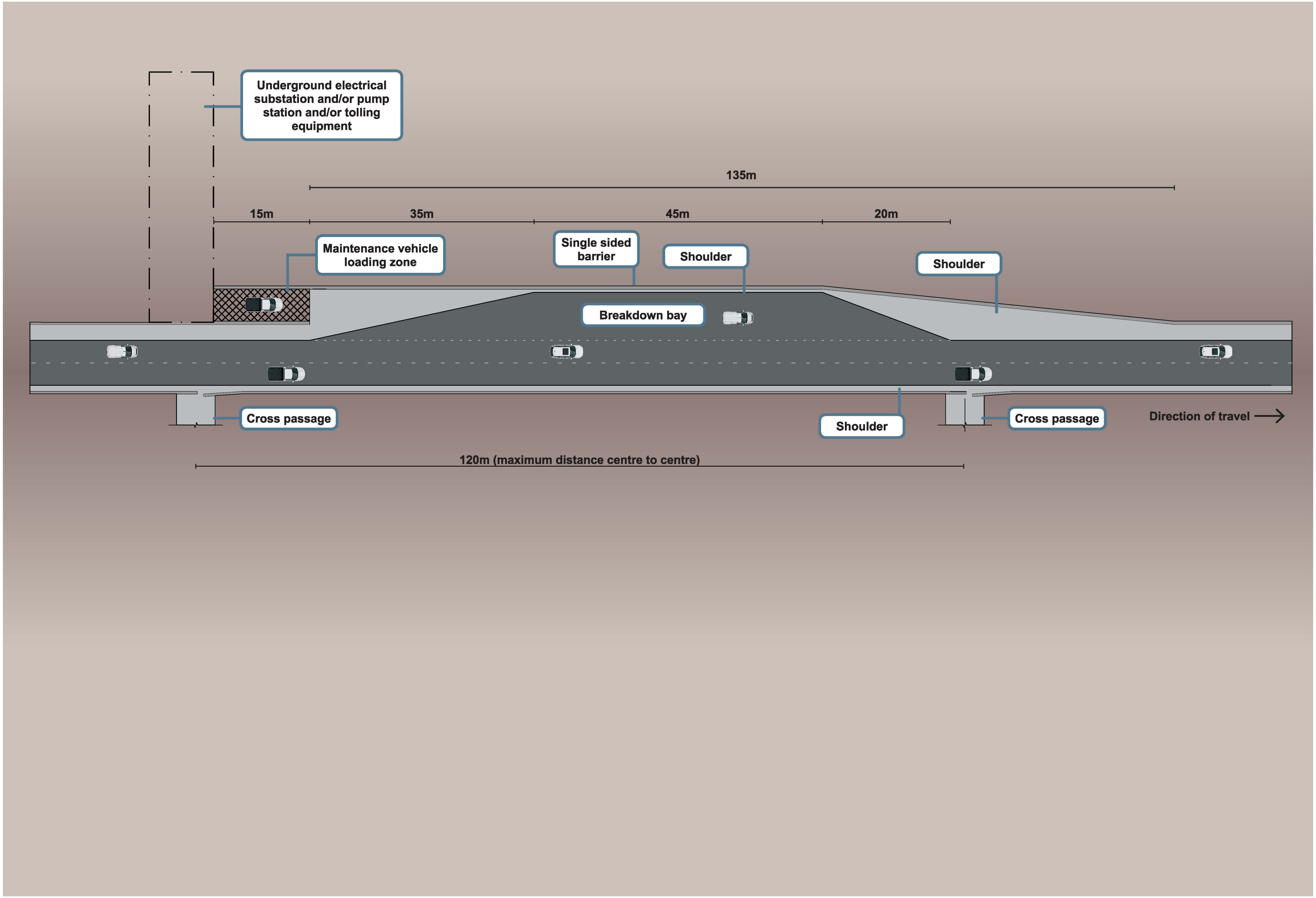


Figure 5-52 Indicative combined breakdown and maintenance bay

5.8.4 Operational management

A ‘single operating entity’ would undertake day-to-day ‘coordinated operations’ for the widened M4 (M4 Widening project), M4 East, New M5 and M4-M5 Link (the ‘WestConnex Motorway’) projects, as well as the existing M5 East, from a combined traffic control room located at the St Peters interchange WestConnex Motorway Control Centre (WMCC). This WMCC is being built as part of the New M5 project, and is proposed to also be used for the M4-M5 Link.

The single operating entity would use an Integrated Operations and Management Control System (IOMCS) and a stand-alone M5 East Operations and Management Control System (OMCS). In addition, a WestConnex Disaster Recovery Site (WDRS), fitted with a secondary OMCS, would be established at the M4 Motorway Control Centre located at Homebush Bay Drive (being built as part of the M4 East project). If the WMCC is temporarily out of service, WestConnex Motorway coordinated operations would be carried out at the WDRS and the M5 East Motorway Control Centre at Marsh Street at Arncliffe.

The WMCC at the St Peters interchange would be located at the Burrows Road motorway operations complex, a component of the approved New M5 project. The use of this site for coordinated operations for the WestConnex Motorway would not require a change to the use, access, vehicle movements or operational hours that were approved as part of the New M5 project.

The project would carry out internal fitout works at the WMCC to provide for integrated use. In addition, there may be a need for minor car parking upgrades to be carried out at the WMCC. The need for car parking upgrades at this location would be confirmed during detailed design and in coordination with the New M5 project.

The M4 Motorway Control Centre at Homebush Bay Drive (approved as part of the M4 East project) is proposed to be converted to be the WDRS. Internal fitout would be carried out to add equipment to the modified space to enable integrated operational functionalities. The project would not change access, vehicle movements or operational hours that were approved as part of the M4 East project and an application to modify the M4 East approval, if required, will be lodged to support these works.

5.8.5 Coordinated operations

The M4-M5 Link mainline tunnels would join and integrate the M4 East and New M5 projects to form a continuous WestConnex Motorway. Prior to the project opening to motorists, M4 and M5 motorway operations would be transferred to the combined Traffic Control Room located in the WMCC.

The WestConnex Motorway would be operated by a ‘single operating entity’ which would:

- Operate, using the integrated traffic, plant and voice communication systems, a single seamless interface for the efficient management of WestConnex network traffic, facilities and equipment
- Manage traffic through the implementation of WestConnex network traffic and incident management strategies, the coordinated deployment of resources and the execution of traffic control plans through an integrated control system
- Provide motorist roadside assistance and incident response though a coordinated traffic control room to ensure the road user is provided with prompt and reliable breakdown assistance and incidents are cleared quickly
- Plan, train and respond to emergencies and threats. The Transport Management Centre (TMC) would liaise with the single operating entity to coordinate the wider network and community response to incidents and emergencies
- Have the resources and systems to manage one or more incidents/emergencies (including fire scenarios), while continuing to operate unaffected sections
- Coordinate resources and systems used to respond to incidents, emergency and threats across the WestConnex Motorway to provide a rapid and coherent response unconstrained by concession boundaries.

5.8.6 Traffic monitoring and management systems

The project would include the integration of 'smart motorways' (also known as managed motorways) features, that would use real-time information, communication and traffic control systems incorporated into and alongside the road, to improve traffic flow.

The following smart motorway infrastructure would be provided as part of the traffic monitoring and management systems to support the future implementation of a smart motorway solution:

- Automatic video-based incident detection within the project tunnels
- Closed-circuit television (CCTV) including a digital video management system
- Infrastructure to enable the future implementation of ramp signalling (ramp metering)
- Driver advisory signs including:
  - Variable message signs (VMS)
  - Changeable message signs
  - Integrated speed limit and lane-use signs
  - Tunnel message signs within the mainline tunnels.

Additional traffic monitoring and management systems to be provided along the tunnels would include:

- Motorway emergency telephones
- Over-height vehicle detection systems
- Public address and radio re-broadcast systems throughout the project tunnels
- A traffic monitoring system
- A tunnel closure system.

The traffic monitoring and management systems would be used to monitor traffic volumes and speeds within the mainline tunnels. Should the video-based detection systems identify heavy congestion and/or an incident within the mainline tunnels, the following measures would be implemented to manage traffic, where required:

- Integrated speed limit and lane-use signs would be used to notify road users of the incident ahead, and to display lowered speed limits, if required
- Road users within the tunnels would be notified of the congestion/incident and the management measures in place within the tunnels over the public address and re-broadcast systems
- The tunnel closure system would be used to prevent additional vehicles from entering the mainline tunnels, where appropriate.

5.8.7 Air quality monitoring and management systems

A description of proposed tunnel ventilation is provided in **section 5.8.2**. Continuous emission monitoring and ambient air quality monitoring would be undertaken during operation of the project to monitor:

- In-tunnel air quality
- Air quality within ventilation outlets
- Ambient air quality at representative locations for a defined period of project operation.

Air quality monitoring and ventilation would be integrated and coordinated across the WestConnex Motorway to ensure:

- Air quality remains within specified limits for motorists and road workers, irrespective of their origin and destination, within the WestConnex Motorway
- Required airflows for safety outcomes in the event of an incident or emergency can be achieved
- Ventilation systems are used efficiently to minimise day-to-day energy usage and cost and to maximise asset life
- Airflows required for safety outcomes in the event of an incident can be achieved.

Continuous emission monitoring equipment for key contaminants (particulate matter ($PM_{2.5}$ and PM_{10}), NO_2 and CO and potentially other pollutants) would be installed at appropriate locations in the tunnels and on the ventilation outlets to ensure the project is operating within the prescribed emission limits for the project set by the conditions of approval, and as set by the NSW Environment Protection Authority (NSW EPA).

Periodic manual monitoring of ventilation outlet emissions would also be undertaken to validate the accuracy of the continuous emission monitoring equipment.

Further details regarding external and in-tunnel air quality and the assessment of the project's ventilation system are provided in **Chapter 9** (Air quality).

5.8.8 Motorway tolling infrastructure

Tolling points would be installed for the M4-M5 Link project. Each tolling point would have a gantry and associated shelter.

Tolling points would be installed at the following locations:

- The entry and exit ramps at the Wattle Street interchange
- The entry and exit ramps at the St Peters interchange
- Within the Rozelle interchange.

5.8.9 Lighting, roadside furniture and signage

Lighting

Lighting that would be installed as part of the project includes:

- Traffic lighting within the tunnels
- Traffic lighting along surface roads and pedestrian/cyclist facilities
- Lighting within and around operational ancillary facilities
- Emergency lighting
- Aviation hazard-lighting.

Tunnel lighting

In-tunnel lighting would be based on road geometry and designed to comply with the Australian/New Zealand Standard AS/NZS 1158.5:2007: *Lighting for roads and public spaces*, and the International Standard CIE 88-2004: *International Commission of Illumination Publication Guide for the Lighting of Road Tunnels and Underpasses*.

Lighting at the tunnel portals would be able to be switched between daytime and night-time lighting in response to varying levels of brightness due to time of day and weather conditions. Uniform lighting would be provided along the tunnels. Tunnel lighting would be provided in rows along the ceilings at sufficient spacing to allow for deluge piping to be installed. Lighting would be adjusted where required to allow jet fans and signage (directional and other) to be installed with the appropriate sight lines maintained.

Surface road lighting

Surface road lighting, including at interchanges, ramps, intersections, roundabouts, bus stops and along local roads upgraded as part of the project have been designed to meet the requirements of Australian Standard AS/NZS 1158: Lighting for roads and public spaces.

To provide lighting at the tolling points, the proposed overhead gantries would emit a blue light during the operations phase similar to that used on many of Sydney's existing toll roads. The lighting is designed to meet the requirements of international and Australian Standards concerning electrical safety and eye safety. The proposed lights would be hooded and directed down towards the toll points to minimise potential light spill.

Emergency lighting

Emergency lighting would be installed to provide adequate illumination for evacuation of the tunnels in the event that primary lighting is inoperable. Emergency lighting would be provided as fixed direction exit signage, illuminated signage and LED light fittings within and in the vicinity of cross-passages and emergency egress paths.

Aviation hazard lighting

Aviation hazard lighting may be required at the Rozelle and St Peters ventilation facilities. All aviation hazard lighting would be provided in accordance with the regulations required by the CASA.

Signage

Traffic, locational, directional, warning and variable message signs would be incorporated within the tunnels and on surface roads at approaches to the tunnels. Directional signage would be installed in accordance with the Austroads and Roads and Maritime standards, with a focus on providing clear and unambiguous direction to motorists. All signage within the tunnels would be backlit and located to provide clear, highly visible, progressive and instructive decision-making information for motorists.

Variable message signs would be mounted on gantries along roads which approach the tunnels and would be used to advise motorists of traffic conditions. The variable message signs within the tunnels would comprise single-line-text advisory signs above traffic lanes.

Integrated speed and lane-use signs would be installed along the length of the project. These signs would generally display the regulatory speed limit along the project, and would be modified at the motorway control centre to display variable speed limits in response to incidents and congestion. The signs would be located around 200 metres before the tunnel portals, around 50 metres before each exit ramp and around 50 metres after each entry ramp.

5.9 Drainage and water treatment facilities

The drainage and water treatment facilities for the project would include three main components:

- Tunnel water drainage and treatment infrastructure
- Surface water drainage and management infrastructure
- Operational water treatment plants to treat surplus groundwater collected within the project tunnels prior to discharge. These would be located at the Darley Road motorway operations complex (MOC1) and the Rozelle East motorway operations complex (MOC3).

The drainage system would be designed to prevent flooding and aquaplaning within the tunnels and to avoid adverse effects on private properties and the surface road networks surrounding the project. Further details on drainage and water quality can be found in **Chapter 15** (Soil and water quality), **Chapter 17** (Flooding and drainage) and **Chapter 19** (Groundwater).

5.9.1 Tunnel drainage and treatment infrastructure

Tunnel drainage and treatment infrastructure would be designed to accommodate a combination of water ingress events including:

- Groundwater ingress
- Stormwater ingress at portals
- Tunnel wash-down water
- Fire suppressant deluge or fire main rupture
- Spillage of flammable or other hazardous materials.

Separate sumps would be provided at tunnel low points to collect tunnel drainage from two input streams: groundwater ingress and other potential water sources. Further information regarding the likely treatment methods and wastewater volumes is provided in **Chapter 15** (Soil and water quality) and **Chapter 17** (Flooding and drainage).

Water that enters the mainline tunnel drainage systems would be pumped to a water treatment plant at the Darley Road motorway operations complex (MOC1) at Leichhardt. Options for discharge of treated water from the Darley Road water treatment plant include:

- Direct discharge to Hawthorne Canal, which would require a pipe to be installed along Canal Road and the construction of a new outlet in the wall of the Hawthorne Canal
- Direct discharge to the existing stormwater pipework in an adjoining road (ie Canal Road), which would require a pipe to be installed to connect to existing piped drainage
- Direct discharge into the sewer system located on the site, which would require a Trade Waste Agreement with Sydney Water.

Further detail regarding these discharge options is included in **Appendix F** (Utilities Management Strategy). The preferred option for treated water discharge from the Darley Road water treatment plant would be confirmed during detailed design.

In addition, tunnel drainage from about one kilometre of the northbound mainline tunnel and 600 metres of the southbound mainline tunnel would be captured by the New M5 drainage system and conveyed to the New M5 operational water treatment plant at Arncliffe.

Tunnel drainage for Rozelle and the Iron Cove Link tunnels would be pumped to a water treatment plant at the Rozelle East motorway operations complex (MOC3), with treated flows discharged to a constructed wetland within the Rozelle Rail Yards. This would provide some ‘polishing’ of the effluent, helping to remove residual dissolved constituents such as nitrogen and phosphorus not removed by the water treatment plant. Treated flows would ultimately flow to Rozelle Bay, via the northern drainage channel and the culvert to be installed below City West Link (see **section 5.6.6** for additional details about this culvert structure).

5.9.2 Surface water drainage and management infrastructure

Surface water drainage and management infrastructure would be provided for new surface roads constructed as part of the project, and where existing, drainage conditions would be modified as part of the project.

Surface water drainage and management infrastructure would be designed to:

- Limit the flow in gutters to acceptable widths
- Convey runoff collected from a 10-year average recurrence interval (ARI) storm event
- Capture pavement runoff at the tunnel portals for storms up to the 100-year ARI event, to limit the volume of rainfall runoff that enters the tunnel drainage system
- Direct collected surface-water runoff through appropriate water quality treatment devices prior to appropriate discharge or disposal.

In addition, temporary drainage infrastructure for the proposed future Western Harbour Tunnel and Beaches Link would be provided. Further detail on the works that would be carried out as part of civil works to construct connections to, and parts of, the proposed future Western Harbour Tunnel and Beaches Link is provided in **Chapter 6** (Construction work).

Wattle Street interchange

At the Wattle Street interchange, the exit ramp drainage would be connected to the entry ramp drainage via a cross-passage. The combined ramp runoff pipe would discharge to a sump located at the entry ramp portal. The sump would not capture any tunnel drainage. A stormwater treatment device would be provided immediately upstream of the sump. Stormwater captured in the portal sump would be pumped to the surface and discharged to the surface drainage network constructed as part of the M4 East project.

St Peters interchange

At the St Peters interchange, drainage is being provided by the New M5 project. The design incorporates a rising main to convey flows away from the portals for treatment and subsequent discharge to Alexandra Canal. The minor flows that bypass this drainage as well as those generated by the small catchment between the limit of the New M5 drainage works and the M4-M5 Link tunnel portals would be captured by the M4-M5 Link tunnel drainage system that starts immediately inside the tunnel portals.

Rozelle interchange and the Iron Cove Link

A local catchment drainage system would be provided to drain features such as external catchment areas, batter slopes and road surfaces. External flows would be kept separate to road surface drainage where possible and practical. The overall system would be designed with due consideration of the urban and landscape design objectives, including implementing aspects of water sensitive urban design (WSUD) where practical.

In general, runoff originating from pervious catchments or those unaffected by the project works would bypass water treatment facilities and discharge at a suitable location to avoid unnecessary flow through treatment infrastructure. A number of external catchments currently drain toward the project works and require diversion through or around the works. Key surface water drainage infrastructure to be provided as part of the Rozelle interchange and Iron Cove Link surface works are described in **Table 5-10** and shown in **Figure 5-25** and **Figure 5-26**.

Table 5-10 Key surface water drainage infrastructure – Rozelle interchange and the Iron Cove Link

Key infrastructure	Description
Rozelle interchange	
Western drainage channel	New drainage infrastructure works being constructed as part of the adjoining CBD and South East Light Rail Rozelle maintenance depot are expected to discharge flows from an external catchment to the west of the Depot into the Rozelle Rail Yards. Flows would enter the Rozelle Rail Yards from two separate outlets constructed by the Sydney Light Rail project. Flows from these outlets would be directed to the western drainage channel. The channel would convey flows along the north of City West Link. The channel would combine with others from throughout the Rozelle Rail Yards before being culverted under City West Link and discharging to Rozelle Bay.
Northern drainage channel	The Easton Park drain currently conveys the runoff from a local urbanised catchment of roughly 55 hectares and passes through the Rozelle Rail Yards from Lilyfield Road in the north to Rozelle Bay in the south. The existing drain would be affected by the project works and a replacement channel would be constructed. The channel would convey the majority of the Easton Park catchment runoff through the Rozelle Rail Yards and would be bridged by a footbridge and a bridge providing maintenance access to the ventilation facility.

Key infrastructure	Description
Eastern drainage channel	A channel would be required to convey runoff from a small catchment draining from the eastern end of the Rozelle Rail Yards. In its upper reaches this channel would resemble a bioretention swale to provide stormwater treatment in addition to drainage. The channel would constrict to a narrower V-shaped channel or similar before discharging to the northern drainage channel.
Whites Creek	Flood mitigation works would be performed along Whites Creek between the light rail bridge and Rozelle Bay. Downstream of the new The Crescent bridge, the flood mitigation works would include widening and improvement works to the channel and naturalisation of the creek banks. The creek design would aim to deliver a similar outcome to that of the planned Sydney Water – Whites Creek Naturalisation works upstream, including sandstone block walls and saltmarsh area (see **Figure 5-30** for an indicative arrangement for these naturalisation works).
City West Link culvert and Rozelle Bay outfall	A culvert would be constructed beneath City West Link to convey flows from the new drains in the Rozelle Rail Yards to Rozelle Bay. The culvert would incorporate a two-tiered arrangement consisting of: · Marine-class reinforced concrete pipes would discharge low flows from the contributing catchments to Rozelle Bay. A floodgate structure would be installed at the upstream end of the pipes to prevent tidal water entering the Rozelle Rail Yards. The downstream invert of these pipes would be set around mean low tide to allow regular draining and flushing from upstream · A bank of precast reinforced-concrete box culverts would be installed above the culverts to allow larger flood flows to discharge from the site. The box culverts would be installed at a level that prevents any tidal ingress.
Iron Cove Link surface works	
Iron Cove Link portals	An external catchment of roughly seven hectares drains from the north along Victoria Road northbound and towards the Iron Cove Link portals. To ensure flood protection of the Iron Cove Link tunnels, overland flows from this catchment that are not contained in the southbound carriageway would require capture and diversion. This would be achieved by upgrading the pit and pipe network along the southbound carriageway of Victoria Road and along Byrnes Street at Rozelle. Flows would then be directed to the new bioretention facility within a car park area south of Manning Street at Rozelle.

Pavement drainage

Drainage would be provided to all new road surfaces to meet the relevant criteria where achievable for a 10-year ARI event for a drainage system. This would include:

- Upgrades to existing pavement drainage networks where necessary, including connection of new drainage at appropriate locations
- New pavement drainage for surface areas fed by gravity to suitable treatment and discharge locations
- Pavement drainage for tunnel portals collected in sumps and pumped to suitable treatment and discharge locations.

Bridge runoff would be captured and conveyed to a suitable outlet location. Where not otherwise provided downstream, spill containment would be incorporated prior to each outlet.

Stormwater treatment

Where suitable space is available, stormwater runoff generated by the project would be treated in an effort to achieve the targets identified in **Chapter 15** (Soil and water quality) and deliver WSUD outcomes. Stormwater treatment infrastructure would include:

- A bioretention swale in the east of the Rozelle Rail Yards to treat runoff from parts of Victoria Road, Anzac Bridge and the Victoria Road/Anzac Bridge to M4 East/Wattle Street interchange portals
- A constructed wetland in the Rozelle Rail Yards, treating surface stormwater runoff from some nearby impermeable catchments and tunnel portals. The wetland would also provide polishing of treated groundwater from the Rozelle water treatment facility
- A linear bioretention strip incorporated in the batter slope between City West Link and the western drainage channel to treat runoff from eastbound and some westbound lanes of City West Link
- A small bioretention basin to treat runoff from Rozelle West motorway operations complex (MOC2) in the west of the Rozelle Rail Yards
- A bioretention facility within a car park area on Manning Street at Rozelle to treat runoff from the Iron Cove Link. The car park area at this location would be upgraded as part of the project.

In some instances, due to the highly constrained urban environment and relative levels, there may not be opportunity to install treatment devices within individual surface catchments and achieve the pollutant load reduction targets. In these highly constrained areas good practice treatment techniques such as gross pollutant traps and hydrodynamic separators (a device that removes sediment and other pollutants from stormwater) would be deployed where feasible and reasonable.

Water treatment facilities

The operational water treatment plants would be designed, constructed and operated to treat tunnel water prior to discharge to the stormwater drainage system. Operational water treatment facilities would be located at:

- The Darley Road motorway operations complex (MOC1) at Leichhardt
- The Rozelle East motorway operations complex (MOC3) at Rozelle.

The water treatment facilities would consist of:

- A balance tank to regulate flows into the plant
- A treatment plant, including clarifier and control room, to treat water prior to discharge into the stormwater drainage system.

The proposed location of the water treatment facilities is shown in **Figure 5-44** and **Figure 5-46**. Further information regarding the likely treatment methods and wastewater volumes is provided in **Chapter 15** (Soil and water quality) and **Chapter 17** (Flooding and drainage).

5.9.3 Noise attenuation

New motorways and other major roads sometimes require additional measures to minimise the levels of traffic noise experienced at residences and other sensitive receiver locations.

The *Road Noise Policy* (Department of Environment Climate Change and Water (DECCW), 2011), *Noise Criteria Guideline* (Roads and Maritime 2015a) and the *Environmental Noise Management Manual* (NSW Roads and Traffic Authority, 2001) establish a process to identify appropriate noise attenuation measures for road projects. This process and how it has been applied to the M4-M5 Link are detailed in **Chapter 10** (Noise and vibration) and **Appendix J** (Technical working paper: Noise and vibration).

The project has been designed to include all feasible and reasonable noise mitigation and management measures, where the noise assessment thresholds in the *Road Noise Policy* (DECCW 2011) have been predicted to be exceeded. This has included the following (in order or application and priority):

- Minimising noise generation at the source. This has been achieved for the project through careful selection of road pavement materials, and design of the project to minimise the potential for secondary traffic noise sources, such as compression (or engine) braking

- Attenuating noise between the noise source and the noise receiver. This has been taken into account for the project through the design and application of noise barriers
- Minimising and managing noise at the receiver. Properties that are potentially eligible for consideration for architectural acoustic treatments to minimise noise impacts have been identified and would be confirmed through the detailed design of the project.

Despite the design of the project to minimise the generation of traffic noise, the noise impact assessment (refer to **Chapter 10** (Noise and vibration)) identifies the need for noise barriers in some areas.

5.10 Utility services

Utilities and services located within proximity of the project would likely need to be protected, relocated or realigned during construction, particularly in areas of surface or shallow soil disturbance. These services include electricity, telecommunications, sewer, water, stormwater, gas and Sydney Trains services.

The project would also require connection to electricity, water and wastewater/sewer utilities.

A Utilities Management Strategy has been prepared for the project and is included in **Appendix F** (Utilities Management Strategy). The Utilities Management Strategy provides information in relation to:

- Utility relocations and adjustments which are currently known and proposed within the project footprint. These have been considered as part of this EIS
- Utility relocations and adjustments which are currently unknown and/or located outside of the project footprint. The Utilities Management Strategy provides the framework for how these utility relocations and adjustments would be assessed and managed
- Utility connections required to facilitate construction and operation of the project.

The Utilities Management Strategy should be read in conjunction with **Chapter 6** (Construction work) and **Chapter 12** (Land use and property).

The location of existing utility service and any changes required would be confirmed by the construction contractor during the detailed design of the project in consultation with the relevant utility provider.

5.10.1 Electricity

Electricity supply infrastructure would be installed to supply power to the tunnels and associated mechanical and electrical equipment needed during operation. It is essential that electrical power to the tunnels be uninterrupted for ventilation, lighting and other safety reasons.

Estimated power demand

The projected estimates of maximum power demands are shown in **Table 5-11**. Operational power for the proposed future Western Harbour Tunnel and Beaches Link project would be supplied separately and as a result no allowance has been included for this project in the estimate of power demand.

Table 5-11 Estimate of maximum power demand

Project element	MVA	Accuracy estimate
Mainline tunnel	35	+10 – 10%
Rozelle interchange and Iron Cove Link	30	+20 – 20%
Total	**65**	

The maximum power demand for the tunnels is driven predominantly by the ventilation system, particularly for scenarios involving congested traffic conditions or a fire within the tunnels. During normal free-flowing traffic conditions the power demand for ventilation is significantly reduced by comparison. Therefore much of the network capacity remains unused for most of the time.

Power supply connection locations

A bulk power supply would be provided in a single location or two locations and then distributed to the ventilation outlets and jet fans within the tunnels. The Ausgrid transmission voltage is 33kV and this is the nominated preference for the bulk power supply.

There are two substations best located to provide the bulk power supply connection for the project:

- Alexandria zone substation, at Bourke Road, Alexandria. This substation is currently under construction and is expected to be completed in late 2017
- Rozelle zone substation, at Manning Street, Rozelle.

An upgrade of the Rozelle zone substation would be required to accommodate the bulk power supply connection for the M4-M5 Link project. It is anticipated that these works would be carried out by Ausgrid.

Substations

Intake substations (substations that would connect to the Ausgrid network and would manage the intake and distribution of the project's power needs) would be required. These would be constructed above ground at the following locations:

- Rozelle West motorway operations complex (MOC2) at Rozelle
- Campbell Road motorway operations complex (MOC5) at St Peters.

The indicative locations of intake substations are shown in **Figure 5-45** and **Figure 5-48**.

From the intake substations, electricity would be distributed to the project via the tunnels, to connect to substations at the Rozelle East motorway operations complex (MOC3) and the Iron Cove Link motorway operations complex (MOC4). In addition, the need for a substation at the Darley Road motorway operations complex (MOC1) is being investigated and would be confirmed during detailed design. The project would also include a series of underground substations at a spacing not exceeding around 1.2 kilometres within the tunnel. An indicative layout of an underground substation is shown in **Figure 5-53**.

Further information about electricity connections for the project is provided in **Appendix F** (Utilities Management Strategy). Where practicable, energy efficiency initiatives would be incorporated into the project to minimise energy consumption (refer to **Chapter 22** (Greenhouse gas) for additional detail).

Redundancy has been built into the electricity supply system for the project. If electricity supply is not available despite the inbuilt redundancy, a system of uninterrupted power supplies would provide back-up power for operation of essential equipment for at least one hour. Essential operational equipment would include:

- Communications and monitoring equipment
- Computer systems
- Fire and life-safety systems
- Tolling systems
- Tunnel signage
- Emergency power outlets
- Closed-circuit television
- Emergency lighting, which would be distributed evenly along the tunnels.

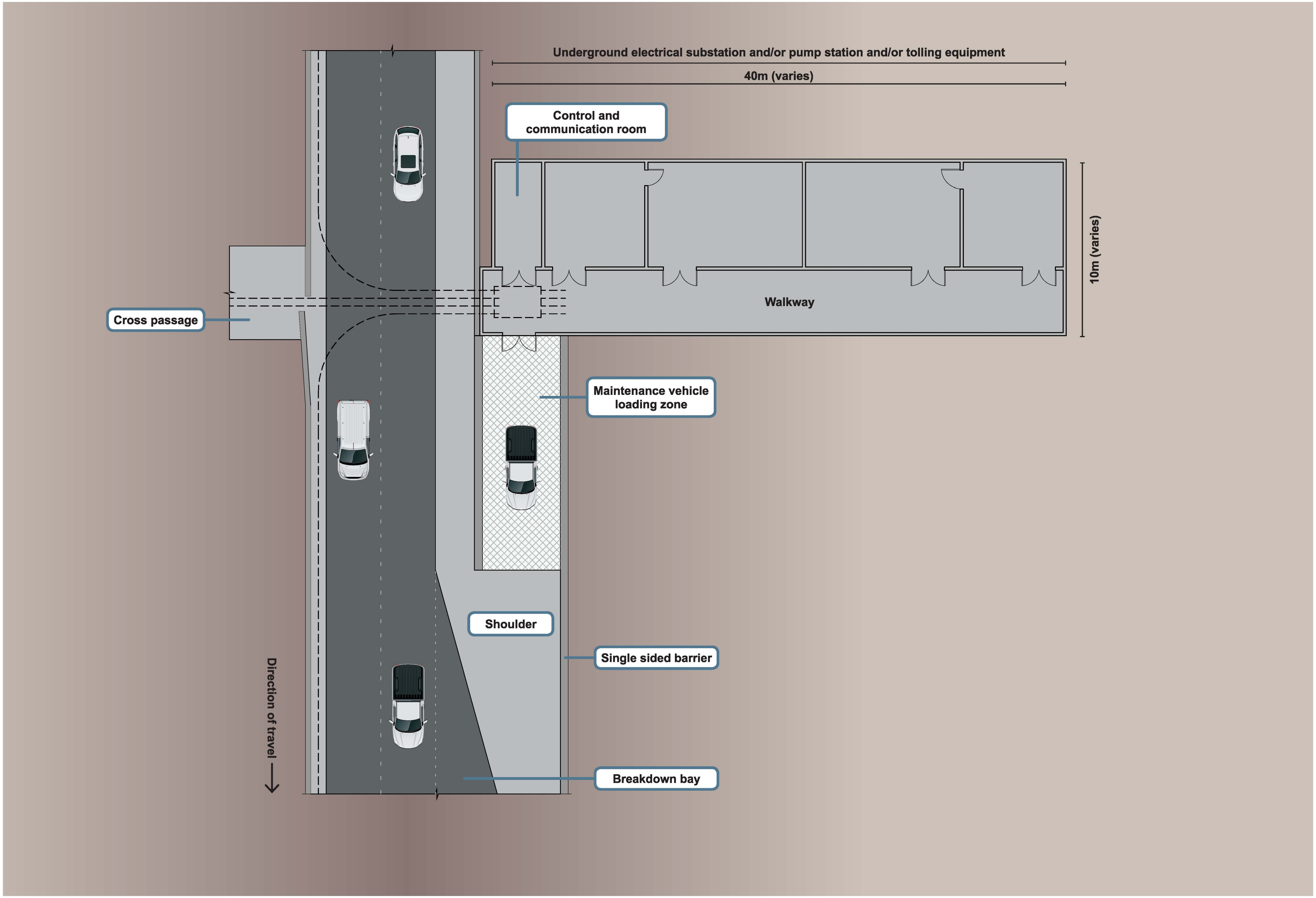


Figure 5-53 Indicative underground substation layout

5.10.2 Water

The project would require around four megalitres of water per annum for operations purposes. This would include water for maintenance activities, fire testing and for domestic purposes at each of the four motorway operations complexes.

Where water quality requirements are met, treated tunnel water would be used to minimise the need to consume potable water. This may include use of treated tunnel water for landscaping management.

Water for use inside the buildings within the motorway operations complexes would be supplied via a connection to the Sydney Water mains feed. Fire water would be stored within tanks at the Rozelle West motorway operations complex (MOC2), and within tanks at the Parramatta Road ventilation facility at Haberfield and at the St Peters interchange, which will be built by the M4 East and New M5 projects respectively. Fire water storage tanks would be sized to provide 100 per cent of the maximum design water flow requirements for up to two hours, and would be fed via connection to the Sydney Water mains feed.

The tunnel deluge and fire suppression system, including number, location and capacity of water storage facilities, would be designed and sized to meet the requirements of FRNSW.

5.10.3 Wastewater/sewer

The tunnels and entry and exit ramps would be subject to groundwater and road runoff ingress. Wastewater captured within the tunnels would also include stormwater entering the tunnels via the portals, deluge water, washdown water and hydrant water. Tunnel wastewater treatment is described in **section 5.9**.

The five motorway operations complexes would be connected to Sydney Water's wastewater system for domestic purposes.

5.11 Property access and acquisition

Where land required for the construction and operation of the project is not currently owned by the NSW Government, discussions are being held with the affected property owners concerning the purchase, lease or licence of the land. As at August 2017, the project would require 51 surface property acquisitions. These property acquisitions are summarised in **Table 5-12**. Further detail is provided in **Chapter 12** (Land use and property). Roads and Maritime would also be required to manage a number of leases on land subject to acquisition.

Table 5-12 Indicative property acquisition requirement for the project

Location	Land use (type)	No. of total acquisitions[1]
Wattle Street interchange surface works	Acquisitions were carried out at this location as part of the M4 East project	None[2]
Parramatta Road West and East civil and tunnel sites	Mixed use	1
Darley Road surface works	Commercial	1
Rozelle surface works	Commercial/industrial	4
Iron Cove Link surface works	Residential	26
	Commercial/industrial	10
Pyrmont Bridge Road tunnel site	Commercial/industrial	9
St Peters interchange surface works	Acquisitions were carried out at this location as part of the New M5 project	None[3]

Notes:

1 Multiple strata titles may exist within each parent lot to be acquired.

2 Refer to the M4 East EIS (September 2015) for acquisitions that occurred at this location.

3 Refer to the New M5 EIS (November 2015) for acquisitions that occurred at this location.

All compulsory acquisition required for the project would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW), the *Land Acquisition Information Guide* (NSW Government 2014b) and the land acquisition reforms announced by the NSW Government in 2016 (NSW Government 2016b), which can be viewed online at:
https://www.finance.nsw.gov.au/sites/default/files/NSW_Government_Response.pdf

Relocation and some other categories of expenses would be claimable under this Act and related policies.

The project would also use government owned land. Roads and Maritime would enter into agreements with the relevant government departments regarding the temporary or permanent use of this land – including acquisition or lease arrangements. Where government owned land is required temporarily, this would generally be established through a lease or a Memorandum of Understanding.

Access to properties not acquired, leased or otherwise occupied for project purposes would generally be maintained at all times during construction and operation. Where temporary impacts on existing property access are unavoidable as a result of construction activities (eg footpath and pavement works), consultation would be carried out with the landowner and/or tenant to provide equivalent standards of access. Short-term changes to access during construction are described further in **Chapter 6** (Construction work).

Indirect, permanent changes to access resulting from road closures and/ or modifications are discussed in the following section. The traffic and transport impacts from these changes are described in **Chapter 8** (Traffic and transport). Impacts on pedestrian and cyclist access and indirect impacts on property access are described in **Chapter 12** (Land use and property).

6 Construction work

This chapter describes the proposed approach to the construction of the project. It outlines the proposed construction program, footprint, methodology, working hours, materials, equipment, traffic management, spoil haulage routes, and temporary construction ancillary facilities. The description of the construction work provided in this chapter is based on methodologies developed to construct the project described in **Chapter 5** (Project description).

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued environmental assessment requirements for the project. These are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 6-1** sets out these requirements and the associated desired performance outcomes that relate to the construction work program, and identifies where they have been addressed in this environmental impact statement (EIS).

Table 6-1 SEARs – construction work

Desired Performance Outcome	SEARs	Where addressed in the EIS
2. Environmental Impact Statement The project is described in sufficient detail to enable clear understanding that the project has been developed through an iterative process of impact identification and assessment and project refinement to avoid, minimise or offset impacts so that the project, on balance, has the least adverse environmental, social and economic impact, including its cumulative impacts.	1. The EIS must include, but not necessarily be limited to, the following: (b) A description of the project and all components and activities (including ancillary components and activities) required to construct and operate it, including:	A description of the project is included in **Chapter 5** (Project description).
	• the proposed route	A description of the project is included in **Chapter 5** (Project description). Construction activities associated with tunnelling for the project are described in **section 6.4.2**. Construction activities associated with other bulk earthworks including upgrades and modifications to the surface road network are described in **section 6.4**, bridge works in **section 6.4.3**, ancillary infrastructure and operational facilities in **section 6.4.4** and drainage and water management infrastructure in **section 6.4.5**.
	• design of the tunnels, interchanges (inclusive of tunnel portals and entry and exit ramps), and connections to Stage 1 and Stage 2 of WestConnex and other proposals, and road user, pedestrian and cyclist facilities, and lighting	A description of the project is included in **Chapter 5** (Project description). Construction activities associated with tunnelling for the project are described in **section 6.4.2**. This section includes a description of the construction activities associated with connecting the project to the M4 East and New M5 projects and other proposals.

Desired Performance Outcome	SEARs	Where addressed in the EIS
		Construction activities associated with other bulk earthworks including upgrades and modifications to the surface road network are described in **section 6.4**, bridge works in **section 6.4.3**, ancillary infrastructure and operational facilities in **section 6.4.4** and drainage and water management infrastructure in **section 6.4.5**. A description of the iterative process of impact identification and assessment and project refinement relating to the construction of the project is included in **Chapter 4** (Project development and alternatives).
	• surface road upgrade works, including road widening, intersection treatment and grade separation works, property access, parking, pedestrian and cyclist facilities (including appropriate locations for overbridges) and public transport facilities	Construction activities associated with other bulk earthworks including upgrades and modifications to the surface road network are provided in **section 6.4**, bridge works in **section 6.4.3**, ancillary infrastructure and operational facilities in **section 6.4.4** and drainage and water management infrastructure in **section 6.4.5**. Direct and indirect impacts on property access are described in **Chapter 5** (Project description) and assessed in **Chapter 12** (Land use and property). Access to properties not acquired, leased or otherwise occupied for project purposes would be maintained at all times during construction and operation. Traffic management and access during construction is detailed in **section 6.6** and includes potential impacts and/or alterations to public transport services and pedestrian and cyclist facilities.

Desired Performance Outcome	SEARs	Where addressed in the EIS
	• ancillary infrastructure and operational facilities, such as operational and maintenance facilities, ventilation structures and systems, and fire and emergency services and infrastructure for the proposal, including (if required) additional infrastructure (such as tolling infrastructure) for the M4 East and New M5 Motorway	A description of the project is included in **Chapter 5** (Project description). Construction activities associated with ancillary infrastructure and permanent operational facilities are described in **section 6.4.4**. Construction activities associated with drainage and water management infrastructure are detailed in **section 6.4.5**. Construction activities associated with finishing works such as tolling infrastructure are detailed in **section 6.4.7**.
	• location and operational requirements of construction ancillary facilities and access	Construction ancillary facilities required to support the tunnelling and surface works associated with the project are described in **section 6.5**.
	• land use changes as a result of the proposal and the acquisition of privately owned, Council and Crown lands, and impacts on Council and Crown lands	Temporary changes to access during construction are described in **section 6.6**. Land use changes as a result of the construction and operation of the project, including property acquisition and impacts on council and Crown lands, are detailed in **Chapter 12** (Land use and property).

6.1 Construction strategy

The construction strategy for the project focuses on balancing the need for construction to occur in a safe and efficient manner, while managing constructability constraints and minimising impacts on local communities, the environment, and users of the surrounding road and other transport networks. The construction methodologies described in this EIS are based on the concept design for the project.

As described in **Chapter 1** (Introduction), this EIS has been prepared prior to the appointment of a design and construction contractor(s) and as such, the construction strategy presented and assessed in this EIS aims to provide an assessment of probable construction methodologies, while retaining flexibility for the contractor to refine the construction methodology following their appointment. This means that the detail of the design and construction approach presented in this concept design is indicative only, and is subject to detailed design to be carried out by the design and construction contractor(s). However, the design presented by the contractor(s) would be consistent with the environmental performance outcomes and environmental management measures described in this EIS, changes identified in a Submissions and Preferred Infrastructure Report, the conditions of approval for the project and other requirements identified during the assessment of the project.

The concept design considers two possible combinations for construction ancillary facilities around Haberfield and Ashfield. These are described and assessed in this EIS as Option A and Option B. The construction ancillary facilities that comprise these options have been grouped together and are denoted by the suffix *a* (for Option A) or *b* (for Option B) eg Wattle Street civil and tunnel site (C1a). The construction ancillary facilities that comprise these options have been selected to assist in informing the preferred combination of construction ancillary facilities that would be used to construct the project. The preferred combination would be determined during detailed design and would meet the environmental performance outcomes stated in the EIS and the Submissions and Preferred Infrastructure Report, satisfy criteria that would be identified in any relevant conditions of approval and manage environmental risks.

Further information on construction ancillary facilities is provided in **section 6.5**. Construction ancillary facilities are shown in overview in **Figure 6-1** and relative to the project's project footprint in **Figure 6-2** to **Figure 6-10**.

The concept design will continue to be refined where relevant to improve road network and safety performance, minimise impacts on receivers and the environment, and in response to feedback from stakeholders and the community. Changes made to the design may be subject to further assessment and consultation, if required by the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).

6.1.1 General principles of the construction strategy

General principles of the construction strategy for the project include:

- The project would be constructed:
  - Generally in accordance with the description of the project in this EIS or as amended by the description in the Submissions and Preferred Infrastructure Report
  - In accordance with all procedures, commitments, preventative actions, performance criteria and mitigation measures set out in the EIS or as amended in the Submissions and Preferred Infrastructure Report (if required), and the project approval
- Design and plan efficient site layouts that ensure the safety of project staff and the public
- Make construction staging and sequencing as safe and efficient as possible, providing a simplified construction process (where practical) and assisting to minimise the duration and significance of impacts from construction works on nearby receivers
- Minimise the length of the construction period and the duration of construction activities, which would assist in minimising the duration of impacts on nearby receivers during construction
- Minimise disruptions to traffic on the existing road network - including during peak times - through construction staging and night works (where appropriate), to allow for safe construction while maintaining vehicle movements on the existing road network
- Where possible, locate temporary construction facilities on sites where permanent works are proposed
- Achieve safe, efficient and convenient access for construction vehicles, plant and equipment, while minimising impacts on the local road network by using state, regional and arterial roads, where possible, for heavy vehicle construction traffic. Some use of local roads by heavy vehicles delivering materials and/or equipment may be required, however this would be minimised as far as practicable
- Minimise adverse changes to the safety, efficiency and accessibility of road and related transport networks (including public transport and pedestrian and cyclist paths) and ensure ongoing community access and connectivity
- Minimise interdependencies between the construction disciplines of tunnelling, surface works, and mechanical and electrical fitout and commissioning to allow for construction activities to occur at the same time, reducing the duration and impact of construction works
- Manage risks to existing infrastructure including roads, railways, utilities and services

- Minimise impacts on parking by providing off-street parking for the construction workforce and encouraging the use of alternative transport (such as buses and light rail) to construction ancillary facilities and construction work sites, where practical
- Manage community and environmental issues including noise, access, amenity and general disruption
- Carry out construction during the hours detailed in the project approval.

6.1.2 Construction staging

As described in **Chapter 5** (Project description), the project would be constructed and opened to traffic in two stages.

Stage 1 would include:

- Construction of the mainline tunnels between the M4 East at Haberfield and the New M5 at St Peters, stub tunnels to the Rozelle interchange (at the Inner West subsurface interchange) and ancillary infrastructure at the Darley Road motorway operations complex (MOC1) and Campbell Road motorway operations complex (MOC5)
- These works are anticipated to commence in 2018 with the mainline tunnels open to traffic in 2022. At the completion of Stage 1, the mainline tunnels would operate with two traffic lanes in each direction. This would increase to generally four lanes at the completion of Stage 2, when the full project is operational.

Stage 2 would include:

- Construction of the Rozelle interchange and Iron Cove Link including:
  - Connections to the stub tunnels at the Inner West subsurface interchange (built during Stage 1)
  - Ancillary infrastructure at the Rozelle West motorway operations complex (MOC2), Rozelle East motorway operations complex (MOC3) and Iron Cove Link motorway operations complex (MOC4)
  - Connections to the surface road network at Lilyfield and Rozelle
  - Construction of tunnels, ramps and associated infrastructure as part of the Rozelle interchange to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project
- Stage 2 works are expected to commence in 2019 with these components of the project open to traffic in 2023.

The total construction period for both stages of the project is expected to be around five years, which includes commissioning that would occur concurrently with the final stages of construction. Further staging details would be confirmed when construction contractors have been engaged.

The potential benefits of a staged opening of the project are detailed in **Chapter 4** (Project development and alternatives). An assessment of the traffic and transport impacts of opening the project in stages is included in **Chapter 8** (Traffic and transport).

Stage 1 – mainline tunnels

The key elements of the project that would be constructed during Stage 1 include:

- Temporary access tunnels to provide construction access to the mainline tunnels from the following construction ancillary facilities:
  - Parramatta Road West civil and tunnel site (C1b) at Ashfield
  - Darley Road civil and tunnel site (C4) at Leichhardt
  - Pyrmont Bridge Road tunnel site (C9) at Camperdown
  - Campbell Road civil and tunnel site (C10) at St Peters

- Twin, mainline tunnels connecting the M4 East/Wattle Street interchange at Haberfield and the New M5/St Peters interchange at St Peters
- Finishing works, including pavement and line marking, at the Wattle Street interchange and the St Peters interchange (which are being built as part of the M4 East and New M5 projects respectively) to integrate the M4–M5 Link entry and exit ramps into these interchanges
- Underground stub tunnels at the Inner West subsurface interchange that would enable future connections between the mainline tunnels and the Rozelle interchange
- Mechanical and electrical fitout of a section of the Parramatta Road ventilation facility (being built as part of M4 East project) to enable use of this facility by the M4-M5 Link project
- Construction of the Darley Road motorway operations complex (MOC1) at Leichhardt including the permanent water treatment facility and substation
- Construction of The Campbell Road motorway operations complex (MOC5) at St Peters including the Campbell Road ventilation facility and an intake substation for the mainline tunnels
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- Earthworks and landscaping works adjacent to permanent operational infrastructure such as the Campbell Road ventilation facility, the Darley Road water treatment facility and electrical substations.

Rehabilitation and landscaping works around the Wattle Street interchange at Haberfield and the St Peters interchange at St Peters would be in accordance with the respective M4 East and New M5 project conditions of approval and Urban Design and Landscape Plans that have been prepared for these projects.

Stage 2 – Rozelle interchange and Iron Cove Link

The key elements of the project that would be constructed during Stage 2 include:

- Tunnel connections between the stub tunnels at the Inner West subsurface interchange (constructed as part of Stage 1), the Rozelle interchange, the Iron Cove Link and the surface road network
- Tunnel portals, dive structures and cut-and-cover tunnels to connect the Rozelle interchange and the Iron Cove Link with the surface road network
- Upgrades and modifications to the surface road network at Lilyfield and Rozelle including City West Link, The Crescent and Victoria Road/Anzac Bridge approach
- Widening and realignment of Victoria Road at the eastern abutment of Iron Cove Bridge to allow for the tunnel portals, dive structures and cut-and-cover tunnels associated with the Iron Cove Link to be built between the Victoria Road eastbound (northern) and westbound (southern) carriageways
- Civil construction to provide connections to the proposed future Western Harbour Tunnel and Beaches Link, including:
  - Tunnels that would allow for underground connections between the M4 East and New M5 motorways and the proposed future Western Harbour Tunnel and Beaches Link (via the M4-M5 Link mainline tunnels)
  - A dive structure, portals and entry and exit ramps (below ground) extending from the Rozelle Rail Yards to the Western Harbour Tunnel and Beaches Link connection tunnels. This would enable future surface connections between the City West Link/The Crescent intersection and the proposed future Western Harbour Tunnel and Beaches Link tunnels
- Minor surface works to local roads
- A constructed wetland, a bioretention basin, bioretention swales and drainage channels at the Rozelle interchange within the Rozelle Rail Yards
- Naturalisation of a section of Whites Creek between The Crescent and Rozelle Bay

- Upgrade and widening of the culvert between the Rozelle Rail Yards and Rozelle Bay, including construction of a new headwall and outlet into Rozelle Bay northeast of the City West Link/The Crescent intersection
- A bioretention facility within King George Park, adjacent to Manning Street at Rozelle, and upgrades to the drainage network along Byrnes Street to pipe water from Victoria Road to the new bioretention facility. Construction works would also include upgrades and improvements to the informal car park at this location. An equivalent number of car parking spaces would be provided as a result of these upgrades and improvements
- Construction of the Rozelle West motorway operations complex (MOC2) including a ventilation supply building and a substation
- Construction of the Rozelle East motorway operations complex (MOC3) including a ventilation exhaust facility and three ventilation outlets. Two of these ventilation outlets would be used for the M4-M5 Link project. The third outlet would be constructed for use by the proposed future Western Harbour Tunnel and Beaches Link project. This outlet would only become operational if this project is approved
- Construction of the Iron Cove Link motorway operation complex (MOC4) including the Iron Cove Link ventilation facility. This facility would be split with the ventilation outlet located between the eastbound and westbound Victoria Road carriageways and the ventilation exhaust facility and associated infrastructure located south of Victoria Road between Springside Street and Toelle Street
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- New and upgraded pedestrian and cyclist facilities at Rozelle and Lilyfield
- Earthworks and landscaping works, including:
  - Adjacent to permanent operational infrastructure such as ventilation facilities, water treatment facilities and substations
  - Adjacent to disturbed areas, such as surface roads that are being upgraded and improved as part of the project
  - Within the Rozelle Rail Yards, associated with the provision of new open space at this location
  - Around the Iron Cove Link tunnel portals, and south of Victoria Road at Rozelle between around Springside Street and Byrnes Street.

The construction strategy recognises that project delivery duration is significantly influenced by the complexity and magnitude of the interfaces between tunnelling activities and the construction of the surface civil structures and would seek to reduce the overall duration of construction, to minimise risk to delivery timing and impacts on nearby communities, including cumulative impacts from construction at Haberfield and St Peters.

6.2 Construction program

As described in **section 6.1.2,** the project would be constructed and opened to traffic in two stages. An indicative construction program is shown in **Table 6-2**.

Table 6-2 Indicative construction program

Construction activity	Indicative construction timeframe 2018				2019				2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Mainline tunnels																								
Site establishment and establishment of construction ancillary facilities			■	■	■	■	■	■	■	■														
Utility works and connections			■	■	■	■	■	■																
Tunnel construction				■	■	■	■	■	■	■	■	■	■											
Portal construction				■	■	■	■	■																
Construction of permanent operational facilities												■	■	■	■	■								
Mechanical and electrical fitout works														■	■	■								
Establishment of tolling facilities															■	■								
Site rehabilitation and landscaping																■	■	■	■					
Surface road works																	■	■	■					
Demobilisation and rehabilitation																			■	■				
Testing and commissioning																■	■	■	■	■				
Rozelle interchange and Iron Cove Link																								
Site establishment and establishment of construction ancillary facilities				■	■	■	■	■	■															
Utility works and connections and site remediation				■	■	■	■	■																
Tunnel construction									■	■	■	■	■	■	■	■	■	■						
Portal construction						■	■	■	■															
Construction of surface road works						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Construction of permanent operational facilities						■	■	■	■	■	■	■	■	■	■	■								
Mechanical and electrical fitout works													■	■	■	■	■	■	■	■				
Establishment of tolling facilities																		■	■					
Site rehabilitation and landscaping																			■	■	■			
Demobilisation and rehabilitation																						■	■	
Testing and commissioning																			■	■	■	■	■	

6.3 Project footprint

The area required for construction and/ or operation of the project is referred to as the 'project footprint'. The project footprint comprises the construction ancillary facility footprint (see **section 6.5** for details about construction ancillary facilities) and additional areas where work would be required to construct the project. In addition, utility works to support the project would occur within and outside the project footprint. These are identified as areas of interest in **Appendix F** (Utilities Management Strategy).

An overview of the project footprint is shown in **Figure 6-1**, with greater detail provided in **Figure 6-2** to **Figure 6-10**. The types of activities that would occur within the project footprint are identified in **section 6.4**.

Figure 6-1 Overview of project footprint and construction ancillary facilities

Figure 6-2 Project footprint – Map 1 (Option A)

LEGEND

Imagery © Nearmap (2017)

M4 East
- Tunnel
- Surface road
- Land subject to M4 East UDLP

M4-M5 Link

Boundaries
- Project footprint
- Ancillary facility
- Surface works

Underground construction
- Mainline tunnel
- Temporary access tunnel

Project features
- Ventilation outlet
- Ventilation facility

A Includes
- Utility treatments
- Traffic management changes and measures
- Installation of safety and environmental controls
- Establishment of temporary pedestrian and cyclist diversions (if required)

Figure 6-3 Project footprint – Map 1 (Option B)

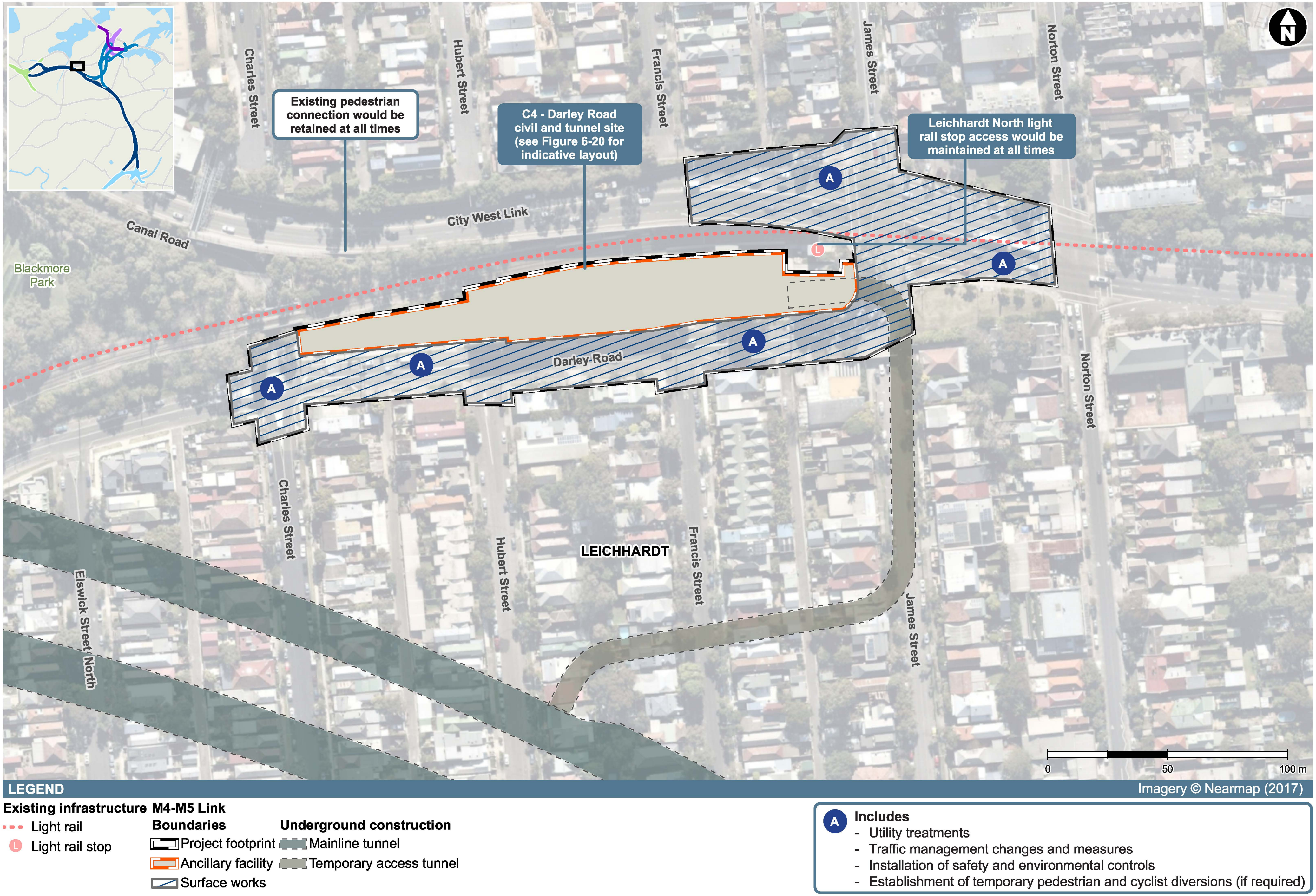


Figure 6-4 Project footprint – Map 2

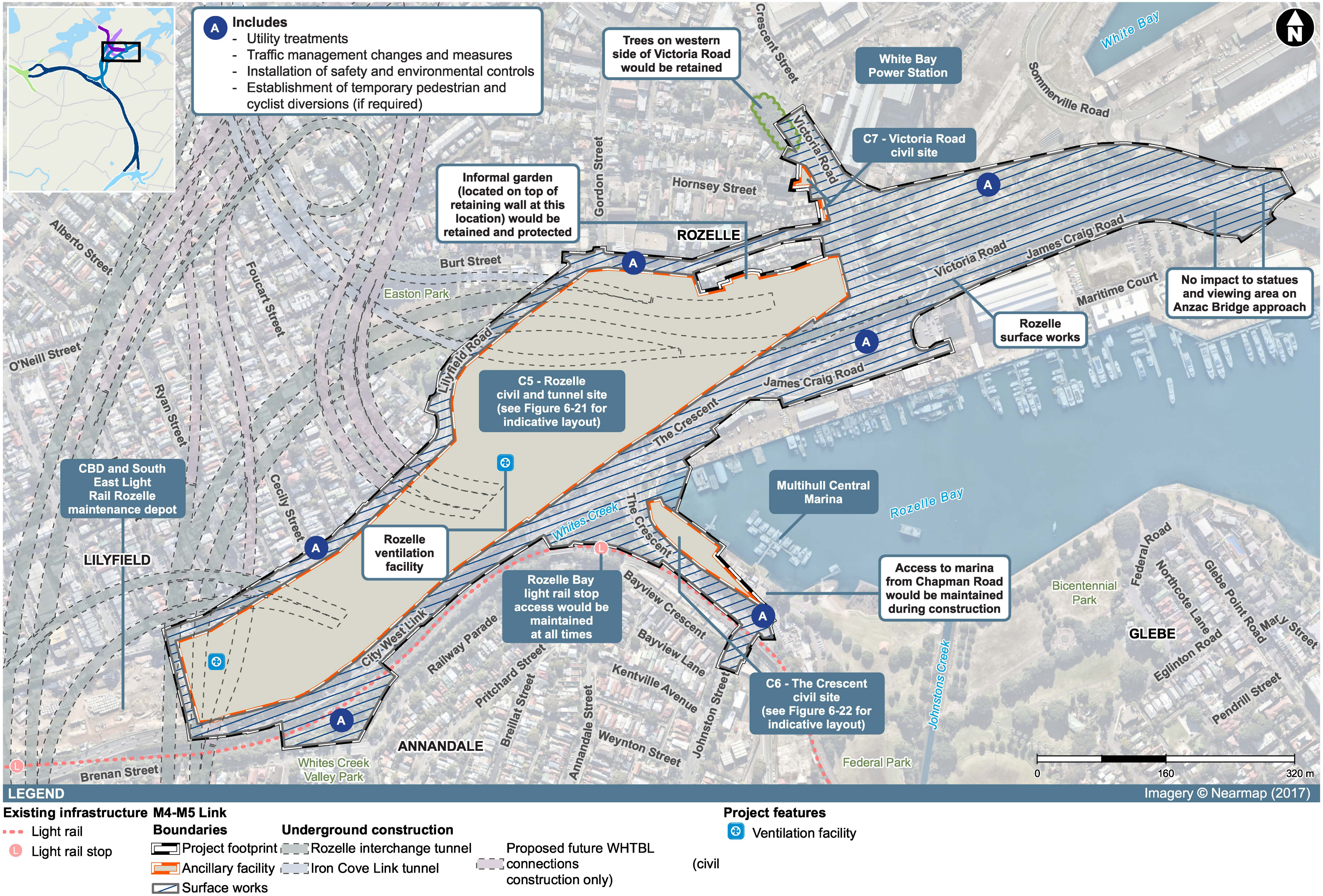
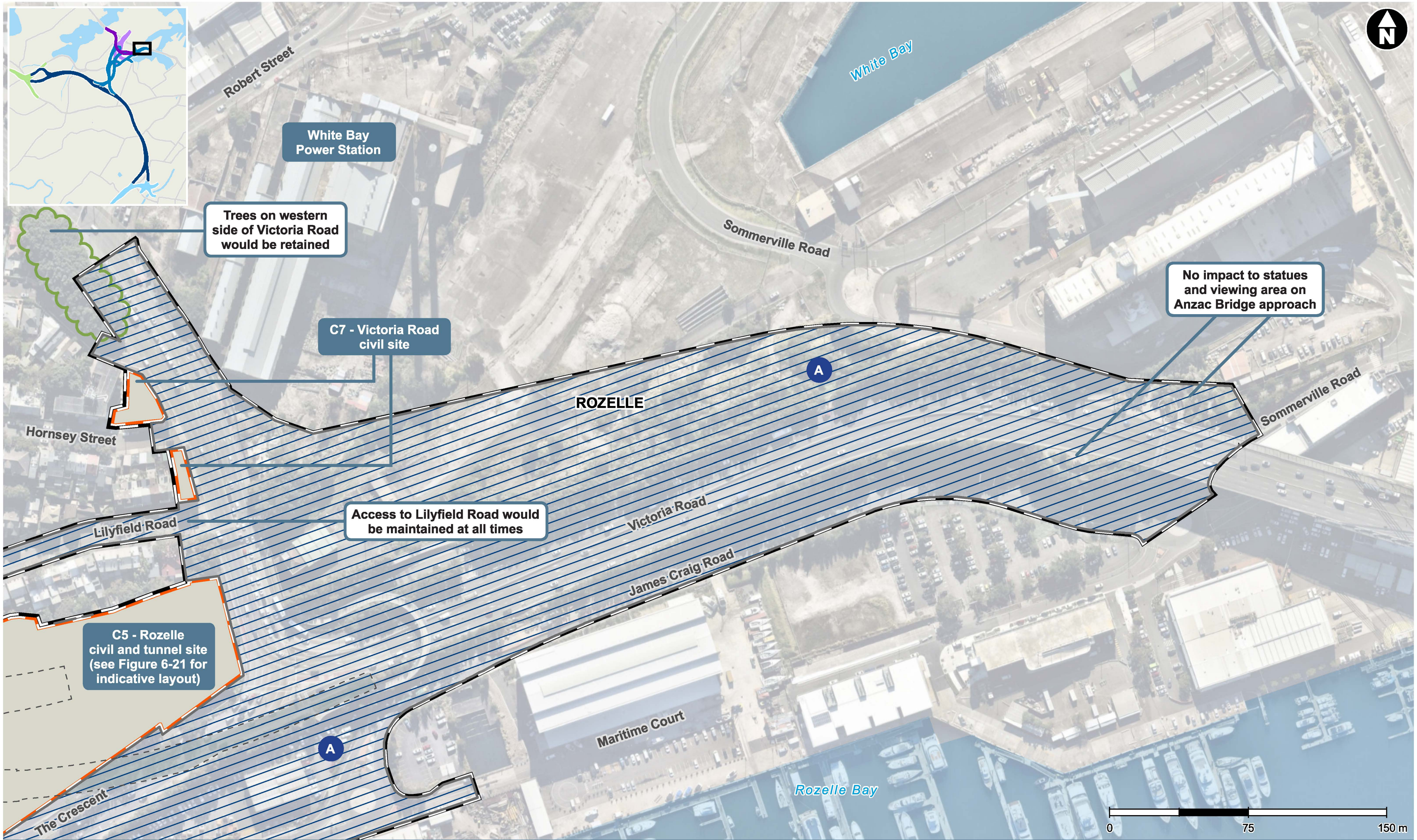


Figure 6-5 Project footprint – Map 3



LEGEND

Imagery © Nearmap (2017)

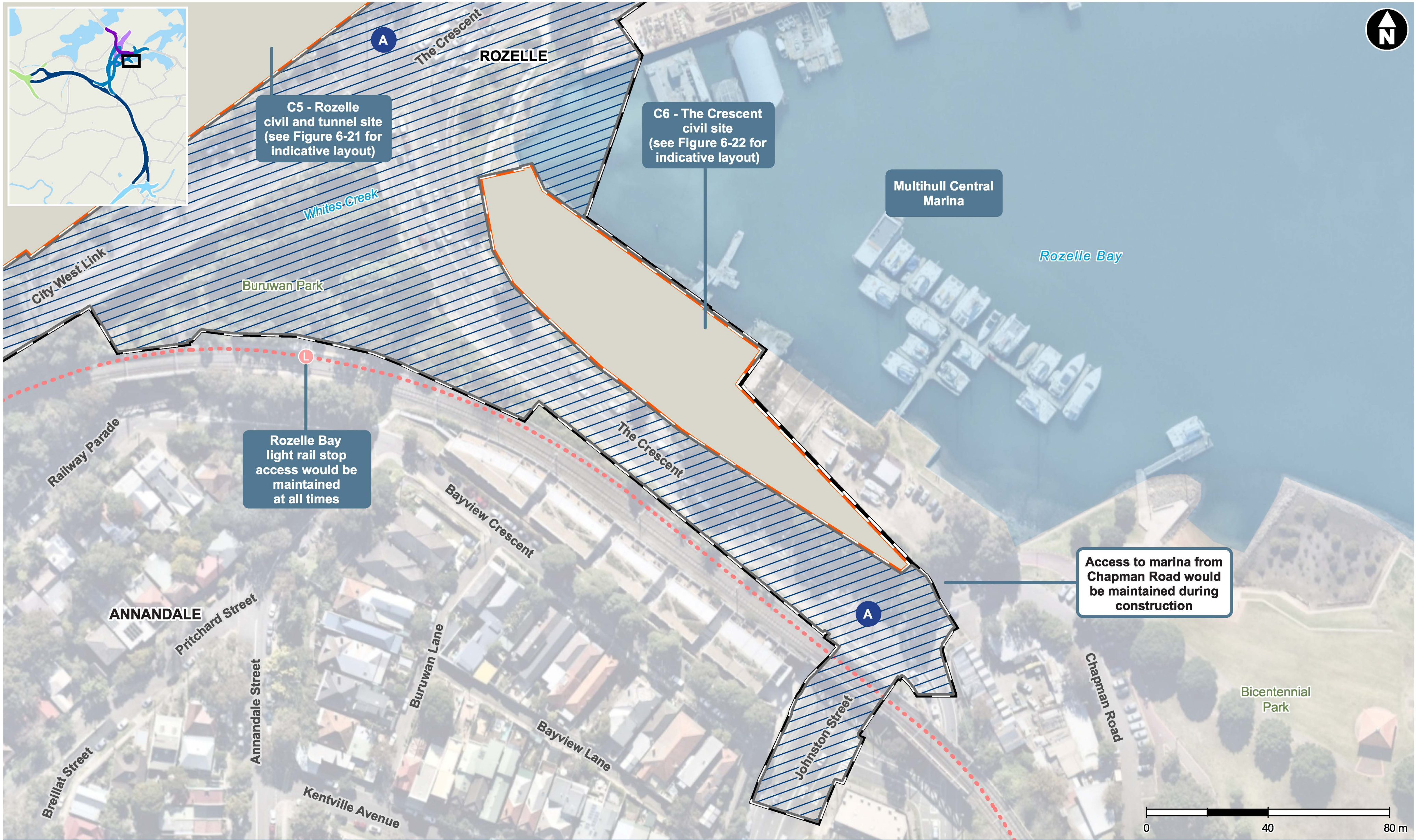
M4-M5 Link

Boundaries
- Project footprint
- Ancillary facility
- Surface works

Underground construction
- Rozelle interchange tunnel

A Includes
- Utility treatments
- Traffic management changes and measures
- Installation of safety and environmental controls
- Establishment of temporary pedestrian and cyclist diversions (if required)

Figure 6-6 Project footprint – Map 4



LEGEND

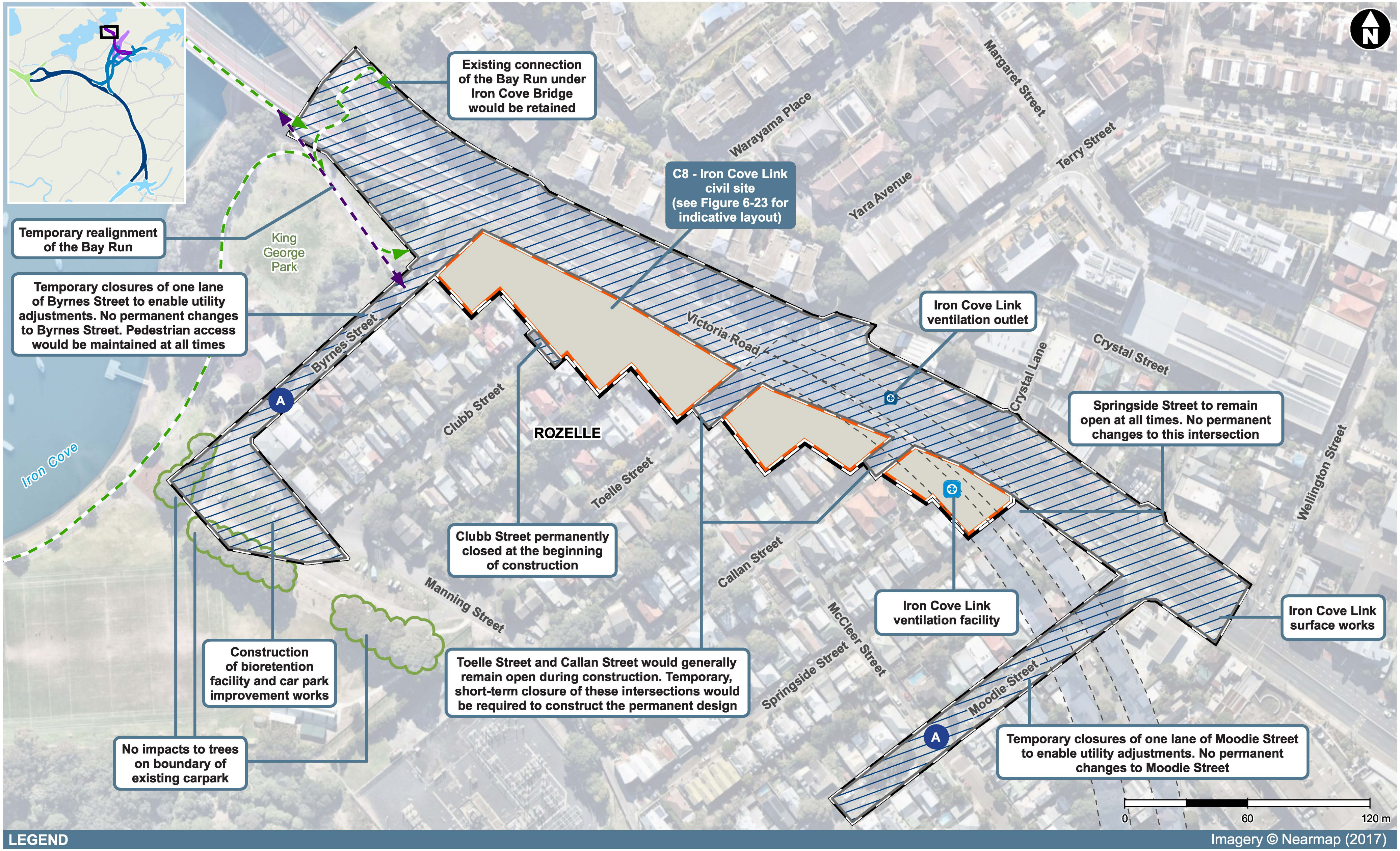
Imagery © Nearmap (2017)

Existing infrastructure
- Light rail
- Light rail stop

M4-M5 Link
Boundaries
- Project footprint
- Ancillary facility
- Surface works

A Includes
- Utility treatments
- Traffic management changes and measures
- Installation of safety and environmental controls
- Establishment of temporary pedestrian and cyclist diversions (if required)

Figure 6-7 Project footprint – Map 5



LEGEND

M4-M5 Link

Boundaries
- Project footprint
- Ancillary facility
- Surface works

Underground construction
- Iron Cove Link tunnel

Project features
- Ventilation outlet
- Ventilation facility

The Bay Run
- Existing shared path
- Temporary diversion

A Includes
- Utility treatments
- Traffic management changes and measures
- Installation of safety and environmental controls
- Establishment of temporary pedestrian and cyclist diversions (if required)

Figure 6-8 Project footprint – Map 6

LEGEND

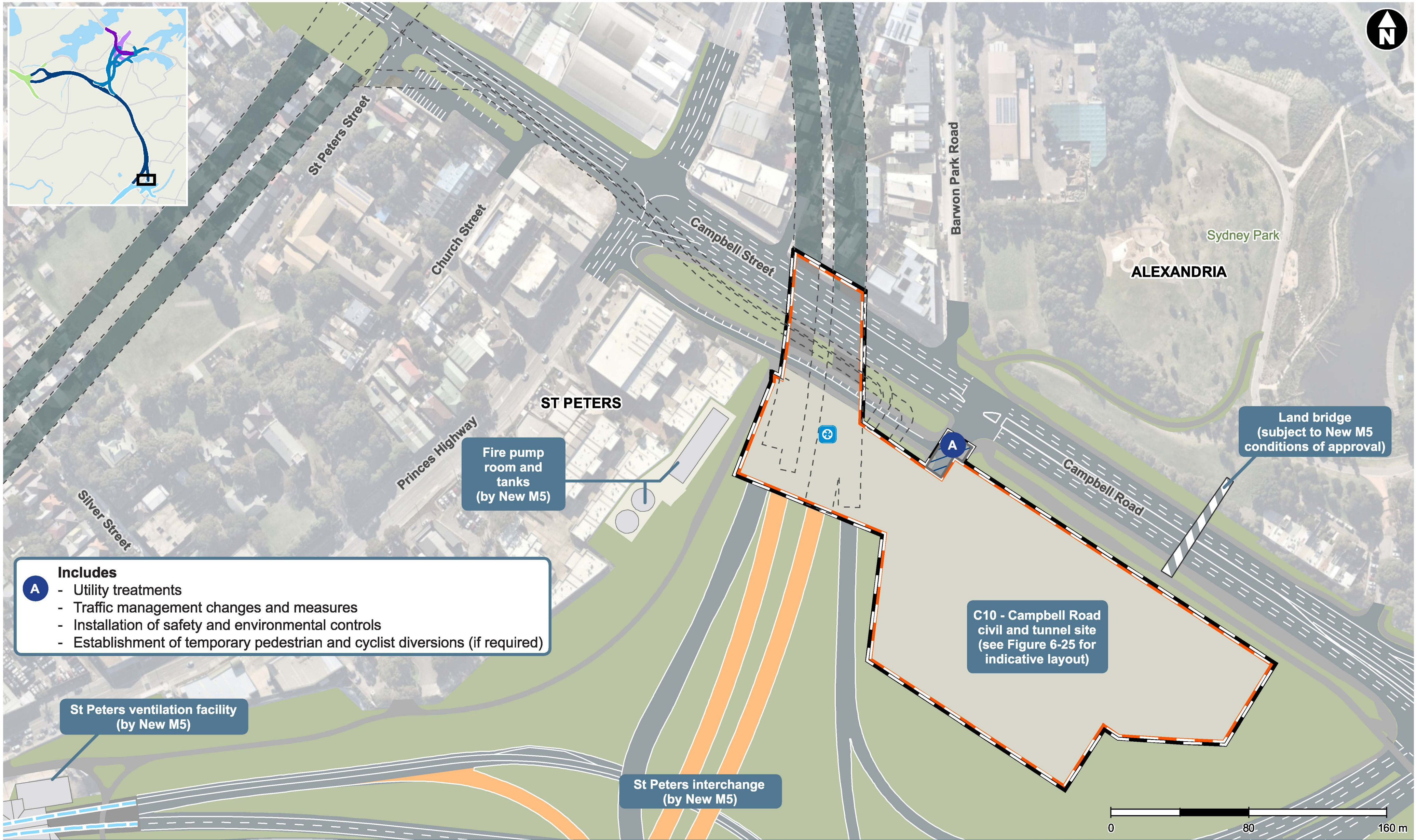
M4-M5 Link

Boundaries
- Project footprint
- Ancillary facility
- Surface works

Underground construction
- Mainline tunnel
- Temporary access tunnel

A Includes
- Utility treatments
- Traffic management changes and measures
- Installation of safety and environmental controls
- Establishment of temporary pedestrian and cyclist diversions (if required)

Figure 6-9 Project footprint – Map 7



LEGEND

New M5
- Tunnel
- Proposed future Sydney Gateway connections (non-operational as part of M4-M5 Link)
- Building
- Surface road
- Shared path
- Land subject to New M5 conditions of approval

M4-M5 Link

Boundaries
- Project footprint
- Ancillary facility
- Surface works

Underground construction
- Mainline tunnel
- Temporary access tunnel

Project features
- Ventilation facility

Figure 6-10 Project footprint – Map 8

6.4 Project construction activities

The proposed construction activities for the project would include site establishment and enabling works, tunnelling activities, and surface civil, road and building works. These activities are summarised in **Table 6-3** and detailed in the respective sections of this chapter.

Table 6-3 Overview of construction activities

Component	Typical activities
Site establishment and enabling works	• Vegetation clearing and removal • Utility works • Traffic management measures • Install safety and environmental controls • Install site fencing and hoarding • Establish temporary noise attenuation measures • Demolish buildings and structures • Carry out site clearing • Heritage salvage or conservation works (if required) • Establish construction ancillary facilities and access • Establish acoustic sheds • Supply utilities (including construction power) to construction facilities • Establish temporary pedestrian and cyclist diversions
Tunnelling	• Construct temporary access tunnels • Excavate mainline tunnels, entry and exit ramps and associated tunnelled infrastructure and install ground support • Spoil management and haulage • Finishing works in tunnel and provision of permanent tunnel services • Test plant and equipment
Surface earthworks and structures	• Vegetation clearing and removal • Topsoil stripping • Excavate new cut and fill areas • Construct dive and cut-and-cover tunnel structures • Install stabilisation and excavation support (retention systems) such as sheet pile walls, diaphragm walls and secant pile walls (where required) • Construct required retaining structures • Excavate new road levels
Bridge works	• Construct piers and abutments • Construct headstocks • Construct bridge decks, slabs and girders • Demolish and remove redundant bridges
Drainage	• Construct new pits and pipes • Construct new groundwater drainage system • Connect drainage to existing network • Construct sumps in tunnels as required • Construct water quality basins, constructed wetland, and bioretention facility and basin • Construct drainage channels • Construct spill containment basin • Construct onsite detention tanks • Adjustments to existing drainage infrastructure where impacted • Carry out widening and naturalisation of a section of Whites Creek • Demolish and remove redundant drainage
Pavement	• Lay select layers and base • Lay road pavement surfacing • Construct pavement drainage

Component	Typical activities
Operational ancillary facilities	• Install ventilation systems and facilities • Construct water treatment facilities • Construct fire pump rooms and install water tanks • Test and commission plant and equipment • Construct electrical substations to supply permanent power to the project
Finishing works	• Line mark to new road surfaces • Erect directional and other signage and other roadside furniture such as street lighting • Erect toll gantries and other control systems • Construct pedestrian and cyclist paths • Carry out earthworks at disturbed areas to establish the finished landform • Carry out landscaping • Closure and backfill of temporary access tunnels (except where these are to be used for inspection and/or maintenance purposes) • Site demobilisation and preparation of the site for a future use

6.4.1 Site establishment and establishment of construction ancillary facilities

Site establishment works for major infrastructure are typically commenced before the start of substantial construction to make ready the key construction sites, including construction ancillary facilities, and provide protection to the public. Site establishment works are expected to include the following:

- Vegetation clearing and removal
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities, and the installation of new utilities
- Installation of traffic management measures and changes
- Installation of sediment and erosion control measures
- Installation of other environmental controls (such as screening and noise attenuation)
- Installation of site fencing and hoarding
- Demolition and clearing of structures, including buildings
- Heritage salvage (if required)
- Establishment of acoustic sheds
- Installation of site offices and crib rooms
- Establishment of temporary pedestrian and cyclist diversions.

6.4.2 Tunnelling

Tunnel excavation

The project would involve tunnel excavation for:

- Twin mainline tunnels, each around 7.5 kilometres long, including connections to the Wattle Street and St Peters interchanges
- The Rozelle interchange, including entry and exit ramps to connect with the surface road network
- The Iron Cove Link
- Connections to the proposed future Western Harbour Tunnel and Beaches Link tunnels at Rozelle
- Temporary access tunnels
- Pedestrian cross-passages and longitudinal egress passages for emergency egress

- Vehicular cross-passages
- Low point sumps (engineered depressions in which water collects). Collected water would be piped to a water treatment facility
- Ventilation tunnels.

The depth of the tunnels below ground level would vary according to geological conditions. The deepest point of the tunnel crowns (top of the tunnels) would be about 65 metres below ground level, with shallower sections approaching the interchanges and the connections to the surface road network. The indicative depths of the tunnel below ground level are shown in **Figure 6-11** (mainline tunnels) and **Figure 6-12** (Rozelle interchange and Iron Cove Link). A long-section of the tunnels is included in **Appendix E** (Geological long-sections).

The tunnel excavation methods would be confirmed by the contractors engaged to construct the project. An indicative description of the likely tunnel excavation process is provided below. It is anticipated that the tunnels would be excavated using a heading and bench construction methodology as determined in **Chapter 4** (Project development and alternatives). Excavation of the heading (top section of the tunnel) would be carried out using roadheaders, launched from the tunnelling sites. A roadheader is an excavation machine consisting of a boom-mounted, rotating cutter head fitted on bulldozer-style tracks (for moving the machine around), and a loader device (usually on a conveyor). An indicative tunnel excavation method using roadheaders is illustrated in **Figure 6-13**.

The bench (lower section) in the mainline tunnels could be excavated using a profiler or roadheader. Another technique that may be used for excavating the bench is by controlled blasting, which would reduce the reliance on roadheaders. The controlled blasting method involves a sequence of:

- Drilling holes and charging the holes with explosive
- Blasting
- Removal of loosened material (mucking out).

Blasting methods can significantly reduce potential exposure to noise and vibration for residents and businesses above the tunnels. If blasting is proposed, a Blast Management Strategy will be prepared in accordance with relevant guidelines before blasting begins. Blast patterns would be designed and sequenced to minimise impacts of vibration on properties above the tunnels and on existing below ground infrastructure such as utilities. Blasting would only be undertaken underground and only in locations where the geology is suitable for safe and effective use. An assessment of the impacts on receivers at the surface from blasting during construction is provided in **Chapter 10** (Noise and vibration). Entry and exit ramp tunnels would be constructed primarily using roadheaders.

Cross-passages between the tunnels would typically be about 5.4 metres wide. Some cross-passages would be used to move excavation machinery between the tunnels, to allow movement of plant in both directions. Cross-passages would typically be excavated by blasting techniques, excavated by roadheaders or excavators with rock hammers.

For the entry and exit ramps, connection to an adjoining tunnel is in some cases impractical and therefore the use of longitudinal egress passages would be required. Longitudinal egress passages would be constructed where the adjoining entry and exit ramps are separated by long distances, are at significantly different elevations or are on either side of the mainline tunnels, which prevents the use of a level cross-passage. Where the ramps begin to move closer to each other, both in separation distance and elevation, the longitudinal egress passages would end and cross-passages would be provided. Cross-passages would typically be excavated by blasting techniques, roadheaders or excavators with rock hammers.

Ground support, including rock bolting and shotcrete, would be installed as the tunnelling face is advanced. Tunnel lining would also be installed progressively following tunnel excavation. The type of lining would depend on the local geology and groundwater inflows:

- In areas that are predominantly dry and occur within low permeability sandstone, a sprayed shotcrete lining will generally be used
- In areas with medium groundwater inflows, a sprayed or sheet waterproofing membrane could be installed, with a shotcrete or cast in situ concrete secondary lining
- Where there are significant groundwater inflows, grouting may also be used to reduce the permeability of the surrounding rock mass.

Tunnelling launch and support sites would be required, as outlined in **section 6.5**. Each tunnelling site would provide support services for the tunnelling activity including power supply, ventilation, water supply, construction water treatment plants, workforce facilities, and spoil handling and removal areas and facilities. At the tunnel launch sites, construction access tunnels that connect to the tunnels would be excavated in generally the same manner as the tunnels.

In addition to the tunnels and entry and exit ramps, the following tunnelled infrastructure would be constructed using either roadheaders, excavators with rock hammers, or blasting:

- Temporary access tunnels to access the road and ventilation tunnels from construction ancillary facilities
- Ventilation shafts and tunnels
- Niches for underground substations
- Breakdown and maintenance bays.

Tunnel civil finishing works

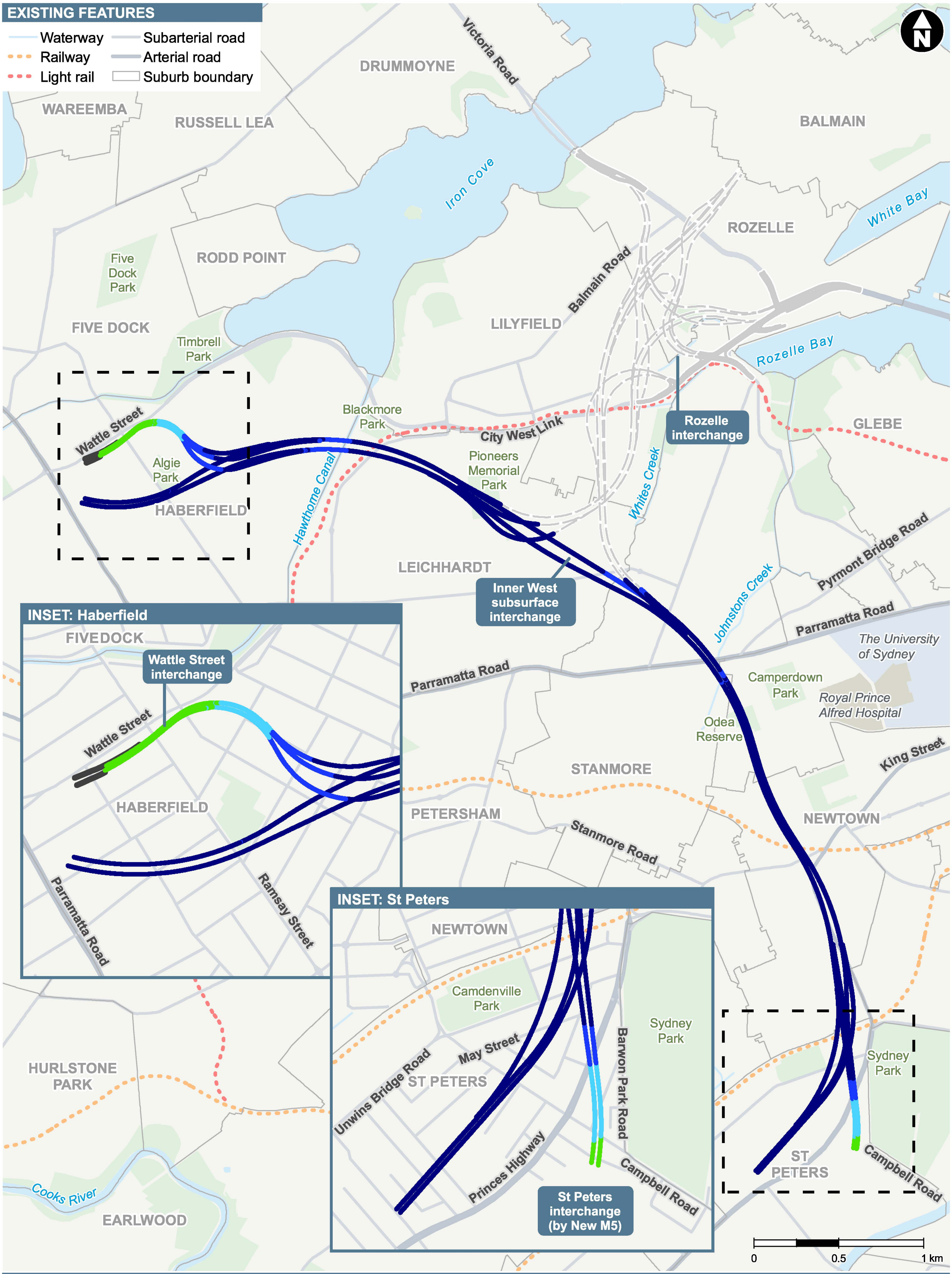
On completion of the tunnel excavation works, a variety of civil finishing works would be carried out, including:

- Installation of stormwater and groundwater drainage systems, including sumps
- Application of waterproofing membrane (where required)
- Finishing of:
  - Cross-passages and longitudinal egress passages
  - Substation niches
- Pavement construction and line marking
- Installation of:
  - Electrical and communication conduits
  - Deluge and hydrant fire mains
  - Road furniture (eg lighting, signage)
  - Architectural panels
- Painting.

Tunnel fitout

Following tunnel excavation and civil finishing works, the tunnels would be fitted out with operational infrastructure including power, ventilation systems, fire safety systems, communications, traffic control device and systems, tunnel lighting, tolling infrastructure and the operations management and control systems.

This would be followed by a comprehensive commissioning process to validate the operation and integration of tunnel systems before the M4-M5 Link tunnels open.



LEGEND

M4-M5 Link

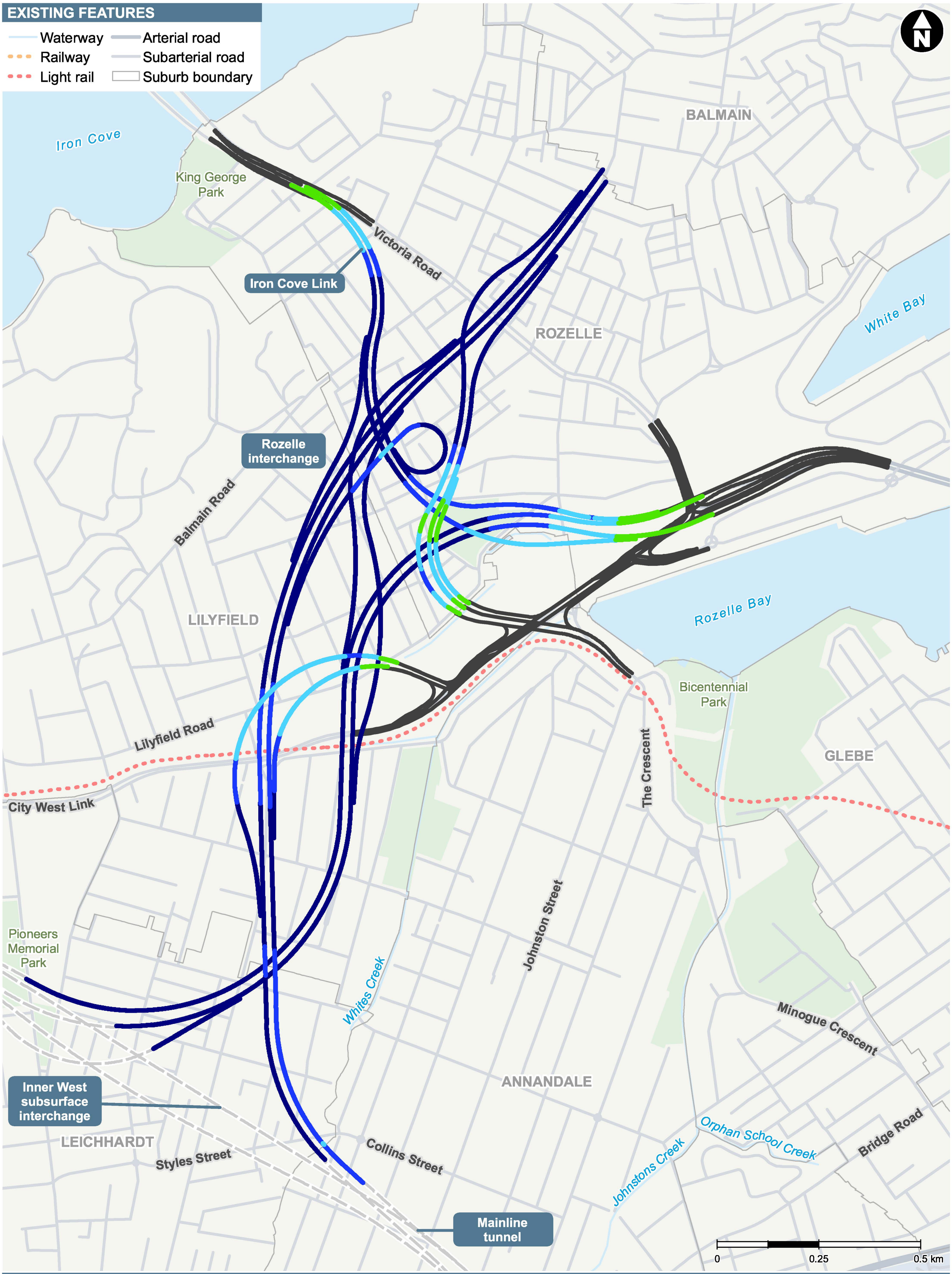
Mainline tunnel

- Above ground
- Ground surface to 10m below ground
- 10m below ground to 20m below ground
- 20m below ground to 35m below ground
- Greater than 35m below ground

Note

Depths are based on an assumed 8m tunnel height. Calculations are based on top of tunnel depth from existing ground level and are indicative for illustrative purposes only.

Figure 6-11 Indicative tunnel depths - mainline tunnels



LEGEND

M4-M5 Link

Rozelle interchange and Iron Cove Link

- Above ground
- Ground surface to 10m below ground
- 10m below ground to 20m below ground
- 20m below ground to 35m below ground
- Greater than 35m below ground

Note
Depths are based on an assumed 8m tunnel height. Calculations are based on top of tunnel depth from existing ground level and are indicative for illustrative purposes only.

Figure 6-12 Indicative tunnel depths - Rozelle interchange and Iron Cove Link

Excavation Sequence

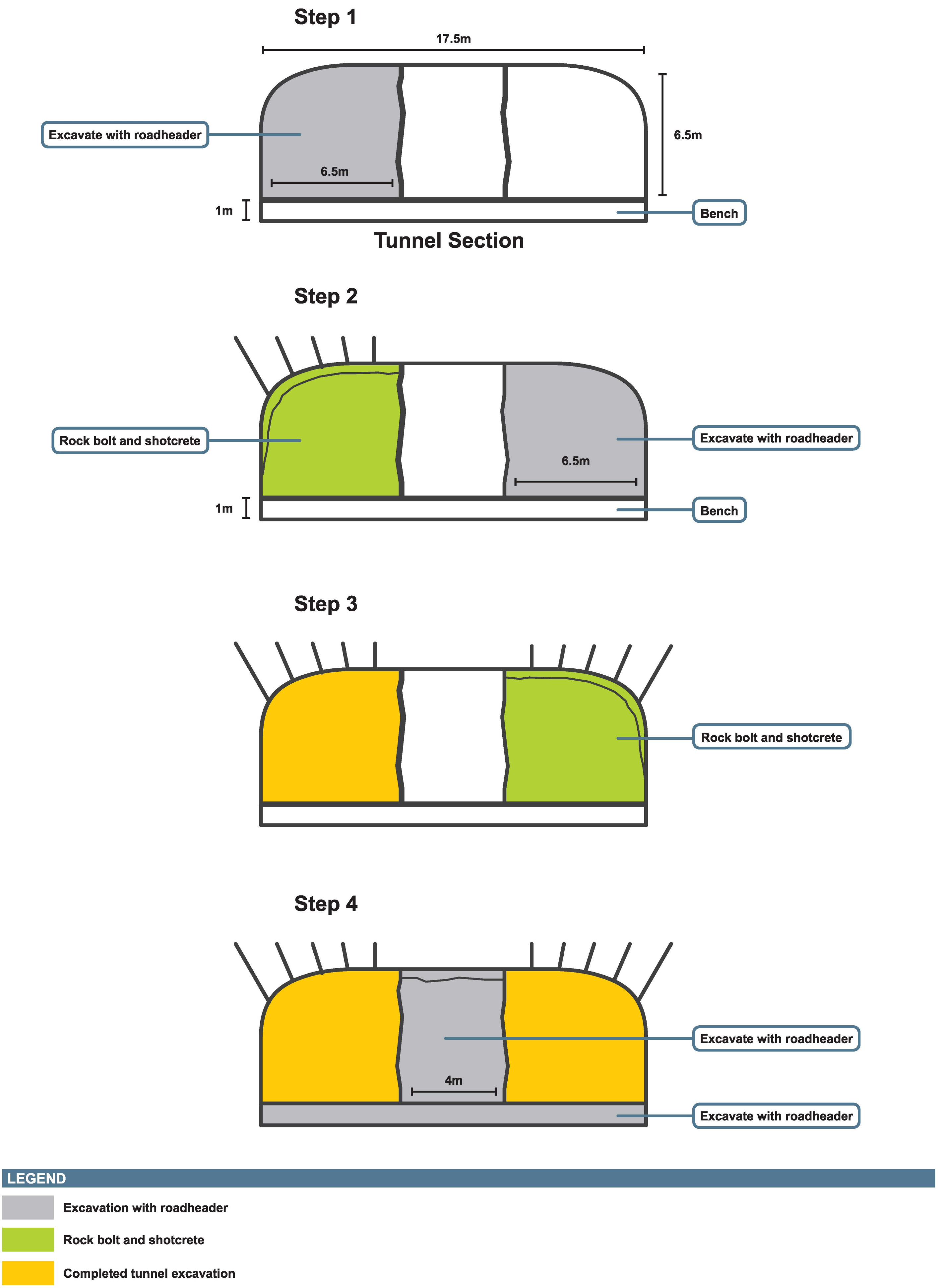


Figure 6-13 Indicative roadheader excavation method

Other bulk earthworks

In addition to tunnel excavation, bulk earthworks would be required for:

- Tunnel dive and cut-and-cover structures
- Managing any contaminated land identified or encountered during site establishment and construction. Further information on contamination is provided in **Chapter 16** (Contamination)
- Constructing the public open space at the Rozelle Rail Yards and around the Iron Cove Link tunnel portals
- Surface road works
- Constructing road and pedestrian and cyclist bridges
- Drainage structures including the constructed wetland, drainage channels, bioretention swales and a bioretention facility
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities.

'Cut-and-cover' is a tunnel excavation methodology that generally involves excavating downwards from the surface of the ground, and installing a tunnel structure including a base, walls and a roof. Once the roof is in place, surface activity can generally resume as construction works continue below. Five cut-and-cover structures would be constructed for the project at locations where the tunnels are close to the surface (ie at the tunnel portals) including:

- Tunnel portals at the Rozelle interchange, comprising:
  - The New M5 to City West Link tunnel portals
  - The M4 East and Iron Cove Link to Victoria Road/Anzac Bridge tunnel portals
  - The proposed future Western Harbour Tunnel and Beaches Link to City West Link/The Crescent tunnel portals
- The Iron Cove Link tunnel portals on Victoria Road at Rozelle near the eastern abutment of Iron Cove Bridge
- A cut-and-cover structure about 60 metres long over the southbound exit ramp at the St Peters interchange, to extend the tunnel to accommodate ventilation exhaust arrangements.

Cut-and-cover structures for the entry and exit ramps at the Wattle Street interchange are being constructed as part of the M4 East project.

Typical construction activities associated with these structures would include:

- Excavation
- Stabilisation and excavation support (retention systems) such as sheet pile walls, diaphragm walls and secant pile walls (where required)
- Piling works
- Construction of pile capping beams
- Installation of temporary and permanent roof beams
- Installation of permanent struts and form, reinforcement and pouring of horizontal beams used for bracing and support
- Waterproofing
- Finishing works.

Surface works

Earthworks would be required for the construction of above ground sections of the project, including the Rozelle surface works and the Iron Cove Link surface works. Earthworks for surface works would be completed using conventional methods of construction and may include the following:

- Vegetation clearing and topsoil stripping
- Areas of new cut and fill, and widening of existing cuts and embankments, including construction of retaining walls and reinforced soil walls to design levels
- Installation of drainage infrastructure
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities.

6.4.3 Bridge works

The project would involve the replacement of two road bridges and the construction of new pedestrian and cyclist bridges. Details on these new and replacement bridges are provided in **Chapter 5** (Project description). Construction of new and replacement bridges would generally involve:

- For road bridges, establishment of traffic management controls to create safe work areas and maintain traffic flow
- Construction of the substructure (piers and abutments), likely to be from cast in situ concrete, in the following sequence:
  - Piling works, such as driven or bored piles
  - Pile cap construction including localised excavation around the piles
  - Pier or column construction
- Construction of the headstock (pier cap, which transfers loads from the superstructure to the piers)
- Construction of the superstructure (bridge deck, slab and girders), likely to be through the placement of precast concrete segments
- Road pavement installation and associated works
- Installation of street furniture including signage and lighting.

6.4.4 Construction of permanent operational infrastructure

As detailed in section 5.8 of **Chapter 5** (Project description), permanent operational infrastructure would be required for the ongoing management and operation of the project. This operational infrastructure would be mainly located in five motorway operations complexes:

- The Darley Road motorway operations complex (MOC1), to be constructed on the site of the Darley Road civil and tunnel site (C4)
- The Rozelle West motorway operations complex (MOC2), to be constructed on the site of the Rozelle civil and tunnel site (C5)
- The Rozelle East motorway operations complex (MOC3), to be constructed on the site of the Rozelle civil and tunnel site (C5)
- The Iron Cove Link motorway operations complex (MOC4), to be constructed on the site of the Iron Cove civil site (C8). This would also include land between the eastbound and westbound carriageways of Victoria Road to accommodate the ventilation exhaust outlet for the Iron Cove Link ventilation facility
- The Campbell Road motorway operations complex (MOC5), to be constructed on the site of the Campbell Road civil and tunnel site (C10).

Key operational infrastructure to be constructed within the motorway operations complexes would include:

- Two water treatment plants; one at the Darley Road motorway operations complex (MOC1) and one at the Rozelle East motorway operations complex (MOC3)
- Ventilation facilities, including outlets, at the Rozelle West motorway operations complex (MOC2), the Rozelle East motorway operations complex (MOC3), the Iron Cove Link motorway operations complex (MOC4) and the Campbell Road motorway operations complex (MOC5)
- Mechanical and electrical fitout of the Parramatta Road ventilation facility at Haberfield (being constructed by the M4 East project)
- Fire and life safety systems
- Emergency evacuation and extraction infrastructure
- Electrical substations.

Construction activities for these key operational infrastructure components are detailed in the following sections.

Water treatment plants

Water treatment plants are anticipated to be constructed within the Darley Road motorway operations complex (MOC1) and the Rozelle West motorway operations complex (MOC3) (refer to **Chapter 5** (Project description)). In addition, a constructed wetland would be constructed adjacent to the water treatment plant at Rozelle.

The water treatment plants would be constructed using prefabricated components, which would be assembled on site as follows:

- Excavation, footing and base slab installation
- Transport components to site
- Mechanical assembly of operational water treatment plant components, including rising main and discharge pipework
- Complete electrical connections between the operational water treatment plant components and incoming power supply
- Commission the operational water treatment plant.

The construction of the constructed wetland would include:

- Earthworks to form the wetlands
- Installation of a drainage network to guide water
- Provision of inlet and outlets to the wetlands
- Provision of landscaping and plant species relevant to the wetlands area.

Ventilation facilities

Ventilation facilities would be constructed at the following locations:

- Rozelle West motorway operations complex (MOC2) (comprising a ventilation supply facility)
- Rozelle East motorway operations complex (MOC3) (comprising a ventilation exhaust facility, including three outlets)
- Iron Cove Link motorway operations complex (comprising a ventilation exhaust facility, including one outlet) (MOC4)
- Campbell Road motorway operations complex (comprising a ventilation supply facility and a ventilation exhaust facility (including four outlets) (MOC5).

The location of the ventilation facilities are shown in **Chapter 5** (Project description). Construction of the ventilation facilities would generally include:

- Excavation, footing and base slab installation
- Erection of precast or in situ poured concrete wall panels for shaft structure stability
- Installation of precast floor or in situ poured elements at the fan room and damper levels
- Installation of roof panels and stair structures for maintenance, access and monitoring of the facilities
- Fixture of façade support structures to shaft walls as per architectural and urban design requirements
- Internal fitout of plant areas, equipment installation and commissioning.

Fitout and installation works would also occur at the Parramatta Road ventilation facility being built as part of the M4 East project to enable use of a section of this facility by the M4-M5 Link project. These works would include installation of mechanical and electrical equipment and testing and commissioning.

Electrical substations

Intake electrical substations (substations that would connect to the Ausgrid network and would manage the intake and distribution of the project's power needs) are anticipated to be constructed above ground at the following locations:

- Rozelle West motorway operations complex (MOC2) at Rozelle
- Campbell Road motorway operations complex (MOC5) at St Peters.

From the intake substations, electricity would be distributed to the project via the tunnels to connect to substations at the Darley Road motorway operations complex (MOC1), the Rozelle East motorway operations complex (MOC3) and the Iron Cove Link motorway operations complex (MOC4). The project would also include a series of underground substations that would be spaced around 1.2 kilometres apart within the tunnels.

The intake substations would be above ground and would be constructed using prefabricated components where possible. The construction methodology for these facilities would typically involve:

- Excavation, footing and base slab installation
- Construction of concrete blockwork and/or precast walls and installation of roofing
- Installation of architectural treatments and façade systems
- Installation of in-ground services
- Internal fitout and commissioning of electrical infrastructure
- Landscaping and installation of fencing and access gates.

The permanent electricity supply for the project is described in more detail in **Chapter 5** (Project description) and **Appendix F** (Utilities Management Strategy).

Fire pump rooms

Fire pump rooms would be constructed at the Rozelle West motorway operations complex (MOC2). The construction methodology for these facilities would typically involve:

- Excavation, footing and base slab installation
- Construction of fire deluge tanks
- Construction of concrete blockwork walls and precast walls for tank enclosure
- Installation of roofing
- Installation of architectural treatments and façade systems

- Installation of in-ground services
- Internal fitout and commissioning of fire pump infrastructure
- Landscaping and installation of fencing and access gates.

The project would also include internal fitout and commissioning of fire pump rooms at the Parramatta Road ventilation facility (being built by M4 East) and St Peters interchange (being built by New M5).

6.4.5 Drainage and water management infrastructure

The project would require construction of new drainage infrastructure and alterations to existing drainage infrastructure (refer to **Chapter 5** (Project description), **Chapter 15** (Soil and water quality) and **Chapter 17** (Flooding and drainage). It would also require the construction of water management infrastructure, including water treatment plants for the construction and operational phases of the project (see **section 6.4.4** for a description of the construction methodology for water treatment plants).

Drainage and water management infrastructure works would include (but not be limited to):

- Construction of a tunnel drainage system
- Construction of water treatment plants including:
  - Construction phase water treatment plants at the construction ancillary facilities that would support tunnelling. These would receive water pumped from the low point of each tunnel and temporary sumps would treat the water so that it is suitable for reuse during tunnelling and construction generally, or for appropriate discharge or disposal
  - Operational phase water treatment plants at the Darley Road motorway operations complex (MOC1) and the Rozelle East motorway operations complex (MOC3)
  - New drainage discharge connections for treated water
- Construction of new surface water drains and drainage pits along surface roads, at intersections and pedestrian crossings, and around entry and exit ramps near where they meet surface roads, and connections to existing stormwater drainage infrastructure as required
- Construction of a constructed wetland and bioretention swale at the Rozelle East motorway operations complex (MOC3) to capture and treat runoff and treated tunnel water from the water treatment facility
- Construction of a bioretention facility within King George Park, adjacent to Manning Street at Rozelle. Water collected from the new surface road areas along Victoria Road would be piped to this facility via a new pipe, which is likely to be installed along Byrnes Street at Rozelle. The informal car park at this location would also be upgraded as part of these works, including provision of an equivalent number of car parking spaces
- Construction of new drainage channels within the Rozelle Rail Yards to drain external catchment areas, batter slopes and road surfaces
- Construction of new and upgraded culverts, including:
  - New culverts below road and pedestrian and cyclist crossings of the drainage channels within the Rozelle Rail Yards
  - Upgrades to and widening of the existing culvert between the Rozelle Rail Yards and Rozelle Bay including a section below City West Link
- Upgrades to the existing drainage infrastructure that serves surface roads, including connection to the existing piped drainage network.

Proposed discharge locations, the existing water quality of potential receiving waterways and proposed discharge criteria are described in **Chapter 15** (Soil and water quality). Discharge criteria for the construction and operational phases of the project would be further developed during detailed design and subsequently documented in relevant management plans.

6.4.6 Road pavement works

Road pavement works would be carried out along the tunnels, surface roads and bridges following construction of the main structures. Existing road pavements would be modified to integrate with the project where required.

Pavement works would involve the construction of:

- Base and select layers of materials
- Pavement surface layers where required
- Pavement drainage, including kerb and gutter (where required)
- Concrete barriers, medians, fencing and guardrails (where required).

In areas where the project would tie into or modify existing roads, pavements could be widened, reconfigured, milled and resurfaced, or removed and cross-stitched. Pavement surfaces would be selected using relevant guidelines to achieve the desired structural capacity, surface texture, skid resistance, water spray, to avoid or minimise aquaplaning and to meet the noise attenuation requirements of the project.

6.4.7 Finishing works

Finishing works would be undertaken towards the completion of construction and would include:

- Line marking of new road surfaces
- Erection of directional and other signage and other roadside furniture such as street lighting
- Erection of toll gantries and other control systems
- Earthworks including cutting, filling and grading to shape the finished surface level in accord with the lands future use
- Landscaping and revegetation works
- Closure and backfill of temporary access tunnels or, where these are to be retained to enable and facilitate routine inspections and maintenance activities, the provision of lighting, ventilation, drainage, power and services to enable these activities
- Site demobilisation and removal of construction ancillary facilities
- Rehabilitation of construction sites.

6.5 Construction ancillary facilities

6.5.1 Overview

Twelve construction ancillary facilities are described and assessed in this EIS. These are shown in overview in **Figure 6-1** and relative to the project footprint in **Figure 6-2** to **Figure 6-10**. The construction ancillary facilities would be used for a combination of civil surface works, tunnelling and tunnelling support, construction workforce parking and administrative purposes, as summarised in **Table 6-5** and described in more detail in the following sections.

The number, location and layout of construction ancillary facilities would be finalised as part of detailed construction planning during detailed design and would meet the environmental performance outcomes stated in the EIS and the Submissions and Preferred Infrastructure Report and satisfy criteria identified in any relevant conditions of approval. Further, additional ancillary facilities may be proposed by the contractor, once engaged. Prior to the establishment of ancillary facilities that are not identified in this EIS, the contractor would need to satisfy criteria that would be identified in any relevant conditions of approval and in accordance with an Ancillary Facilities Management Plan.

To assist in informing the development of a construction methodology that would manage constructability constraints and the need for construction to occur in a safe and efficient manner, while minimising impacts on local communities, the environment, and users of the surrounding road and other transport networks, two possible combinations of construction ancillary facilities at Haberfield and Ashfield have been assessed in this EIS (see **Table 6-4**). The construction ancillary facilities that comprise these options have been grouped together in this EIS and are denoted by the suffix *a* (for Option A) or *b* (for Option B) eg Wattle Street civil and tunnel site (C1a).

Table 6-4 Possible construction ancillary facility combinations at Haberfield and Ashfield assessed in this EIS

Option A	Option B
Wattle Street civil and tunnel site (C1a)	Parramatta Road West civil and tunnel site (C1b)
Haberfield civil and tunnel site (C2a)	Haberfield civil site (C2b)
Northcote Street civil site (C3a)	Parramatta Road East civil site (C3b)

The layout and access arrangements for the construction ancillary facilities are based on the concept design only and would be confirmed and refined during detailed design. The final construction site layouts and access arrangements would have regard to the following amenity criteria:

- Where practicable, temporary buildings and structures (such as offices and amenities) would be used to provide a noise barrier between the construction site and adjacent sensitive receivers
- The location of temporary buildings and structures would have regard to overlooking and overshadowing impacts on adjacent sensitive receivers
- Where feasible and reasonable, acoustic sheds would be provided to ensure that noise-generating activities undertaken outside standard construction hours would comply with relevant noise goals
- Lighting would be designed to minimise light spill onto adjoining properties
- Spoil stockpiles would be located away from adjacent sensitive receivers where possible
- Appropriate erosion and sediment controls would be incorporated
- Vehicle access points and internal circulation roads would be located away from adjacent sensitive receivers
- Vehicle access points would have ready access to the arterial road network and would minimise the need for heavy vehicles to travel on local roads through residential areas
- Construction sites would provide sufficient area for the storage of raw materials to minimise, to the greatest extent practical, the number of deliveries required outside standard construction hours.

Site establishment activities would initially be carried out at each construction ancillary facility. This would involve:

- Demolition of buildings and clearing landscaped vegetation, where required
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- Provision of services required for construction, such as power, water, sewer and communications
- Establishment of site compound and ancillary facilities, such as offices, amenities and workshops
- Establishment of vehicle access and egress points
- Establishment of truck wheel wash facilities or rumble grids
- Establishment of internal roads
- Establishment of hardstand areas for storage and car parking
- Establishment of acoustic sheds
- Establishment of site hoardings, noise barriers and/or fencing around the perimeter of the site.

Some of these site establishment activities may be carried out as enabling works (see **section 6.4.1**). During site establishment, all vehicles would enter and exit the sites using existing access points, until the new construction entry and exit points as described below are constructed and operational.

Table 6-5 Proposed construction ancillary facilities and indicative activities

No.	Site	Temporary facilities												Permanent facilities						
		Site offices	Staff and workforce amenities	Stores and laydown	Workshop/maintenance	Tunnel launch & support	Tunnel spoil management	Civil and surface works	Construction water treatment plant	Sedimentation pond	Temporary ventilation plant	Temporary substation	Parking	Ventilation facility	Ventilation supply facility	Substation	Motorway operations complex(es)	Workshop facilities/bulky equipment store	Operational water treatment facility	Fire pump room and water tanks
C1a	Wattle Street civil and tunnel site	✓	✓			✓	✓	✓			✓		✓							
C2a	Haberfield civil and tunnel site*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓
C3a	Northcote Street civil site			✓				✓					✓							
C1b	Parramatta Road West civil and tunnel site	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							
C2b	Haberfield civil site*	✓	✓	✓	✓			✓					✓	✓	✓	✓		✓		✓
C3b	Parramatta Road East civil site	✓	✓										✓							
C4	Darley Road civil and tunnel site	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓
C5	Rozelle civil and tunnel site	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C6	The Crescent civil site	✓	✓	✓	✓			✓	✓	✓			✓							
C7	Victoria Road civil site	✓	✓	✓	✓			✓		✓			✓							
C8	Iron Cove Link civil site	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓		✓	✓			
C9	Pyrmont Bridge Road tunnel site	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓							
C10	Campbell Road civil and tunnel site	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓

Notes:

* The permanent facilities being provided at the Haberfield civil and tunnel site, including the Parramatta Road ventilation facility, are being built on the corner of Parramatta Road and Wattle Street at Haberfield as part of WestConnex M4 East. Fitout works to prepare these facilities for use by the M4-M5 Link would be carried out as part of the project.

Temporary and permanent facilities may change when the construction contractor is engaged and detailed construction methodologies are developed.

6.5.2 Wattle Street civil and tunnel site (C1a)

The Wattle Street civil and tunnel site would be located above and below ground along Wattle Street at Haberfield between Parramatta Road and Ramsay Street. This construction ancillary facility would use land above ground that is currently being used as a construction zone for the M4 East project. In addition, the entry and exit ramps and cut-and-cover structures being built by the M4 East project would be used to support tunnelling; including stockpiling and loading of spoil and spoil removal.

Prior to being made available for use for construction of the M4-M5 Link project, the construction site for the M4 East project will be demobilised and the area rehabilitated to a condition that is suitable for use for construction of the M4-M5 Link.

An indicative construction site layout for the Wattle Street civil and tunnel site is shown in **Figure 6-14**, and an indicative cross-section showing how spoil would be managed within the entry and exit ramps is shown in **Figure 6-15**. The construction activities program relevant to the site is outlined in **Table 6-6**.

There is also the potential to use this site for tunnelling and tunnel support only, which would mean that the construction area at the surface between the Wattle Street carriageways would not be needed for M4-M5 Link construction purposes. Using the Wattle Street civil and tunnel site in this arrangement would mean that landscaping along Wattle Street would be able to be carried out by the M4 East project at the completion of construction of the M4 East project (estimated to be in 2019). This would be confirmed as part of detailed construction planning during detailed design and would meet the environmental performance outcomes stated in the EIS and the Submissions and Preferred Infrastructure Report and satisfy criteria identified in any relevant conditions of approval.

Key construction activities to be carried out at and supported by the Wattle Street civil and tunnel site would include:

- Establishment of site offices, amenities and temporary infrastructure, including temporary fencing
- Establishment of temporary noise attenuation measures
- Completion of excavation and stabilisation works in the dive structures and cut-and-cover structures (that are being built as part of the M4 East project)
- Delivery, laydown and storage of materials, including precast concrete
- Tunnel excavation, as well as stockpiling of excavated material and spoil haulage
- Excavation of cross-passages, longitudinal egress passages and niches in the tunnels
- Civil tunnel fitout works (including pavement and drainage works)
- Installation of mechanical and electrical services within the tunnel and fitout of the tunnel with additional infrastructure (eg signage)
- Civil works to integrate the tunnels with the surface road network at the Wattle Street interchange
- Finishing works including asphalting, lighting, line marking and signage installation
- Rehabilitation and landscaping to be consistent with the M4 East Urban Design and Landscape Plan
- Demobilisation.

Roadheaders would be launched from this site to excavate the tunnels that would connect the Wattle Street interchange entry and exit ramps with the M4-M5 Link mainline tunnels. Works at this site would also be supported by the facilities at the Haberfield civil and tunnel site (C2a) and car parking and laydown at the Northcote Street civil site (C3a). Light vehicles would enter and exit the site to and from the eastbound Wattle Street carriageway.

The Wattle Street interchange entry and exit ramps that will be constructed as part of the M4 East project would be used for spoil removal. Heavy vehicles would enter the site via the eastbound entry ramp, be loaded with spoil underground within the tunnels, and then exit the site to Wattle Street via the westbound exit ramp. Details about spoil haulage routes are included in **section 6.6.5** and **Chapter 23** (Resource use and waste minimisation).

Spoil handling at this site would occur 24 hours a day, seven days a week. Where practical, spoil would be removed during the day, outside of peak periods. Acoustic barriers and devices at each portal would be considered and implemented where reasonable and feasible to minimise potential noise impacts associated with out-of-hours works within the tunnels. Feasible and reasonable management strategies would be investigated to minimise the volume of heavy vehicle movements at night. Any spoil removal outside standard construction hours would meet the relevant noise criteria. Excavated spoil from tunnelling would only be stockpiled underground. Further details about construction hours are included in **section 6.7.2**.

Table 6-6 Wattle Street civil and tunnel site (C1a) indicative construction program

Construction activity	Indicative construction timeframe															
	2019				2020				2021				2022			
Initial road works and traffic management			■													
Site establishment and utility works			■	■	■	■										
Below ground site set up					■	■										
Tunnelling					■	■	■	■	■	■						
Civil and mechanical fitout										■	■	■				
Testing and commissioning												■	■	■	■	
Site rehabilitation and landscaping															■	■

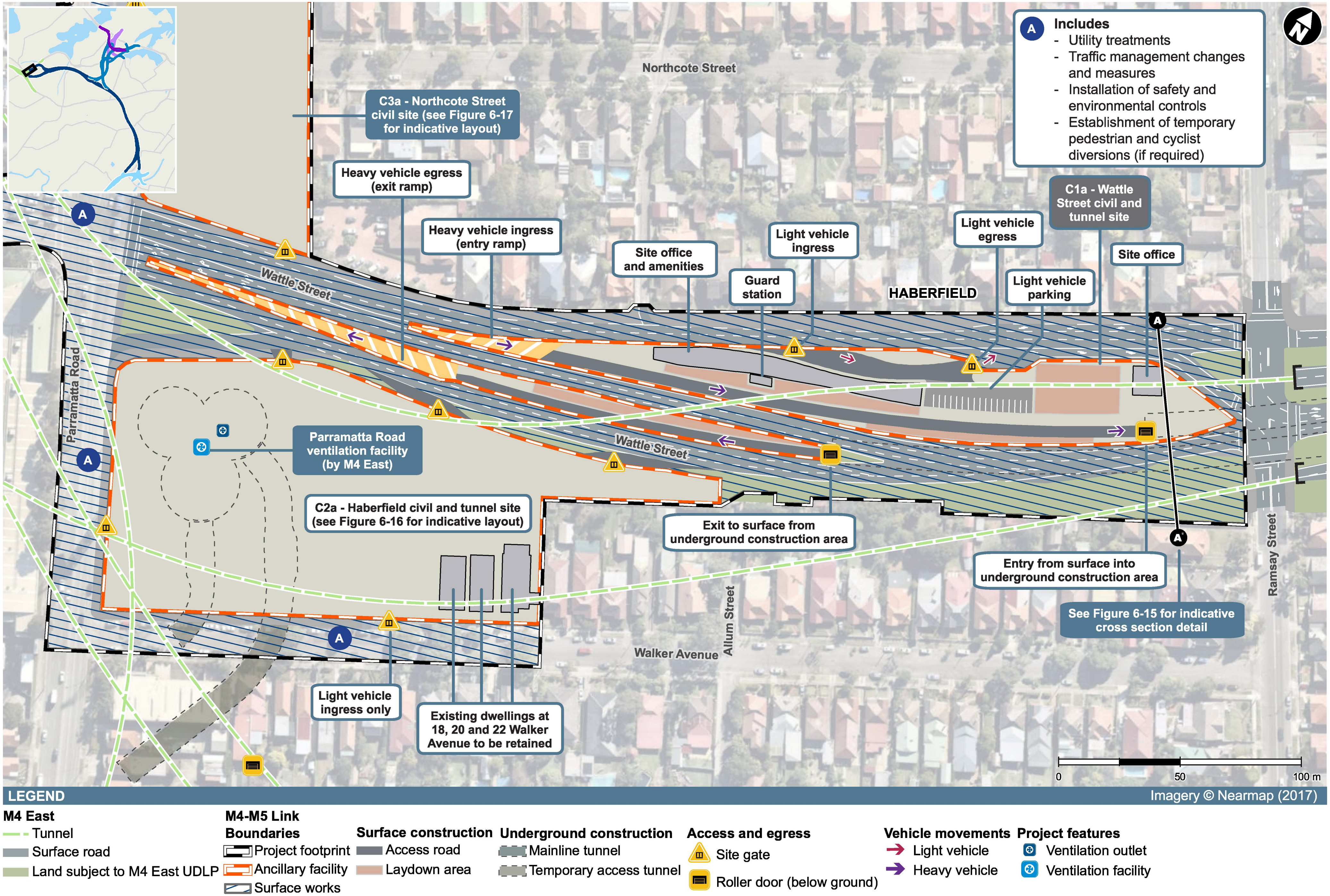
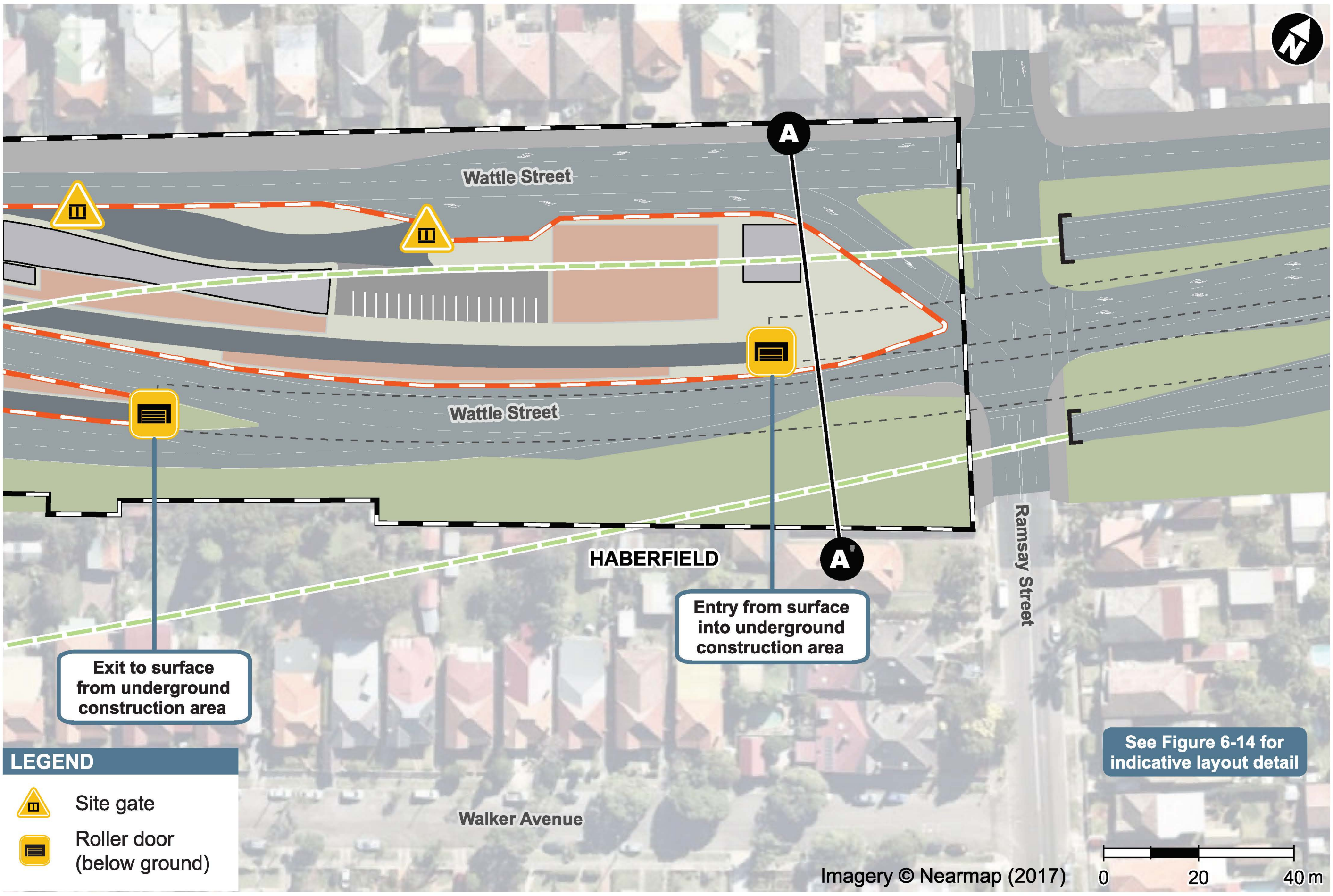


Figure 6-14 Indicative Wattle Street civil and tunnel site (C1a) layout



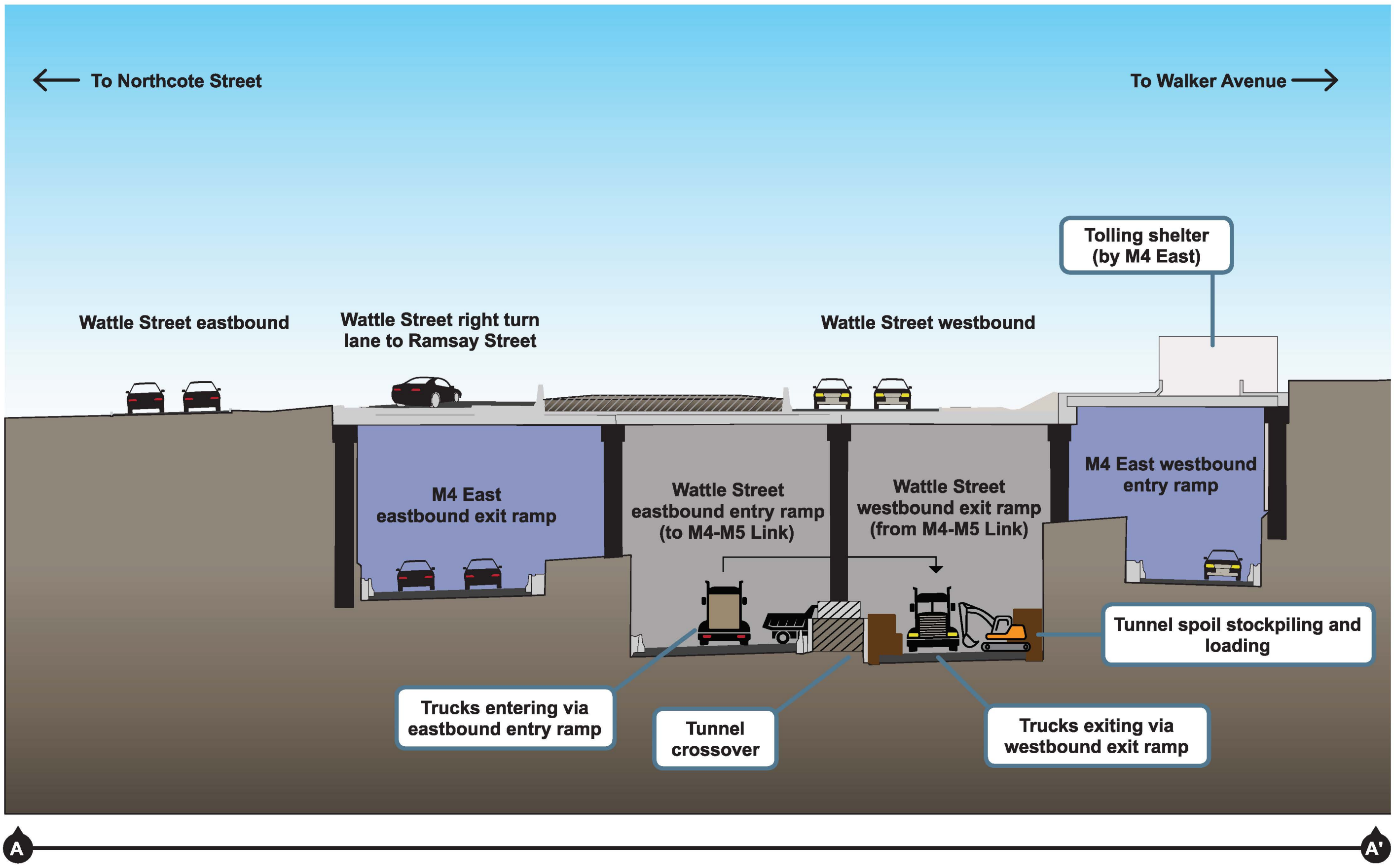


Figure 6-15 Indicative Wattle Street civil and tunnel site (C1a) cross-section

6.5.3 Haberfield civil and tunnel site (C2a)

The Haberfield civil and tunnel site (C2a) would be used for tunnelling support and civil construction, and would be located above and below ground around the south-eastern corner of the Parramatta Road and Wattle Street intersection, extending along Parramatta Road between Wattle Street and Walker Avenue at Haberfield.

This construction ancillary facility would use land above ground that is currently being used as a construction ancillary facility for the M4 East project. Prior to being made available for use for construction of the M4-M5 Link project, the construction site for the M4 East project will be demobilised and the area rehabilitated to a condition that is suitable for use for construction of the M4-M5 Link.

Three dwellings at 18, 20 and 22 Walker Avenue are within the Haberfield civil and tunnel site footprint. These dwellings will be retained in accordance with the M4 East conditions of approval, with the future use of these dwellings to be determined in the M4 East Urban Design and Landscape Plan and/or the M4 East Residual Land Management Plan (in accordance with the M4 East conditions of approval).

An indicative construction site layout for the Haberfield civil and tunnel site (C2a) is shown in **Figure 6-16** and a construction activities program relevant to the site is outlined in **Table 6-7**.

Key construction activities to be carried out at and supported by the Haberfield civil and tunnel site (C2a) would include:

- Establishment of site offices, amenities and temporary infrastructure including temporary noise attenuation measures
- Delivery, laydown and storage of materials, including precast concrete
- Tunnel excavation, as well as stockpiling of excavated material and spoil haulage (using the M4 East tunnel stubs being built by the M4 East project)
- Excavation of cross-passages, longitudinal egress passages and niches in the tunnels
- Civil tunnel fitout works (including pavement and drainage works)
- Installation of mechanical and electrical services within the tunnel and fitout of the tunnel with additional infrastructure (eg signage)
- Mechanical and electrical fitout of a section of the Parramatta Road ventilation facility (that will be built as part of the M4 East project)
- Finishing works including asphalting, lighting, line marking and signage installation
- Rehabilitation and landscaping to be consistent with the M4 East Urban Design and Landscape Plan
- Demobilisation.

The Haberfield civil and tunnel site would support tunnelling of the mainline tunnels from the M4 East stub tunnels being built by the M4 East project. Roadheaders would be launched from this site to excavate the mainline tunnels. Access to the M4 East stub tunnels for construction would be via the M4 East mainline tunnels. During construction, traffic management would be used to manage interactions between the operational sections of the M4 East project and the construction areas in the M4 East stub tunnels and the M4-M5 Link mainline tunnels.

Access to the tunnels for construction personnel, small plant and materials would also occur directly from the Haberfield civil and tunnel site via the ventilation shafts that will be built as part of the M4 East project.

Tunnel spoil would be stockpiled within the M4 East stub tunnels. Trucks would enter the eastbound stub tunnel from the M4 East mainline tunnels, be loaded with spoil, and exit to the westbound M4 East mainline tunnels. No tunnel spoil would be removed to the surface via the Haberfield civil and tunnel site – all spoil would be transported below ground via the M4 East mainline tunnels. Details about spoil haulage routes are included in **section 6.6.5** and **Chapter 23** (Resource use and waste minimisation). Spoil handling below ground would occur 24 hours a day, seven days a week. Further details about construction hours are included in **section 6.7.2**.

Works at the surface that would occur at the Haberfield civil and tunnel site (C2a) would be used to support civil construction, including construction of a substation, and fitout of permanent operational infrastructure including the Parramatta Road ventilation facility (being constructed by the M4 East project). During construction, the site would include temporary site offices, workshop and storage facilities, laydown areas, ingress and egress for heavy and light vehicles, a temporary substation, a temporary ventilation plant, a construction water treatment plant and sediment pond, workforce amenities and car parking.

Heavy vehicles delivering materials and equipment would enter and exit the Haberfield civil and tunnel site (C2a) via the westbound Wattle Street carriageways. Light vehicles would enter and leave the site via Wattle Street, Walker Avenue and Parramatta Road. Workforce car parking for this area would also be located at the Northcote Street civil site (C3).

Table 6-7 Haberfield civil and tunnel site (C2a) indicative construction program

Construction activity	Indicative construction timeframe															
	2019				2020				2021				2022			
Initial road works and traffic management			■													
Site establishment and utility works			■	■	■	■										
Below ground site set up				■	■	■										
Establish temporary ventilation systems for Wattle Street and mainline				■	■											
Fitout of ventilation station and substation						■	■	■	■	■	■	■				
Tunnelling					■	■	■	■	■	■						
Civil and mechanical fitout										■	■	■				
Testing and commissioning												■	■	■	■	
Site rehabilitation and landscaping															■	■

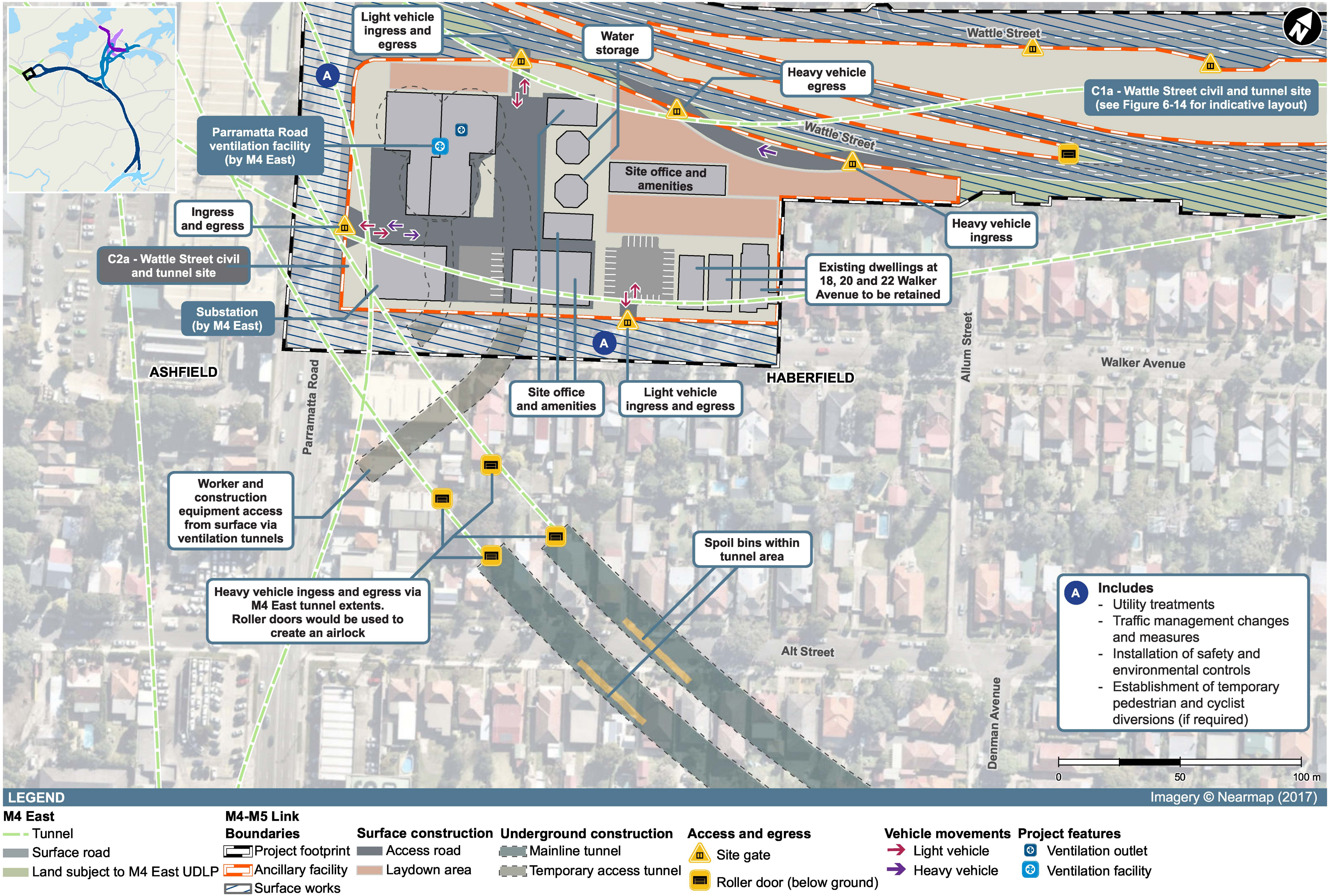


Figure 6-16 Indicative Haberfield civil and tunnel site (C2a) layout

6.5.4 Northcote Street civil site (C3a)

The Northcote Street civil site at Haberfield would be located between Wattle Street and Wolseley Street at Haberfield. This construction ancillary facility would use land that is currently being used as a construction ancillary facility for the M4 East project. Prior to being made available for use for construction of the M4-M5 Link project, the construction site for the M4 East project will be demobilised and the area rehabilitated to a condition that is suitable for use for construction of the M4-M5 Link.

The site would be used for construction workforce parking and to support construction activities at the nearby civil and tunnel sites, including laydown and storage of materials. Around 150 car parking spaces would be established on this site. An indicative construction site layout for the Northcote Street civil site is shown in **Figure 6-17** and an indicative program for works to be carried out within the Northcote Street civil site is provided in **Table 6-8**.

Heavy vehicles would enter and exit the site to and from Parramatta Road. Light vehicles would enter the site via Wolseley Street and an egress only point for light vehicles would be provided on to Wattle Street. During construction, Northcote Street would be closed at the intersection with Parramatta Road and the site would occupy around 100 metres of Northcote Street east of Parramatta Road. Northcote Street would be reopened to Parramatta Road when construction is complete.

The use of the laydown area and light vehicle parking would occur 24 hours a day, seven days a week. Feasible and reasonable management strategies would be investigated to minimise potential noise impacts associated with out-of-hours construction activities at the site, including minimising the volume of heavy vehicles using the laydown area at night and the provision of temporary barriers along the boundary with adjoining residential properties. Further details about construction hours are included in **section 6.7.2**. Further detail about the construction noise and vibration impacts of the project and proposed management strategies are provided in **Chapter 10** (Noise and vibration).

At the completion of construction, the Northcote Street civil site (C3a) would be rehabilitated in preparation for a future use that would be determined in accordance with the M4 East Residual Land Management Plan.

Table 6-8 Northcote Street civil site (C3a) indicative construction program

Construction activity	Indicative construction timeframe															
	2019				2020				2021				2022			
Site establishment and utility works				■	■	■										
Construct car park				■	■											
Construct laydown area				■	■											
Operation of car park and laydown area					■	■	■	■	■	■	■	■	■	■		
Site rehabilitation and landscaping															■	■

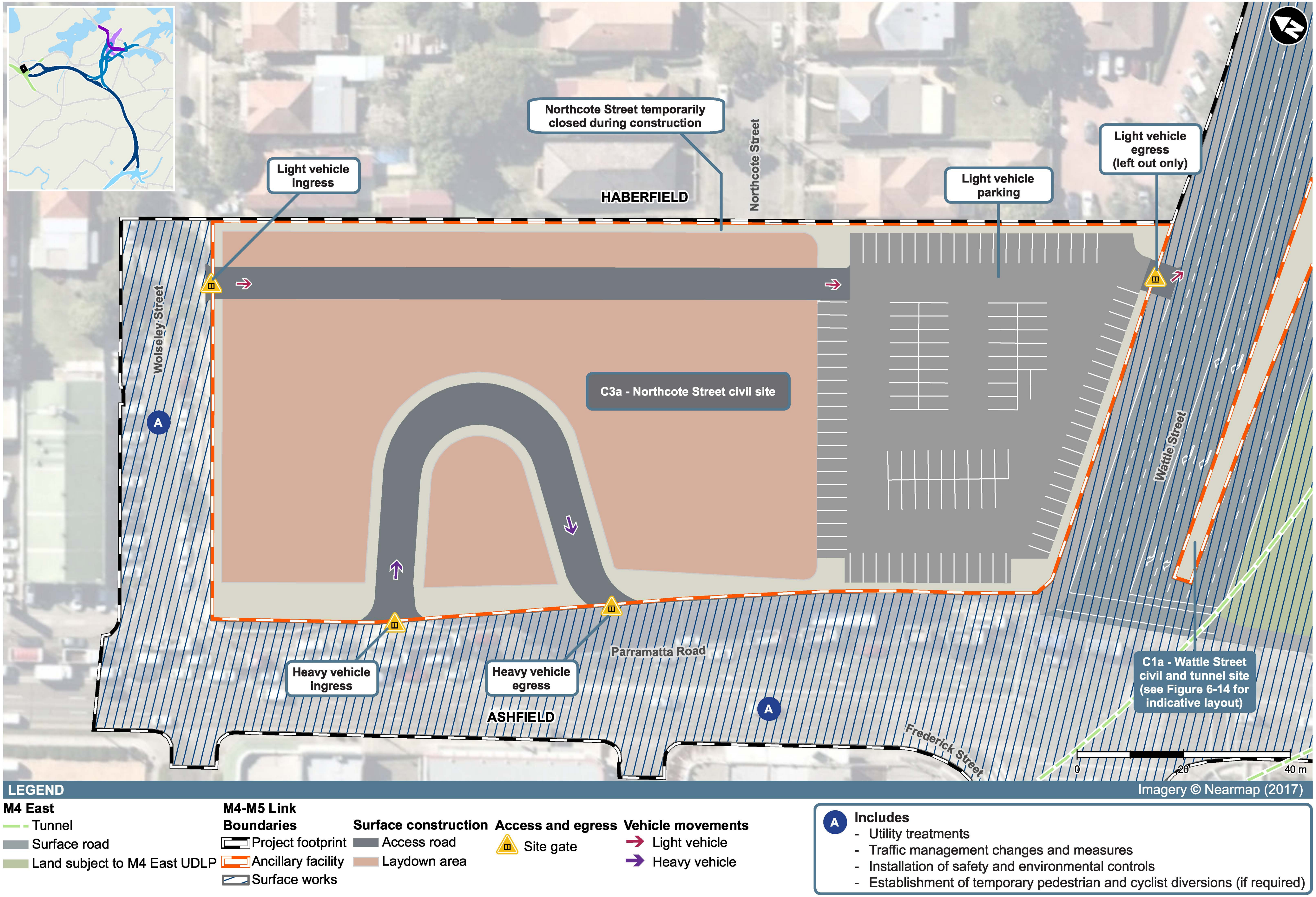


Figure 6-17 Indicative Northcote Street civil site (C3a) layout

6.5.5 Parramatta Road West civil and tunnel site (C1b)

The Parramatta Road West civil and tunnel site (C1b) would be located west of Parramatta Road, between north of Alt Street and Bland Street at Ashfield. The site is currently occupied by several commercial properties that would be demolished to facilitate construction. Residential properties including single dwellings and apartment blocks are located to the immediate west and north. A construction site for the M4 East project is located to the south on the opposite side of Bland Street. It is expected that adjacent M4 East construction will conclude in early 2019.

The site would be used for tunnelling support during construction and would include temporary site offices, a workshop and storage facilities, a laydown area, entry and exit points for construction traffic, a temporary substation, temporary ventilation for the tunnels, a temporary water treatment plant and sediment pond, workforce amenities and car parking. The location of the construction ancillary facility and an indicative layout of the site are shown in **Figure 6-18**. An indicative program for works to be conducted within the Parramatta Road West civil and tunnel site is provided in **Table 6-9**.

Key construction activities to be carried out at and supported by the Parramatta Road West civil and tunnel site would include:

- Demolition of buildings and structures
- Vegetation clearing and removal
- Establishment of temporary noise attenuation measures
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- Establishment of site offices, amenities and temporary infrastructure
- Laydown and storage of materials
- Delivery of materials, plant and equipment
- Construction of an acoustic shed
- Construction of a temporary access tunnel
- Tunnel excavation using roadheaders, as well as stockpiling of excavated material and spoil haulage
- Excavation of cross-passages, longitudinal egress passages and niches in the tunnels
- Civil tunnel fitout works (including pavement and drainage works)
- Installation of mechanical and electrical services within the tunnel and fitout of the tunnel with additional infrastructure (eg signage)
- Installation of mechanical and electrical services within the tunnels and fitout of the tunnels with additional infrastructure (eg signage)
- Demobilisation including works to prepare the site for a future use in accordance with the Residual Land Management Plan.

An acoustic shed with a roller door would be established on the site to minimise noise from out-of-hours tunnelling and spoil handling. In addition, temporary noise mitigation measures may include noise barriers and other temporary structures such as site buildings, which would be positioned to minimise effects from noise on surrounding properties.

Construction traffic would enter and exit the site to and from the western (northbound) carriageway of Parramatta Road via new driveways. Temporary traffic management measures would be established to enable access and egress arrangements. These would be detailed in a Construction Traffic and Access Management Plan (CTAMP), which would be prepared to manage construction traffic associated with the project. Details about spoil haulage routes are included in **section 6.6.5** and **Chapter 23** (Resource use and waste minimisation). Further details about the construction traffic and transport for the project is provided in **Chapter 8** (Traffic and transport).

Spoil handling on the site would occur 24 hours a day, seven days a week, within an acoustic shed. Excavated spoil from tunnelling would only be stockpiled within the acoustic shed. Heavy vehicle movements associated with the removal of spoil from tunnelling would only occur via access and egress directly to and from Parramatta Road. Spoil removal outside standard construction hours would meet the relevant noise criteria. Further details about construction hours are included in **section 6.7.2.**

All reasonable and feasible work practices to meet the noise affected level, including for works outside recommended standard hours (as identified in the *Interim Construction Noise Guideline* (NSW Department of Environment and Climate Change (DECCW) 2009a) (ICNG)) will be applied. With the exception of emergencies, activities will not take place outside standard daytime construction hours without prior notification of local residents, businesses and the NSW Environment Protection Authority (NSW EPA).

Table 6-9 Parramatta Road West civil and tunnel site (C1b) indicative construction program

Construction activity	Indicative construction timeframe																			
	2018				2019				2020				2021				2022			
Site establishment and utility works				■	■	■														
Construction of temporary access tunnel						■	■													
Tunnelling								■	■	■	■	■	■							
Civil and mechanical fitout													■	■	■	■	■			
Testing and commissioning																	■	■		
Site rehabilitation																		■		

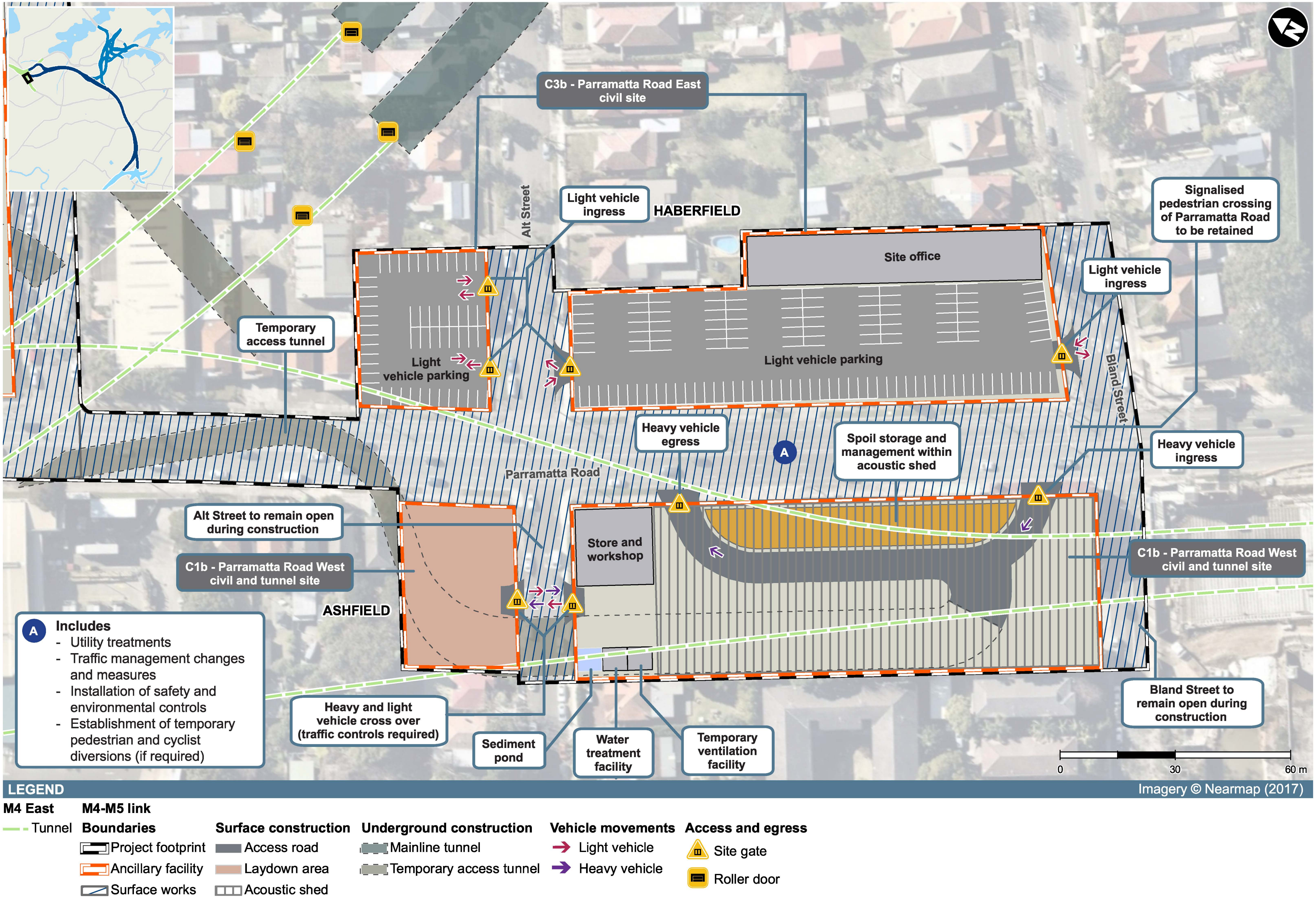


Figure 6-18 Indicative Parramatta Road West civil and tunnel site (C1b) and Parramatta Road East civil site (C3b) layout

6.5.6 Haberfield civil site (C2b)

The Haberfield civil site (C2b) is an alternative design to the Haberfield civil and tunnel site (C2a). The main purpose of the Haberfield civil site (C2b) would be to support fitout of a section of the Parramatta Road ventilation facility (which is being built by the M4 East project). This civil site would not be used to support tunnelling. In addition, the Haberfield civil site (C2b) would require less land at the surface when compared to the Haberfield civil and tunnel site (C2a), enabling the M4 East project to carry out landscaping on a section of land east of the Parramatta Road ventilation facility between Wattle Street and Walker Avenue at the completion of their construction (estimated to be in 2019).

The number, location and layout of construction ancillary facilities would be finalised as part of detailed construction planning during detailed design and would meet the environmental performance outcomes stated in the EIS and the Submissions and Preferred Infrastructure Report and satisfy criteria identified in any relevant conditions of approval.

The Haberfield civil site (C2b) would be located around the south-eastern corner of the Parramatta Road and Wattle Street intersection, extending along Parramatta Road between Wattle Street and Walker Avenue at Haberfield. This construction ancillary facility would use land that is currently being used as a construction ancillary facility for the M4 East project. The Haberfield civil site (C2b) would be used to support civil construction of a substation, and fitout of permanent operational infrastructure including the Parramatta Road ventilation facility (being constructed as part of the M4 East project). The site would include temporary site offices, workshop and storage facilities, laydown areas, ingress and egress for heavy and light vehicles, workforce amenities and car parking.

An indicative construction site layout for the Haberfield civil site (C2b) is shown in **Figure 6-19** and a construction activities program relevant to the site is outlined in **Table 6-10**.

Key construction activities to be carried out at and supported by the Haberfield civil site would include:

- Establishment of site offices, amenities and temporary infrastructure including fencing
- Establishment of temporary noise attenuation measures
- Delivery, laydown and storage of materials, including precast concrete
- Mechanical and electrical fitout of a section of the Parramatta Road ventilation facility (that will be built as part of the M4 East project)
- Landscaping to be consistent with the M4 East Urban Design and Landscape Plan
- Demobilisation.

Heavy vehicles delivering materials and equipment would enter and exit the Haberfield civil site (C2b) via the westbound Wattle Street carriageways. Light vehicles would enter and exit the site via Wattle Street and Walker Avenue. It is anticipated that construction activities at the Haberfield civil site (C2b) would occur during standard daytime construction hours. Further details about construction hours are included in **section 6.7.2**.

Table 6-10 Haberfield civil site (C2b) indicative construction program

Construction activity	Indicative construction timeframe															
	2019				2020				2021				2022			
Initial road works and traffic management			■													
Site establishment and utility works			■	■	■	■										
Fitout of Parramatta Road ventilation facility and substation						■	■	■	■	■	■	■				
Civil and mechanical fitout										■	■	■	■			
Testing and commissioning												■	■	■	■	
Site rehabilitation and landscaping															■	

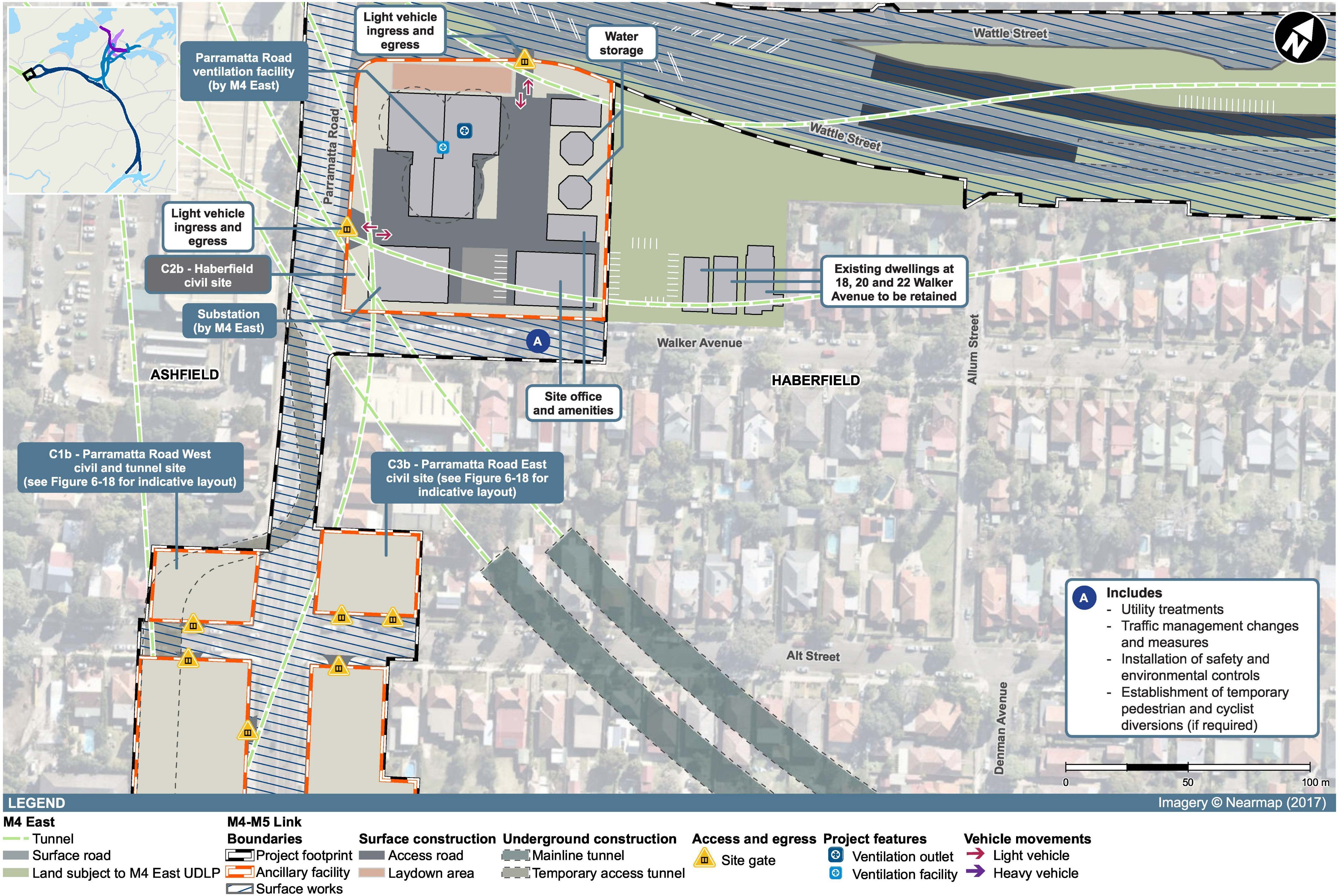


Figure 6-19 Indicative Haberfield civil site (C2b) layout

6.5.7 Parramatta Road East civil site (C3b)

The Parramatta Road East civil site (C3b) would be located east of Parramatta Road at Haberfield, between north of Alt Street and Bland Street. The site is occupied by several commercial premises that would be demolished to facilitate construction. Residential properties are located to the immediate east and north. A construction site for the M4 East project is located to the south.

The Parramatta Road East civil site (C3b) would be used to support tunnelling construction activities that would occur at the Parramatta Road West civil and tunnel site (C1b) and to provide construction workforce parking. Around 140 car parking spaces would be established on this site. The site would include temporary site offices, ingress and egress for light vehicles, workforce amenities and car parking.

Key construction activities to be carried out at and supported by the Parramatta Road East civil site would include:

- Demolition of existing buildings and structures
- Vegetation clearing and removal
- Establishment of site offices, amenities and temporary infrastructure including temporary noise attenuation measures and temporary fencing
- Utility works, including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- Establishment of site offices and workforce amenities
- Support for the construction of the mainline tunnels and the Wattle Street interchange entry and exit ramps (no tunnelling would occur from the Parramatta Road East civil site (C3b))
- Demobilisation including works to prepare the site for a future use in accordance with the Residual Land Management Plan that would be prepared for the project.

Temporary traffic management measures would be established to enable access and egress arrangements. These would be detailed in a CTAMP, which would be prepared to manage construction traffic associated with the project. It is anticipated that use of this site would occur up to 24 hours per day, seven days per week. Further details about construction hours are included in **section 6.7.2**.

An indicative construction site layout for the Parramatta Road East civil site (C3b) is shown in **Figure 6-18.** A construction activities program relevant to the site is outlined in **Table 6-11**.

Table 6-11 Parramatta Road East civil site (C3b) indicative construction program

Construction activity	Indicative construction timeframe																							
	2018				2019				2020				2021				2022				2023			
Site establishment and utility works				■	■	■																		
Use of car park and site amenities during construction						■	■	■	■	■	■	■	■	■	■	■	■	■	■					
Demobilisation																			■					

6.5.8 Darley Road civil and tunnel site (C4)

The Darley Road civil and tunnel site would be located at Leichhardt between the Inner West Light Rail line to the north and Darley Road to the south. The site is currently occupied by a commercial premise. that would be demolished to facilitate construction. Immediately adjacent in the northeast corner of the site is the Leichhardt North light rail stop.

The site would be used for tunnelling support during construction, and for the Darley Road motorway operations complex (MOC1), including a water treatment facility and substation during operation. During construction the site would include temporary site offices, a workshop and storage facilities, a laydown area, entry and exit points for construction traffic, an acoustic shed, a temporary substation, temporary ventilation for the tunnels, a temporary water treatment plant and sediment pond, workforce amenities and car parking. The location of the construction ancillary facility and an indicative layout of the site are shown in **Figure 6-20**.

Key construction activities to be carried out at and supported by the Darley Road civil and tunnel site would include:

- Demolition of existing buildings and structures
- Vegetation clearing and removal
- Establishment of temporary noise attenuation measures (such as acoustic hoarding)
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- Establishment of site offices, amenities and temporary infrastructure including fencing
- Laydown and storage of materials
- Delivery of materials, plant and equipment
- Construction of an acoustic shed
- Construction of a temporary access tunnel
- Tunnel excavation tunnels using roadheaders, as well as stockpiling of excavated material and spoil haulage
- Excavation of cross-passages, longitudinal egress passages and niches in the tunnels
- Civil tunnel fitout works (including pavement and drainage works)
- Installation of mechanical and electrical services within the mainline tunnel and fitout of the tunnel with additional infrastructure (eg signage)
- Construction of the Darley Road motorway operations complex (MOC1) including a substation and water treatment facility
- Finishing works including asphalting, line marking and signage installation
- Rehabilitation and landscaping adjacent to the motorway operations complex (MOC1) in accordance with the Urban Design and Landscape Plan
- Rehabilitation and works to prepare the remaining project land on the site for a future use in accordance with the Residual Land Management Plan that would be prepared for the project
- Demobilisation.

Roadheaders would be launched from this site and would excavate the temporary access tunnel and the mainline tunnels. Acoustic barriers and devices at the access tunnel entrances would be considered and implemented where reasonable and feasible to minimise potential noise impacts associated with out-of-hours works within the tunnels. In addition, temporary noise mitigation measures may include noise barriers and other temporary structures such as site buildings, which would be provided to minimise noise impacts on surrounding properties.

It is anticipated that the majority of construction traffic would enter the site from the southern (westbound) carriageway of Darley Road via new driveways. Heavy vehicles associated with spoil haulage would travel eastbound on City West Link and turn right into Darley Road. A temporary right turning lane at the intersection of City West Link and Darley Road would be provided for use by construction vehicles. Heavy vehicles would exit the site by turning left onto Darley Road before turning left onto City West Link.

Construction traffic may also access the Darley Road civil and tunnel site (C4) via the westbound lanes of City West Link. Details about spoil haulage routes are included in **section 6.6.5** and **Chapter 23** (Resource use and waste minimisation). Temporary traffic management measures would be established to enable access and egress arrangements. These would be detailed in a CTAMP, which would be prepared to manage construction traffic associated with the project. Further details about the construction traffic and transport for the project is provided in **Chapter 8** (Traffic and transport).

Investigations into alternative access for the Darley Road civil and tunnel site (C4) are also occurring. This could include ingress and egress to and from the westbound lanes of City West Link via Canal Road/Charles Street. If feasible, alternative access to and from the Darley Road civil and tunnel site would be assessed in the Preferred Infrastructure Report and/or in accordance with relevant conditions of approval, and would be documented in an Ancillary Facilities Management Plan.

Temporary changes to Darley Road to enable access to and from the ancillary facility would likely be required. These may include changes to line marking to provide a temporary turning lane for construction traffic and temporary diversions to the pedestrian path on the northern side of Darley Road. These would be confirmed during detailed design following the appointment of a design and construction contractor and in consideration of the safety and function of the road network, maintaining access to the Leichhardt North light rail stop and providing for continued pedestrian and cyclist movement.

Spoil handling associated with tunnelling supported by the Darley Road civil and tunnel site would occur 24 hours a day, seven days a week. Spoil would be handled below ground wherever practicable to reduce the potential for amenity impacts in adjacent areas. Spoil handing at the surface outside standard day time construction hours would occur within an acoustic shed to manage potential amenity impacts. Spoil removal from this site would only occur within standard construction hours, between 7.00 am and 6.00 pm Monday to Friday, and between 8.00 am and 1.00 pm on Saturdays. Further details about construction hours are included in **section 6.7.2**.

Reasonable and feasible work practices and mitigation measures would be implemented to minimise potential noise impacts due to activities occurring at the Darley Road civil and tunnel site. Local residents, businesses and the NSW EPA would be kept informed about works outside standard day time construction hours at the site.

An indicative program for works to be conducted within the Darley Road civil and tunnel site is provided in **Table 6-12**.

Table 6-12 Darley Road civil and tunnel site (C4) indicative construction program

Construction activity	Indicative construction timeframe																			
	2018				2019				2020				2021				2022			
Site establishment and utility works			■	■	■															
Construction of temporary access tunnel				■	■															
Tunnelling					■	■	■	■	■	■	■	■	■							
Construction of motorway operational infrastructure										■	■	■	■							
Civil and mechanical fitout											■	■	■	■	■					
Testing and commissioning															■	■	■	■	■	
Site rehabilitation and landscaping																		■	■	■

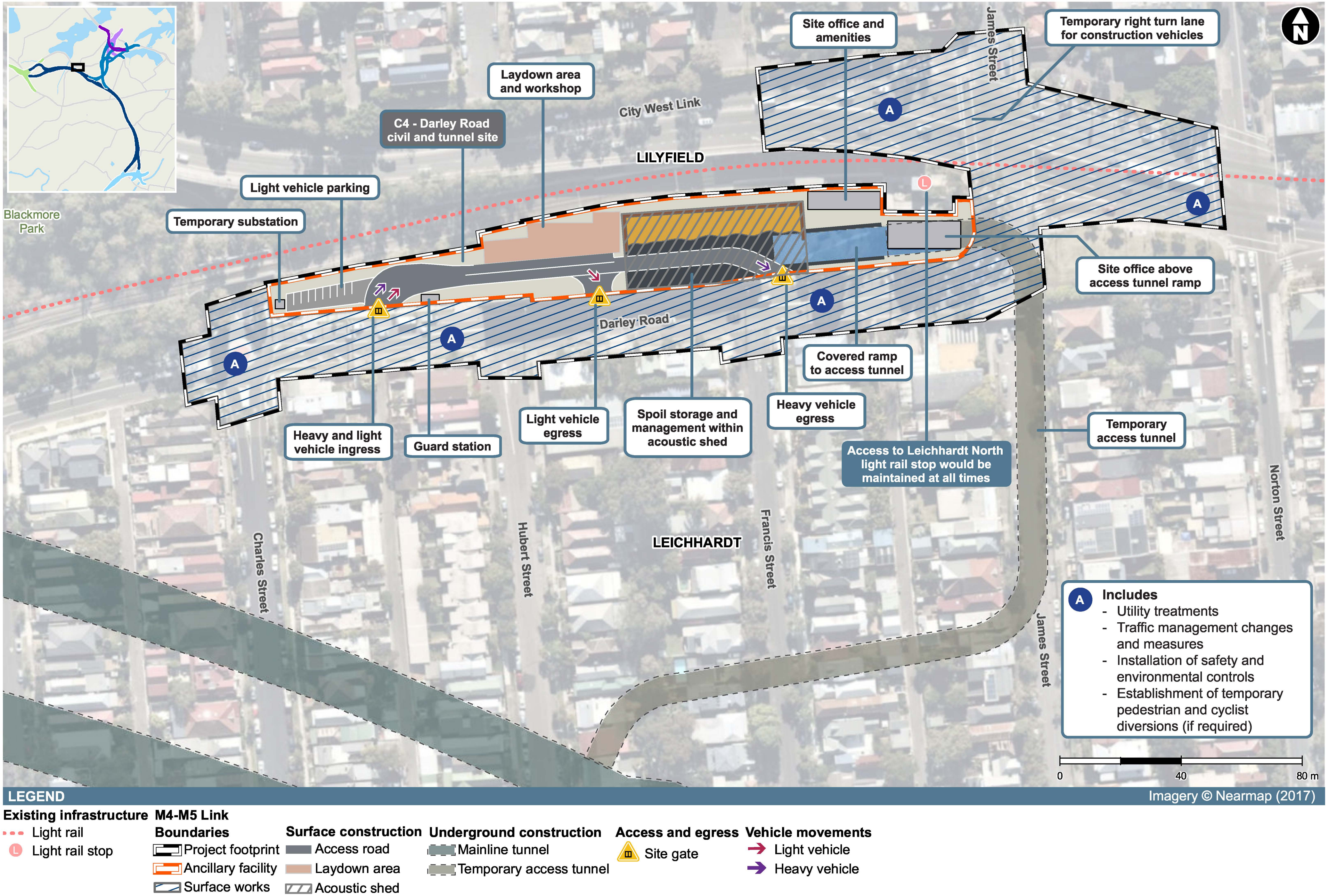


Figure 6-20 Indicative Darley Road civil and tunnel site (C4) layout

6.5.9 Rozelle civil and tunnel site (C5)

The Rozelle civil and tunnel site would be located between Lilyfield Road to the north, City West Link and The Crescent to the south, Victoria Road to the east and the Sydney CBD and South East Light Rail maintenance depot to the west. The site would be predominantly located on disused land that forms part of the Rozelle Rail Yards.

The site would also use land adjacent to Lilyfield Road and Gordon Street at Rozelle that is currently occupied by commercial and industrial properties. These properties would be acquired for the project and demolished to facilitate construction of the Rozelle interchange (refer to **Chapter 12** (Land use and property) for further details about properties that would be acquired for the project). An informal garden (located on the top of the sandstone cutting at the north-eastern end of the site) would be retained and protected during construction.

An indicative site layout for the Rozelle civil and tunnel site is shown in **Figure 6-21**. The construction activities program relevant to the site is outlined in **Table 6-13**.

Key construction activities to be carried out at and supported by the Rozelle civil and tunnel site would include:

- Site establishment, including construction of temporary intersections on City West Link to enable construction traffic ingress and egress
- Demolition of buildings and structures
- Demolition of hardstand areas and slabs
- Vegetation clearing and removal
- Removal of redundant rail infrastructure
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- Establishment of site offices, amenities and temporary construction hoarding (including acoustic hoarding if required)
- Construction of acoustic sheds
- Temporary stockpiling of fill and pavement materials as well as materials generated from construction activities prior to off-site removal
- Construction of the cut-and-cover structures including piling, concrete works, excavation of dive structures and installation of a precast concrete roof
- Decline and tunnel excavation using roadheaders, as well as stockpiling of material and spoil haulage
- Tunnel excavation of the Rozelle interchange, Iron Cove Link and proposed future Western Harbour Tunnel and Beaches Link tunnels using roadheaders, as well as stockpiling of excavated material and spoil haulage
- Excavation of cross-passages, longitudinal egress passages and niches in the tunnels
- Excavation of the ventilation tunnels
- Construction of the Rozelle West motorway operations complex (MOC2) including a ventilation supply facility
- Construction of the Rozelle East motorway operations complex (MOC3) including a ventilation exhaust facility and three outlets
- Mechanical and electrical fitout of the ventilation facilities
- Construction of new and upgraded drainage infrastructure including drainage channels, a bioretention swale, a constructed wetland and upgrades to the culvert between the Rozelle Rail Yards and Rozelle Bay (below City West Link)
- Civil tunnel fitout works (including pavement and drainage works)

- Finishing works including asphalting, line marking and signage installation
- Excavating, filling and grading of disturbed areas including works to deliver the finished landform within the Rozelle Rail Yards
- Rehabilitation and landscaping to be consistent with the Urban Design and Landscape Plan including delivery of new open space and construction of pedestrian and cyclist paths and bridges
- Demobilisation.

The site would include temporary site offices, workshops and storage facilities, laydown areas, entry and exit driveways for construction traffic, internal access roads, a temporary substation, temporary ventilation for the tunnels, temporary water treatment plants and sediment ponds, workforce amenities and car parking. Around 400 car parking spaces would be established at the Rozelle civil and tunnel site (C5).

A section of the Rozelle Rail Yards around the proposed future Western Harbour Tunnel and Beaches Link entry and exit ramps would be kept as an area of hardstand, in anticipation of it being used to support construction of the proposed future Western Harbour Tunnel and Beaches Link project. As part of the project, this area would be physically separated from the remainder of the interchange to restrict access. The possible future use of this area would mean that landscaping and revegetation works may need to be staged.

Roadheaders would be launched from this site to excavate the Rozelle interchange, the Iron Cove Link and the entry and exit ramp tunnels for the proposed future Western Harbour Tunnel and Beaches Link. To ensure compliance with relevant noise management levels outside standard day time construction hours, three acoustic sheds would be built at spoil handling locations within the site.

Tunnelling and spoil management would also be carried out within the cut-and-cover sections of the tunnels at the eastern end of the site. Acoustic treatments would be considered for the cut-and-cover sections to minimise noise from out-of-hours tunnelling and spoil handling. Tunnel spoil would be transported to a stockpile within the cut-and-cover structures, with sufficient space for about two heavy vehicles to be loaded with spoil. Following tunnelling activities, civil, mechanical and electrical fitout works would be carried out to prepare the tunnels for use.

Temporary noise mitigation measures would be provided. These could include noise barriers around the site to reduce noise experienced by nearby receivers. Temporary noise mitigation measures would be removed at the end of construction to ensure connections into and out of the new open space to be provided in the Rozelle Rail Yards. Other temporary structures such as site buildings would be located to minimise noise impacts on surrounding properties.

Heavy vehicle access would be via City West Link. It is anticipated that construction vehicles would enter the site from the eastbound carriageway of City West Link via new slip lanes and driveways. A temporary signalised intersection would be built along City West Link and a new northern leg added to the intersection with The Crescent to enable vehicles to exit the site and turn right at both these locations to head westbound on City West Link. Up to five light vehicle access points would be constructed along Lilyfield Road to enable light vehicle access and egress. Temporary traffic management measures would be established to enable access and egress arrangements. These would be detailed in a CTAMP, which would be prepared to manage construction traffic associated with the project.

Spoil handling and haulage would occur 24 hours a day, seven days a week. Heavy vehicle movements associated with the removal of spoil from tunnelling would only occur via access and egress directly to and from City West Link. Spoil removal outside standard construction hours would meet the relevant noise criteria. Further details about construction hours are included in **section 6.7.2**.

Table 6-13 Rozelle civil and tunnel site (C5) indicative construction program

Construction activity	Indicative construction timeframe																							
	2018				2019				2020				2021				2022				2023			
Site establishment and utility works				■	■	■	■	■																
Traffic diversions and intersection works						■	■	■																
Construction of cut-and-cover and tunnel portals						■	■	■	■															
Tunnelling									■	■	■	■	■	■	■	■	■	■						
Construction of motorway operational infrastructure									■	■	■	■	■	■	■	■	■	■						
Civil and mechanical fitout													■	■	■	■	■	■	■					
Site rehabilitation and landscaping																			■	■	■			
Demobilisation																						■	■	
Testing and commissioning																			■	■	■	■	■	

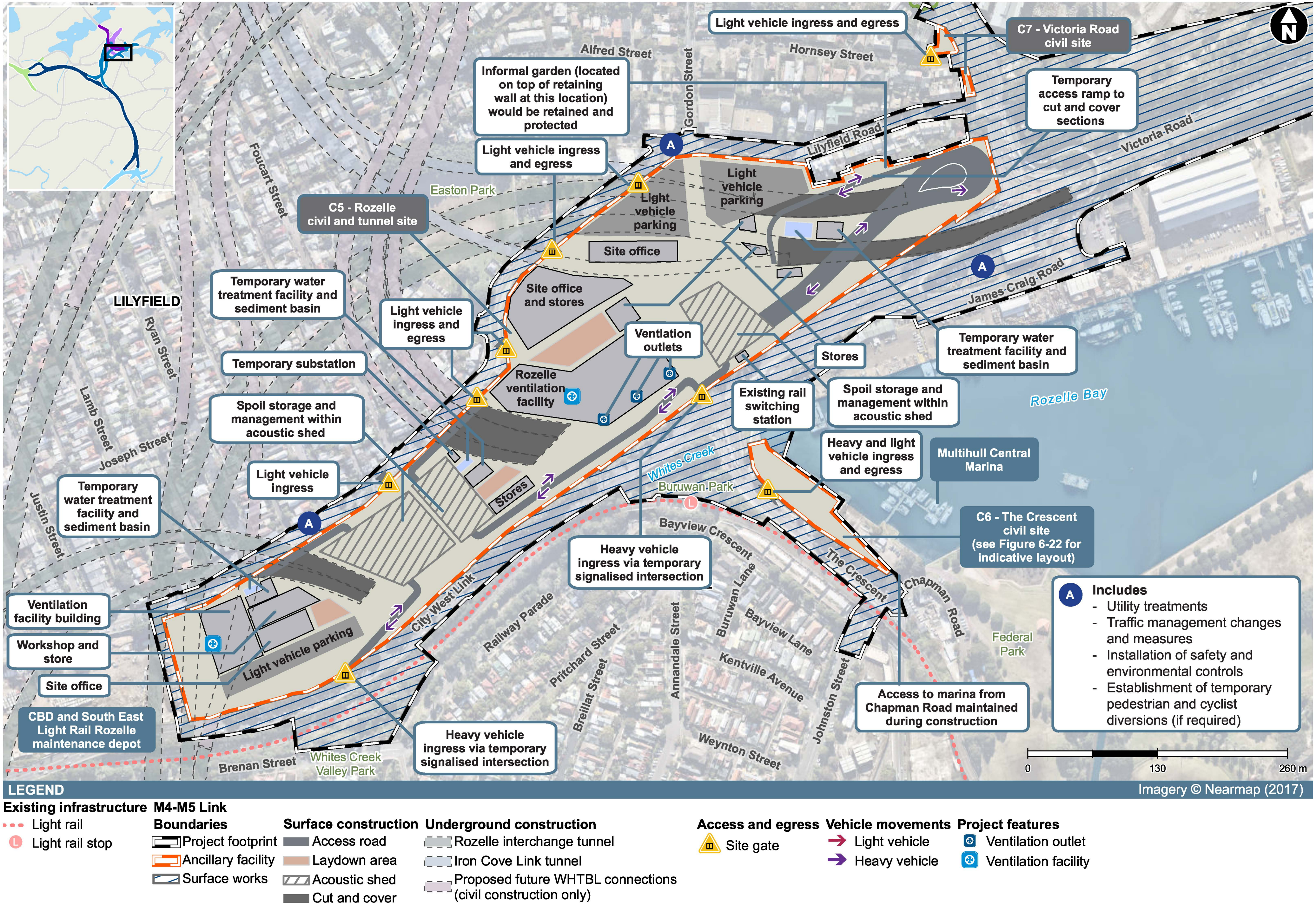


Figure 6-21 Indicative Rozelle civil and tunnel site (C5) and Victoria Road civil site (C7) layout

6.5.10 The Crescent civil site (C6)

The Crescent civil site (C6) would be located between The Crescent and Rozelle Bay on land owned by Roads and Maritime. The site would be cleared and a hardstand and laydown area, site offices, workforce amenities and car parking established.

Key construction activities to be carried out at and supported by The Crescent civil site would include:

- Vegetation clearing and removal
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- Site establishment, including establishment of a hardstand and laydown area, erection of temporary fencing and gates and establishment of construction access points
- Establishment of site offices, amenities and temporary construction hoarding (including acoustic hoarding if required)
- Temporary stockpiling of fill and pavement materials as well as materials generated from construction activities prior to off-site removal
- Realignment of The Crescent including construction of a new bridge over Whites Creek
- Widening and improvement works along Whites Creek, including naturalisation of a section of Whites Creek between The Crescent and Rozelle Bay
- Construction of the culvert below City West Link that would convey flows from the Rozelle Rail Yards to Rozelle Bay, including upgrades to the Rozelle Bay outfall
- Finishing works including asphalting, line marking and signage installation
- Excavating, filling and grading of disturbed areas
- Construction of pedestrian and cyclist paths and bridges
- Rehabilitation and landscaping adjacent to disturbed areas to be consistent with the Urban Design and Landscape Plan
- Demobilisation and rehabilitation of the remainder of the site to generally its pre-construction state.

An indicative site layout for The Crescent civil site is shown in **Figure 6-22**. The construction activities program relevant to the site is outlined in **Table 6-14**. At the completion of construction, a portion of this site would be occupied by operational road infrastructure. The remainder of the site would be rehabilitated.

The Crescent civil site (C6) would be established on land immediately adjacent to Rozelle Bay and Whites Creek and would support construction activities in and adjacent to these waterways. Although the project would be exempt from the controlled activity provisions of the *Water Management Act 2000* (NSW) relating to activities on waterfront land (refer to **Chapter 2** (Assessment process)), consideration would be given to relevant NSW Department of Primary Industries (Water) (DPI-Water) guidelines to minimise effects to water flow, maintain bed and bank stability and minimise harm to the waterfront and in-stream environments. In addition, the proposed waterway crossing at Whites Creek would be designed and constructed to have no greater impact on aquatic habitat than the existing crossing type (bridge).

It is anticipated that construction vehicles would enter the site via a left-in from The Crescent (southbound). They would then travel through the site, turn around and exit back onto The Crescent northbound via a right hand turn. Temporary traffic management measures would be established to enable access and egress arrangements. These would be detailed in a CTAMP, which would be prepared to manage construction traffic associated with the project. Details about spoil haulage routes are included in **section 6.6.5** and **Chapter 23** (Resource use and waste minimisation).

It is anticipated that construction works at The Crescent civil site (C6) would be carried out during standard daytime construction hours. Further details about construction hours are included in **section 6.7.2**.

Table 6-14 The Crescent civil site (C6) indicative construction program

Construction activity	Indicative construction timeframe																							
	2018				2019				2020				2021				2022				2023			
Site establishment and utility works					■	■	■																	
Surface road and intersection works					■	■																		
Whites Creek widening and improvement works						■	■	■	■															
Drainage works including construction of the culvert below City West Link and upgrades to the drainage outfall to Rozelle Bay						■	■	■	■	■														
Construction of Whites Creek Bridge and demolition of existing bridge									■	■	■	■	■											
Rehabilitation and landscaping													■	■	■	■								

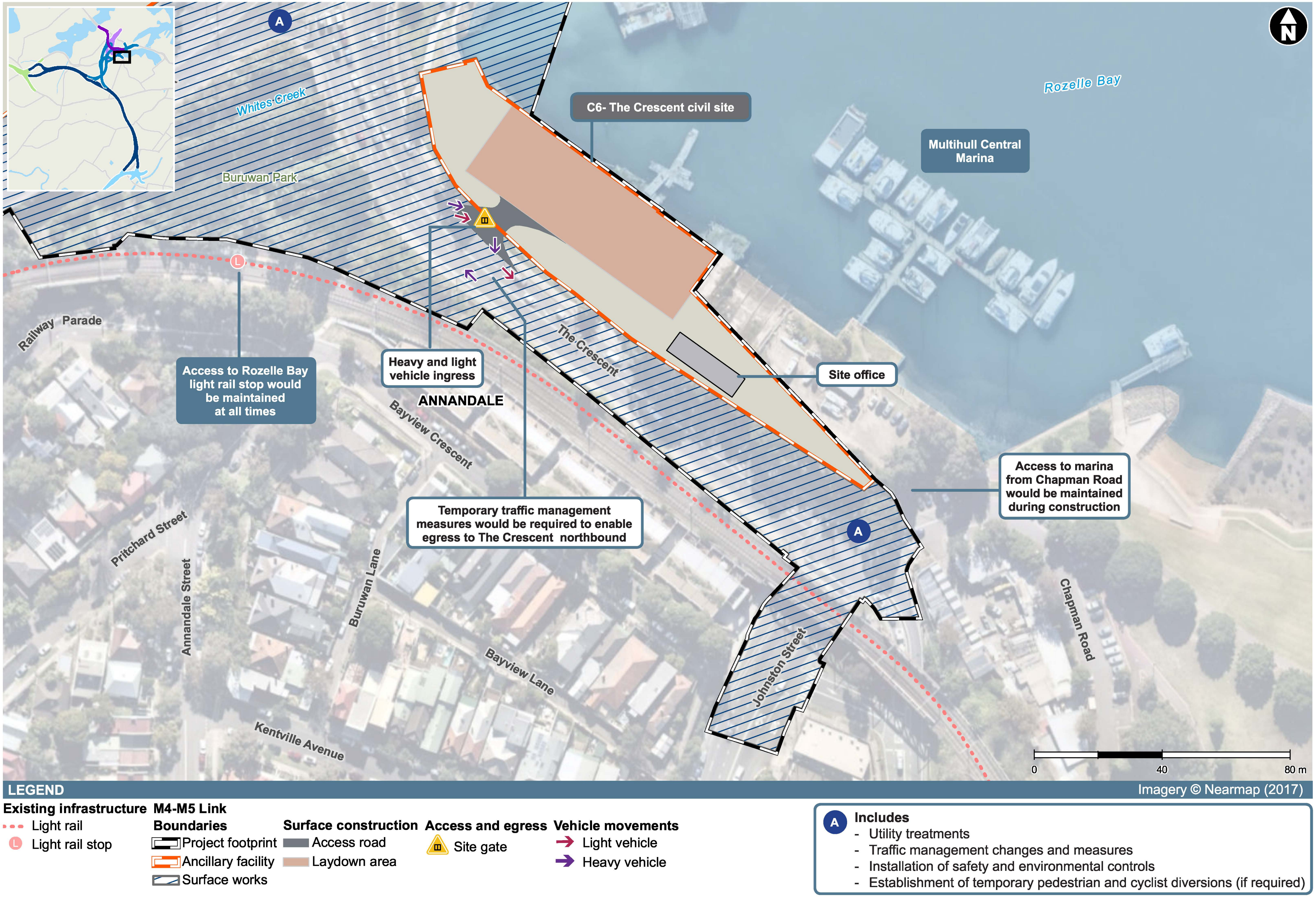


Figure 6-22 The Crescent civil site (C6) layout

6.5.11 Victoria Road civil site (C7)

The Victoria Road civil site (C7) would be located on the western side of Victoria Road between Quirk Street and Lilyfield Road. The existing buildings and other structures on the site would be demolished to facilitate establishment of temporary site offices, a laydown area, workforce amenities and car parking. A portion of this site would be occupied by operational road infrastructure during operation with land adjacent to disturbed areas subject to landscaping.

The location of the Victoria Road civil site and an indicative layout of the site are shown in **Figure 6-21**. The construction activities program relevant to the site is outlined in **Table 6-15**.

Key construction activities to be carried out at and supported by at the Victoria Road civil site would include:

- Support for the reconstruction of Victoria Road and the construction of the replacement bridge at the Victoria Road/The Crescent intersection, including:
  - Demolition of existing structures including buildings that have been acquired
  - Vegetation clearing and removal
  - Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
  - Establishment of site offices, amenities and temporary construction hoarding (including acoustic hoarding if required)
  - Removal of the existing pedestrian and cyclist overpass over Victoria Road
  - Finishing works including asphalting, line marking and signage installation
  - Excavating, filling and grading of disturbed areas
  - Site rehabilitation
  - Rehabilitation and landscaping adjacent to disturbed areas to be consistent with the Urban Design and Landscape Plan, including upgrades to the pedestrian and cyclist paths adjacent to the northbound and southbound carriageways of Victoria Road
  - Demobilisation.

Heavy and light vehicles would enter and exit the site to and from the northbound Victoria Road carriageway. It is anticipated that the Victoria Road civil site (C7) would be used during standard daytime construction hours. The construction activities program relevant to the site is outlined in **Table 6-15**.Further details about construction hours are included in **section 6.7.2**.

Table 6-15 Victoria Road civil site (C7) indicative construction program

Construction activity	Indicative construction timeframe																			
	2018				2019				2020				2021				2022			
Site establishment and utility works					■	■	■													
Support for the reconstruction of Victoria Road including construction of the new bridge						■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Site rehabilitation and landscaping																				■

6.5.12 Iron Cove Link civil site (C8)

The Iron Cove Link civil site (C8) would be located along the southern side of Victoria Road at Rozelle between Byrnes Street and Springside Street. The site would be located on land currently occupied by Victoria Road and residential and commercial properties that are to be acquired and subsequently demolished. Further details about acquisitions that would occur as part of the project are provided in **Chapter 12** (Land use and property).

The site would be used to support construction of the Iron Cove Link surface works, including tunnel entry and exit ramps, upgrades and modifications to the eastbound and westbound carriageways of Victoria Road. There is no provision at this site to operate roadheaders (as tunnel excavation of the Iron Cove Link is anticipated to occur from the Rozelle civil and tunnel site (C5)), however the site may be used to support limited excavation of the initial sections of the Iron Cove Link tunnels.

The site would also be used to support construction of a bioretention facility within an informal car park within King George Park (adjacent to Manning Street) at Rozelle. As part of these works, a section of the car park would be improved including sealing of the car park surface and landscaping.

The site would include temporary site offices, a workshop and storage facilities, sediment basin and construction water treatment plant, a temporary substation, workforce amenities and car parking. During operation, a portion of the site would be occupied by the Iron Cove Link motorway operations complex (MOC4) including the Iron Cove Link ventilation facility. In addition, a ventilation outlet would be constructed between the eastbound and westbound carriageways of Victoria Road at around Springside Street.

The location of the Iron Cove Link civil site (C8) and an indicative layout are shown in **Figure 6-23**. The construction activities program relevant to the site is outlined in **Table 6-16**.

Key construction activities to be carried out at and supported by the Iron Cove Link civil site (C8) would include:

- Demolition of existing structures including residential and commercial buildings that have been acquired
- Vegetation clearing and removal
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- Establishment of site offices, amenities and temporary infrastructure including temporary noise barriers
- Support for the construction of the Iron Cove Link tunnel portals and entry and exit ramps along Victoria Road
- Limited tunnel excavation of the initial sections of the Iron Cove Link using excavators (with rock hammers and rock saws as required), as well as stockpiling of material and spoil haulage. There is no provision at this site to operate road headers
- Support for the construction of surface road network upgrades and modifications to Victoria Road and the local road network including pedestrian and cyclist paths and crossings
- Support for the construction of the bioretention facility and car park improvement works adjacent to Manning Street at Rozelle. This would include support for the installation of drainage infrastructure along Byrnes Street at Rozelle to connect to the bioretention facility
- Construction of the Iron Cove Link motorway operations complex (MOC4) including the Iron Cove Link ventilation facility and one outlet
- Civil tunnel fitout works (which would include pavement and drainage works)
- Mechanical and electrical fitout of the ventilation facility
- Finishing works including asphalting, line marking and signage installation
- Excavating, filling and grading disturbed areas

- Rehabilitation and landscaping to be consistent with the Urban Design and Landscape Plan including upgrades to pedestrian and cyclist infrastructure
- Demobilisation.

It is anticipated that construction vehicles would enter and exit the site to and from the southern (westbound) Victoria Road carriageway. Details about spoil haulage routes are included in **section 6.6.5** and **Chapter 23** (Resource use and waste minimisation).

Temporary changes to the local road network would be required to enable construction of the permanent design and the operation of the Iron Cove Link civil and tunnel site during construction. The Clubb Street/Victoria Road intersection would be permanently closed before the start of construction.

The Toelle Street and Callan Street intersections with Victoria Road would generally remain open during construction. There would be instances where one of these intersections would be closed temporarily to construct the permanent design, however these works would be short-term and conducted during non-peak times, where practical. Regard would also be given to the peak periods of use of King George Park when considering temporary closures. When construction is complete, these intersections would be reopened in the same arrangement as existing (ie left-in, left-out).

Access to and from Manning Street and the works to construct the bioretention facility would be via Toelle Street or Callan Street at Rozelle. Temporary traffic management measures would be established to enable access and egress arrangements. These would be detailed in a CTAMP, which would be prepared to manage construction traffic associated with the project.

Westbound pedestrian and cyclist routes along Victoria Road would be temporarily diverted via Springside Street, McCleer Street, Callan Street, Manning Street and Byrnes Street during construction. These would connect with the westbound shared path along Victoria Road via the terminus of Byrnes Street. Following the completion of construction, the pedestrian and cyclist network would be reinstated.

During construction, a section of King George Park would be used to support the widening works along Victoria Road. The Bay Run would be temporarily realigned to retain pedestrian and cyclist connectivity with the path over Iron Cove Bridge. The existing arrangement would be reinstated at the completion of construction. Further details about temporary pedestrian and cyclist diversions are provided in **Chapter 8** (Traffic and transport).

It is anticipated that construction activities at the Iron Cove Link civil site (C8) and at the Manning Street bioretention facility would be carried out during standard daytime construction hours. Further details about construction hours are included in **section 6.7.2**.

Table 6-16 Iron Cove Link civil site (C8) indicative construction program

Construction activity	Indicative construction timeframe																							
	2018				2019				2020				2021				2022				2023			
Site establishment and utility works				■	■	■	■	■	■	■	■	■												
Traffic diversions and intersection works						■	■	■																
Construction of cut-and-cover and tunnel portals									■	■	■	■	■	■	■	■	■	■	■	■				
Construction of motorway operational infrastructure									■	■	■	■	■	■	■	■	■	■	■	■				
Site rehabilitation and landscaping																			■	■	■			
Testing and commissioning																			■	■	■	■	■	

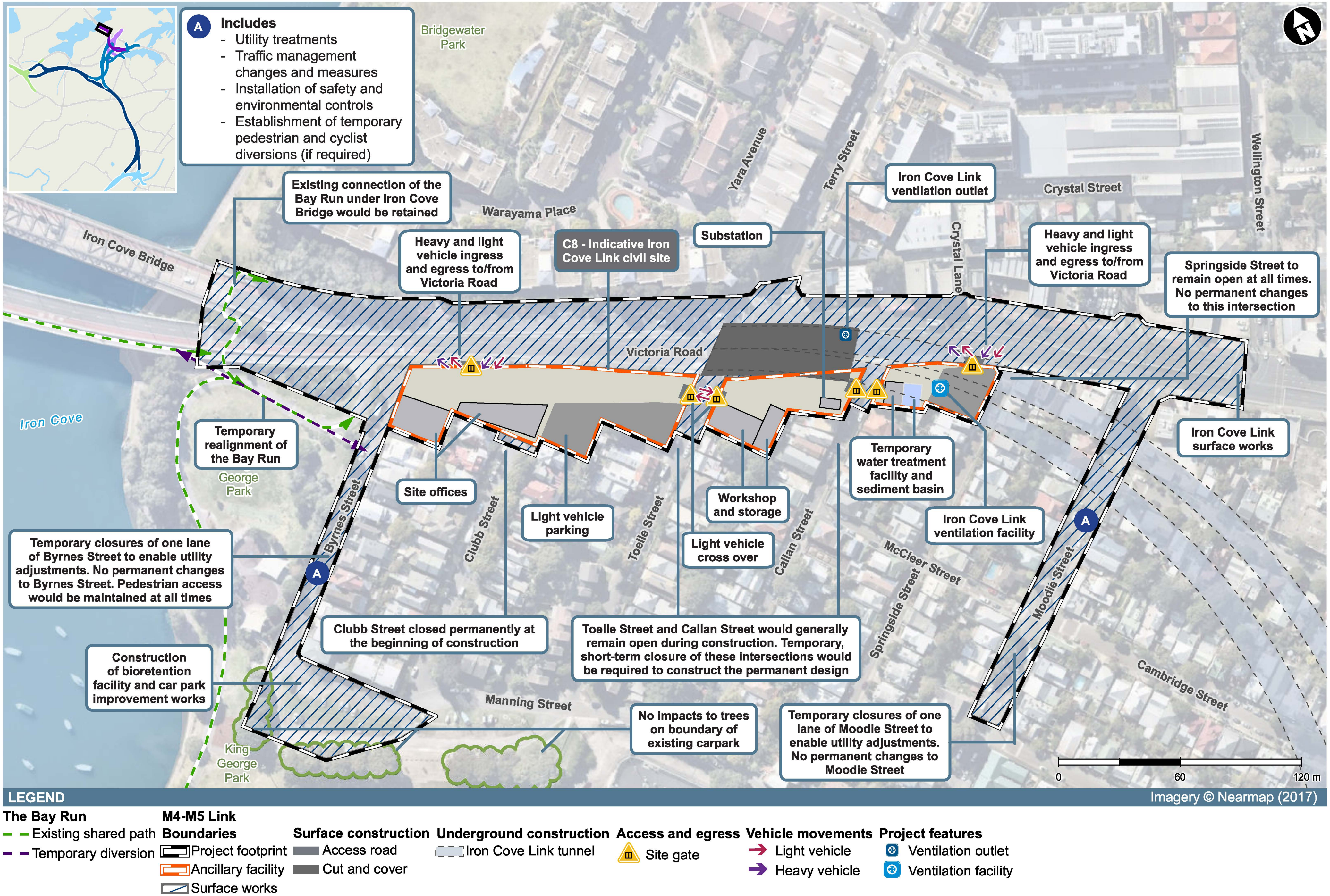


Figure 6-23 Indicative Iron Cove Link civil site (C8) layout

6.5.13 Pyrmont Bridge Road tunnel site (C9)

The Pyrmont Bridge Road tunnel site (C9) would be located between Parramatta Road and Pyrmont Bridge Road at Annandale on land currently occupied by commercial and light industrial businesses, which are to be acquired and demolished for the project. Further details about acquisitions that would occur as part of the project are provided in **Chapter 12** (Land use and property).

The construction ancillary facility would be used to support tunnelling construction activities. The site would include temporary site offices, a workshop and storage facilities, a laydown area, entry and exit points for construction traffic, a temporary substation, temporary ventilation for the tunnels, a temporary water treatment plant and sediment pond, workforce amenities and car parking.

Key construction activities to be carried out at and supported by the Pyrmont Bridge Road tunnel site would include:

- Demolition of existing structures including buildings
- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- Establishment of site offices, amenities and temporary construction hoarding (including acoustic hoarding if required)
- Permanent realignment of Bignell Lane to ensure property owners have ongoing access to properties during construction and operation
- Construction of a driveway along the Parramatta Road frontage to enable access into the site for heavy vehicles
- Provision of a temporary signalised intersection or other temporary traffic control measures along Pyrmont Bridge Road to provide for heavy vehicle egress and light vehicle ingress and egress
- Construction of an acoustic shed
- Construction of a temporary access tunnel for tunnelling works
- Tunnel excavation of the northbound and southbound mainline tunnels
- Spoil handling and haulage
- Excavation of cross-passages, longitudinal egress passages and niches in the tunnels
- Civil tunnel fitout works (including pavement and drainage works)
- Installation of mechanical and electrical services within the mainline tunnels and fitout of the tunnels with additional infrastructure (eg signage)
- Rehabilitation including works to prepare the site for a future use in accordance with the Residual Land Management Plan
- Demobilisation.

Roadheaders would be launched from this site and would initially excavate the temporary access tunnel, and then the eastbound and westbound mainline tunnels. An acoustic shed would be established on the site to ensure that noise levels associated with tunnelling and spoil handling outside standard day time construction hours comply with relevant noise management activities. In addition, temporary noise mitigation measures may be employed, including temporary acoustic hoarding and other temporary structures such as site buildings, which would be located to minimise noise impacts on surrounding properties.

Heavy vehicle access to the site would be from the northern (eastbound) carriageway of Parramatta Road. Vehicles would enter via a new driveway, travel in an anti-clockwise direction via an internal access road, and exit the site onto Pyrmont Bridge Road via a new temporary signalised intersection. Light vehicle ingress and egress would be from Pyrmont Bridge Road. Temporary traffic management measures would be established to enable access and egress arrangements. These would be detailed in a CTAMP, which would be prepared to manage construction traffic associated with the project. Details about spoil haulage routes are included in **section 6.6.5** and **Chapter 23** (Resource use and waste minimisation).

Spoil handling associated with the tunnelling works supported by the site would occur 24 hours a day, seven days a week. Where practical, spoil would be handled below ground and removed during the day, outside of peak periods. Heavy vehicle movements associated with the removal of spoil from tunnelling would only occur via ingress from Parramatta Road and egress to Pyrmont Bridge Road. Feasible and reasonable management strategies would be investigated to minimise the volume of heavy vehicle movements outside standard day time construction hours. Any spoil removal outside standard construction hours would meet the relevant noise criteria. Further details about construction hours are included in **section 6.7.2**.

The location of the Pyrmont Bridge Road tunnel site and an indicative layout of the site are shown in **Figure 6-24**. An indicative program for works to be conducted within the Pyrmont Bridge Road tunnel site is provided in **Table 6-17.**

Table 6-17 Pyrmont Bridge Road tunnel site (C9) indicative construction program

Construction activity	Indicative construction timeframe																			
	2018				2019				2020				2021				2022			
Initial road works and traffic management			■																	
Site establishment and utility works			■	■	■															
Construction of temporary access tunnel				■	■	■														
Tunnelling						■	■	■	■	■	■	■	■							
Civil and mechanical fitout												■	■	■	■					
Testing and commissioning																■	■	■	■	
Site rehabilitation																			■	■

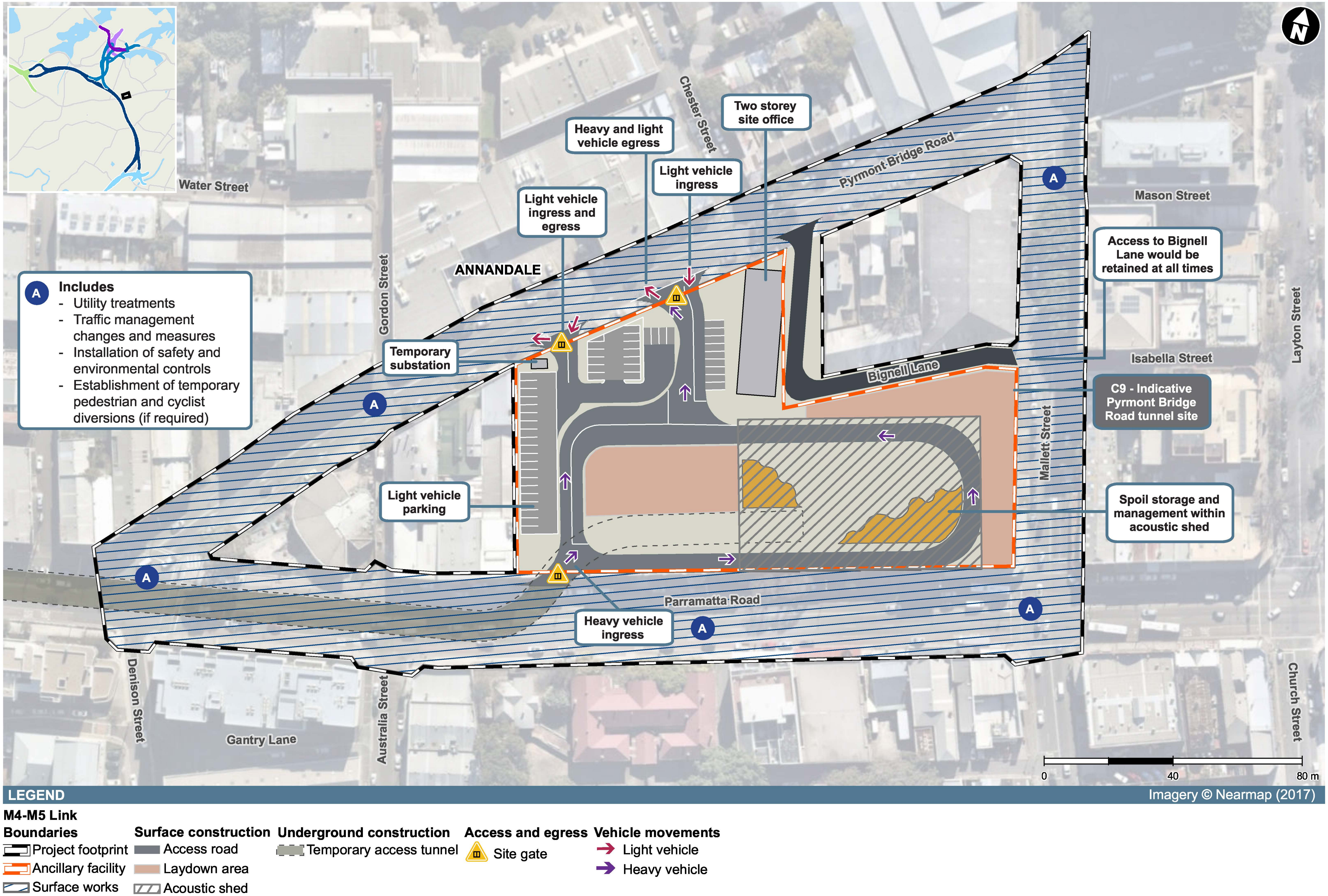


Figure 6-24 Indicative Pyrmont Bridge Road tunnel site (C9) layout

6.5.14 Campbell Road civil and tunnel site (C10)

The Campbell Road civil and tunnel site (C10) would be located within the St Peters interchange site on the southern side of Albert Street and Campbell Road at St Peters. The Campbell Road civil and tunnel site would use land on the surface that is being used as a construction site for the New M5 project. An additional area at the southern end of the Campbell Road civil and tunnel site would be handed over to the project in 2020. This area would be used for light vehicle parking and as a laydown area. Around 150 car parking spaces would be established at the Campbell Road civil and tunnel site.

Prior to being made available for use for construction of the M4-M5 Link project, the construction site for the New M5 project will be demobilised and the area rehabilitated to a condition that is suitable for use for construction of the M4-M5 Link.

The Campbell Road civil and tunnel site would include temporary site offices, a workshop and storage facilities, a laydown area, entry and exit points for construction traffic, a temporary substation, temporary ventilation for the tunnels, a temporary water treatment plant and sediment pond, workforce amenities and car parking. The location of the construction ancillary facility and an indicative layout of the site are shown in **Figure 6-25**. An indicative program for works to be conducted within the Campbell Road construction ancillary facility is provided in **Table 6-18**.

The site would be used to support tunnelling of the mainline tunnels and the construction of the entry and exit ramps that would connect the St Peters interchange with the M4-M5 Link mainline tunnels. A portion of the site would be used for the Campbell Road motorway operations complex (MOC5) during operation, including the Campbell Road ventilation facility. The remainder of the site would be rehabilitated and landscaped in accordance with the Urban Design and Landscape Plan, and consistent with the conditions of approval (and Urban Design and Landscape Plan) for the New M5 project.

Key construction activities to be carried out at and supported by the Campbell Road civil and tunnel site would include:

- Establishment of site offices, amenities and temporary infrastructure
- Construction of an acoustic shed and other temporary noise attenuation measures
- Excavation of the mainline tunnels and the St Peters interchange entry and exit ramps, as well as stockpiling of excavated material and spoil haulage
- Excavation of cross-passages, longitudinal egress passages and niches in the tunnels
- Civil tunnel fitout works (including pavement and drainage works)
- Installation of mechanical and electrical services within the mainline tunnels and fitout of the tunnels with additional infrastructure (eg signage)
- Excavation of the ventilation tunnels
- Construction of a cut-and-cover structure for the St Peters interchange entry and exit ramps within the St Peters interchange site (south of Campbell Road)
- Construction of the St Peters motorway operations complex (MOC5) including the Campbell Road ventilation facility and four ventilation outlets
- Mechanical and electrical fitout of the ventilation facility
- Civil works at the surface to integrate the tunnels with the surface road network of the St Peters interchange
- Finishing works including asphalting, line marking and signage installation
- Demobilisation
- Earthworks and finishing works to prepare the site for future landscaping works that will be carried out in accordance with the Urban Design and Landscape Plan.

Roadheaders would be launched from this site and would excavate the entry and exit ramps and mainline tunnels. Spoil handling would occur within the cut-and-cover structure below Campbell Road being built as part of New M5 project. An acoustic shed would also be established on the site, to ensure that noise from tunnelling and spoil handling outside standard day time construction hours complies with relevant noise management levels. In addition, temporary noise attenuation measures, such as temporary acoustic hoarding and other structures such as site buildings, would be provided to minimise the effects of construction noise on surrounding properties.

Vehicles would enter and exit the site from Albert Street via the signalised intersection on Campbell Road that is being built as part of the New M5 local road upgrade works. Temporary traffic management measures would be established to enable access and egress arrangements. These would be detailed in a CTAMP, which would be prepared to manage construction traffic associated with the project. Details about spoil haulage routes are included in **section 6.6.5** and **Chapter 23** (Resource use and waste minimisation). Within the site, an access driveway would provide access between Albert Road and the acoustic shed and cut-and-cover structure.

Spoil handling associated with tunnelling work supported by the site would occur 24 hours a day, seven days a week. Where practical, spoil would be handled below ground and removed during the day, outside of peak periods. Heavy vehicle movements associated with the removal of spoil from tunnelling would only occur via access and egress directly to and from Campbell Road. Feasible and reasonable management strategies would be investigated to minimise the volume of heavy vehicle movements at night. Any spoil removal outside standard construction hours would meet the relevant noise criteria. Further details about construction hours are included in **section 6.7.2**.

Table 6-18 Campbell Road civil and tunnel site (C10) indicative construction program

Construction activity	Indicative construction timeframe																			
	2018				2019				2020				2021				2022			
Initial road works and traffic management				■																
Site establishment and utility works				■	■	■														
Tunnelling						■	■	■	■	■	■	■	■							
Civil and mechanical fitout													■	■	■	■				
Construction of motorway operational infrastructure												■	■	■	■	■	■			
Testing and commissioning																■	■	■	■	■
Site demobilisation and rehabilitation																			■	■

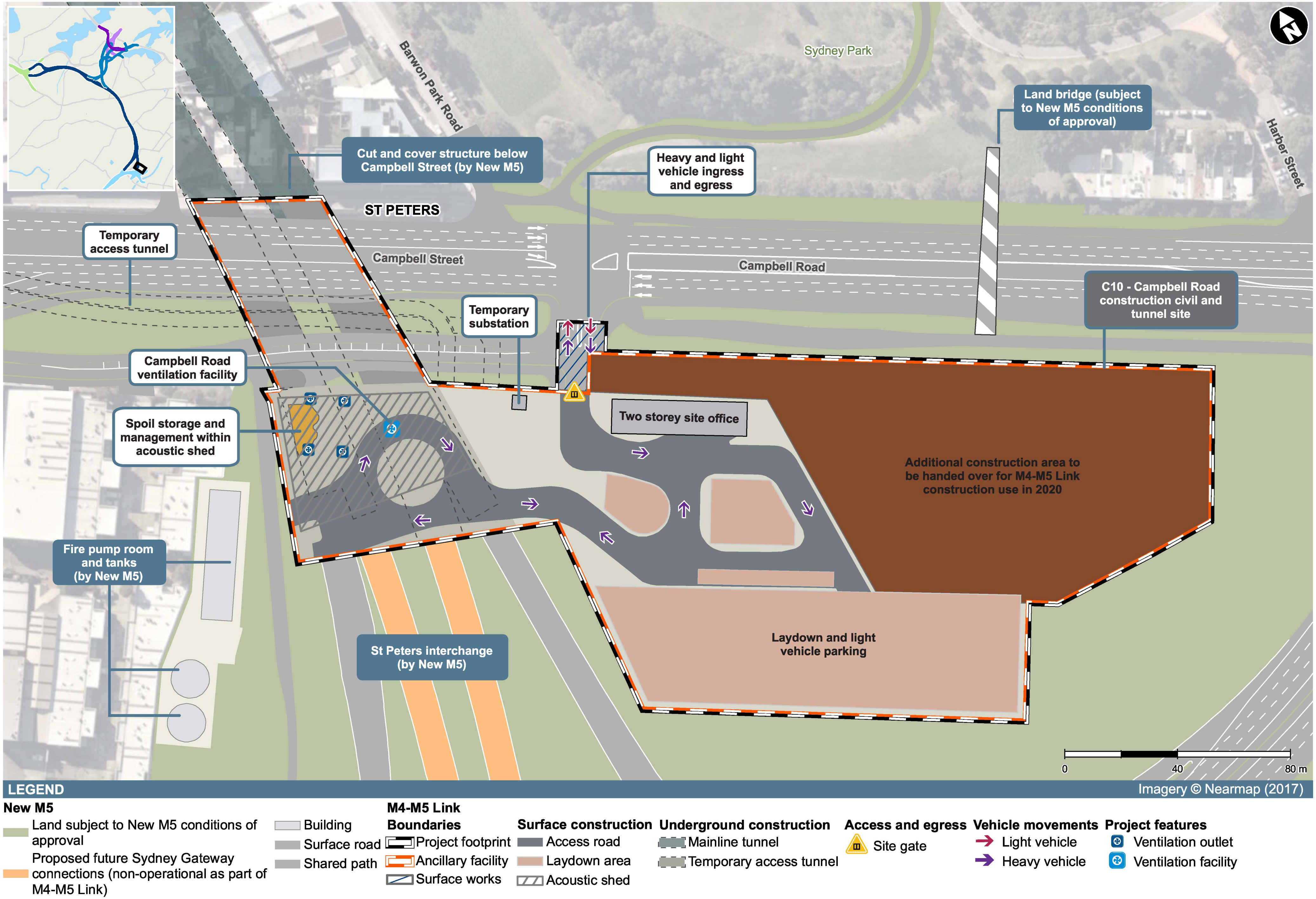


Figure 6-25 Indicative Campbell Road construction civil and tunnel site (C10) layout

6.6 Traffic management and access

This section provides an overview of the traffic management and access provisions that would be put in place during construction of the project, to maintain the functionality of surrounding roads, and to protect the safety of all road users, including pedestrians, cyclists, motorists, public transport users and construction personnel. This section also provides indicative heavy and light vehicle volumes associated with construction, details of parking for the construction workforce, heavy vehicle haulage routes to spoil reuse and disposal sites and the use of alternative routes in the case of 'exceptional circumstances'.

Construction of the project would be subject to careful traffic management to ensure the functionality of surrounding roads is maintained, as well as the safety of members of the public, motorists and construction personnel. Generally, temporary road pavements would be constructed as early as possible within the construction program to separate motorists from construction work zones. However, a number of phases of traffic management and traffic switches would be required at some locations to facilitate construction.

Traffic management measures implemented during construction would be determined during detailed design and documented in a CTAMP that would be prepared as part of the CEMP, and may include:

- Carrying out the works in stages to reduce traffic impacts
- Temporary speed restrictions within construction work zones
- Reduced shoulder widths and erection of traffic barriers along construction work zones
- Scheduling spoil haulage to occur outside of peak periods (where practicable)
- Provision of appropriate warning and advisory signposting
- Provision of temporary access arrangements with private landowners whose property is adjacent to construction activities (where required)
- Provision for public transport and emergency services to ensure disruption is minimised.

At all locations where temporary and/or permanent road closures are required, access to properties would be maintained and signage for road closures or detours would be installed. Further details and the potential impacts of these modifications are provided in **Chapter 8** (Traffic and transport). Roads that would permanently be closed as a result of the project are described in **Chapter 5** (Project description).

6.6.1 Changes to the road network during construction

It is anticipated that road network modifications would be required to facilitate construction of the project. These are identified indicatively in **Table 6-19**. A strategy for managing changes to the road network during construction would be provided as part of the CTAMP, which would be prepared during detailed design. Further information about indicative changes to the road network is provided in **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).

Table 6-19 Indicative road network modifications

Location	Indicative road network modifications	Indicative duration[1]	Road reinstatement
Wattle Street interchange	• Northcote Street would be closed at the intersection with Parramatta Road for the duration of construction. This would be a continuation of the current closure of this section of Northcote Street to facilitate construction of the M4 East project.	• Until completion of tunnel works in 2022.	Once construction is complete, the Northcote Street/Parramatta Road intersection would be reinstated.
Parramatta Road West civil and tunnel site (C1b) and Parramatta Road East civil site (C3b)	• Works would be carried out on Alt Street and Bland Street to facilitate access via new driveways to the Parramatta Road West civil and tunnel site (C1b) and the Parramatta Road East civil site (C3b) • Temporary closures of one lane of Alt Street and Bland Street may be required for establishment of construction vehicle access provisions including installation of driveways and associated construction activities. Traffic management, that could include temporary diversions, would be implemented during temporary closures • Kerbside parking along a section of Alt Street near the intersection with Parramatta Road would be removed to facilitate driveway access to the construction ancillary facilities.	• Q3 2018 to Q1 2019 to complete road modifications • Q3 2018 to Q4 2022 including construction duration and reinstatement of roads.	Once road modification works are complete, both lanes along Alt Street and/or Bland Street would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the existing arrangement. Kerbside parking along Alt Street would be reinstated at the end of construction.
Darley Road civil and tunnel site (C4)	• Works would be carried out to facilitate access to the Darley Road civil and tunnel site (C4) including establishment of a temporary right hand turn lane for construction traffic to access Darley Road from City West Link • Temporary diversions along Darley Road may be required during construction (to enable establishment of construction vehicle access provisions) • One lane in each direction along Darley Road (between around Francis Street and Charles Street at Leichhardt) would generally be maintained, with temporary closures of one lane required for establishment of construction vehicle access provisions including installation of driveways and associated construction activities. Traffic management, that could include temporary diversions, would be implemented during temporary closures • Kerbside parking along the northern (eastbound) carriageway of Darley Road between around Francis Street and Charles Street would be removed (around 20 spaces) during construction.	• Q3 2018 to Q1 2019 to complete road modifications • Q3 2018 to Q4 2022 including construction duration and reinstatement of roads.	Once road modification works are complete, Darley Road would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the existing arrangement. Kerbside parking along Darley Road would be reinstated at the end of construction.

Location	Indicative road network modifications	Indicative duration[1]	Road reinstatement
City West Link and The Crescent at Lilyfield and Rozelle	• Works would be carried out to facilitate ingress and egress for the Rozelle civil and tunnel site (C5) including establishment temporary intersections, slip lanes and driveways • Works would be carried out to upgrade and improve the eastbound and westbound carriageways of City West Link and The Crescent • Temporary diversions would be put in place to allow for construction along the existing alignment • Under existing and diverted arrangements, all traffic lanes in each direction would generally be maintained with some short-term lane closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences.	• Q4 2018 to Q2 2019 to complete road modifications • Q4 2018 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads.	When construction is complete, the road would be reinstated as per the permanent design shown in **Chapter 5** (Project description).
The Crescent at Annandale and Rozelle	• Works would be carried out to establish a new driveway for ingress and egress for The Crescent civil site (C6) • Works would be carried out to realign The Crescent and reconstruct the intersection with City West Link • The new alignment of The Crescent would be constructed 'offline' (that is, next to the existing alignment). Traffic would be switched onto the new alignment when ready, and the old alignment of The Crescent would be demolished • All traffic lanes in each direction would generally be maintained with some short-term lane closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences • Temporary changes to the intersection of The Crescent/Chapman Road may be required. Access to the commercial premises, including the Multihull Central Marina, that use Chapman Road as well as the Glebe Foreshore Parklands would be protected and maintained at all times • Traffic signal modifications at the intersection with City West Link in line with the temporary and permanent design.	• Q1 2019 to Q2 2019 to complete road modifications • Q1 2019 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads.	Once road modification works are complete, the road would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the permanent design.

Location	Indicative road network modifications	Indicative duration[1]	Road reinstatement
Victoria Road at Rozelle	• All traffic lanes in each direction would generally be maintained with some short-term lane closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences • Traffic signal modifications at the intersection with The Crescent in line with the permanent design • Temporary diversions would be put in place at the intersection with The Crescent to allow for construction of the new bridge in line with the permanent design. This could include the construction a temporary bridge next to the existing bridge, onto which traffic would be switched during construction of the new bridge. When complete, traffic would be switched onto the new bridge and the temporary bridge would be removed.	• Q4 2018 to Q2 2019 to complete road modifications • Q4 2018 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads.	Once road modification works are complete, the road would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the permanent design.
Gordon Street south of Lilyfield Road at Rozelle	• Gordon Street between Lilyfield Road and the Rozelle Rail Yards would be permanently closed as part of the project.	N/A	Gordon Street would be permanently closed.
Lilyfield Road at Rozelle	• Temporary closures to one lane would be required for short periods of time to allow for construction of the construction access driveways, utility works and construction of the cut-and-cover structures • Access to Lilyfield Road from Victoria Road may be temporarily restricted to allow for integration with the revised Victoria Road alignment. Closures would be outside of peak periods where feasible and reasonable. During these periods, alternative access to Lilyfield Road would be available from Hornsey Street and Gordon Street.	• Q4 2018 to Q2 2019 to complete road modifications • Q2 2019 to Q4 2019 for utility relocations • Q4 2018 to Q3 2023 including construction duration staging and reinstatement of roads.	Once works are completed, the road would be reopened in line with permanent design.
Hornsey Street at Rozelle	• One lane in each direction would generally be maintained during construction • Access to Hornsey Street from Victoria Road would require full closure for short periods of time during realignment and upgrade works to Victoria Road • Alternative access to Hornsey Street would be available from Lilyfield Road and Gordon Street.	• Q4 2018 to Q2 2019 to complete road modification • Q4 2018 to Q3 2023 including construction duration staging and reinstatement of roads.	Once works during the stage are completed, the road would be reopened in line with permanent design.

Location	Indicative road network modifications	Indicative duration[1]	Road reinstatement
Quirk Street at Rozelle	• One lane in each direction would generally be maintained during construction • Access to Quirk Street from Victoria Road would require full closure for short periods of time during realignment and upgrade works to Victoria Road • Alternative access to Quirk Street would be available from Hornsey Street and Gordon Street.	• Q4 2018 to Q2 2019 to complete road modifications • Q4 2018 to Q3 2023 including construction duration staging and reinstatement of roads.	Once works during the stage are completed, the road would be reopened in line with permanent design.
Iron Cove Link civil site (C8) and Victoria Road	• Works would be carried out along Victoria Road to facilitate ingress and egress for the Iron Cove Link civil site (C8) • All traffic lanes in each direction would generally be maintained with some short-term lanes closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences • Temporary diversions would be put in place to allow for construction along the existing alignment.	• Q4 2018 to Q2 2019 to complete road modifications for ingress and egress • Q4 2018 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads.	Once works are complete, the road would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the permanent design.
Moodie Street at Rozelle	• Short-term, temporary closure of one lane of Moodie Street may be required during construction to facilitate utility works.	• Q4 2018 to Q3 2023.	Once construction is completed, Moodie Street would be reopened as per the existing design.
Callan Street at Rozelle	• Access to Callan Street from Victoria Road would generally remain open during construction • Temporary closures at the intersection with Victoria Road to allow for integration with the revised Victoria Road alignment may occur. Closures would be outside of peak periods where feasible and reasonable subject to road occupancy licences • During these periods, alternative access to Callan Street would be available from Springside Street and McCleer Street at Rozelle.	• Q4 2018 to Q3 2023.	Once works are completed, the road would be reopened in line with permanent design.

Location	Indicative road network modifications	Indicative duration[1]	Road reinstatement
Toelle Street at Rozelle	• Access to Toelle Street from Victoria Road would generally remain open during construction • Temporary closures at the intersection with Victoria Road to allow for integration with the revised Victoria Road alignment may occur. Closures would be outside of peak periods where feasible and reasonable subject to road occupancy licences • During these periods, alternative access to Toelle Street would be available from Springside Street, McCleer Street, Callan Street and Manning Street at Rozelle.	• Q4 2018 to Q3 2023.	Once works are completed, the road would be reopened in line with permanent design.
Clubb Street at Rozelle	• Access between Clubb Street and Victoria Road would be permanently closed and a cul-de-sac established to accommodate the revised alignment of Victoria Road • Access to Clubb Street would be available from Springside Street, McCleer Street, Callan Street and Manning Street.	• N/A (closed at the start of construction).	Access to Clubb Street from Victoria Road would be permanently closed.
Byrnes Street at Rozelle	• Short-term, temporary closure of one lane of Byrnes Street may be required during construction to facilitate utility works • Works would also be carried out to move the terminus near Victoria Road south to accommodate the revised design.	• Q1 2019 to Q4 2019.	Once utility works are completed, Byrnes Street would be reopened as per the existing layout. Once works on the cul-de-sac of Byrnes Street are complete, this section of the road would be reopened in line with the permanent design.
Pyrmont Bridge Road tunnel site (C9)	• Works would be carried out along Parramatta Road and Pyrmont Bridge Road to facilitate ingress and egress for construction traffic • Works would be carried out to realign Bignell Lane between Mallett Street and Pyrmont Bridge Road at Annandale • Short-term, temporary closure of Bignell Lane would be required during construction to allow for the realignment works • Rear-access to commercial properties along Bignell Lane would be maintained during construction.	• Q3 2018 to Q4 2018 to complete road modifications • Q3 2018 to Q3 2022 including construction duration and reinstatement of roads.	Once construction is completed, roads would be reopened in line with the permanent design (ie realigned Bignell Lane).

[1] Table note: Q refers to quarter, where Q1 is January to March, Q2 is April to June, Q3 is July to September and Q4 is October to December

Traffic staging approach

The construction of major infrastructure in constrained urban environments requires detailed consideration of the staging of construction works. There are three key areas of the project which will require the preparation of detailed traffic staging plans during construction:

- **Victoria Road/The Crescent/Anzac Bridge approach intersection** – reconstructing the intersection to accommodate existing connectivity, the new M4 East Motorway/Iron Cove Link to Anzac Bridge connections and construction of a new bridge at Victoria Road
- **City West Link/The Crescent intersection** – realigning The Crescent at Annandale to the west, building a new bridge over Whites Creek and modifying the intersection
- **Victoria Road at Iron Cove** – realigning the westbound (southern) carriageway of Victoria Road to create sufficient space to build new tunnel portals and entry and exit ramps for the Iron Cove Link.

These works would be carried out on parts of the arterial road network that are heavily trafficked and provide important network connectivity. The construction of these works would require the implementation of multiple traffic stages that meet the requirements of the construction contractor, Roads and Maritime, Transport Management Centre (TMC) and other key stakeholders.

The traffic staging would likely require the creation of temporary carriageways, intersections and bridges offline from the existing infrastructure to enable the construction of the new works and the switching of traffic.

Temporary infrastructure would be sized to adequately convey the existing traffic through the site. Temporary closure and diversions, outside of peak hours, would likely be required and would be undertaken following consultation with the TMC. Staging arrangements would be confirmed by the construction contractor during detailed design.

In preparing the traffic staging plans during construction the key considerations would include:

- Maintaining traffic and lane capacity on the arterial road network during peak periods
- Minimising delays to motorists utilising this part of the arterial road network
- Undertaking the works efficiently to minimise the duration of traffic impacts
- Maintaining the safety of motorists, members of the public and construction personnel
- Minimising impacts on public transport services and providing alternative arrangements where necessary
- Minimising impacts on key active transport links and providing alternative arrangements where necessary.

6.6.2 Changes to pedestrian and cyclist facilities

It is anticipated that some modifications would be needed to be made to pedestrian and cyclist facilities to facilitate construction of the project. An indicative list of these modifications is outlined in **Table 6-20**.

A strategy for the maintenance of pedestrian and cyclist access throughout construction would be provided as part of the CTAMP, which would be prepared during detailed design. Further information about alternative pedestrian and cyclist routes is provided in **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).

Table 6-20 Indicative modifications to pedestrian and cyclist facilities during construction

Location	Indicative modifications to pedestrian and cyclist facilities
Northcote Street civil site (C3a)	• Temporary closure of a section of footpaths on both sides of Northcote Street at Haberfield during construction. This would be a continuation of the current closure of this section of footpaths along Northcote Street to facilitate construction of the M4 East project • Alternative access to Parramatta Road would be provided via Ash Lane and either Wolseley Street or Wattle Street at Haberfield.
Parramatta Road West civil and tunnel site (C1b) and Parramatta Road East civil site (C3b)	• Periodic, short-term closures of footpaths on both sides of Alt Street on the eastern and western sides of Parramatta Road. These would be most likely to occur during site establishment, when access to these sites is being established • Where a footpath is temporarily closed, the corresponding footpath on the other side of the road would remain open • Traffic management measures would be implemented at the entry and exit driveways on Parramatta Road, Alt Street and Bland Street to manage potential interactions between construction traffic and pedestrians and cyclists.
Darley Road civil and tunnel site (C4)	• Temporary closure of the footpath on the northern side of Darley Road at Leichhardt, between around Canal Road and Darley Road, may be required. This would be most likely to occur during site establishment, when access to the Darley Road civil and tunnel site (C4) is being established • The footpath along the southern side of Darley Road would remain open at all times, and would act as an alternative to the northern footpath during temporary closures • There is an on-road cyclist route on Darley Road at Leichhardt that connects to the Lilyfield Road commuter route via the City West Link/James Street intersection. No diversions would be required • Traffic management measures would be implemented at the entry and exit driveways to manage potential interactions between construction traffic and pedestrians and cyclists • The project would not affect the existing pedestrian path that runs along the southern side of City West Link and connects the Leichhardt North light rail stop with Charles Street at Lilyfield (via the bridge over City West Link).
Rozelle civil and tunnel site (C5)	• Periodic closures of the footpath on the southern side of Lilyfield Road between around Lamb Street at Lilyfield and Victoria Road at Rozelle. The footpath along the northern side of Lilyfield Road would not be affected by the project • Temporary realignment of a section of the pedestrian path between Anzac Bridge and Victoria Road at Rozelle to minimise interaction with construction activities • Periodic, short-term closures of the footpath on one side of James Craig Road at Rozelle during construction. During these instances, the footpath on the other side of James Craig Road would be used as an alternative route • Permanent closure of two pedestrian and cyclist bridges at Rozelle; one over City West Link and the other over Victoria Road. Alternative routes during construction are described in **Chapter 8** (Traffic and transport) and would be established before closure of these bridges. New permanent pedestrian and cyclist links that would provide similar or improved connectivity would also be provided as part of the project (refer to **Appendix N** (Technical working paper: Active transport strategy)) • Temporary, periodic closure of the shared paths on the eastern and western sides of Victoria Road at Rozelle. Works would be staged so that the shared path on either the eastern or western side of Victoria Road at Rozelle would remain open at all times.

Location	Indicative modifications to pedestrian and cyclist facilities
The Crescent civil site (C6)	• Periodic, temporary closures of the footpath on the eastern and western side of The Crescent at Annandale between City West Link and Johnston Street at Annandale during construction. Works would be staged so that the shared path on either the eastern or western side of The Crescent would remain open at all times • Permanent closure of the shared path through Buruwan Park connecting The Crescent with Bayview Crescent at Annandale. Alternative access to the Rozelle Bay light rail stop from The Crescent, Johnston Street and Bayview Crescent at Annandale would be provided at all times during construction.
Iron Cove Link civil site (C8)	• Temporary closure of the shared path on the southern side of Victoria Road at Rozelle during construction. A temporary diversion would be provided along Springside Street, McCleer Street, Callan Street, Manning Street and Byrnes Street at Rozelle • Temporary diversion of The Bay Run connection to the shared path along Iron Cove Bridge during construction. Alternative access to Iron Cove Bridge would be provided.
Pyrmont Bridge Road tunnel site (C9)	• Temporary diversions around the heavy vehicle ingress and egress points along Parramatta Road and Pyrmont Bridge Road at Annandale during construction • Traffic management measures would be implemented at the entry and exit driveways on Parramatta Road and Pyrmont Bridge Road to manage potential interactions between construction traffic and pedestrians and cyclists.
Campbell Street civil and tunnel site (C10)	• As part of the New M5 project, the Campbell Road/Albert Street intersection would be upgraded to a signalised intersection to cater for M4-M5 Link construction traffic entering and leaving the Campbell Road civil and tunnel site (C10) • This signalised intersection would provide signalised crossing for pedestrians and cyclists using the new pedestrian and cyclist paths along the southern side of Campbell Road at St Peters.

6.6.3 Changes to the public transport network

It is anticipated that some modifications would be needed to the public transport network to facilitate construction of the project. Where bus stops are relocated, pedestrian access, including disabled facilities would be maintained.

Changes to the public transport network around the project would include:

- The bus stops on The Crescent (northbound and southbound) at Annandale near the intersection with City West Link would be moved south towards Johnston Street to allow for realignment of The Crescent. The northbound bus stop would be permanently moved south to accommodate the new alignment. The southbound bus stop would be reinstated in generally the same location. Alternative access from The Crescent to the Rozelle Bay light rail stop would also be provided during construction
- Three bus stops on Victoria Road at Rozelle (two on the northbound side and one on the southbound side) near the intersection with The Crescent would be relocated north to accommodate the reconstruction of Victoria Road. These bus stops would be reinstated in generally the same location at the completion of construction
- Two bus stops on Victoria Road near Iron Cove Bridge at Rozelle would be temporarily relocated to allow for the widening works along Victoria Road. The bus stop on the eastbound side is currently located between Terry Street and Crystal Lane at Rozelle. The bus stop on the westbound side is currently located between Toelle Street and Callan Street at Rozelle. It is anticipated that these bus stops would be temporarily relocated to the east during construction and would be reinstated in generally the same location at the completion of construction.

Pedestrian access to the Leichhardt North light rail stop at Leichhardt and the Rozelle Bay light rail stop at Annandale would be maintained during construction and operation. The project would also deliver an improved pedestrian connection to the Rozelle Bay light rail stop as part of the permanent design (refer to **Chapter 5** (Project description)). An assessment of the impacts of the project on the public transport network during construction and operation is provided in **Chapter 8** (Traffic and transport).

The proposed modifications would be reviewed during detailed design with the objective of minimising disruptions to public transport services and customers. Any bus stop relocations would be agreed with Transport for NSW and all affected bus operators. Details on the integration of the project with the public transport network are provided in **Chapter 5** (Project description).

6.6.4 Access routes and vehicle numbers

The proposed access to the construction sites is summarised in **Table 6-21**. Wherever possible, access is proposed to be gained directly from major arterial roads. Some use of local roads by heavy vehicles delivering materials and/or equipment may also be required, however this would be minimised as far as practicable. **Table 6-22** sets out estimated daily construction vehicle numbers in the 'worst case scenario'. Details about construction hours, including hours during which spoil haulage would occur, are provided in **section 6.7.2**.

Access routes would be documented in the CTAMP. Further information relating to haulage routes, construction traffic impacts and mitigation is provided in **Chapter 8** (Traffic and transport). Indicative access routes to and from construction ancillary facilities would be confirmed during detailed design and documented in the CTAMP that would be prepared for the project.

The use of a marshalling area(s) for spoil trucks would be investigated to further assist in staggering the arrival of vehicles to site. This would be located in a non-residential area and in close proximity to the arterial road network and construction ancillary facilities where tunnelling would occur. This measure would assist in preventing queuing and parking of heavy vehicles on local roads in the vicinity of the project. Marshalling area(s) and provisions for their use would be identified in the CTAMP.

Table 6-21 Indicative access routes to and from construction ancillary facilities

Site	Access and egress points (heavy vehicles)[1]	Access and egress points (light vehicles)
Wattle Street civil and tunnel site (C1a)	• Parramatta Road then Wattle Street via M4-M5 Link entry and exit ramps.	• Parramatta Road then Wattle Street northern (eastbound) carriageway (right in, right out).
Haberfield civil and tunnel site (C2a)	• Below ground: via the WestConnex M4 East tunnels • Above ground: Wattle Street (left-in, left-out).	• Wattle Street southern westbound) carriageway (left-in, left-out) • Walker Avenue • Parramatta Road.
Northcote Street civil site (C3a)	• Parramatta Road (left-in, left-out).	• Wolseley Street • Wattle Street (left-out).
Parramatta Road West civil and tunnel site (C1b)	• Parramatta Road (left-in, left-out) • Alt Street (crossover between sites only).	• Parramatta Road (left-in, left-out) • Alt Street.
Haberfield civil site (C2b)	• Wattle Street (left-in, left-out) • Parramatta Road (left-in, left-out).	• Wattle Street (left-in, left-out) • Parramatta Road (left-in, left-out) • Walker Avenue (left-in, left-out).
Parramatta Road East civil site (C3b)	• Parramatta Road (left-in, left-out).	• Parramatta Road (left-in, left-out) • Alt Street • Bland Street.
Darley Road civil and tunnel site (C4)	• City West Link then Darley Road[2]	• City West Link then Darley Road.

Site	Access and egress points (heavy vehicles)[1]	Access and egress points (light vehicles)
Rozelle civil and tunnel site (C5)	• City West Link (left-in from eastbound carriageway, right-out to westbound carriageway).	• Lilyfield Road.
The Crescent civil site (C6)	• The Crescent (left-in, right-out).	• The Crescent.
Victoria Road civil site (C7)	• Victoria Road (left-in, left-out).	• Victoria Road (left in, left out) • Hornsey Street.
Iron Cove Link civil site (C8)	• Victoria Road (left-in, left-out).	• Victoria Road (left-in, left-out).
Pyrmont Bridge Road tunnel site (C9)	• Parramatta Road (left-in) • Pyrmont Bridge Road (left-out).	• Pyrmont Bridge Road.
Campbell Road civil and tunnel site (C10)	• Albert Road via Campbell Road and Princes Highway.	• Albert Road via Campbell Road.

Notes:

1 Some use of local roads by heavy vehicles delivering materials and/or equipment may also be required, however this would be minimised as far as practicable

2 Spoil haulage vehicles would enter and exit the Darley Road civil and tunnel site (C4) via City West Link. Refer to **Table 6-23** for further details about spoil haulage routes.

Table 6-22 Indicative construction vehicle numbers

Location		Daily vehicles (one way)		AM peak hour (7.30–8.30am)				PM peak hour (4.15–5.15pm)			
		Heavy	Light	Heavy vehicles		Light vehicles		Heavy vehicles		Light vehicles	
				Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart
C1a	Wattle Street civil and tunnel site[1]	133	50	7	7	10	N/A	7	7	N/A	50
C2a	Haberfield civil and tunnel site[1]	136	90	7	7	30	N/A	7	7	N/A	90
C3a	Northcote Street civil site	100	150	5	5	50	N/A	5	5	N/A	150
C1b	Parramatta Road West civil and tunnel site[1]	140	10	7	7	10	N/A	7	7	N/A	10
C2b	Haberfield civil site	10	20	2	2	10	N/A	2	2	N/A	10
C3b	Parramatta Road East civil site	30	150	3	3	50	N/A	3	3	N/A	150
C4	Darley Road civil and tunnel site	100	70	7	7	10	N/A	7	7	N/A	70
C5	Rozelle civil and tunnel site[1]	517	350	23	23	100	N/A	23	23	N/A	350
C6	The Crescent civil site	10	20	2	2	0	N/A	2	2	N/A	5
C7	Victoria Road civil site	42	140	2	2	0	N/A	2	2	N/A	0
C8	Iron Cove Link civil site	42	140	2	2	15	N/A	2	2	N/A	140
C9	Pyrmont Bridge Road tunnel site[1]	133	70	7	7	20	N/A	7	7	N/A	70
C10	Campbell Road civil and tunnel site[1]	133	70	7	7	20	N/A	7	7	N/A	70

Notes:

1 Spoil haulage would occur 24 hours a day, seven days a week.

Indicative construction vehicle numbers (daily and for the AM and PM peak hour) would vary based on the final construction methodology and program.

6.6.5 Spoil haulage routes

Excess spoil that cannot be reused within the project would require off-site reuse/disposal. Around 95 per cent of uncontaminated spoil would be beneficially reused in accordance with the project spoil management hierarchy. Further information is provided in **Chapter 23** (Resource use and waste minimisation).

It is anticipated that spoil would be hauled using heavy vehicles to spoil reuse and disposal sites. The indicative spoil haulage routes are described in **Table 6-23** and shown in **Figure 6-26** to **Figure 6-31**.

Table 6-23 Indicative spoil haulage routes

Location		Indicative spoil haulage route
C1a	Wattle Street civil and tunnel site[1]	• Entry: via the Wattle Street interchange entry ramp • Exit: via the Wattle Street interchange exit ramp and onto Parramatta Road, heading west.
C2a	Haberfield civil and tunnel site[1]	• Entry and exit via the M4 East tunnel connection.
C3a	Northcote Street civil site	No spoil haulage would occur from this site.
C1b	Parramatta Road West civil and tunnel site	• Entry: eastbound along the M4 Motorway, southbound along Centenary Drive, eastbound along the Hume Highway, then left onto Parramatta Road heading north • Exit: northbound along Parramatta Road.
C2b	Haberfield civil site	No spoil haulage would occur from this site.
C3b	Parramatta Road East civil site	No spoil haulage would occur from this site.
C4	Darley Road civil and tunnel site	• Entry: via City West Link and Darley Road • Exit: via Darley Road and then City West Link.
C5	Rozelle civil and tunnel site[1]	• Entry: eastbound along City West Link and into the site • Exit: westbound along City West Link.
C6	The Crescent civil site	• Entry: City West Link, then south along The Crescent and into the site • Exit: northbound along The Crescent (to be facilitated via construction traffic management measures), then City West Link.
C7	Victoria Road civil site	No spoil haulage would occur from this site.
C8	Iron Cove Link civil site	• Entry: northbound along Victoria Road and into the site • Exit: northbound along Victoria Road.
C9	Pyrmont Bridge Road tunnel site[1]	• Entry: eastbound along Parramatta Road and into the site • Exit: westbound along Pyrmont Bridge Road and then Parramatta Road.
C10	Campbell Road civil and tunnel site[1]	• Entry: southbound along Campbell Road and then into the site • Exit: northbound along Campbell Road, then south along the Princes Highway.

Note:

[1] Indicative spoil haulage routes may vary based on the final construction methodology and program.

Where spoil haulage is carried out outside of the standard daytime construction hours, reasonable and feasible work practices and mitigation measures, consistent with the requirements of the *Interim Construction Noise Guideline* (DECCW 2009a), would be implemented to manage potential noise impacts, especially late night vehicle movements past sensitive receptors.

Further details regarding spoil generation and management are provided in **Chapter 8** (Traffic and transport). Construction traffic and noise impacts that arise from spoil haulage are assessed in **Chapter 8** (Traffic and transport) and **Chapter 10** (Noise and vibration) respectively.

Other disposal/reuse sites may be used depending on need at the time spoil is generated. In addition, there is the potential that spoil could be removed by barge, subject to further investigations.

The proposed haulage routes would not always meet all of the transport requirements of the project. Therefore, alternative haulage routes would be available for spoil trucks under ‘exceptional circumstances’, which may include:

- Queuing of heavy vehicles onsite, requiring other heavy vehicles to temporarily bypass construction ancillary facility sites to prevent possible queuing on public roads while they wait to access the site
- Road works or an accident/incident that prevents heavy vehicles from accessing or travelling on the designated haulage route
- A designated traffic manager for the project determines that a temporary hazard (eg illegally parked vehicle, a lost vehicle load or floodwater) requires a heavy vehicle(s) to bypass an access gate or designated route to avoid causing damage to public and/or private property
- During temporary road closures.

Table 6-24 identifies alternative routes that may be used during ‘exceptional circumstances’. These alternative routes may vary depending on the final construction methodology. Alternative routes would avoid the use of local roads where practicable. The use of alternative routes would be in accordance with relevant conditions of approval.

Table 6-24 Alternative spoil haulage routes (during exceptional circumstances)

Construction ancillary facility	Alternative spoil haulage routes (during exceptional circumstances)
Wattle Street civil and tunnel site (C1a)	• East on Wattle Street towards City West Link then Victoria Road (to the north via The Crescent) • East on Wattle Street towards City West Link, then Anzac Bridge and the Western Distributor (via The Crescent and Victoria Road)
Haberfield civil and tunnel site (C2a)	No alternative route proposed
Parramatta Road West civil and tunnel site (C1b)	• Entry: Southbound on Parramatta Road, left into Tebbutt Street, left into Hathern Street, left into Brown Street left into Cook Street, left into Old Canterbury Road and left back onto Parramatta Road towards the site
Darley Road civil and tunnel site (C4)	• East on City West Link then Victoria Road (to the north via The Crescent) • East on City West Link, then Anzac Bridge and the Western Distributor
Rozelle civil and tunnel site (C5)	• East on City West Link then Victoria Road • East on City West Link, then Anzac Bridge and the Western Distributor (via The Crescent and Victoria Road)
The Crescent civil site (C6)	• Johnston Street then Parramatta Road • The Crescent, Ross Street and Pyrmont Bridge Road
Iron Cove Link civil site (C8)	No alternative route proposed
Pyrmont Bridge Road tunnel site (C9)	• Pyrmont Bridge Road towards Ross Street, then The Crescent and City West Link • Parramatta Road then Old Canterbury Road
Campbell Road civil and tunnel site (C10)	• Campbell Street then Princes Highway and Sydney Park Road

Figure 6-26 Indicative spoil haulage route – Wattle Street and Haberfield civil and tunnel sites (C1a and C2a)

Figure 6-27 Indicative spoil haulage route – Parramatta Road West civil and tunnel site (C1b)

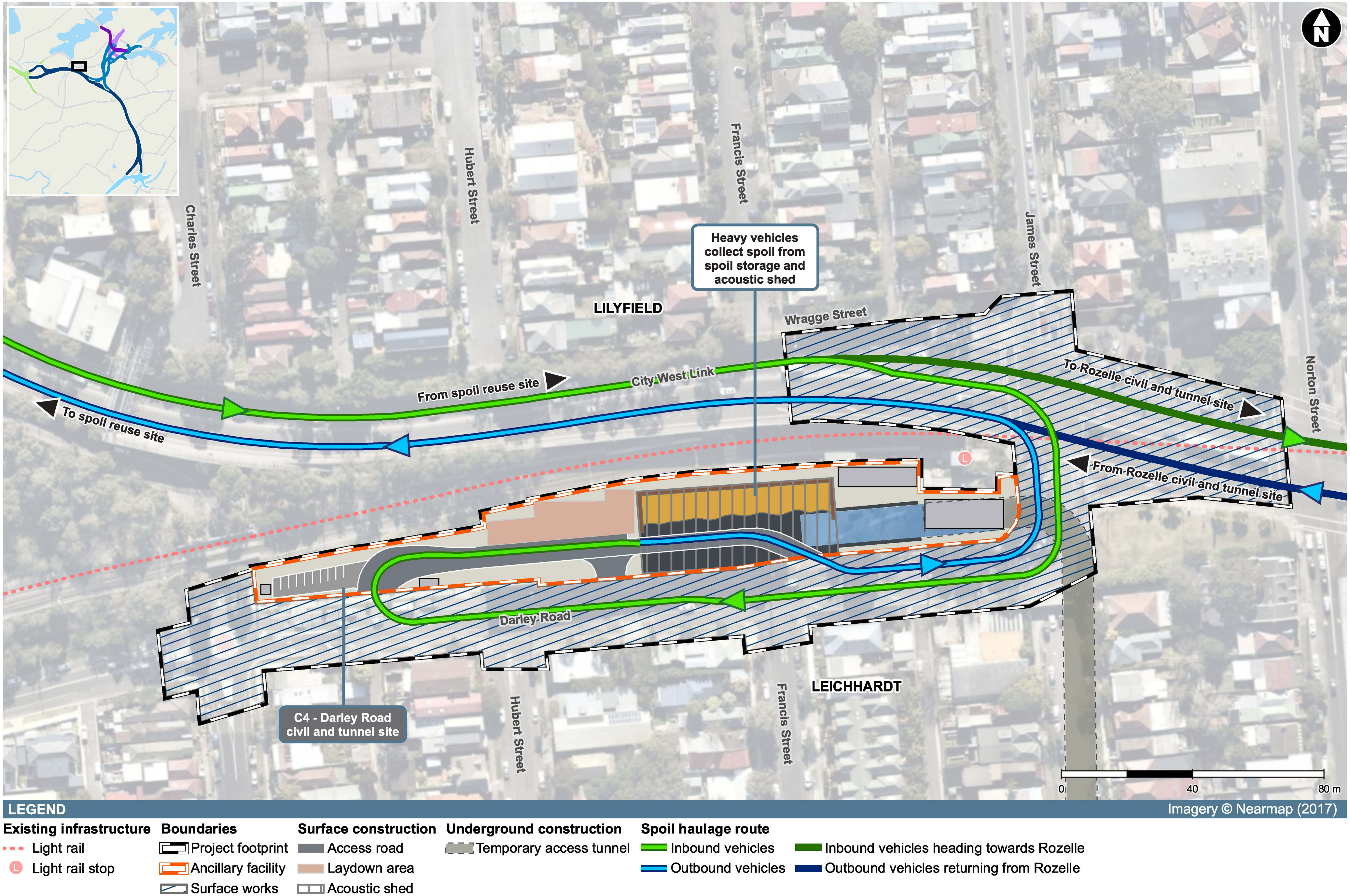


Figure 6-28 Indicative spoil haulage route – Darley Road civil and tunnel site (C4)

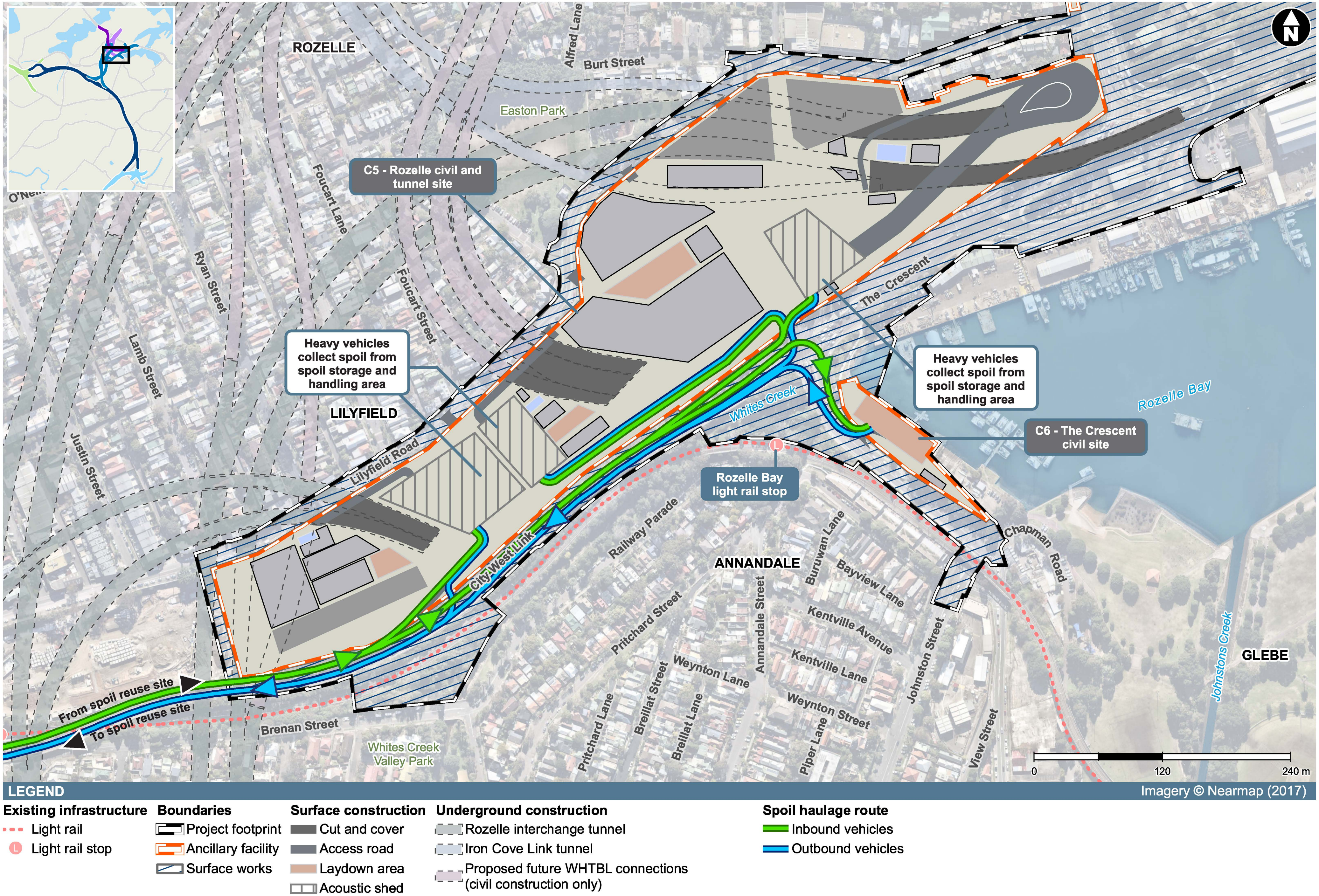


Figure 6-29 Indicative spoil haulage route – Rozelle civil and tunnel site (C5) and The Crescent civil site (C6)

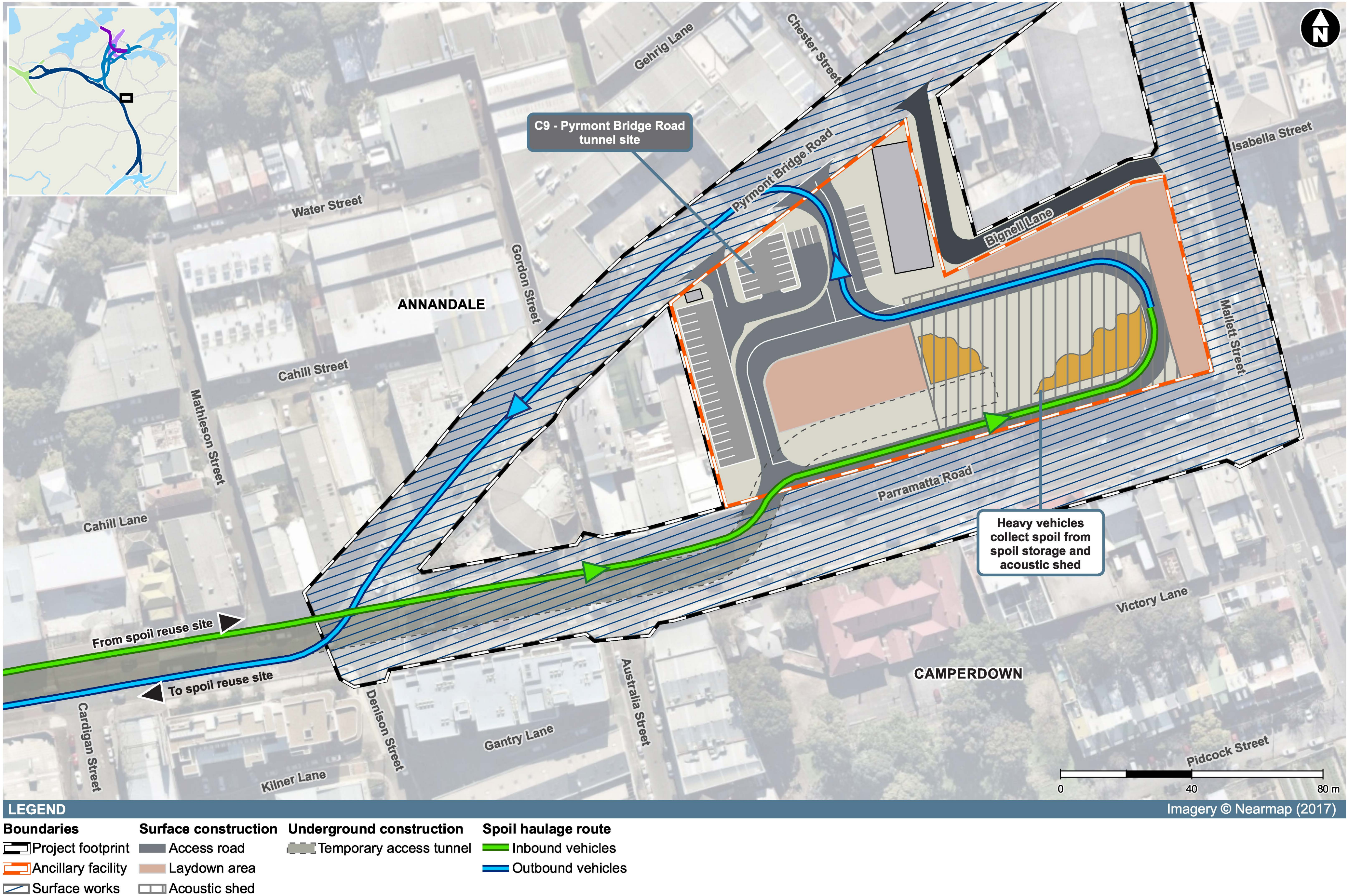


Figure 6-30 Indicative spoil haulage route – Pyrmont Bridge Road tunnel site (C9)

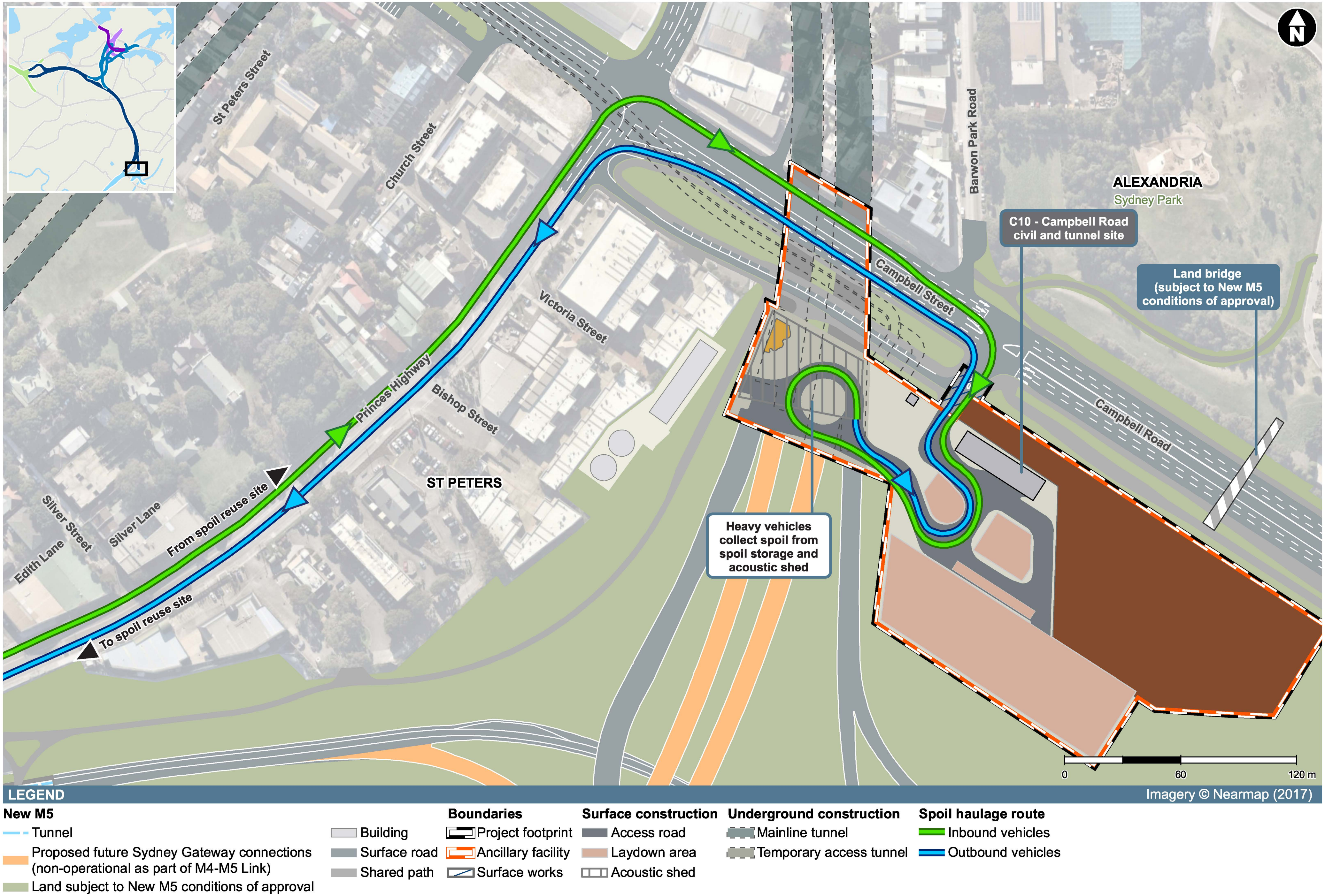


Figure 6-31 Indicative spoil haulage route – Campbell Road civil and tunnel site (C10)

6.6.6 Construction workforce parking

A number of the project's staff and labour force would be expected to drive to construction sites and would therefore require car parking. The numbers of construction personnel requiring parking would vary over the duration of the construction program.

It is anticipated that construction workforce parking would be primarily provided at the following sites:

- Northcote Street civil site (C3a) – around 150 car parking spaces (Option A)
- Parramatta Road East civil site (C3b) – around 140 car parking spaces (Option B)
- Rozelle civil and tunnel site (C5) – around 400 car parking spaces
- Campbell Road civil and tunnel site (C10) – around 150 car parking spaces.

These facilities would be used to provide worker parking and shuttle bus transfers to other nearby construction sites.

Due to the generally constrained nature of the other construction sites, only minimal car parking for construction workers would be provided at these locations. Typically, these sites would provide between four to 20 parking spaces intended to be used by engineers and other construction management staff. Some parking of construction-related vehicles in adjacent local roads would occur, particularly during site establishment. The potential impacts on on-street parking in areas adjacent to the project footprint have been considered further in **Appendix H** (Technical working paper: Traffic and transport) and **Chapter 8** (Traffic and transport).

The construction workforce would be encouraged to use public transport. Victoria Road and Parramatta Road are major transport corridors that have multiple bus routes. The Inner West Light Rail line runs along the southern side of City West Link with stops near the Rozelle Rail Yards at Rozelle Bay and Lilyfield; and at the Darley Road civil and tunnel site (Leichhardt North light rail stop). The T3 Bankstown Line stops at St Peters Station around 800 metres north of the Campbell Road civil and tunnel site.

Measures to manage parking impacts in adjacent streets would be addressed in a car parking strategy, included in the CTAMP. This would be developed prior to the commencement of establishment and use of construction ancillary facilities. This would include the identification of areas where there are high levels of existing parking demand around the construction ancillary facilities and works sites and identifying alternative car parking sites for use by the construction workforce.

6.7 Construction workforce numbers and work hours

6.7.1 Construction workforce

The indicative peak construction workforce at each site is detailed in **Table 6-25**. Peaks at each construction location do not necessarily occur at the same time, so these numbers cannot be added together to give a whole of project peak workforce number.

The construction workforce would comprise trades and construction personnel, subcontract construction personnel and engineering, functional and administrative staff. The size of the workforce would vary across the working day with a reduction in personnel for the evening and night shifts. The total peak workforce is around 1,500 personnel.

Table 6-25 Peak construction workforce estimates

Site name/location	Approximate day shift peak construction workforce	Approximate afternoon shift peak construction workforce	Approximate night shift peak construction workforce
Wattle Street civil and tunnel site (C1a)	70	30	70
Haberfield civil and tunnel site (C2a)	130	45	85
Northcote Street civil site (C3a)	50	30	10
Parramatta Road West civil and tunnel site (C1b)	140	40	90
Haberfield civil site (C2b)	30	10	0
Parramatta Road East civil site (C3b)	10	10	10
Darley Road civil and tunnel site (C4)	100	30	0
Rozelle civil and tunnel site (C5)	500	200	200
The Crescent civil site (C6)	50	30	50
Victoria Road civil site (C7)	200	0	0
Iron Cove Link civil site (C8)	200	0	0
Pyrmont Bridge Road tunnel site (C9)	100	30	100
Campbell Road civil and tunnel site (C10)	100	30	100
Total	**1,530**	**435**	**615**

6.7.2 Construction hours

Proposed construction hours are shown in **Table 6-26**. These hours have been developed based on a balanced consideration of reducing the overall length of the construction program and the need to minimise noise and traffic related impacts. Construction activities required for the project would be managed in six broad categories:

- Tunnelling and tunnelling support activities, including spoil handling and haulage, deliveries and underground construction and fitout works. These activities would be carried out up to 24 hours a day and seven days a week
- Out-of-hours construction activities that cannot be conducted during standard construction hours for safety or traffic operational reasons. These activities would include integration works with the M4 East and New M5 projects) and works affecting parts of the surface road network subject to high traffic volumes
- Most other construction activities, which would be carried out within standard construction hours (see below)
- Blasting and rock breaking, which would be conducted within reduced construction hours and subject to provision of respite periods
- Minor or ancillary activities that would not result in noise levels at receivers above acceptable levels, or are otherwise authorised by an environmental protection licence under the *Protection of the Environment Operations Act 1997* (NSW) (POEO Act)
- Activities that are required to be conducted under direction from a relevant authority (such as Police) or are required to prevent an imminent loss of life or environmental damage.

Above ground construction works would be undertaken in accordance with the ICNG. The majority of these would occur during the standard working hours of between:

- 7.00 am and 6.00 pm Monday to Friday
- 8.00 am and 1.00 pm on Saturdays.

Table 6-26 Construction hours

Activity	Construction hours	Comments or exception
Tunnelling, tunnelling support and underground construction activities		
Tunnelling and underground excavation	24 hours a day, up to seven days a week.	• Activities that support tunnelling works may need to occur 24 hours a day, up to seven days a week.
Underground construction and tunnel fitout	24 hours a day, up to seven days a week.	• Activities that support underground construction and tunnel fitout would occur 24 hours a day, up to seven days a week • Deliveries for underground construction and tunnel fitout would occur 24 hours a day, up to seven days a week.
Surface construction activities		
Demolition and surface construction activities	7.00 am to 6.00 pm on weekdays, 8.00 am to 1.00 pm on Saturdays, no works on Sundays or public holidays.	• Aboveground work supporting underground construction activities (eg concrete pumping, truck loading) are expected to be required 24 hours a day, up to seven days per-week where noise mitigation is in place • Non-disruptive preparatory work, repairs or maintenance may be carried out outside standard daytime construction hours • Activities requiring the temporary possession of roads or to accommodate road network requirements may need to be carried out outside the standard daytime construction hours during periods of low traffic volumes to minimise safety impacts and inconvenience to road users.
Construction traffic for material supply and spoil removal		
Construction traffic for material supply to, and spoil removal from, tunnelling and underground excavation	24 hours a day, up to seven days a week.	• Spoil removal from the Darley Road civil and tunnel site (C4) would only occur during standard daytime construction hours. No spoil would be removed from this site on Sundays or public holidays.
Blasting and rock breaking		
Blasting	Between 9.00 am and 5.00 pm, Mondays to Fridays and 9.00 am to 1.00 pm on Saturdays.	• Blasting would occur up to six days a week (Monday to Saturday). Blasts would be limited to one single detonation in any one day per receiver group, unless otherwise agreed by the Secretary or the NSW EPA.
Rock breaking (with potential for impulsive or tonal noise impact at a sensitive receiver)	Between 8.00 am and 6.00 pm Monday to Friday and 8.00 am to 1.00 pm Saturdays, with respite periods.	• Respite periods would be scheduled to minimise the frequency and duration of extended rock breaking activities with potential for impulsive or tonal noise emissions • Rock breaking and other high impact noise activities could also occur outside these standard day time construction hours if authorised by an environmental protection licence.

Activity	Construction hours	Comments or exception
Minor or ancillary activities		
Minor activities	At any time.	• Minor activities would include activities that do not lead to an exceedance of the applicable noise management level at an affected receiver.
Activities authorised by an environment protection licence	As specified in the environment protection licence.	• Construction activities would be managed as required by the Environment Protection Licence.
Emergency or directed activities		
Emergency or directed activities	At any time.	• Activities would be carried out as directed by a relevant authority • Activities would be carried out if required to prevent an imminent loss of life or environmental damage.

A summary of the proposed construction work hours at each construction ancillary facility is provided in **Table 6-27**.

Table 6-27 Construction work hours at construction ancillary facilities

Construction ancillary facility	Type of construction activity	Construction work hours
Wattle Street civil and tunnel site (C1a)	Tunnelling and spoil handling	• 24 hours a day, seven days a week
	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
Haberfield civil and tunnel site (C2a)	Tunnelling and spoil handling	• 24 hours a day, seven days a week
	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
Northcote Street civil site (C3a)	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
	Construction workforce parking	• 24 hours a day, seven days a week
Parramatta Road West civil and tunnel site (C1b)	Tunnelling and spoil handling	• 24 hours a day, seven days a week
	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
Haberfield civil site (C2b)	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
Parramatta Road East civil site (C3b)	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
	Construction workforce parking	• 24 hours a day, seven days a week
Darley Road civil and tunnel site (C4)	Tunnelling and spoil handling[2]	• 24 hours a day, seven days a week
	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
Rozelle civil and tunnel site (C5)	Tunnelling and spoil handling	• 24 hours a day, seven days a week
	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
The Crescent civil site (C6)	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
Victoria Road civil site (C7)	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
Iron Cove Link civil site (C8)	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays

Construction ancillary facility	Type of construction activity	Construction work hours
Pyrmont Bridge Road tunnel site (C9)	Tunnelling and spoil handling	• 24 hours a day, seven days a week
	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays
Campbell Road civil and tunnel site (C10)	Tunnelling and spoil handling	• 24 hours a day, seven days a week
	Civil construction[1]	• 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturdays

Notes:

1 Some works outside of standard construction hours may be required

2 Spoil haulage from the Darley Road civil and tunnel site (C4) would occur between 7.00 am and 6.00 pm Monday to Friday and 8.00 am and 1.00 pm on Saturdays.

Works outside of standard construction hours

Other activities that would be carried out outside of the standard daytime construction hours would include:

- Work determined to comply with the relevant noise management level at the nearest sensitive receiver
- The delivery of materials outside approved hours as required by the NSW Police or other authorities (including Roads and Maritime) for safety reasons
- Emergency situations where it is required to avoid the loss of lives and property and/or to prevent environmental harm
- Situations where agreement is reached with affected receivers.

With the exception of emergencies, activities would not take place outside standard daytime construction hours without prior notification of the local community affected.

An assessment of potential noise impacts associated with construction of the project as well as management measures, including for works outside of standard construction hours is included in **Chapter 10** (Noise and vibration). Reasonable and feasible work practices and mitigation measures, consistent with the requirements of the ICNG would be implemented to manage potential noise impacts. These would be identified in a Construction Noise and Vibration Management Plan that will include:

- Identification of nearby residences and other sensitive land uses
- Description of approved work hours
- Description and identification of all construction activities, including work areas, equipment and duration
- Description of the work practices (generic and specific) that will be implemented to minimise noise and vibration
- A complaints handling process
- Noise and vibration monitoring procedures
- Overview of community consultation required for identified high impact works.

In addition, environmental management measures will also be applied for out-of-hours surface works (refer to **Chapter 10** (Noise and vibration).

6.8 Construction noise attenuation

Temporary noise attenuation at construction ancillary facilities may include:

- Temporary acoustic hoarding along the boundaries of construction ancillary facilities at locations that face sensitive receivers
- Acoustic sheds around temporary access tunnels and associated above ground spoil handling areas where out-of-hours works would be undertaken near sensitive receivers, including:
  - Parramatta Road West civil and tunnel site (C1b)
  - Darley Road civil and tunnel site (C4)
  - Rozelle civil and tunnel site (C5)
  - Pyrmont Bridge Road tunnel site (C9)
  - Campbell Road civil and tunnel site (C10).

In addition, spoil stockpiling and management would occur within cut-and-cover tunnel structures at the Wattle Street civil and tunnel site (C1a), at the eastern end of the Rozelle civil and tunnel site (C5) and the Campbell Road civil and tunnel site (C10), and within the M4 East stub tunnels at Haberfield. Acoustic barriers (or similar) and other acoustic treatments would be installed as required to reduce noise propagation to adjacent areas from cut-and-cover tunnel structures.

The construction noise assessment tables which summarise the construction noise impacts predicted from each construction ancillary facility are provided in **Chapter 10** (Noise and vibration).

6.9 Construction plant and equipment

The plant and equipment listed in **Table 6-28** is planned to be used during the construction of the project. The actual plant and equipment would be confirmed during detailed design, taking into account any requirements of the environmental planning approval for the project.

Table 6-28 Indicative construction plant and equipment

Plant/equipment	Wattle Street civil and tunnel site (C1a)	Haberfield civil and tunnel site (C2a)	Northcote Street civil site (C3a)	Parramatta Road West civil and tunnel site (C1b)	Haberfield civil site (C2b)	Parramatta Road East civil site (C3b)	Darley Road civil and tunnel site (C4a)	Rozelle civil and tunnel site (C5)	The Crescent civil site (C6)	Victoria Road civil site (C7)	Iron Cove Link civil site (C8)	Pyrmont Bridge Road tunnel site (C9)	Campbell Road civil and tunnel site (C10)
Articulated dump truck	♦	♦		♦			♦	♦	♦			♦	♦
Asphalt paver	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Bulldozer	♦	♦		♦			♦	♦		♦	♦	♦	♦
Chainsaw							♦	♦		♦	♦	♦	♦
Concrete cutter	♦	♦		♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Concrete pump/boom pump	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Crawler crane	♦	♦		♦			♦	♦	♦	♦	♦	♦	♦
Diesel generator	♦	♦		♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Drill rig	♦	♦		♦			♦	♦		♦	♦	♦	♦
Dust scrubber	♦	♦		♦			♦	♦		♦	♦	♦	♦
Excavator (<25T) c/w attachments	♦	♦		♦	♦	♦	♦	♦	♦		♦	♦	♦
Excavator (>25T) c/w attachments	♦	♦		♦			♦	♦	♦	♦	♦	♦	♦
Front end loader	♦	♦		♦			♦	♦				♦	♦
Jumbo drill rig	♦	♦		♦			♦	♦	♦			♦	♦
Mobile crane (<50T)	♦	♦	♦	♦	♦		♦	♦	♦	♦	♦	♦	♦
Mobile crane (50T to 200T)				♦	♦			♦	♦	♦	♦		
Mobile crane (>200T)									♦	♦			
Piling rig	♦	♦		♦			♦	♦	♦	♦	♦	♦	♦
Roadheader	♦	♦		♦			♦	♦				♦	♦
Road profiler	♦	♦					♦	♦	♦	♦	♦	♦	♦
Rockbolting jumbo	♦	♦		♦			♦		♦			♦	♦
Shotcrete rig (diesel)	♦	♦		♦			♦	♦		♦	♦	♦	♦
Shotcrete rig (electric)	♦	♦		♦			♦					♦	♦

Plant/equipment	Wattle Street civil and tunnel site (C1a)	Haberfield civil and tunnel site (C2a)	Northcote Street civil site (C3a)	Parramatta Road West civil and tunnel site (C1b)	Haberfield civil site (C2b)	Parramatta Road East civil site (C3b)	Darley Road civil and tunnel site (C4a)	Rozelle civil and tunnel site (C5)	The Crescent civil site (C6)	Victoria Road civil site (C7)	Iron Cove Link civil site (C8)	Pyrmont Bridge Road tunnel site (C9)	Campbell Road civil and tunnel site (C10)
Slipform paver							♦						
Surface miner	♦	♦		♦			♦	♦		♦		♦	♦
Truck and dogs (trailers)	♦	♦		♦	♦	♦	♦	♦		♦	♦	♦	♦
Vibratory roller	♦	♦		♦	♦	♦	♦	♦	♦	♦	♦	♦	♦

6.10 Construction waste management

Details relating to construction waste management are provided in **Chapter 23** (Resource use and waste minimisation).

6.11 Construction resource use and management

Details relating to the use of construction materials, construction energy use and construction water use are provided in **Chapter 23** (Resource use and waste minimisation).

7 Consultation

NSW Roads and Maritime Services (Roads and Maritime) has commissioned Sydney Motorway Corporation (SMC) to deliver WestConnex, on behalf of the NSW Government. Roads and Maritime is the proponent for the project.

This chapter provides an overview of the consultation activities undertaken before and during the preparation of this environmental impact statement (EIS), and outlines the activities planned during the public exhibition of the EIS as well as before and during the construction stage of the M4-M5 Link project (the project).

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued environmental assessment requirements for the project. These are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 7-1** sets out these requirements and the associated desired performance outcomes that relate to consultation, and identifies where they have been addressed in this EIS.

Table 7-1 SEARs – consultation

Desired performance outcome	SEARs	Where addressed in the EIS
4. Consultation The project is developed with meaningful and effective engagement during project design and delivery.	1. The project must be informed by consultation, including with relevant local, State and Commonwealth government agencies, infrastructure and service providers, special interest groups (including Local Aboriginal Land Councils, Aboriginal stakeholders, and pedestrian and bicycle user groups), affected landowners, businesses and the community.	Details of consultation activities carried out and information provided to stakeholders during preparation of the EIS are provided throughout this chapter. The chapter summarises the broad range of engagement and consultation activities undertaken with the relevant local, State and Commonwealth government agencies, infrastructure and service providers, special interest groups (including Local Aboriginal Land Councils, Aboriginal stakeholders, and pedestrian and cyclist user groups), affected landowners, businesses and the community.
	2. The Proponent must document the consultation process, and demonstrate how the project has responded to the inputs received.	The consultation process is outlined in **section 7.1**. **Section 7.1** outlines the issues raised by government agencies, local councils and the community and identify where these issues have been addressed in the EIS. **Section 7.2** provides a summary of design considerations and responses to issues and requests made.

Desired performance outcome	SEARs	Where addressed in the EIS
	3. The Proponent must describe the timing and type of community consultation proposed during the design and delivery of the project, the mechanisms for community feedback, the mechanisms for keeping the community informed, and procedures for complaints handling and resolution.	**Section 7.6.2** details the consultation process and the mechanisms for community feedback, the mechanisms for keeping the community informed, and procedures for complaints handling and resolution. **Section 7.6.3** details the consultation process for the project's operational phase.
6. Biodiversity The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity. Offsets and/or supplementary measures are assured which are equivalent to any remaining impacts of project construction and operation.	2. The Proponent must assess any impacts on biodiversity values not covered by the FBA. Impacts on species, populations and ecological communities that will require further consideration and provision of information specified in section 9.2 of the FBA include any identified through consultation with the OEH. Species specific surveys shall be undertaken for those species and in accordance with the survey requirements specified by the OEH. The Proponent must identify whether the project as a whole, or any component of the project, would be classified as a Key Threatening Process (KTP) in accordance with the listings in the *Threatened Species Conservation Act 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act) and *Environment Protection and Biodiversity Conservation Act 2000* (Commonwealth) (EPBC Act).	The assessment and management of biodiversity is detailed in **Chapter 18** (Biodiversity). Details of meetings with the NSW Office of Environment and Heritage (OEH) can be found in **section 7.3.4** in this chapter.
9. Socio-economic, Land Use and Property The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities. The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure.	7. Where the project is predicted to impact on utilities the Proponent must undertake a Utilities Management Strategy. The strategy must identify proposed management strategies, including relocation or adjustment of the utilities, and their estimated timing and duration. This strategy must be developed in consultation with the relevant utility owners or providers. 8. A Draft Community Consultation Framework must be prepared identifying relevant stakeholders, procedures for distributing information and receiving/responding to feedback and procedures for resolving stakeholder and community complaints during construction and operation. Key issues that must be addressed in the	**Section 7.3.5** describes consultation with utility and service providers that has been carried out for this project. A Utilities Management Strategy has been developed in consultation with utility and service providers. Refer to **Appendix F** (Utilities Management Strategy). A Draft Community Consultation Framework is included in **Appendix G** (Draft Community Consultation Framework). **Chapter 14** (Social and economic) and **Appendix P** (Technical working paper: Social and economic) describes the business impact surveys that

Desired performance outcome	SEARs	Where addressed in the EIS
	draft Framework include, but are not limited to: (a) traffic management (including property access, pedestrian access) (b) landscaping/urban design matters (c) construction activities including out of hours work (d) noise and vibration mitigation and management.	were carried out for the project.
12. Flooding The project minimises adverse impacts on existing flooding characteristics. Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure.	1.The Proponent must assess and (model where required) the impacts on flood behaviour during construction and operation for a full range of flood events up to the probable maximum flood (taking into account sea level rise and storm intensity due to climate change) including: (h) impacts the development may have upon existing community emergency management arrangements for flooding. These matters must be discussed with the State Emergency Services and Council;	**Chapter 17** (Flooding and drainage) outlines the flooding assessment and management measures for the project that have been developed in consultation with relevant stakeholders. **Section 7.3.4** and **section 7.3.7** details the meetings held with stakeholders including council and State Emergency Services as well as other emergency service providers.
14. Heritage The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places. The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage and Aboriginal objects and places.	4. Where impacts to Aboriginal objects and/or places are proposed, consultation must be undertaken with Aboriginal people in accordance with the current guidelines.	Consultation undertaken for this assessment is outlined in **Chapter 21** (Aboriginal heritage). A summary is provided in this chapter in **section 7.3.8**. For the construction and operational phases of the project, should it be approved, a Construction Heritage Management Plan would detail how construction impacts on historic and Aboriginal heritage would be minimised and managed, including training and induction processes for construction personnel.

7.1 Community and stakeholder engagement overview

7.1.1 The project as part of the WestConnex program of works

The project is a component of the WestConnex program of works, which is part of the NSW Government's integrated transport solution for Sydney. The WestConnex program of works is made up of projects comprising the M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link (the subject of this EIS).

There are two elements to the community and stakeholder engagement approach including:

- Consultation and communication undertaken to support the WestConnex program of works
- Consultation and communication undertaken to support the development of the project.

These elements are described below.

Program consultation and communication

Engagement on WestConnex started in 2012 with early consultation during the development of the original *WestConnex Strategic Environmental Review* (Sydney Motorways Project Office 2013a) and the *WestConnex Business Case* (Sydney Motorways Project Office 2013b). The Strategic Environmental Review and an executive summary of the business case (Sydney Motorways Project Office 2013a) were published on the WestConnex website.

During development of the WestConnex program of works since 2012, the focus of communication and engagement was to articulate the local and broader regional and state-wide benefits of WestConnex. The aims were to build awareness and understanding of the program, identify key issues and community and stakeholder concerns and develop design solutions to mitigate impacts on local communities.

In 2015, the Strategic Environmental Review and WestConnex Strategic Business Case were updated with the latest detail on WestConnex projects, including the M4-M5 Link. This information was published in the *WestConnex Updated Strategic Business Case* (Sydney Motorway Corporation 2015) and is available on the WestConnex website (https://www.westconnex.com.au/resources).

Consultation and communications have continued since that time, with the M4-M5 Link being explained and described as part of the broader WestConnex program of works.

Consultation and communication on the overall WestConnex program of works is ongoing and includes:

- Briefings with key stakeholders about progress across all component projects
- Advertising as part of Transport for NSW's Tomorrow's Sydney campaign
- The WestConnex website
- Facebook page and Twitter feed
- A monthly electronic newsletter called The Inside Lane
- Other direct engagement and outreach activities.

Program communication is critical to providing context to local communities about how the work in their area relates to the WestConnex program of works and to demonstrate to the broader community the need for and benefits of WestConnex. Communications about the WestConnex program of works include high level information on the project.

Project consultation and communication

Communication and consultation activities support the development and construction activities for each component of WestConnex, focusing on communities near the project footprint. During project development, the main objective of these activities is to provide clear opportunities for feedback on the project design and its benefits and potential impacts.

During construction and operation of the project, the focus would be on keeping the community informed and providing clear channels for feedback or complaints about impacts. The stages of consultation mirror the project milestones, as shown in **Figure 7-1**.

7.1.2 Project consultation overview

Detailed, project specific consultation began with stakeholders following the lodgement of the State significant infrastructure Application Report (SSIAR) in January 2016.

On 21 July 2016, the NSW Government announced that the project's Rozelle interchange would be mostly underground, at the site of the Rozelle Rail Yards, with the inclusion of up to 10 hectares of new green space for local communities. At the same time, the NSW Government announced the inclusion of an underground link from the Rozelle interchange to Victoria Road at the eastern abutment of Iron Cove Bridge, known as the 'Iron Cove Link'. A comprehensive community engagement process followed this announcement, with a focus on identifying new ideas and understanding community needs and values in relation to the project. The feedback from consultation activities was collated and published on the WestConnex website in a community feedback report. This report has been considered during the planning, design development and environmental assessment for the project.

Roads and Maritime undertook a review of environmental factors (REF) for site management works at part of the Rozelle Rail Yards. This REF was displayed for community and stakeholder comment between 23 November and 13 December 2016. The REF display was advertised in the Inner West Courier and on the WestConnex website and letters, emails and doorknocking activities were communication tools used in addition to the advertisements. During the REF consultation, a number of issues were raised relating to the development of the project and proposed works at Rozelle.

On 10 November 2016, the NSW Government announced some key project design changes, including the removal of the entry and exit ramps originally proposed for the project at Camperdown, and an increase in the number of lanes in the motorway tunnels from three lanes to up to four lanes in each direction. In part, this decision was informed by stakeholder feedback. Refer to **Chapter 4** (Project development and alternatives) for more information on the development of the project.

Throughout consultation, SMC, on behalf of Roads and Maritime, has adapted and updated the early design in response to community and stakeholder feedback. This includes making commitments to protect open spaces with a high value to the community during construction, including Easton Park and Blackmore Park. Details of how feedback has informed the project design can be found in **section 7.2**. **Figure 7-1** details the consultation process for the M4-M5 Link at each key project milestone.

A detailed stakeholder analysis has informed the communication and engagement strategy for the project. Stakeholders include:

- Government – including local, state and Commonwealth representatives and officers as well as government agencies
- Local Aboriginal stakeholders
- Interest groups including industry, business, community groups, pedestrian and cyclist user groups
- Residents and businesses near the project footprint
- Utilities and service providers including water, gas, electricity and telecommunications
- The broader community, including potential future users of the project.

Stakeholders have been provided with project specific information and opportunities to raise questions and provide suggestions and feedback.

Section 7.1 outlines feedback received from government agencies, local councils and the community, including businesses, during the detailed stakeholder analysis and references to the sections of the EIS where this feedback has been addressed.

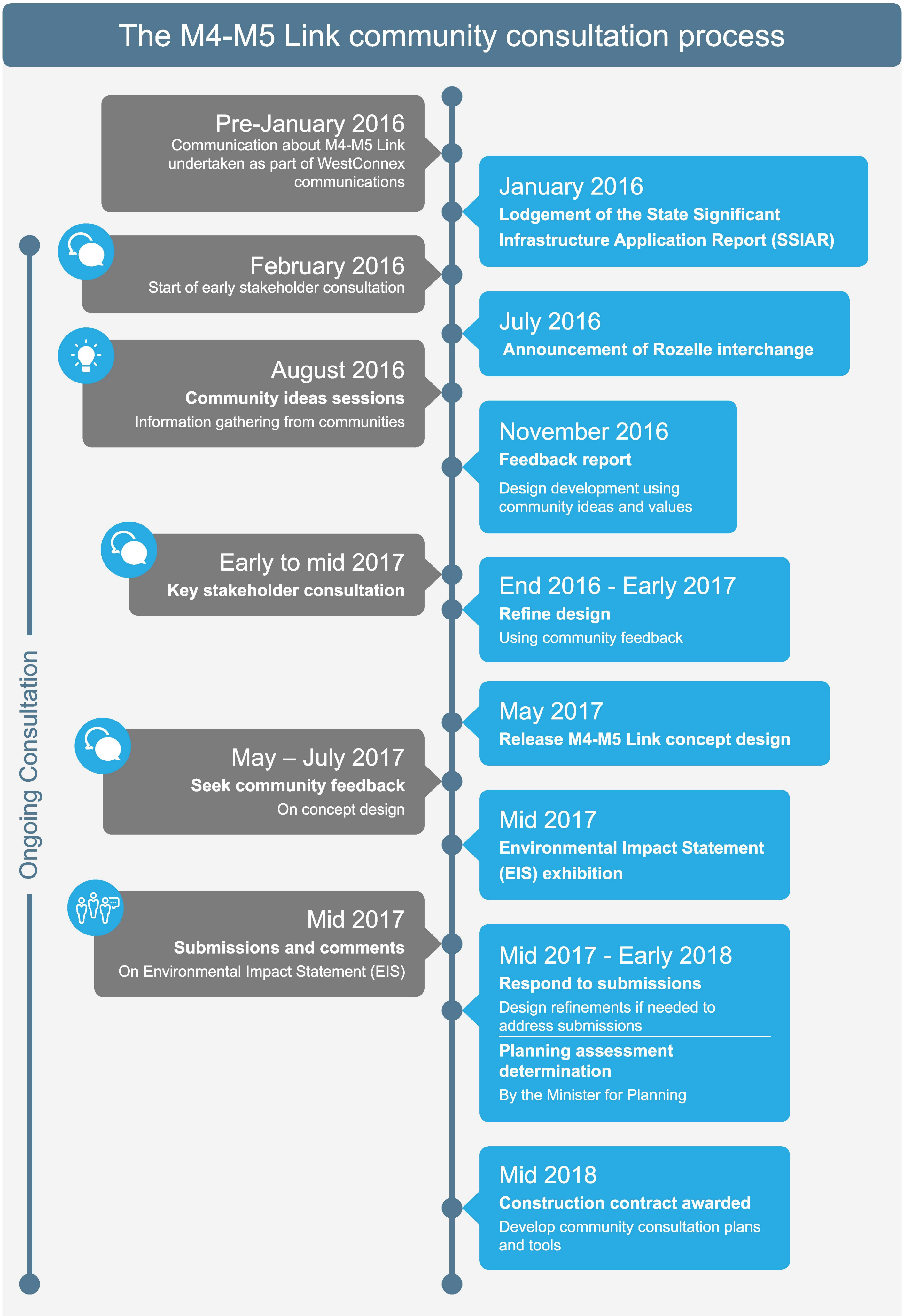


Figure 7-1 M4-M5 Link community consultation process

7.1.3 Consultation objectives

All consultation for the WestConnex program is carried out in accordance with the WestConnex engagement principles. In working with stakeholders and the community, SMC (on behalf of Roads and Maritime) always endeavours to:

- Make the most of all opportunities to involve local communities and stakeholders in the project
- Arrange engagement activities at times and places that are convenient for the community and stakeholders, and provide online options
- Respond to reasonable requests for additional engagement activities and information
- Acknowledge and understand diverse views on the project
- Use feedback to positively influence the project.

The community and stakeholder consultation objectives for the M4-M5 Link are consistent with those for the broader WestConnex program:

- Ensure an open, accountable and transparent community involvement process
- Increase community and stakeholder awareness of the need for the project
- Increase community and stakeholder awareness of the project development, environmental assessment process and opportunities to participate
- Provide accessible information on the project and ensure appropriate consultation tools are used, taking into account demographics such as language, literacy and access to the internet
- Engage early with landowners regarding the potential need for property acquisition for the development of the project
- Ensure the views of the community are considered when preparing the EIS and project design
- Provide timely responses to the community and other stakeholders in relation to environmental assessment outcomes
- Ensure community concerns regarding environmental and community impacts are considered and addressed where possible.

7.2 Overview of design changes and commitments in response to early feedback

Table 7-2 provides an overview of how SMC, on behalf of the proponent, Roads and Maritime, has used feedback from stakeholders and community to influence design outcomes. **Section 7.5** describes the feedback from specific stakeholders and the community in more detail.

Table 7-2 Design considerations in response to early feedback

Stakeholder and community feedback	Response
Easton Park The community expressed concerns about the proposed use of Easton Park, at Rozelle, during construction. In particular, the community highlighted the limited open space and high value of open space in the area.	Design options were developed to avoid any direct impact on Easton Park. A commitment for the project to develop up to 10 hectares of new open space has also been made.
Blackmore Park The community expressed concerns about the possible use of Blackmore Park at Leichhardt during construction. In particular, concerns were raised about potential impacts on the Canal Road Film Centre and arts precinct, which adjoins the oval.	Blackmore Park would not be directly impacted during construction.

Stakeholder and community feedback	Response
Active transport The community provided significant feedback and ideas on pedestrian and cyclist connectivity within the project footprint. In particular, the community is keen to see options better linking Rozelle, Annandale, Lilyfield and Glebe; suburbs currently divided by City West Link, The Crescent, Victoria Road and the Rozelle Rail Yards (inaccessible to the public). There was a strong desire to provide better access to Bicentennial Park/Jubilee Park (Glebe Foreshore).	An Active Transport Strategy has been developed for the project, with a focus on identifying the missing links in the existing pedestrian and cyclist network, particularly in areas where construction work would occur at the surface. Refer to **Appendix N** (Technical working paper: Active transport strategy). Key active transport links are planned in and around the Rozelle Rail Yards and at Iron Cove Link, to better connect the surrounding communities with existing and future open space.
Camperdown The community and key stakeholders expressed concerns about the location of tunnel exit and entry points at Camperdown. In particular, concerns were raised about the potential for tunnelling to impact sensitive equipment at the Royal Prince Alfred Hospital (RPA) Hospital and the surrounding medical precinct, potential construction impacts on local residents and items of heritage significance and traffic impacts on Parramatta Road, Camperdown.	Following community and stakeholder feedback, additional modelling and design refinements, the Camperdown interchange was removed from the project design. The mainline tunnels were also realigned further west, further reducing the likelihood of any tunnelling impacts on the medical precinct or the RPA Hospital.
Derbyshire Road The community and stakeholders including Sydney Secondary College expressed concern about the location of a potential mid-tunnel construction site at 29 Derbyshire Road, Leichhardt.	In response to concerns raised from the community over the use of this site as a potential construction compound, the property at Derbyshire Road, Leichhardt would not be used as a mid-tunnel construction site. A mid-tunnel construction site is still required between Haberfield and Rozelle.
Traffic on Victoria Road Roads and Maritime, Transport for NSW and local community members identified a desire for WestConnex to address congestion on Victoria Road at Rozelle as part of the M4-M5 Link project. The average daily two-way traffic count on: • Victoria Road between The Crescent and Robert Street is 73,000 vehicles per day • Victoria Road between Robert Street and Gordon Street is 55,500 vehicles per day.	The Iron Cove Link was added to the project design in July 2016. This link would provide direct underground access from the eastern abutment of Iron Cove Bridge to and from the Rozelle interchange. The link simplified the interchange arrangement at Rozelle and would significantly reduce surface traffic on Victoria Road at Rozelle (east of Iron Cove Bridge), easing congestion, and increasing opportunities for amenity improvements and development of active transport and public transport infrastructure.
Accommodating bus lanes on Victoria Road Transport for NSW requested that the project design should accommodate bus lanes on Victoria Road.	The Iron Cove Link portals and Victoria Road surface widening have been designed to accommodate kerbside bus lanes on Victoria Road, east of Iron Cove Bridge.
Connections for future motorways Roads and Maritime provided feedback on the need to connect WestConnex to the proposed future Western Harbour Tunnel and Beaches Link at Rozelle.	A tunnel connection to the proposed future Western Harbour Tunnel and Beaches Link project would be provided as part of the Rozelle interchange.

Stakeholder and community feedback	Response
Provision of new open space Key stakeholders including UrbanGrowth NSW and Inner West Council, as well as local community members, identified the need for new open space to be generated by the project.	The NSW Government has committed to creating up to 10 hectares of new open space at the site of the Rozelle Rail Yards. The project would also generate up to 2.5 hectares of green space at the St Peters interchange site (which was announced as part of the New M5 project). In addition, the project is exploring opportunities to use remaining project land along Victoria Road, near the eastern abutment of Iron Cove Bridge, for community purposes. The options for using remaining project land would be developed in consultation with the community and stakeholders. Further details are described in **Chapter 12** (Land use and property) and **Appendix L** (Technical working paper: Urban design).
Provision of connections for The Bays Precinct and future development at White Bay Power Station Key stakeholders including UrbanGrowth NSW requested that consideration be given to the future connections needed for a revitalised White Bay Power Station and The Bays Precinct.	Access to White Bay has been considered in the design of the surface roads around the Rozelle interchange. The project would provide new active transport connections both east–west and north–south to The Bays Precinct. These proposals have been developed in consultation with UrbanGrowth NSW.
Road closures along Victoria Road Community members raised concerns about the closure of Clubb, Toelle and Callan streets and the impacts this would have on local traffic movements and community safety.	The need to create a cul-de-sac at Toelle and Callan streets (south of Victoria Road, at the eastern abutment of Iron Cove Bridge) was assessed further and it was determined that they were not essential for the project. These roads would therefore remain open during the construction of the project. Clubb Street would be turned into a cul-de-sac.

7.3 Project consultation process and activities

Consultation and feedback received at both the program and project level have informed project development, the environmental assessment activities and ongoing communications.

Broadly, the consultation process for the WestConnex program of works to date has included:

- Targeted stakeholder discussions and briefings with NSW Government agencies, local councils, advocacy groups, elected representatives and peak bodies
- Roundtable discussions with stakeholders such as councils, the freight industry and business groups
- Information sessions with community members and stakeholders in key communities
- Discussions with individual stakeholders, landowners and community members
- Business impact surveys with business owners within the project footprint
- Research groups involving residents, professional road users and business operators.

7.3.1 Communication and engagement channels and tools

In September 2013, a range of permanent channels were established for the WestConnex program of works, to seek input from stakeholders and communities and to support engagement on an ongoing basis. These channels include:

- A website (www.westconnex.com.au) (the WestConnex website), which provides background information, maps, videos, customer surveys and details of how to provide feedback on elements of the project
- A toll-free, centralised WestConnex information telephone line (1800 660 248) for feedback, enquiries and complaints
- A project email address (info@westconnex.com.au) to disseminate news updates to subscribers, solicit comments and respond to community feedback
- A postal address (GPO Box 3905, Sydney NSW 2001) to receive written feedback
- A project specific subscription service, to allow interested parties to receive regular email updates on the entire program or specific projects. People can register for this service at information sessions, using the above contact points, or by signing up online.

A range of additional tools have been used to support communication and engagement for the project, including:

- Media releases
- WestConnex project website updates
- Project information line and email address
- Community newsletters
- Fast fact postcards
- Newspaper advertisements
- Direct emails to people registered to receive updates
- Door-knocking
- Resident meetings
- WestConnex Facebook page
- National Translation and Interpreting Service
- WestConnex Assist counselling services.

Written communication materials produced in support of the project have included information on the various translation services available.

7.3.2 Consultation chronology

As outlined in **section 7.1**, communication and consultation on the M4-M5 Link project has been carried out at a program level since 2012 and at a project level since the SSIAR was lodged in January 2016.

This consultation activity can largely be described in timeframes reflecting project progress:

- Mid 2012 to January 2016 – pre-SSIAR lodgement with DP&E
- January 2016 to July 2016 – SSIAR lodgement with DP&E
- July 2016 to November 2016 – ongoing design development including NSW Government’s announcement on the Rozelle interchange and the Iron Cove Link
- November 2016 to May 2017 – ongoing design development including the NSW Government announcement that the project would no longer include on and off-ramps at Camperdown

- May to August 2017 – ongoing design development including the NSW Government release of the concept design for the project.

Key activities and tools used during these periods are provided in the following sections. Consultation activities with key stakeholders are described in more detail from **section 7.3.4**. Future consultation activities proposed during exhibition of the EIS, during construction and throughout operation of the project are described in **section 7.6**.

7.3.3 Summary of key consultation activities and communication tools

A range of consultation and communication activities have been carried out to support the design and planning process for the project, before and during the development of this EIS. The following section details some of the key consultation activities carried out for the WestConnex program of works, including the project, since mid-2012.

Community and stakeholders have been encouraged to contact the proponent at any time to discuss the project via phone, email or post, or by visiting the local information centres. **Table 7-3** provides an overview of the key program and project communication and consultation activities from mid-2012 through to August 2017.

Table 7-3 Details of the program and project consultation activities at key phases and the key communication tools used

<table>
<tr><th rowspan="2">Key consultation purpose or outcome</th><th colspan="2">Consultation activity and communication summary</th><th colspan="2">Communication tools used (in addition to permanent channels)</th></tr>
<tr><th>WestConnex program of works</th><th>M4 M5 Link project</th><th>Activity</th><th>Summary</th></tr>
<tr><td colspan="5">Mid 2012 to January 2016 – pre-SSIAR lodgement</td></tr>
<tr><td rowspan="5">Development of the WestConnex Strategic Environmental Review
Broad program consultation
Consultation on other WestConnex projects undergoing assessment
Publication of the Updated WestConnex Strategic Business Case and updated Strategic Environmental Review.</td><td rowspan="5">Extensive consultation on WestConnex projects undergoing assessment and construction including:
• M4 Widening
• King Georges Road Interchange Upgrade
• M4 East
• New M5.
In addition, communication activities to support the broader program including presenting and hosting trade stands at key conferences and briefing key stakeholders on an ongoing basis have been carried out.</td><td rowspan="5">Program communications included high level information on the M4-M5 Link project.
In addition, consultation on the M4 East and New M5 projects provided some high-level details on the M4-M5 Link, including:
• The M4-M5 Link would join the two motorways together to form a seamless motorway network
• Information on the connections provided for the M4-M5 Link as part of these projects, including underground connections (tunnel stubs) at St Peters and Haberfield, and above ground connections at St Peters interchange
• Information on some of the known construction areas and infrastructure at St Peters, including:
– St Peters interchange ancillary construction facility needed for the M4-M5 Link
– Communicating an indicative location for the M4-M5 Link ventilation facility at St Peters</td><td>Advertising</td><td>Advertising the WestConnex program of works in major metropolitan publications including Sydney Morning Herald and the Daily Telegraph, the former mX magazine, and online advertising.</td></tr>
<tr><td>Media</td><td>Media announcements were widely covered by metropolitan television, radio, print and digital news outlets; and trade and advocacy publications like NRMA’s Open Road magazine.</td></tr>
<tr><td>Stakeholder and roundtable discussions</td><td>Meetings with advocacy groups, local councils, elected representatives, government agencies, the freight industry, business groups, peak bodies and community members.</td></tr>
<tr><td>Online survey</td><td>An online survey sought feedback on how stakeholders would like to be engaged during the planning and development of the project.</td></tr>
<tr><td>Industry engagement</td><td>Four leading Australian and international design and construction companies developed and improved design and construction solutions for specific sections of WestConnex during the preparation of the business case.
Market briefings and workshops were held to inform industry and get feedback on the scope, program, reference delivery model and timing alternatives.</td></tr>
</table>

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	M4 M5 Link project	Activity	Summary
		– Information on ventilation at Haberfield, including the fact that the M4 East ventilation facility has been constructed to accommodate the ventilation needs of the M4-M5 Link.	Other	Information about WestConnex was included in motor vehicle registration renewals, postcards and community updates. Presenting and hosting trade stands at key conferences and briefing key stakeholders on an ongoing basis.
	In November 2015, the WestConnex Updated Strategic Business Case and supporting technical papers was published, including a consultation history, traffic report, updated Strategic Environmental Review and economic assessment.	The Updated Strategic Business Case included an early design for the M4-M5 Link, mirroring the design presented in the SSIAR (lodged January 2016).		
January 2016 to July 2016 – SSIAR lodgement				
Key stakeholder consultation.		Meetings with key stakeholders to outline the scope of the project and seek information and feedback.	Meetings	Meetings were held with local councils, elected representatives, government agencies, and peak bodies to seek input and feedback on key considerations influencing project design.
July 2016 to November 2016 – ongoing design development				
Consultation on early design to inform the design development. This approach was adopted in response to feedback received	***Tomorrow's Sydney* campaign** Transport for NSW rolled out a new phase of its *Tomorrow's Sydney* campaign, to provide	In July 2016 the NSW Government announced the M4-M5 Link Rozelle interchange would be built at the site of the Rozelle Rail Yards and would be predominantly underground. The government also announced the	Media	Media announcements were widely covered by metropolitan television, radio, print and digital news outlets; local media outlets, and trade and advocacy publications like NRMA's Open Road magazine.

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	M4 M5 Link project	Activity	Summary
during consultation for the M4 East and New M5 projects, where the community sentiment was that earlier consultation would have been preferable on those projects.	context for major infrastructure projects underway across Sydney and demonstrating the integrated transport solution being delivered across the city. The campaign also prepares the broader Sydney community for disruption associated with infrastructure development. WestConnex has been part of the *Tomorrow's Sydney* campaign since mid-2016. The campaign includes television and other advertising and a website showing the major projects underway.	inclusion of the Iron Cove Link. Following this announcement, five community ideas sessions were hosted so communities could learn more about the project and provide feedback to help inform the development of the project design. Other communication tools included: • Newspaper advertisements in the Inner West Courier • Updates to the project website, which includes a collaborative map that allows people to post comments referenced to a specific location • Social media posts • Written submissions • Stakeholder briefings • An online survey. The feedback from these consultation activities was collated and published on the WestConnex website in a community feedback report. This report has been considered during the project planning, design and environmental assessment. Issues raised by the community are included in **section 7.1** and design considerations in response to early feedback are	Community update newsletters (also made available on the project website)	A community update was distributed to residents near the project footprint, including the suburbs of Abbotsford, Drummoyne, Russell Lea, Canada Bay, Five Dock, Haberfield, Ashfield, Birchgrove, Rozelle, Balmain, Lilyfield, Leichhardt, Petersham, Dulwich Hill, Glebe, Annandale, Camperdown, Newtown, The Rocks, Haymarket, Ultimo, Surry Hills, Alexandria, Beaconsfield, St Peters, Chiswick, Rodd Point, Summer Hill, Lewisham, Enmore, Forest Lodge, Pyrmont, Balmain, Barangaroo, Waterloo, Redfern and Erskineville.
			Direct emails	Direct emails have been sent to more than 2,200 registered stakeholders, including residents, landowners, stakeholders, businesses and community groups: • 21 July 2016: coinciding with the NSW Government's announcement about the design features at Rozelle and the inclusion of the Iron Cove Link • 1 August 2016: to encourage people to attend the five community ideas sessions.
			Newspaper advertisements	Three newspaper advertisements appeared in the *Inner West Courier* on 2, 9 and 16 August 2016. The ads were placed to encourage participation in the community ideas sessions.

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	M4 M5 Link project	Activity	Summary
		included in **section 7.2**. Key topics covered in the community feedback report include: • Public transport • Traffic congestion • Design • Walking and cycling • Engagement process • Air quality • Open space • Construction • Property • Environment and heritage.	Webpage updates	The project website has been updated regularly with information provided at key project phases. Copies of media releases and community update newsletters have been uploaded to the website. During the community consultation sessions in July and August 2016, a dedicated engagement page was established. Information on the Rozelle interchange was uploaded onto the WestConnex website on 21 July 2016.
			Social media	Twelve posts were made to the WestConnex Facebook page including: • General posts on the M4-M5 Link design or features: • 25 May 2016 – 563 people reached • 9 September 2016 – 3,847 people reached • Update regarding the Rozelle interchange: – 21 July 2016 – 4,434 people reached – 22 July 2016 – 1,090 people reached – 25 July 2016 – 3,583 people reached – Promotion of the community ideas sessions: – 26 July 2016 – 860 people

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	M4 M5 Link project	Activity	Summary
				reached – 1 August 2016 – 1,434 people reached – 9 August 2016 – 431 people reached • Promotion of the online collaborative map: – 2 August 2016 – 5,347 people reached – 3 August 2016 – 361 people reached – 10 August 2016 – 844 people reached – 18 August 2016 – 1,150 people reached.
			Collaborative map	The online collaborative map was launched on the WestConnex website on 1 August 2016 and was available until 14 November 2016. A total of 246 comments were received on the map. Of these: • 53 were directly related to other stages of WestConnex • 193 related to WestConnex generally or the M4-M5 Link specifically. The collaborative map offered people the opportunity to vote on existing comments to show agreement or disagreement. In total, 523 votes were made on comments.

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	**M4 M5 Link project**	**Activity**	**Summary**
	Community Connections Program In September 2016, the Community Connections Program was launched, to support communities and businesses that would be served and/or impacted by the WestConnex program of works. The Program includes outreach activities, community grants and the delivery of engagement and outreach programs through key partnerships with Wests Tigers and GWS Giants. The program includes a Community Grant Scheme, which delivers grants to community groups and organisations delivering services to communities within the WestConnex corridor.		Community ideas sessions	Five community ideas sessions were held between 10 and 22 August 2016, to seek feedback and ideas and discuss the project process with the community. Property and air quality experts were at the sessions to provide specialist information. These sessions were held on: • Wednesday 10 August 2016, 4.00 pm–7.00 pm Canada Bay Club, Five Dock • Saturday 13 August 2016, 11.00 am – 2.00 pm Leichhardt Town Hall, Leichhardt • Thursday 18 August 2016, 4.00 pm – 7.00 pm Rydges, Camperdown • Saturday 20 August 2016, 11.00 am – 2.00 pm Balmain Town Hall, Balmain • Monday 22 August 2016, 4.00 pm – 7.00 pm Balmain Town Hall, Balmain. A total of 410 people attended the community ideas sessions.
			Submissions	Formal submissions about the project were received from six stakeholders during this consultation period: • The Glebe Society • Rozelle resident • Community member • Forest Lodge resident • Rozelle Against WestConnex • City of Sydney.

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	**M4 M5 Link project**	**Activity**	**Summary**
			Stakeholder briefings	Seven briefings were held with peak associations, including NRMA, Australian Logistics Council, Infrastructure Partnerships Australia, Greater Sydney Commission, and local, state and Commonwealth Government stakeholders.
November 2016 to May 2017 – ongoing design development and changes				
Announcement of significant design changes. Continued engagement with stakeholders and community members to seek feedback.	In November 2016, expressions of interest were sought from community members and stakeholder groups to join the WestConnex Community Reference Group. The reference group provides a forum for discussion and feedback between the WestConnex project team and representatives of the community, stakeholder groups and local councils. Two community representatives have been appointed for each of the	In November 2016, the NSW Government announced that the project would no longer include entry and exit ramps at Camperdown and that the mainline tunnels would include up to four lanes in each direction (increased from three lanes in each direction). In November and December 2016 face-to-face meetings were held with businesses near the project footprint to understand how their business operates, how they may be impacted by the project and possible ideas for resolving or reducing potential impacts. During February and March 2017 there were numerous key stakeholder meetings regarding the	Media	Media announcements were made at key project development phases: • In November 2016, the NSW Government announced that the project would no longer include entry and exit ramps at Camperdown and that the project would include up to four lanes in each direction (increased from three lanes in each direction) • On 31 March 2017, the Minister for WestConnex announced that the site adjoining Sydney Secondary College's Leichhardt campus previously investigated as a mid-tunnel construction site would no longer be considered as such for the WestConnex M4-M5 Link. This was in response to community feedback, particularly the school community.

<table>
<tr><th rowspan="2">Key consultation purpose or outcome</th><th colspan="2">Consultation activity and communication summary</th><th colspan="2">Communication tools used (in addition to permanent channels)</th></tr>
<tr><th>WestConnex program of works</th><th>M4 M5 Link project</th><th>Activity</th><th>Summary</th></tr>
<tr><td rowspan="3"></td><td rowspan="3">WestConnex projects, including the M4-M5 Link.
In January 2017, The Inside Lane, a monthly newsletter on WestConnex projects was launched. The newsletter is distributed by email to over 6,700 key stakeholders and subscribers and each month provides information on:
• The status of the M4-M5 Link
• Upcoming events and opportunities to provide feedback on the project
• Key facts and statistics on the project
• Contact details for further information.</td><td rowspan="3">mid-tunnel construction site in the Leichhardt area and notifications distributed to local residents and businesses.
On 31 March 2017, the Minister for WestConnex announced that the site adjoining Sydney Secondary College's Leichhardt campus, which had previously been investigated as a mid-tunnel construction site, would no longer be considered as such for the M4-M5 Link. This was in response to community feedback, in particular from the school community.</td><td>Community update newsletters</td><td>A community update was distributed to residents near the project footprint, including the suburbs of Abbotsford, Drummoyne, Russell Lea, Canada Bay, Five Dock, Haberfield, Ashfield, Birchgrove, Rozelle, Balmain, Lilyfield, Leichhardt, Petersham, Dulwich Hill, Glebe, Annandale, Camperdown, Newtown, The Rocks, Haymarket, Ultimo, Surry Hills, Alexandria, Beaconsfield, St Peters, Chiswick, Rodd Point, Summer Hill, Lewisham, Enmore, Forest Lodge, Pyrmont, Balmain, Barangaroo, Waterloo, Redfern and Erskineville. Community updates have also been made available on the project website.</td></tr>
<tr><td>Stakeholder briefings</td><td>Seven briefings were held with peak bodies, including NRMA, Australian Logistics Council, Infrastructure Partnerships Australia, Greater Sydney Commission, and local, state and Commonwealth Government stakeholders.</td></tr>
<tr><td>Social media</td><td>Seven posts were made to the WestConnex Facebook page including:
• General posts on the M4-M5 Link design or features:
– 2 November 2016 – 1,794 people reached
– 4 November 2016 – 3,867 people reached
– 15 November 2016 – 1,392</td></tr>
</table>

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	**M4 M5 Link project**	**Activity**	**Summary**
				people reached – 6 December 2016 – 3,376 people reached – 15 December 2016 – 3,221 people reached – Notification of geotechnical investigations: – 4 November 2016 – 1,008 people reached – 5 January 2017 – 3,954 people reached. • Advice that community members can request a meeting to discuss M4-M5 Link project: – 6 December 2016 – 5,632 people reached.
May to August 2017 – NSW Government release of the concept design for the project				
Early consultation on the concept design prior to the EIS exhibition phase in response to feedback from community.	Monthly release of Inside Lane newsletter. Monthly meetings of the WestConnex Community Reference Group. Outreach information stands at Wests Tigers and GWS Giants home games. Ongoing Community Grants Scheme.	The concept design was released for a 12-week public consultation period in May 2017.Consultation activities were undertaken during the pre-EIS exhibition phase. This consultation period provided an opportunity for communities to learn more about the project and to provide input to the design. Feedback and ideas collected through this phase informed additional mitigation measures and design refinement to take place	Media	On 12 May 2017, the NSW Premier announced the release of the concept design.
			Hardcopy of concept design & offer of briefing	On the 12 May, 2017, a copy of the M4-M5 Link concept design was provided to: • NSW Premier • Minister for WestConnex • Minister for Roads • Minister for Planning • Member for Balmain • Member for Newtown

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	M4 M5 Link project	Activity	Summary
		during detailed design.		• Member for Summer Hill • Member for Grayndler • Member for Sydney • Member for Kingsford Smith • City of Sydney • Inner West Council • City of Canada Bay Council. This was followed by a phone call offering a project briefing.
			Community update newsletters	A community update was distributed to residents near the project footprint, including the suburbs of Abbotsford, Drummoyne, Russell Lea, Canada Bay, Five Dock, Haberfield, Ashfield, Birchgrove, Rozelle, Balmain, Lilyfield, Leichhardt, Petersham, Dulwich Hill, Glebe, Annandale, Camperdown, Newtown, The Rocks, Haymarket, Ultimo, Surry Hills, Alexandria, Beaconsfield, St Peters, Chiswick, Rodd Point, Summer Hill, Lewisham, Enmore, Forest Lodge, Pyrmont, Balmain, Barangaroo, Waterloo, Redfern and Erskineville. Community updates have also been made available on the project website.
			Direct emails	Direct emails have been sent to more than 3,600 registered stakeholders, including residents, landowners, stakeholders, businesses and community groups: • 12 May 2017: advising the release of

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	M4 M5 Link project	Activity	Summary
				the concept design • 19 May 2017: to invite people to provide feedback on concept design and attend information sessions • 24 May 2017: to invite people to provide feedback on concept design and attend information sessions • 31 May 2017: calling for feedback and advising of consultation closing date.
			Newspaper advertisements	Two newspaper advertisements appeared in the *Inner West Courier* on 23 May, 30 May 2017 to encourage participation in the community information sessions.
			Webpage updates	On 12 May 2017, the concept design was released and a page on the M4–M5 Link design was published online.
			Social media	Six posts were made to the WestConnex Facebook page about the concept design release and consultation: • 12 May 2017 – 60,322 people reached • 18 May 2017 – 33,594 people reached • 23 May 2017 – 9,164 people reached • 6 June 2017 – 2,700 people reached • 15 June 2017 – 31,108 people reached • 31 July 2017 – 4,251 people reached.
			Community information sessions	Five community information sessions were held during May to June 2017. The objectives of these sessions were to: • Communicate key information about

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	M4 M5 Link project	Activity	Summary
				the M4-M5 Link design to the community, counter misinformation and explain the consultation, planning and design development process • Provide a forum for communities to provide feedback including ideas and issues to assist with the M4-M5 Link design and environmental assessment process • Confirm aspects of the project that are negotiable and aspects the community can influence • Gather feedback on the design, in particular: – the masterplan for the Rozelle Rail Yards – the concept plan for the Iron Cove Link – the future use of the mid-tunnel construction sites at Leichhardt/Lilyfield and Annandale/Camperdown – active transport connections – the architectural design of ventilation facilities and tunnel entry/exit points – landscape treatments at Haberfield, Rozelle, Iron Cove, Leichhardt/Lilyfield and Annandale/Camperdown – the in-tunnel environment and

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	**M4 M5 Link project**	**Activity**	**Summary**
				driver experience • Demonstrate to key stakeholders that a comprehensive engagement program is being undertaken and community and stakeholder feedback is being addressed. These sessions were held on: • **Camperdown:** Thursday 25 May 2017, 4pm-7pm, Rydges Camperdown, 9 Missenden Road, Camperdown • **Leichhardt:** Saturday 27 May 2017, 11am-2pm, La Via Event Venue, Suite 29, The Italian Forum, 23 Norton Street, Leichhardt • **Newtown:** Tuesday 30 May 2017, 4pm-7pm, Tom Foster Community Centre, 11-13 Darley Street, Newtown • **Balmain**: Thursday 1 June 2017, 4pm – 7pm, Balmain Town Hall, 370 Darling Street, Balmain • **Haberfield**: Wednesday 7 June 2017, 4-7pm, Michael Maher Room, Ground Floor, 78-80 Dalhousie Street, Haberfield (within Haberfield Library). A total of 542 people attended the community information sessions.
			Collaborative map	An online collaborative map featuring the draft design was available on the WestConnex website from 12 May 2017 to 4 August 2017 to support consultation for the concept design release. A total of

Key consultation purpose or outcome	Consultation activity and communication summary		Communication tools used (in addition to permanent channels)	
	WestConnex program of works	M4 M5 Link project	Activity	Summary
				876 comments were received on the map.

7.3.4 Consultation with local, state and Commonwealth Government agencies and elected representatives

Table 7-4 provides a summary of the consultation activities undertaken with local, state and Commonwealth Government agencies and elected representatives during the development of this EIS. Consultation has been ongoing since before the development of the EIS, and would continue during design and construction of the project. In addition to the meetings outlined in **Table 7-4,** regular phone and email correspondence has taken place with these agencies and representatives.

Changes to the local government structure influenced the consultation program for the project. On 12 May 2016, the NSW Government announced reforms to local government, which saw the amalgamation of local councils to form new councils. The Inner West Council was formed by the amalgamation of the Ashfield, Leichhardt and Marrickville councils.

In January 2017, the NSW Government announced a dedicated Minister for WestConnex.

Table 7-4 Consultation with local, state and Commonwealth Government agencies and elected representatives

Stakeholder	Purpose of consultation	Date
DP&E and NSW Planning Assessment Commission	A meeting to discuss the EIS process and SEARs, site visit with agencies to inform preparation of SEARs.	11 January 2016
The Hon. Duncan Gay, NSW Minister for Roads, Maritime and Freight	Regular meetings with the NSW Minister for Roads, Maritime and Freight to provide updates on the project.	From 20 January 2016 to 19 December 2016
Planning focus meeting with DP&E, Department of Premier and Cabinet (DPC), NSW Environment Protection Authority (NSW EPA), Sydney Local Health District, NSW Health, OEH, Transport for NSW, Inner West Council, City of Sydney Council and UrbanGrowth NSW	The planning focus meeting with relevant government agencies to provide a briefing on the approach to the preparation of the EIS. A site inspection along the tunnel corridor alignment was carried out with the relevant agencies and the proposed assessment methodologies were discussed.	12 February 2016
Advisory Committee on Tunnel Air Quality	A meeting to discuss in-tunnel air quality for the WestConnex projects including the M4-M5 Link.	23 February 2016
City of Sydney Council and Inner West Council	Three workshops with the councils were held to during the development of the project, in particular the urban design master plans and active transport strategy.	22 March 2016 21 April 2016 30 May 2016
Jamie Parker MP, NSW Member for Balmain	A meeting to provide an overview of the project and the community consultation strategy.	26 April 2016
	A briefing to provide information on the project and specifically Rozelle interchange.	11 August 2016
	A briefing on the concept design for the project.	18 May 2017
Mark Coure MP, NSW Member for Oatley	A briefing on the project.	24 August 2016
	A briefing on the M4-M5 Link project.	5 April 2017
The Office of the NSW Premier	Two briefing meetings to provide updates on the project.	28 October 2016 13 November 2016
Tanya Plibersek MP,	A briefing on the project.	28 October 2016

Stakeholder	Purpose of consultation	Date
Federal Member for Sydney	A briefing on the concept design for the project.	9 June 2017
The Hon. Rob Stokes NSW Minister for Planning	A briefing on the project.	3 November 2016
The Hon. Andrew Constance, NSW Minister for Transport and Infrastructure	A briefing regarding design changes including the removal of Camperdown ramps.	7 November 2016
The Hon. Paul Fletcher, Federal Minister for Urban Infrastructure and The Hon. Duncan Gay, NSW Minister for Roads, Maritime and Freight	A briefing session regarding the project and WestConnex program of works.	19 December 2016
Anthony Albanese MP, Federal Member for Grayndler, Mr Darcy Byrne and Mark Ely, Newtown Precinct Business Association	Meeting to discuss impact on King Street, Newtown and the project overall.	14 December 2016
Infrastructure NSW	A meeting to discuss the wider WestConnex program.	3 June 2016
	A briefing regarding the Camperdown interchange.	1 November 2016
NSW Department of Health	Four meetings as part of the formal process of the Health Partnerships Gateway Review.	24 May 2016 31 May 2016 1 June 2016 27 October 2016
Transport for NSW	Regular meetings with Transport for NSW, including specific agency departments such as the Sydney Metro City and Southwest. Meetings have also been held to discuss the project design and ongoing coordination regarding bus requirements including bus priority on Victoria Road at Rozelle, public transport options to serve The Bays Precinct, and the adjoining CBD and South East Light Rail Rozelle maintenance depot.	Since February 2016
Royal Prince Alfred Hospital and Sydney Local Health District	Three meetings to discuss the project, the community consultation process and design developments, particularly around the removal of the Camperdown ramps.	15 June 2016 3 August 2016 18 November 2016
NSW EPA	Ongoing meetings to discuss: • Project progress • EIS process and communications strategy • Construction work and hours of operation • Presentation of noise and vibration assessment methodology for the EIS • Presentation on the noise and vibration modelling results, assessment and proposed mitigation measures • Presentation on the air quality assessment	Since February 2016

Stakeholder	Purpose of consultation	Date
	methodology and modelling domain • Presentation on air quality and human health risk modelling results, assessment and proposed mitigation measures • Presentation on the ventilation design for the project and the assessment undertaken for the EIS • Cumulative construction assessment.	
The Hon. Rob Stokes NSW Minister for Planning, Minister for Planning, DPC and Greater Sydney Commission	A briefing to provide details about the Iron Cove Link.	7 July 2016
NSW Heritage Council	A meeting to provide a background on the project and relevant heritage considerations.	6 July 2016
	A meeting to provide an update on the project design and the preliminary findings of the Non-Aboriginal heritage assessment for the project.	12 April 2017
Inner West Council	Meetings with Inner West Council have been held regularly during the development of the concept design and EIS. This has included discussions and presentations on urban design and active transport designs, surface water and flooding, construction ancillary facilities, project design and design refinements, EIS program, community consultation overviews, noise monitoring, use of King George Park during construction of the project, possible impact on Easton Park, geotechnical investigations. Prior to the council amalgamation on 12 May 2016, ongoing meetings were held with the former Ashfield, Leichhardt and Marrickville councils.	Since April 2016
Western Sydney Regional Organisation of Councils Ltd (WSROC)	A meeting to provide an update on the project.	26 July 2016
City of Sydney, DP&E, DPC, Inner West Council and Transport for NSW	Active transport workshop.	27 July 2016
Inner West Council and DPC	An update on the project.	3 August 2016
City of Sydney and Sydney Local Health District	A meeting to discuss the project.	5 August 2016
City of Sydney and Infrastructure NSW	An interview for the assessment of the Glebe Island Preliminary Business Case as part of Infrastructure NSW's Infrastructure Investor Assurance Framework.	11 August 2016
DP&E, NSW EPA, NSW Chief Scientist, DOH and SSWAHS	A meeting to present the project's air quality assessment methodology.	12 August 2016
	Presentation on the ventilation design for the project and the assessment undertaken for the EIS.	18 May 2017
	Presentation on air quality and human health risk	28 June 2017

Stakeholder	Purpose of consultation	Date
	modelling results, assessment and proposed mitigation measures.	
City of Sydney Council	Submission: a formal written submission was received from City of Sydney. Details from this submission are included in **Table 7-9**.	August 2016
	A briefing on the concept design.	1 June 2017
Roads and Maritime Heritage Committee	A meeting to discuss the heritage considerations associated with the Camperdown and Rozelle precincts.	1 September 2016 April 2017
City of Canada Bay Council	A meeting to discuss the project.	2 September 2016
The Hon. Paul Green, Member of the NSW Legislative Council	A meeting to provide an overview of the project.	17 October 2016
NSW Treasury and Transport for NSW	A meeting to discuss project finance.	20 October 2016
Department of Primary Industries Water (DPI-Water)	Four meetings to provide a project overview and update and to discuss topics such as groundwater, drainage and flooding, and contamination.	20 July 2016 22 November 2016 15 December 2016 22 May 2017
OEH	An invitation to meet has been offered.	9 September 2016
Sydney Metro West	Update on Sydney Metro West and WestConnex M4-M5 Link.	15 November 2016
NSW EPA and DP&E	A meeting to discuss: • Noise assessment scope/boundary area for both construction and operational assessment • Construction work and hours of operation • Overview of cumulative construction assessment • Operational overview including cumulative operational assessment.	7 December 2016
UrbanGrowth NSW	Meetings held to discuss the concept for the Rozelle Rail Yards, including: • Active transport connections between the Rozelle Rail Yards and White Bay • Land use within the Rozelle Rail Yards and The Bays Precinct for surface roads and open space • Maximising useable remaining project land.	8 December 2016
Department of Education	A meeting to provide an overview of the project.	9 December 2016
City of Sydney, Inner West Council and City of Canada Bay Council	Ongoing liaison with councils regarding interchange design, EIS content and analysis, outcomes of the Camperdown options study, and the Rozelle concept design.	12 December 2016
City of Sydney	Regular meetings with the Council. Discussions have included: • Overview of the project • Consideration of Council policies and documents • EIS process and communications strategy.	Since 7 March 2016
Transport for NSW Parramatta Light Rail	A meeting to discuss the project.	19 July 2016

Stakeholder	Purpose of consultation	Date
Transport for NSW Sydney Light Rail	Regular meetings to discuss items such as: • Project overview • Project schedule • EIS process and communications strategy • Project interfaces and interface agreements.	Since 4 March 2016
Australian Government Department of Infrastructure and Regional Development (DIRD), Civil Aviation Safety Authority (CASA) and Sydney Airport Corporation Limited (SACL)	Regular meetings to discuss items such as: • Project overview • Project schedule • EIS process and communications strategy • Methodology and timing for the plume rise assessment • Regulatory approval process for infrastructure near airport land or airspace.	Since 25 July 2016
Anthony Albanese MP, Federal Member for Grayndler	A briefing on the M4-M5 Link project.	24 March 2017
	A briefing on the concept design.	17 July 2017
DP&E, NSW Office of Water, NSW EPA, OEH	A presentation on the surface water, flooding and drainage impact assessment undertaken for the EIS.	12 May 2017
Jo Haylen, Member for Summer Hill	A briefing on the concept design.	28 June 2017
DP&E, DPC, NSW Health, NSW Chief Scientist, Sydney Local Health District, NSW EPA	A presentation on the air quality and human health impact assessments undertaken for the EIS.	28 June 2017
DP&E, DPC, NSW EPA	A presentation on the noise and vibration impact assessment undertaken for the EIS.	4 July 2017
DP&E, UrbanGrowth NSW, Port Authority NSW	A presentation on the traffic and transport impact assessment undertaken for the EIS.	5 July 2017
CASA, SACL, DIRD	A presentation on the plume rise assessment undertaken for the project.	5 July 2017
The Hon. Stuart Ayres MP, Minister for Western Sydney, Minister for WestConnex, and Minister for Sport	A presentation on future land use of remaining project land.	6 July 2017
	A briefing on the M4-M5 Link project and design evolution, community consultation and key findings of the EIS.	24 July 2017
The Hon. Melinda Pavey, Minister for Roads, Maritime and Freight	A briefing on the M4-M5 Link project, including the EIS.	28 July 2017

7.3.5 Consultation with utility and service providers

Consultation with utility and service providers has been carried out to discuss potential impacts on existing and future utility supply, adjustments and project timing. Consultation has been ongoing since before the development of the EIS and would continue should the project be approved. **Table 7-5** provides a summary of the consultation undertaken with utilities and service providers during the development of this EIS.

The approach to utility relocations or protection, potential impacts and measures to mitigate these impacts is outlined in the **Appendix F** (Utilities Management Strategy). The strategy includes ongoing consultation with utility and service providers to ensure activities can be coordinated as far as possible to minimise impacts on communities.

Table 7-5 Consultation with utility and service providers

Stakeholder	Key items discussed	Date
Ausgrid	Regular meetings to discuss: • Permanent and construction power supply solutions for the M4-M5 Link • Tracking status of permanent and construction power designs • Possible impacts on Ausgrid assets by proposed Project infrastructure or related construction staging • Treatment solutions for impacted assets • Detailed design progress for impacted Ausgrid assets • EIS process and communications strategy • Overall approach and key principles of the Utilities Management Strategy (refer to **Appendix F**).	Since May 2016
Sydney Trains	Regular meetings to discuss: • Development Deed • Property impact • Possible impacts on Sydney Trains assets by proposed project infrastructure or related construction staging • Treatment solutions for impacted assets • Detailed design progress for impacted Sydney Trains assets.	Since September 2016
Jemena	A meeting to introduce the project and discuss relocation and protection of Jemena's assets. Further meetings have been offered.	20 October 2016
Sydney Water	Monthly coordination meetings to discuss key issues including: • Relocation and protection of Sydney Water assets • Approval processes for EIS and communications strategy • Update on progress of design and network assessments • Program update and discussion of timelines and agreed milestones • Interface agreements. In addition, a meeting was held 7 June 2017 to discuss the overall approach and key principles of the Utilities Management Strategy (refer to **Appendix F**) and a presentation provided on the surface water, flooding and drainage impact assessment 6 July 2017.	Since April 2016
Telstra	Two meetings to discuss topics including: • Planned consultation process • Relocation and protection of Telstra assets.	2 August 2016 3 November 2016
Optus	A meeting to introduce the project and discuss relocation and protection of Optus' assets. Further meetings have been offered.	8 September 2016
TPG (AAPT)	One meeting held. Topics discussed include: • Planned consultation process • Relocation and protection of TPG assets.	29 March 2017

7.3.6 Consultation with directly impacted land owners and residents

All acquisition required for the project would be undertaken in accordance with *the Land Acquisition (Just Terms Compensation) Act 1991* (NSW) (Just Terms Act), the *Land Acquisition Information Guide* (NSW Government 2014) and the land acquisition reforms announced by the NSW Government in 2016[1].

The Customer Service Commissioner, Michael Pratt, recently undertook a review of the process of residential property acquisition in NSW to look at ways to improve the resident experience. Completed in September 2016, the 'Pratt Review' made a number of recommendations to improve the customer experience during acquisition.

These included:

- Increasing the maximum amount payable for solatium (now known as 'Disadvantage Resulting from Relocation') to $75,000
- Appointing a Personal Manager Acquisitions for each land owner/resident to assist them through the acquisition process and help them relocate.

The Pratt Review and the reforms arising from it followed a review of the Just Terms Act by David Russell SC in February 2014 and the NSW Government's response to that review, which resulted in amendments to the Just Terms Act being passed by NSW Parliament in November 2016. Those amendments commenced on 1 March 2017 and included, among other changes, a minimum six-month negotiation period before the compulsory acquisition process may commence; and allowing residential owner occupiers to remain in their properties for up to 90 days without paying rent following compulsory acquisition.

Roads and Maritime has assigned a Personal Manager Acquisitions to assist each of the land owners and residents affected by acquisition for the M4-M5 Link project. The Personal Manager Acquisitions was appointed at the beginning of the acquisition process and would continue to work with the land owners and residents to offer them assistance and support throughout the acquisition and relocation process.

7.3.7 Other industry and stakeholder consultation

Consultation with other industry and stakeholders started before the development of the EIS, particularly in relation to the WestConnex program of works. Consultation would continue during design and construction. **Table 7-6** provides a summary of the consultation during the development of this EIS.

Table 7-6 Consultation with industry and other stakeholders

Stakeholder	Key items discussed	Date
Greater Sydney Commission	Regular meetings to provide information and updates on the project. Discussions have focused on the Greater Sydney Commission's draft 20-year District Plans for Sydney.	Since 8 February 2016
NRMA	A meeting to provide an update on the project.	23 February 2016
NSW Police Newtown Local Area Command	A meeting to provide an update on survey and geotechnical investigations proposed for the project.	12 April 2016
Australian Logistics Council, NRMA Infrastructure Partnerships Australia	A meeting to provide an overview of the project and the wider WestConnex program.	26 July 2016

[1] See: https://www.finance.nsw.gov.au/sites/default/files/NSW_Government_Response.pdf. Relocation and some other categories of expenses would be claimable under this Act

Stakeholder	Key items discussed	Date
and WSROC		
Industry partners	A briefing to provide an update on the new design features of the project. The speakers discussed a range of changes, including an increase in capacity for the M4-M5 Link twin tunnels from three to four lanes in each direction, the removal of exit and entry ramps at Camperdown, and a shift in tunnel alignment.	16 November 2016
Infrastructure Partnerships Australia	A meeting to provide an overview of the wider WestConnex program.	19 November 2016
Australian Institute of Landscape Architects	A meeting to introduce the project.	20 October 2016
Coalition of Glebe Groups	Regular meetings to discuss project features of specific interest to this stakeholder, like the Camperdown interchange (before it was removed from the design).	Since November 2016
Balmain community meeting	A session hosted by the community. An overview of the project was provided and a question and answer session was held.	8 December 2016
NSW Fire and Rescue	A meeting to provide information on the project, including a general project description and how the project connects with other stages of the WestConnex program.	14 February 2017
State Emergency Services	A meeting was offered and a submission on the concept design was received.	19 July 2017
BayBUG (Bay Bicycle User Group)	An invitation to meet has been offered.	May 2017
Pedestrian Council of Australia	An invitation to meet has been offered.	May 2017
Bicycle NSW	A meeting to discuss active transport options for the M4-M5 Link project.	22 May 2017
Bikeast	A meeting to discuss active transport options for the M4-M5 Link project.	22 May 2017
Inner West Bicycle Coalition	A meeting to discuss active transport options for the M4-M5 Link project.	19 June 2017
Hunter Baillie Memorial Presbyterian Church, Annandale	A meeting to discuss the concept design, the heritage of the church and possible impacts.	11 July 2017
Bike Sydney	A meeting to discuss active transport connections to be delivered by the project.	4 August 2017

7.3.8 Aboriginal cultural heritage consultation

The methodology adopted for the Aboriginal heritage assessment was developed in accordance with the requirements of the Roads and Maritime *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) (Roads and Maritime 2011a). By adopting the PACHCI process, the assessment is consistent with the OEH *Aboriginal cultural heritage consultation requirements for proponents* (DECCW 2010a).

In accordance with the Roads and Maritime Stage 2 PACHCI process (refer to **Chapter 21** (Aboriginal heritage)), the following Aboriginal community consultation process was implemented:

- Identification of key Aboriginal stakeholders and the relevant local Aboriginal Land Council (LALC) through searches of the National Native Title Register and Registrar of Aboriginal Owners
- Engagement of identified Aboriginal stakeholders to participate in the archaeological survey
- Preparation (by identified Aboriginal stakeholders) of a cultural heritage survey report.

Searches of the National Native Title Register and Register of Aboriginal Owners did not identify any Aboriginal stakeholders. The Metropolitan LALC (MLALC) was identified as the relevant LALC for this assessment. Jay Daley from MLALC participated in the archaeological surveys. No native title applicants or Aboriginal owners were identified.

7.4 Contact summary

More than 20,000 individuals have been contacted during the development of the WestConnex program of works, which includes the M4-M5 Link project. Over 4,807 individuals have been contacted or have made contact with the project team specifically for the M4-M5 Link over 5,597 consultation events (not including social media events or subscribers to project updates).

Table 7-7 provides an overview of the method of contact and number of contacts that have been made for the project since consultation commenced in January 2016.

Table 7-7 Summary of project contact from January 2016 to July 2017

Method of contact	Number of contacts
WestConnex information telephone line (inbound calls)	1,185
Inbound email, letters and other written correspondence	1,026
Properties door-knocked	352
Subscribers to project updates (M4-M5 Link)	4,216
Completing online feedback form (website)	1,724
Completing feedback form (hard copy)	127
Customer enquiries issued as Ministerial enquiries	77
Outbound notification letters, phone calls, SMS notification, general correspondence letters, community updates, mail outs and other	1,044
Meetings (targeted stakeholders)	25
Public displays and meetings	24
Contact on site	13
Total engagement on social media (number of people reached)	189,327
Total contacts (inbound and outbound and not including social media and subscribers to project updates)	5,597

7.5 Responding to early feedback

Ideas provided by government agencies, local government and the community were recorded and considered during the preparation of this EIS and throughout the development of the project.

A range of commitments have been made in relation to the project in response to early feedback (see **section 7.2**). In addition, the EIS provides an assessment of matters raised during consultation. **Table 7-8** and **Table 7-9** summarise the feedback provided by government agencies and raised at meetings with the relevant councils and indicates where in the EIS this topic has been addressed.

Table 7-10 provides a summary of feedback received up until July 2017 from the community, community groups (including pedestrian and cyclist user groups), businesses and adjoining and affected landowners during the preparation of this EIS. **Table 7-10** consolidates feedback from the community for the purpose of this EIS and provides a response or indicates where in the EIS this topic has been addressed. Detailed summaries of feedback received from the community can also be found in the Community Feedback Report published in November 2016 and available on the WestConnex website.

Table 7-8 Feedback from government agencies

Stakeholder	Feedback	Where addressed in EIS
Transport for NSW	**Integrated design and cumulative impact** • The project needs to integrate with the broader transport plans for Sydney • Other projects underway need to be considered in developing the M4-M5 Link design • Steps should be taken to allow for bus lanes on Victoria Road.	Refer to **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport). Refer to **Chapter 3** (Strategic context and project need) for an explanation of WestConnex in the context of other transport project. A discussion of the potential interfaces with other transport projects is provided in **Chapter 26** (Cumulative impacts). The project design has allowed for bus lanes on Victoria Road.
Sydney Local Health District	**Air quality and human health** • University of Sydney (Camperdown campus) is a sensitive receiver • Concerns over the proposed ventilation facility at Broadway • The needs of the RPA Hospital to be considered, including underground car parking, nuclear medicine facilities and laser equipment sensitive to vibration.	Refer to **Chapter 4** (Project development and alternatives) which describes the removal of the Camperdown interchange from the project and the impacts avoided on the University of Sydney and the RPA Hospital. A discussion of air quality and human health impacts is provided in **Chapter 9** (Air quality) and **Chapter 11** (Human health risk).
	Heritage • Consideration of the RPA Hospital heritage items.	Refer to **Chapter 4** (Project development and alternatives) which describes the removal of the Camperdown interchange from the project and the impacts avoided on the RPA Hospital. Refer to **Chapter 20** (Non-Aboriginal heritage) and **Appendix U** (Technical working paper: Non-Aboriginal heritage).
NSW Health	**Land use and socio-economic** • Encourage emphasis on public transport.	Refer to **Chapter 4** (Project development and alternatives), **Chapter 5** (Project description) and **Chapter 12** (Land use and property).
	Soil and water • Consideration of contaminated soil • The EIS should detail the methods to remove any contaminated material and spoil.	Refer to **Chapter 15** (Soil and water quality) and **Chapter 16** (Contamination).

Stakeholder	Feedback	Where addressed in EIS
UrbanGrowth NSW	**Traffic and transport** • Potential for future public transport at Rozelle Rail Yards, Camperdown and Parramatta Road needs to be considered • Consideration for the provision of active transport (pedestrian and cyclist) in and around the Rozelle Rail Yards, in particular connecting to White Bay and the future the Bays Precinct.	Refer to **Chapter 4** (Project development and alternatives), **Chapter 5** (Project description), **Chapter 8** (Traffic and transport), **Chapter 12** (Land use and property), and **Appendix N** (Technical working paper: Active transport strategy).
	Land use and socio-economic • Need to consider the creation of high quality urban environments and public amenity – playing fields, open space provision at Rozelle • A desire for contiguous land parcels that maximise usable remaining project land • UrbanGrowth's preference is for the Rozelle interchange to be predominantly underground.	Refer to **Chapter 12** (Land use and property) and **Chapter 13** (Urban design and visual amenity) and **Appendix L** (Technical working paper: Urban design).
	Heritage • White Bay Power Station needs to be considered.	Refer to **Chapter 20** (Non-Aboriginal heritage), **Chapter 13** (Urban design and visual amenity), **Appendix U** (Technical working paper: Non-Aboriginal heritage) and **Appendix L** (Technical working paper: Urban design).

Table 7-9 Feedback from local government

Stakeholder	Feedback	Where addressed in EIS
City of Sydney	**Traffic and transport** • Extent of the study area needs to be increased to address broader impacts, including transport impacts, in context of constrained urban areas • Consideration to be given to the opportunities for growth of active transport • Assessment timeframes in the EIS need to be sufficient – eg longer term assessment post-2031.	Refer to **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport). Refer also to **Appendix N** (Technical working paper: Active transport strategy).
	Air quality and human health • Study area needs to be considered • Air quality impacts along surface routes need to be assessed • Forward planning for residential buildings that may be affected by air quality	Refer to **Chapter 9** (Air quality), **Chapter 11** (Human health risk), **Appendix I** (Technical working paper: Air quality) and **Appendix K** (Technical working paper: Human health risk assessment).

Stakeholder	Feedback	Where addressed in EIS
	• Parramatta Road – community health needs to be assessed, not just tunnel and portals* • Noise is a human health factor, and more cars on Parramatta Road would generate additional noise and have impacts on residents and future planning for the area.	
	Noise and vibration and traffic • Concerns about noise impacts in relation to the Camperdown interchange and its potential to increase traffic along Parramatta Road at Camperdown*.	Refer to **Chapter 4** (Project development and alternatives), **Chapter 5** (Project description) and **Chapter 8** (Traffic and transport).
	Land use and socio-economic • CBD impacts on local communities* • Victoria Park (Camperdown) – heritage and open space considerations* • Concerns over noise and other impacts that may trigger the need for zoning changes • Concern over impacts of the project on land values and future development* • Concern on impacts on community groups.	Refer to **Chapter 12** (Land use and property), **Chapter 13** (Urban design and visual amenity), **Chapter 14** (Social and economic) and **Appendix P** (Technical working paper: Social and economic).
	Urban design • Increasing open space and active recreation. It is not appropriate to plant superficial landscaping to try and hide the motorway; the landscaping needs to be suitable for its location • Need to maximise value around excess land and expectation that any future use of excess land is assessed appropriately.	Refer to **Chapter 12** (Land use and property), **Chapter 13** (Urban design and visual amenity) and **Appendix L** (Technical working paper: Urban design).
	Heritage • Need to consider Heritage Conservation Areas including properties/items facing Parramatta Road*.	Refer to **Chapter 20** (Non-Aboriginal heritage) and **Appendix U** (Technical working paper: Non-Aboriginal heritage).
Inner West Council	**Integrated design and cumulative impacts** • Consideration and co-ordination with other plans and projects in the area such as The Bays Precinct, the proposed future Western Harbour Tunnel and Beaches Link and the Parramatta Road Corridor Urban Transformation Strategy.	Meetings with key stakeholders to co-ordinate on other projects within or near the project footprint have been held and would continue to be held should the project be approved. See **section 7.3.2** for details of meetings with relevant stakeholders.

Stakeholder	Feedback	Where addressed in EIS
		Refer to **Chapter 3** (Strategic context and project need) for an explanation of WestConnex in the context of other transport and infrastructure projects, plans and strategies. A discussion of the potential interfaces with other projects is provided in **Chapter 26** (Cumulative impacts).
	Construction work • Concern about the potential use of Reg Coady Reserve as a temporary construction employee car park and the associated impact on residents. Suggestion to use the Cove Street depot site as an alternative • Request that where possible impacts on council assets such as roads and parks should be avoided.	Refer to **Chapter 4** (Project development and alternatives), **Chapter 5** (Project description) and **Chapter 6** (Construction work).
	Design • Concern about the impact on residents of a tunnel dive site at Leichhardt and a preference to have no dive site at Leichhardt.	During February and March 2017 there were numerous key stakeholder meetings regarding the proposed mid-tunnel construction site in the Leichhardt area and notifications were distributed to local residents and businesses. Consultation on the draft design, including the proposed location for a mid-tunnel dive site, would continue through the public exhibition of the EIS and during the detailed design phase, should the project be approved. The potential impacts of the construction ancillary facilities proposed for the project have been assessed throughout this EIS and are described in Refer to **Chapter 4** (Project development and alternatives), **Chapter 5** (Project description) and **Chapter 6** (Construction work).
	Consultation • Request for more information and certainty around the project • Establishment of a WestConnex Community Reference Group is an important priority for Council to allow residents to have a forum for their concerns related to WestConnex.	In November 2016, expressions of interest were sought from community members and stakeholder groups to join the WestConnex Community Reference Group.
	Active transport • Consideration to be given to the opportunities for growth of active transport.	Refer to **Appendix N** (Technical working paper: Active transport strategy).

Note:
* This feedback was relevant to the Camperdown interchange and this design feature has been subsequently removed from the design.

Table 7-10 Feedback from the community

Feedback	Detail	Response or where addressed in EIS
Camperdown interchange	• Concerns about the proposed Camperdown interchange including impacts on traffic and community.	Following community and stakeholder consultation and subsequent design changes, the Camperdown interchange was removed (refer to **Chapter 4** (Project development and alternatives)).
	• Concern that Roads and Maritme and SMC have given too much weight to the views of Sydney University and the RPA Hospital in reaching a decision to remove the Camperdown ramps • Concern that the impacts on the road network associated with the removal of the Camperdown ramps would not be assessed in the EIS.	A traffic assessment of the impacts of removing the Camperdown ramps has been carried out. Refer to **Appendix H** (Technical working paper: Traffic and transport). Refer also to **Chapter 4** (Project development and alternatives) for more details on the removal of the Camperdown ramps.
Active and public transport	• Suggestions that improved public transport would reduce traffic congestion and remove need for project • Requests for additional public transport including heavy rail, light rail, additional buses, ferries, metro, trams • Requests for dedicated bus lanes on surface roads • Concerns about whether the toll road operator contracts have clauses prohibiting competing public transport • Comments and suggestions regarding existing public transport services • Question if the project would help to introduce more buses on Victoria Road and Anzac Bridge.	Refer to **Chapter 3** (Strategic context and project need), **Chapter 4** (Project development and alternatives), **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport). Some of this feedback is outside the scope of the project.
Traffic	Community feedback on the topic of traffic includes: • Queries and concerns about integrating the project with the surface road network and local road access • Concern that traffic modelling has not taken into account induced traffic, local rat running and changes in technology such as driverless cars and electric cars • Concerns motorists and trucks would use local roads to avoid tolls • Concerns that the project would worsen traffic conditions on local roads particularly those surrounding the Rozelle and St Peters interchanges and suggestions that upgrades to key surface road would be required • Concern that King Street, Newtown, would be made a 24 hour clearway. Responses from the businesses surveys highlighted that traffic management	Refer to **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport). Roads and Maritime has no plans to change the existing clearways on King Street.

Feedback	Detail	Response or where addressed in EIS
	was important including: • Avoiding bottlenecking near tunnel entry and exit ramps • Suggestions that removing construction spoil outside of peak hours would help to minimise further traffic congestion on main roads • Preventing construction workers from using customer parking spots during business operational hours.	
	Requests for specific details about the traffic modelling including: • Who is conducting the traffic modelling for the project and would the model be made available to the public • How have travel times through the tunnels been calculated and are there differences between different tunnel sections • What are the estimated speeds within each section of the tunnel and how long would a driver typically spend underground • What difference does the removal of the exit at Camperdown mean to the volumes of traffic flowing north at Euston Road.	Refer to **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).
	Questions about how the project would improve existing congestion on Anzac Bridge, particularly for citybound buses during peak hour.	Refer to **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).
	Concern that traffic congestion on Anzac Bridge might lead to drivers spending extended periods in the tunnel.	Refer to **Chapter 8** (Traffic and transport) and **Appendix H** (Technical working paper: Traffic and transport).
Rozelle interchange	Concern about the Rozelle interchange and potential impacts on the local area.	The Rozelle interchange would be located primarily underground below Lilyfield and Rozelle. Tunnel portals and entry and exit ramps would be constructed within the Rozelle Rail Yards. Works along City West Link, The Crescent and Victoria Road for connection to the interchange tunnel portals would also be required. By locating the interchange primarily below ground in tunnels, and using the Rozelle Rail Yards for the construction of tunnel portals and entry and exit ramps, total land acquisition required for construction and operation of the interchange would be minimised. Refer to **Chapter 5** (Project description).
	Concern about the location of three ventilation outlets at Rozelle near a recreation area.	
	Various suggestions regarding the design of the Rozelle interchange including: • Locate most of the interchange underground • Double-stacked tunnels • Use the existing City West Link as part of the interchange • Keep Victoria Road–City West Link intersection separate from the rest of the interchange, and develop it first • Consider that not all combinations of routes need to be prioritised at the interchange	

Feedback	Detail	Response or where addressed in EIS
	• Use the Iron Cove Link portal to run a tunnel under Rozelle to Anzac Bridge and Western Distributor • Parking should be included in the design of the Rozelle interchange.	
	Concern that the masterplan shown in the concept design for Iron Cove Link raises an expectation for landscaping in the middle of Victoria Road which is unlikely to be completed.	The options for use of remaining project land would be developed in consultation with the community and stakeholders. Details of remaining project land are described in **Chapter 12** (Land use and property) and **Appendix L** (Technical working paper: Urban design).
	Questions about the costs of constructing the Rozelle interchange.	The estimated cost of the M4-M5 Link project is around $7.2 billion ($2015), and this includes the cost of the Rozelle interchange.
Design	• Various questions regarding the design including: – Where vehicles that use the project would park – Requests for information about the tunnel route and depth as well as the location of the surface connections – Why the tunnel would not be built underneath Parramatta Road – The height of the ventilation outlets and concern for the associated visual impacts – Whether sustainable design and improvements in technology had been considered in the design • Various suggestions regarding the design including: – Colour-coding the tunnel interior so that drivers can identify the tunnel – Continuing the tunnel through to Gladesville Bridge at Drummoyne – Changing the route of tunnels to reduce property impacts – Moving the M4-M5 Link tunnel slightly south – Moving the M4-M5 Link portals to the west end of the Rozelle Rail Yards – Starting the sub-entrance portals at the west end of the Rozelle Rail Yards • Requests to change arrangements at existing roads, including but not	Refer to **Chapter 4** (Project development and alternatives), **Chapter 5** (Project description), **Chapter 8** (Traffic and transport), **Chapter 13** (Urban design and visual amenity) and **Chapter 27** (Sustainability).

Feedback	Detail	Response or where addressed in EIS
	limited to: – City West Link – Hartley Street, Rozelle – Springside Street, Rozelle – Manning Street, Rozelle – Clubb Street, Rozelle – Lilyfield Road, Rozelle – Victoria Road, Rozelle • Concern that local roads would be closed.	
Walking and cycling	• Requests to improve pedestrian and cyclist infrastructure, including connected cycleways and dedicated cyclist lanes in Rozelle and Camperdown • Concerns about the potential impact of the project on the Bay Run • Suggestion to make a new footbridge at the University of Sydney • Suggestions to re-open Glebe Island Bridge for pedestrians and cyclists • Comment that steel plates on the road pose a hazard for cyclists.	Refer to **Chapter 5** (Project description), **Chapter 8** (Traffic and transport), **Appendix H** (Technical working paper: Traffic and transport) and **Appendix N** (Technical working paper: Active transport strategy).
Engagement process	Suggestions that community consultation should have been conducted at an earlier stage of project development.	During consultation for the M4 East and New M5 projects, the community provided feedback that they would have liked to have been consulted sooner. As a result, for the M4-M5 Link, consultation began soon after the SSIAR was lodged with DP&E. The design was in its early stages and there was limited detail available on the project. This has provided the community with more opportunity to provide feedback and ideas to inform the development of the design (see **section 7.2**).
	Questions on the consultation process and timing of the public exhibition of the EIS.	The consultation process is described in this chapter. See **section 7.1** for an overview of the consultation process. See **section 7.3.3** for a summary of key consultation activities and communication tools for the project and for the wider WestConnex program of work. See **section 7.6.1** for details of the public exhibition of the EIS.
	Comments on the location of feedback sessions, how they were advertised and how the contact lists are organised.	

Feedback	Detail	Response or where addressed in EIS
	Questions around how much time the community will have to make a submission on the EIS. Concern about the scale and complexity of the EIS documentation and the limited time available during public exhibition to fully comprehend the information contained in it.	The EIS would be available for viewing for a period of at least 30 days. See **section 7.6.1** for details of the public exhibition of the EIS. A range of activities are planned to support the display of the EIS and provide opportunities for discussion with community and interested parties. This includes five community sessions and an EIS summary document with details of the key information contained in the EIS (refer to **Appendix A** (Project synthesis)).
	Seeking confirmation on consultation undertaken with the Gadigal and Wangal people of the Eora Nation.	The Gadigal and Wangal people have been consulted through the Metropolitan Local Aboriginal Land Council (MLALC). The MLALC's boundaries include the language group areas of the Eora, Dharug, Darkinung and Kuring-Gai, as defined by Horton on the Australian Institute of Aboriginal and Torres Strait Islander Studies Map of Indigenous Australia. Refer to **Chapter 21** (Aboriginal heritage) and **section 7.3.8**.
	Questions on how feedback from the community is being collated and if this will be published.	During the preparation of the EIS, feedback has been sought from community, local government and government agencies. Feedback collected during the preparation of the EIS has been used to develop the EIS and concept design. This table provides a summary of feedback from the community, community groups, businesses and adjoining and affected landowners during the preparation of this EIS. Roads and Maritime is required to respond to all submissions received during the exhibition of the EIS in a submissions report and this may result in changes to the design.
	Suggestions for future communication and engagement activities such as community ideas sessions, public meeting, online survey, easy to read version of EIS, emails and Q&A sessions.	Ongoing communication and engagement activities would include forums like the ideas sessions, meetings with community groups, emails, online information and newsletters. See **section 7.6.1**.
	Concern about the format and the amount of information available at the ideas sessions, as well as feedback on the display material at the sessions. Concern that the community information sessions were not adequately	M4-M5 Link consultation started soon after the SSIAR was lodged with DP&E. The design was in its early stages and there was limited detail available on the project. The

Feedback	Detail	Response or where addressed in EIS
	publicised and not enough notice was given.	community ideas forums were promoted via a number of channels including: • Letter box drops between 2 and 4 August 2016 to 130,000 residents and businesses in the local area • An email to more than 2,200 subscribers on 1 August 2016 • On the WestConnex website from 1 August 2016 • In posts on the WestConnex Facebook page on 1 and 9 August 2016 • Advertisements in the Inner West Courier on 2, 9 and 16 August 2016. Community members can receive regular project updates by subscribing at: www.westconnex.com.au/subscribe.
	Concern about the level of engagement and how information is provided to the community. Various suggestions about the format of communication material such as the concept design including the size of files for download and the size of the text when printed.	The format and type of communication material continues to be developed in response to feedback received. The Project synthesis (**Appendix A**) would be a standalone report that the public would be able to download. Hardcopies would also be provided at consultation venues during exhibition of the EIS. The EIS is divided into key chapters detailing the project and the specific environmental assessments. The EIS would be available for viewing for a period of at least 30 days. Refer to **section 7.6.1** for details of the public exhibition of the EIS. A range of activities are planned to support the display of the EIS and provide opportunities for discussion with communities and interested parties. This includes communication services that cater for those persons whose first language is a language other than English and material accessible for disabled persons.
	Comments that the concept design is indicative and lacked detail such as: • Number of tunnel lanes • Depth of tunnels	The concept design was released early for community feedback. This was in response to feedback from communities requesting to be consulted earlier in project development. The design shown has been informed by the

Feedback	Detail	Response or where addressed in EIS
	• Traffic speed limits • Visualisations of surface infrastructure for example ventilation outlets • Visualisations or details around traffic light and line marking arrangements at proposed road intersections.	results of technical investigations and community feedback up to the date of release. Roads and Maritime continues to develop and refine the design of the M4-M5 Link. Technical investigations are continuing and the extended consultation period on the concept design would result in further changes and improvements to the design. Pending project approval, the final M4-M5 Link design would be confirmed when a preferred contractor has been appointed. This is expected to be in 2018.
	Concern around how the design might change once a construction contractor is engaged and whether community will have an opportunity to provide feedback on the detailed design.	Refer to **section 7.6.2**.
	Question about why St Peters is not shown on maps during early consultation.	The engagement activities and ideas sessions held between 21 July and 31 August focused on gaining ideas and feedback on the Rozelle interchange and new design features. Individuals and stakeholders were able to provide their feedback on St Peters using the online collaborative map. A comprehensive engagement program with the St Peters area, relating to the St Peters interchange specifically, was undertaken as part of the New M5 project between 2014 and July 2016, when that project received planning approval.
Air quality	Requests that the ventilation outlets be filtered. Questions on filtration of ventilation outlets including if filtration reduces air pollution and why the project is proposing unfiltered ventilation outlets. Also clarity on what is meant by unfiltered ventilation outlets 'providing value for money'.	Refer to **Chapter 9** (Air quality), **Chapter 11** (Human health risk), **Appendix I** (Technical working paper: Air quality) and **Appendix K** (Technical working paper: Human health risk assessment).
	Queries and concerns about the location of ventilation outlets and proximity to residential areas. Suggestions for where the ventilation outlets should and should not be located.	
	Requests for detailed explanations of the air quality modelling for the project including where air quality monitors have been placed and when and for how long they were collecting data. Also questions on which pollutants were monitored.	

Feedback	Detail	Response or where addressed in EIS
	Questions related to the safety limits for $PM_{2.5}$ and smaller particles and how fine particle risks are assessed.	
	Questions on how the NSW air quality guidelines compare to World Health Organisation guidelines and other international best practice.	
	Concerns about health impacts from ventilation outlet emissions and air quality within the tunnels. Questions around how these impacts will be managed and prevented including how contaminated air will be removed. Questions on whether additional ventilation infrastructure not currently included in the project design would be constructed to allow for removal of emissions if air quality in the tunnel decreases. Also questions on whether this additional infrastructure would require further property acquisition.	
	Request to gather and publish air quality data before project approval.	
	Will air quality be measured after project completion? Will the results be published and how regularly?	
Open space	• Requests for additional landscaping and open space in the inner west, specifically around Rozelle, Camperdown and St Peters • Suggestion for a dog water park in Camperdown • Suggestions for features/facilities in the new Rozelle ‘parkland’.	Refer to **Chapter 13** (Urban design and visual amenity) and **Appendix L** (Technical working paper: Urban design).
	Concern about the potential for significant redevelopment of residual land particularly at Rozelle, Iron Cove, Darley Road and Pyrmont Bridge Road.	The options for use of remaining project land would be developed in consultation with the community and stakeholders. Details of residual land are described in **Chapter 12** (Land use and property) and **Appendix L** (Technical working paper: Urban design).
Water use and treatment	• Request to reuse groundwater to irrigate parks • Question on where the water treatment plants would be located.	Refer to **Chapter 23** (Resource use and waste minimisation). Refer to **Chapter 5** (Project description).
Construction	Concerns about tunnelling and the impact of vibration on heritage-listed and other homes and buildings including settlement and ground-borne vibration impacts. Questions around the processes to measure the effect of vibration and how residents can make a complaint. Also questions about the length of time after tunnel completion that claims may be accepted. Suggestions that building condition surveys should be conducted by an independent specialist not associated with Roads and Maritime, SMC or the contractor.	If the project is approved, during construction, vibration would be monitored to ensure that the levels are in accordance with construction standards and codes, including Roads and Maritime’s *Construction Noise and Vibration Guideline*, British Standard BS7385: Part 2 1993 *Evaluation and measurement for vibration in buildings* and German Standard DIN 4150-3: *Structural vibration – effects of*

Feedback	Detail	Response or where addressed in EIS
		vibration on structures. Refer to **Chapter 10** (Noise and vibration), **Chapter 12** (Land use and property), **Chapter 20** (Non-Aboriginal heritage), **Appendix J** (Technical working paper: Noise and vibration) and **Appendix U** (Technical working paper: Non-Aboriginal heritage).
	Concerns and questions about construction noise impacts and the duration and level of construction noise.	Refer to **Chapter 6** (Construction work), **Chapter 10** (Noise and vibration) and **Appendix J** (Technical working paper: Noise and vibration).
	Suggestion that construction noise be capped at 5 dBA above background.	Refer to **Chapter 10** (Noise and vibration) and **Appendix J** (Technical working paper: Noise and vibration).
	Concerns about dust created during construction and the removal of spoil from sites.	Refer to **Chapter 9** (Air quality) and **Appendix I** (Technical working paper: Air quality).
	Questions regarding how construction excavated material (spoil) would be reused.	Refer to **Chapter 6** (Construction work) and **Chapter 23** (Resource use and waste minimisation).
	Suggestions to use port facilities to bring construction materials in and out.	Refer to **Chapter 4** (Project development and alternatives).
	Questions about where construction sites and tunnelling dive sites would be located and distance between construction sites and residences.	Refer to **Chapter 5** (Project description).
	Concern about proposed mid-tunnel construction sites at Darley Road and Pyrmont Bridge Road including that the reasons for selecting these locations has not been adequately explained and that alternative sites have not been considered.	Refer to **Chapter 4** (Project development and alternatives) and **Chapter 5** (Project description).
	Concern about the impacts on residents who may experience construction of more than one stage of WestConnex. Questions on the social impact assessment for residents currently experiencing construction at St Peters and Haberfield.	Refer to **Chapter 11** (Human health risk), **Chapter 26** (Cumulative impacts), **Appendix K** (Technical working paper: Human health risk assessment) and **Appendix P** (Technical working paper: Social and economic).
	Concerns about construction impacts on parks and open spaces, including: • Blackmore Park • Bridgewater Park • Easton Park • King George Park • Barnwell Park Golf Course	Refer to **Chapter 6** (Construction work), **Chapter 12** (Land use and property) **Chapter 13** (Urban design and visual amenity) and **Appendix L** (Technical working paper: Urban design).

Feedback	Detail	Response or where addressed in EIS
	• Bicentennial Park • Callan Park • Sydney Park • The University of Sydney.	
	Concerns about traffic impacts on local roads and the wider arterial road network during construction from construction traffic (including spoil haulage) and local road closures. Questions around the location of construction sites and the proposed truck movements at each site. Also questions on the differences between each construction site. Comments that the Pyrmont Bridge Road site may not be large enough to accommodate queueing trucks and therefore surrounding streets would be used for parking. Comments that the proposed truck marshalling facility at White Bay is too remote to be useful alternative for the proposed sites at Pyrmont Bridge Road and Campbell Road.	Refer to **Chapter 6** (Construction work) and **Chapter 8** (Traffic and transport).
	Questions about the hours of construction. Concerns about tunnelling construction activities out of normal daytime working hours eg night time and weekends.	Refer to **Chapter 6** (Construction work), **Chapter 10** (Noise and vibration) and **Appendix J** (Technical working paper: Noise and vibration).
	Seeking a commitment to maintain access to public transport during construction.	Access to public transport would be maintained during construction. Work may require the temporary relocation of some public transport facilities (eg bus stops). However, this would be done in consultation with Transport for NSW and the community to ensure any changes retain adequate access for local people. Refer to **Chapter 5** (Project description) and **Chapter 6** (Construction work).
	Question regarding whether construction would include the use of sustainable building/construction materials.	In 2015, SMC published the WestConnex Sustainability Strategy. This outlines the sustainability vision, objectives and targets for the WestConnex program of work. Refer to **Chapter 27** (Sustainability).

Feedback	Detail	Response or where addressed in EIS
Property	Concerns about the impact on property values – especially those adjacent to the project.	Refer to **Chapter 12** (Land use and property), **Chapter 14** (Social and economic) and **Appendix P** (Technical working paper: Social and economic).
	Concerns about the fairness of the property acquisition process and requests for fair and appropriate acquisition compensation for directly impacted and adjacent properties. Questions on how the property acquisition process compares to other WestConnex stages.	Information on consultation with affected landowners is provided in **section 7.3.6**. Also refer to **Chapter 12** (Land use and property) and **Appendix P** (Technical working paper: Social and economic).
	Questions regarding the number of properties that would be acquired for the project. Concerns that more properties would be acquired at Haberfield, near Easton Park, Glebe, Forest Lodge, and for construction sites.	The project has been designed to minimise the impact on properties, with over two thirds of the project being constructed as underground tunnels. The owners of residential properties which need to be acquired at Rozelle have been informed. Several commercial sites and land owned by councils as well as NSW Government are being considered for use during the construction and operation of the project. Refer to **Chapter 12** (Land use and property).
	Suggestion that additional support be made available to directly impacted landowners.	Roads and Maritime would provide additional support to landowners through its community and stakeholder engagement team, including relocation assistance, and would also facilitate access to counselling and other support services. See **section 7.3.6** for more details of consultation with directly impacted landowners and residents and recent changes to the *Land Acquisition (Just Terms Compensation) Act 1991.*
Geotechnical investigations	Requests for detail on the geotechnical investigations. Questions on the timing of further geotechnical investigations. Questions around why no geotechnical investigations have been carried out on the eastern side of King Street, Newtown.	Refer to **Chapter 15** (Soil and water quality) and **Appendix E** (Technical working paper: Geological long-sections).
Environment and heritage	Concerns about impacts on heritage items, including stone retaining wall, fence, palisade and buildings at Glebe.	These items would have been potentially impacted by construction of the Camperdown interchange. This interchange is no longer proposed as part of the project. Refer to **Chapter 4** (Project development and alternatives). In addition, an assessment of heritage has been undertaken in **Chapter 20** (Non-Aboriginal heritage), **Chapter 21**

Feedback	Detail	Response or where addressed in EIS
		(Aboriginal heritage), **Appendix U** (Technical working paper: Non-Aboriginal heritage) and **Appendix V** (Technical working paper: Aboriginal heritage).
	Request to relocate disused railway carriage at Rozelle Rail Yards to a rail museum for restoration and display.	Refer to **Chapter 20** (Non-Aboriginal heritage) and **Chapter 13** (Urban design and visual amenity).
	Concerns about the management and treatment of acid sulfate soils.	Refer to **Chapter 15** (Soil and water quality) and **Chapter 16** (Contamination).
	Concern about protecting animal and bird habitat including fairy wren/blue wren.	Refer to **Chapter 18** (Biodiversity) and **Appendix S** (Technical working paper: Biodiversity).
	Requests to reduce impact on trees and concern about the loss of trees in the public domain.	
Environmental Impact Statement process	Question about the independence of the authors of the EIS.	Roads and Maritime is the government client agency for the WestConnex program and is the proponent for the project. AECOM Australia Pty Ltd has been engaged to prepare the EIS on its behalf. The EIS would be independently assessed by DP&E and work can only proceed if the project is approved by the NSW Minister for Planning. Information on the assessment process is outlined in **Chapter 2** (Assessment process).
	Question about whether the recommendations of the EIS will be implemented.	This EIS identifies environmental management measures for the project to reduce its potential impacts. If the project is approved, final measures identified would be incorporated into construction management plans and the operational plans for the project. These measures may also be included as conditions of approval for the project. The DP&E would regulate adherence to the measures to ensure they are being implemented. A summary of mitigation measures is provided in **Chapter 29** (Summary of environmental management measures).
	Comments that the EIS should have been completed as an initial stage of WestConnex.	WestConnex is being delivered as six component projects, which would link together to form a continuous motorway. Each of the projects are assessed separately. This EIS has been prepared in accordance with the relevant provisions of the *Environmental Planning and Assessment*

Feedback	Detail	Response or where addressed in EIS
		Act 1979 (NSW) (EP&A Act). Information on the assessment process is outlined in **Chapter 2** (Assessment process).
	Questions on why the acquisition of property started prior to the selection of construction sites.	There are a limited number of sites that can be used for construction. The project footprint is within an existing urban environment and construction sites need to be near tunnel portals, close to the road network and away from community facilities such as parks and schools. Wherever possible, government owned land or vacant land has been selected. However, the concept design guides the location of construction sites. Discussions with landowners about acquisition started as early as possible to give people time to prepare.
Project alternatives	Various suggestions and questions around project alternatives have been received including public transport initiatives, active transport as well as ideas on improvements to existing road networks.	Refer to **Chapter 4** (Project development and alternatives).
Funding and project financing	Suggestion to introduce a congestion tax. Question regarding whether a betterment levy would be introduced.	Congestion tax and betterment levies are not in accordance with current government policy, and are therefore not being considered for the project.
	Request to disclose cost details.	The estimated cost of the overall WestConnex motorway project is about $16.8 billion ($2015). The estimated cost of the M4-M5 Link is around $7.2 billion ($2015). This nominal outturn cost includes contingency. These figures were included in the WestConnex Updated Strategic Business Case (SMC 2015), which was published on the WestConnex website in November 2015. Details of the benefit cost ratio for WestConnex and specifically for the project, are provided in **Chapter 3** (Strategic context and project need).
	Question about project funding.	WestConnex is being financed through a strategy that involves asset recycling and private sector debt financing. The people of NSW would receive more than $20 billion in economic benefits and the total upfront cost to taxpayers is a third of the total value of the project. The NSW Government is currently exploring a range of options to fund the M4-M5

Feedback	Detail	Response or where addressed in EIS
		Link. The government's investment would be returned, to be used on other critical infrastructure projects, including public transport. Ultimately, people using the motorway and paying tolls would fund the project. Motorists would only pay for the section of motorway they use, and tolls would be capped. Details on project funding are described in **Chapter 3** (Strategic context and project need) and information on tolling is provided in **Chapter 14** (Social and economic).
	Question on which organisation takes the risk on the cost overrun.	Pending project approval, the detailed design and construction of the project would be undertaken by a private contractor. Subject to contract terms and conditions, the construction contractor would be liable for cost overruns.
	Questions about tolling of the tunnel.	WestConnex would have a capped, distance-based tolling system, which means motorists would only pay for the section of motorway they use. The Iron Cove Link would not be tolled. Further information on tolling is provided in **Chapter 3** (Strategic context and project need) and **Chapter 14** (Social and economic).
	Concern that the proposed sale of SMC would mean that commitments in the EIS would not be met. Concern around who would take responsibility for ensuring commitments were met.	Roads and Maritime has commissioned SMC to deliver WestConnex, on behalf of the NSW Government. However, Roads and Maritime is the proponent for the project. The M4-M5 Link would be operated as part of the combined WestConnex program of works.
Social impacts	Concern regarding impacts on local businesses. Questions on how businesses are compensated if their operation is interrupted or they are forced to vacate. Questions on how many businesses may be impacted by the project.	Refer to **Chapter 14** (Social and economic) and **Appendix P** (Technical working paper: Social and economic).
	Concerns about impact on communities around surface infrastructure.	This EIS explores and assesses all potential impacts on the community and details mitigation measures to reduce these impacts. Refer to **Chapter 14** (Social and economic) and **Appendix P**

Feedback	Detail	Response or where addressed in EIS
		(Technical working paper: Social and economic).
Flooding and drainage	Questions on the methodology for the flooding assessment. Have the flooding issues such as those around Glebe/Camperdown been considered?	Refer to **Chapter 17** (Flooding and drainage) and **Appendix Q** (Technical working paper: Surface water and flooding).
	Comment that the Rozelle interchange should be designed to cope with storm events without flooding.	
	Concern about groundwater related subsidence and impacts on property.	Refer to **Chapter 12** (Land use and property), **Chapter 19** (Groundwater) and (**Appendix T** (Technical working paper: Groundwater).
Business case	Requests for a business case.	The WestConnex Updated Strategic Business Case (November 2015) is available on the WestConnex website at www.westconnex.com.au.
Strategic justification	Comments that the WestConnex program of works will not address traffic congestion and would rather create further traffic problems.	Refer to **Chapter 3** (Strategic context and project need) and **Chapter 30** (Project justification and conclusion).
Other projects	Requests for information on the proposed future Western Harbour Tunnel and predicted impacts.	The NSW Government has allocated $32 million in the current state budget to investigate possible future links to the Sydney motorway system, including a proposed future Western Harbour Tunnel (SMC 2016). Roads and Maritime is currently carrying out early planning and investigation work for the potential project. A description of potential cumulative impacts of the M4-M5 Link and the proposed future Western Harbour Tunnel and Beaches Link project is provided in **Chapter 26** (Cumulative impacts).
	Concern about the scale of construction impacts associated with the M4 East and New M5 projects and requests to see complaint records from these projects.	The construction impacts for the M4 East and New M5 projects have been assessed under separate EIS's. A description of potential cumulative impacts with the M4-M5 Link are provided in **Chapter 26** (Cumulative impacts). The complaints records for the M4 East and New M5 projects are managed by the contractors for these projects. DP&E receives, registers and investigates complaints, and reports on these on a monthly basis.
	Question about how cumulative impacts of this project and other projects would be assessed. Question about who would be responsible for damage to properties affected by multiple projects. Question about how the impact on	Cumulative impacts have been assessed and are presented in **Chapter 26** (Cumulative impacts). Details on the cumulative impact assessment methodology are presented in **Appendix Y** (Cumulative impact assessment

Feedback	Detail	Response or where addressed in EIS
	Haberfield and St Peters communities in particular would be assessed.	methodology).
	Concern that the project would impact on The Bays Precinct development. Questions regarding the coordination between the project and UrbanGrowth NSW.	Meetings are held regularly with UrbanGrowth NSW to ensure the design of the project integrates with emerging plans for The Bays Precinct.
	Questions and concerns about the potential impacts of the project on the light rail and a future extension of the light rail network.	The project does not impact on the current Inner West Light Rail line. The project has considered the development of future light rail projects. Refer to **Chapter 3** (Strategic context and project need), **Chapter 4** (Project development and alternatives) and **Chapter 26** (Cumulative impacts).
	Question on the potential impacts of the project on the New Parramatta Road proposal.	By reducing traffic on Parramatta Road, the project plays a positive role in enabling the long-term aspirations of the Parramatta Road Corridor Urban Transformation Strategy. Refer to **Chapter 3** (Strategic context and project need).
	Questions about high rise development on Glebe Island.	UrbanGrowth NSW is currently preparing a business case for the future of Glebe Island as part of The Bays Precinct Urban Transformation program. The Ports Authority is working closely with UrbanGrowth NSW to determine the future of port operations at Glebe Island.
	Concern about how the project at Rozelle might affect the NSW Government's proposed West Metro project.	The project has considered the development of future public transport projects. Insufficient information is publicly available on the Sydney Metro West project to be considered in any detail. Refer to **Chapter 3** (Strategic context and project need), **Chapter 4** (Project development and alternatives) and **Chapter 26** (Cumulative impacts).
	Comments and suggestions regarding other WestConnex projects.	These have been passed on to the relevant WestConnex project teams for consideration.
	Questions on the scope and objectives of the King Street Gateway project including when is it planned, will it entail construction work or only road realignment and will it include further work on the Princes Highway?	A brief description of the King Street Gateway project is provided in **Appendix C** (Cumulative impact assessment methodology).

7.6 Future consultation

7.6.1 Consultation during the exhibition of the EIS

Display of the EIS

Once the EIS is complete, copies would be available for viewing for at least 30 days at the following locations:

- Council offices:
  - City of Sydney Council: Town Hall House, Level 2, 456 Kent Street Sydney NSW 2000
  - Inner West Council
    - Ashfield Customer Service Centre: 260 Liverpool Road, Ashfield NSW 2131
    - Leichhardt Customer Service Centre: 7-15 Wetherill Street, Leichhardt NSW 2040
    - Petersham Customer Service Centre: 2-14 Fisher Street, Petersham NSW 2049
- Redfern Neighbourhood Centre: 158 Redfern Street, Redfern NSW 2016
- Nature Conservation Council of NSW: Level 14, 338 Pitt Street, Sydney NSW 2000
- Roads and Maritime (Head office): 20-44 Ennis Road, Milsons Point NSW 2061
- Libraries: Ashfield Library, Balmain Library, Emanuel Tsardoulias Community Library, Five Dock Library, Glebe Library, Haberfield Library, Leichhardt Library, Marrickville Library, Newtown Library, St Peters Library, Stanmore Library and Ultimo Library.

Electronic copies of the EIS would be made available for viewing and download from the DP&E and WestConnex websites. In addition, for people without a home internet connection an electronic copy of the EIS would be available for viewing at local NSW Service Centres.

Community drop-in information sessions

A series of community drop-in information sessions would be held during the public exhibition period to describe the project and the assessment of impacts and mitigation measures identified during the assessment process. During these sessions community members would have the opportunity to discuss the EIS with technical specialists and learn about the submissions process.

Sessions would be held as an informal drop-in style and scheduled at different dates and times during and after business hours to allow community members and interested parties opportunities to attend at a time convenient to them. The timing and location of these sessions would be promoted via advertisements in local and metropolitan papers, published on the WestConnex website, detailed in a community update and sent via an email to registered stakeholders.

Other consultation during exhibition of the EIS

A range of activities are planned to support the display of the EIS and provide opportunities for discussion with community and interested parties. These activities include:

- A project overview document (refer to **Appendix A** (Project synthesis))
- Community update newsletter and notifications to residents and businesses near the project footprint
- Email blast to registered stakeholders to notify them that the EIS is on display
- Targeted stakeholder briefings and meetings
- Advertisements to promote the exhibition of the EIS and community consultation opportunities
- Project fact sheets
- Project email and information phone line to manage enquiries and provide information on the EIS.

Submissions

During the EIS exhibition, the community, government agencies and other interested parties may make written submissions on the project to the Secretary of DP&E.

The Secretary of DP&E would provide copies of submissions to Roads and Maritime as the project proponent. The Secretary of DP&E would then require the proponent to prepare a submissions report to respond to the issues raised in submissions and a preferred infrastructure report to outline any proposed changes to the project. If the Secretary of DP&E considers that significant changes to the project are proposed, the Secretary of DP&E may make the preferred infrastructure report publicly available in accordance with section 115Z(7) of the EP&A Act.

DP&E would prepare the Secretary's environmental assessment report and provide it to the Minister for Planning. The Minister for Planning would then decide whether to approve the project and, if approved, identify a set of conditions of approval for Roads and Maritime to adhere to during construction and operation of the project.

Roads and Maritime would continue to engage with the community and stakeholders during the assessment process. Further details, including a flow chart outlining the assessment and approval process following EIS submission, can be found in **Chapter 2** (Assessment process).

7.6.2 Consultation during construction of the project

If the project is approved a construction contractor would be engaged to undertake the detailed design and construct the project. Together with the proponent, the construction contractor would be responsible for communication and consultation with stakeholders and the community during construction.

Communication and consultation with stakeholders and the community during construction would focus on providing updates on construction activities and program, responding to enquiries and concerns in a timely manner and minimising potential impacts where possible.

During construction, a dedicated community relations team would deliver:

- A detailed Community Communication Strategy (identifying relevant stakeholders, procedures for distributing information and receiving/responding to feedback, and procedures for resolving stakeholder and community complaints during construction and operation)
- Notification letters and phone calls to residents and businesses directly affected by construction works, changes to traffic arrangements and out of hours works
- Face-to-face meetings with landowners as needed
- Regular community updates on the progress of the construction program
- Regular updates to the WestConnex website
- Media releases and project advertising in local and metropolitan English language and non-English language newspapers to provide contact information for the project team
- Site signage around construction ancillary facilities
- 24 hour, toll-free project information and complaints line, a dedicated email address and postal address.

A Complaints Management System will be in place for the duration of construction. This system will include the recording of complaints and how the complaint was addressed (within a Complaints Register). A Community Complaints Commissioner, who is an independent specialist, would oversee the system and would follow-up on any complaint where the public is not satisfied with the response.

Further details on the approach to community consultation are provided in **Appendix G** (Draft Community Consultation Framework).

7.6.3 Ongoing consultation during operation of the project

Community liaison would continue during the operational phase of the project. A Communications Plan would be developed to support maintenance and operations of the motorway as a key part of the Operational Environmental Management Plan framework.

This would include protocols for:

- Ongoing management of community complaints and enquiries during operations
- Community notifications prior to major maintenance activities
- Wider notifications of major maintenance activities that require full tunnel carriageway closure
- Notifications and communication with emergency services during an emergency.

8 Traffic and transport

This chapter outlines the potential traffic and transport impacts associated with the M4-M5 Link project (the project). A detailed traffic and transport assessment has been prepared for the project and is included in **Appendix H** (Technical working paper: Traffic and transport). This chapter provides a summary of the technical working paper and details:

- The assessment methodology and approach used to carry out the traffic and transport assessment
- The existing traffic and transport environment within the study area
- Future traffic and transport conditions without the project
- Potential impacts of the project on the road network during construction and operation
- Recommended safeguards and management measures to avoid, minimise and/or mitigate potential traffic and transport impacts.

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued environmental assessment requirements for the project. These are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 8-1** sets out these requirements and the associated desired performance outcomes as they relate to traffic and transport, and identifies where they have been addressed in this environmental impact statement (EIS).

Table 8-1 SEARs – traffic and transport

Desired performance outcome	SEARs	Where addressed in the EIS
1. Transport and traffic Network connectivity, safety and efficiency of the transport system in the vicinity of the project are managed to minimise impacts. The safety of transport system customers is maintained. Impacts on network capacity and the level of service are effectively managed. Works are compatible with existing infrastructure and future transport corridors.	1. The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to: (a) a considered approach to route identification and scheduling of transport movements, particularly outside standard construction hours;	Construction haulage routes and the scheduling of transport movements are described in **section 8.3.1**.
	(b) the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements);	Potential construction impacts are described in **section 8.3.1**.
	(c) construction worker parking;	Construction workforce parking is discussed in **section 8.3.1**.
	(d) the nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements);	Potential construction impacts are described in **section 8.3.1**.
	(e) access constraints and impacts on public transport, pedestrians and cyclists;	Potential impacts on public and active transport are discussed in **section 8.3**.

Desired performance outcome	SEARs	Where addressed in the EIS
	(f) the need to close, divert or otherwise reconfigure elements of the road, cycle and pedestrian network associated with construction of the project. Where the closure, diversion or reconfiguration are temporary, provide an estimate of the duration of the altered access arrangements; and	Possible road closures and temporary changes to the active transport network are described in **section 8.3**.
	(g) the cumulative traffic impacts of other key infrastructure projects preparing for or commencing construction, including but not limited to other stages of WestConnex;	Construction traffic impacts are discussed in **Chapter 26** (Cumulative impacts).
	2. The Proponent must model and/or the operational transport impacts of the project including, but not necessarily limited to: (a) forecast travel demand and traffic volumes (expressed in terms of total numbers and heavy and light vehicle numbers) for the project and the surrounding road, cycle and public transport network, including potential shifts of traffic movements on alternate routes outside the proposal area (such as toll avoidance) and impact of permanent street closures directly attributable to the SSI;	Operational impacts are discussed in **section 8.3.3**.
	(b) travel time analysis;	Travel time analysis is discussed in **section 8.3.3**.
	(c) performance of key interchanges and intersections by undertaking a level of service analysis at key locations, for peak periods;	Operational impacts are discussed in **section 8.3.3**.
	(d) wider transport interactions (local and regional roads, cycling, public and freight transport), taking into account the Sydney City Centre Access Strategy and planned future urban release areas such as the Bays Precinct and planned future port activities and uses;	Operational impacts are discussed in **section 8.3.3**.
	(e) the redistribution of traffic and impacts on traffic volumes and levels of service on the road network resulting from changes to the design of the M4-M5 Link as modelled in the traffic assessments for the M4 East and New M5 projects;	Operational impacts are discussed in **section 8.3.3**.
	(f) induced traffic and operational implications for existing and proposed public transport (particularly with respect to strategic bus corridors and bus routes and permanent closure/relocation of bus stops) and consideration of opportunities to improve public transport;	Operational impacts are discussed in **section 8.3.3**.
	(g) impacts on cyclists and pedestrian access and safety, including on known routes and future proposals such as along Lilyfield Road;	Refer to **Appendix N** (Technical working paper: Active transport strategy).

Desired performance outcome	SEARs	Where addressed in the EIS
	(h) opportunities to integrate cycling and pedestrian elements with surrounding networks and within the project; and	Refer to **Appendix N** (Technical working paper: Active transport strategy).
	(i) property and business access and on street parking.	Operational impacts are discussed in **section 8.3.3**.
	The assessment must provide an explanation for the scope of the modelled area, including justification of the nominated boundaries.	A description of the assessment methodology is provided in **section 8.1.4**.

8.1 Assessment methodology

8.1.1 Strategic transport context

The transport network in Sydney is expected to be put under increasing pressure over the next 20 years. *A Plan for Growing Sydney* (NSW Government 2014) indicated that from 2011 to 2031, Sydney's population is forecast to increase from 4.3 to 5.9 million, which equates to an average of around 80,000 additional residents per year. Moreover, by 2036, the number of trips made around Sydney each day is forecast to increase by 31 per cent from 16 to 21 million vehicle movements. This growth will place increasing pressure on the NSW transport network and the key travel demand corridors connecting regional cities and major centres across the greater Sydney metropolitan area, as shown in **Figure 8-1**.

Key corridors currently accommodate high levels of daily traffic including freight, commuter and leisure travel. Users of these corridors frequently experience congestion and delay, particularly during weekday and weekend peak periods. Both the *NSW Long Term Transport Master Plan* (Transport for NSW 2012) and the *State Infrastructure Strategy Update 2014* (*State Infrastructure Strategy*) (Infrastructure NSW 2014) identified the need to plan and invest in the future of Sydney's motorway network, which provides vital infrastructure connections within and between key travel demand corridors. Any investment in motorway infrastructure must be aligned with supporting public and active transport initiatives to achieve an increase in capacity, while aiming to reduce the reliance on and demand for private vehicles on the future road network.

The WestConnex project is one part of a broader solution to these growing pressures. While public transport is also part of the overall transport plan, it is recognised that not all trips across Sydney can be served by public transport, especially trips to dispersed destinations, commercial trips requiring the movement of large or heavy goods/materials or trade and service-related journeys. In addition, Sydney is home to two-thirds of NSW's manufacturing sector, with many of the state's major aviation, pharmaceutical, biotechnology, electronics and automotive industries based in western Sydney. These businesses rely heavily on the road network and its connectivity to the port and airport precincts.

A congested road network also affects public transport; with bus travel times experiencing the same delays as other road users. Providing new, tunnel alternatives to sections of the arterial road network will improve road-based public transport travel times and provide opportunities for new rapid transit options.

For these reasons, the NSW Government is investing in light rail, metro, bus rapid transit and motorways to provide a multi-modal response to current and future transport challenges. In this context, WestConnex is also an enabler of integrated transport and land use planning, supporting the development of initiatives including The Bays Precinct and the Parramatta Road Corridor Urban Transformation Strategy.

The key strategic traffic objectives of the project are to:

- Provide an efficient motorway link between the M4 and M5 motorways and improve traffic flow on the motorway network
- Enable long term motorway network development, including facilitating new cross-harbour capacity and connections to Sydney's south
- Improve accessibility and reliability of commercial vehicle movement in the M4 and M5 corridors to economic centres, including to Sydney Airport and Port Botany economic zone
- Improve traffic conditions and ease future congestion on the inner western and south-western network, including Parramatta Road, supporting urban regeneration and growth
- Improve overall network productivity.

A detailed discussion of the strategic context and justification for the project is provided in **Chapter 3** (Strategic context and project need). This includes a description of transport policies, strategies and plans that are relevant to the project and the WestConnex program of works. A description of the alternatives to the project, which explains how and why the project design was selected as the preferred option for assessment in this EIS is provided in **Chapter 4** (Project development and alternatives).

Figure 8-1 Sydney travel demand corridors

8.1.2 Traffic forecasting and modelling process

The Technical working paper: Traffic and transport (**Appendix H**) has assessed the potential impacts of the project during construction and operation, including cumulative impacts associated with the WestConnex program of works, as well as the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension projects.

The traffic and transport impact assessment undertaken for the project consisted of three key components:

- Characterising the existing traffic and transport environment within the study area using a combination of data from Transport for NSW Transport Performance and Analytics and Roads and Maritime, traffic counts and survey data. A description of the study area for the traffic and transport assessment is included in **section 8.1.4**
- The development and application of a regional strategic traffic model; the WestConnex Road Traffic Model (WRTM), to determine the anticipated future growth in traffic on the road network in the Sydney metropolitan area, based on planned and forecast changes in population and employment, and to understand the metropolitan-wide impacts of the project
- Operational modelling of the road network to determine the traffic and transport conditions in future years with and without the project on roads:
  - Around the Wattle Street interchange
  - On the M4-M5 Link Motorway
  - Around the Rozelle interchange
  - Around St Peters interchange
  - Around the construction ancillary facilities during construction of the project.

The study area for the traffic and transport assessment, as well as the methodology for undertaking these key traffic and transport assessments is discussed in **section 8.1.4** to **section 8.1.8**.

8.1.3 Relevant guidelines and policies

The following guidelines were followed in carrying out the traffic and transport assessment:

- *Guide to Traffic Management – Part 3 Traffic Studies and Analysis* (Austroads 2013)
- *Traffic Modelling Guidelines* (NSW Roads and Maritime Services (Roads and Maritime) 2013)
- *Guide to Traffic Generating Developments Version 2.2* (NSW Roads and Traffic Authority (RTA) 2002).

8.1.4 Study area

The study area for the traffic and transport assessment was informed by the forecast traffic and transport changes from the WRTM version 2.3 (WRTM v2.3), a strategic traffic model that covers the Sydney metropolitan area. The extent of the study area and the areas requiring operational modelling assessment were determined through analysis of forecast WRTM v2.3 traffic flow differences as a result of the project. This process allowed for identification of those areas of Sydney's road network where the project was forecast to have a substantial impact (adverse or beneficial).

The study area for the traffic and transport assessment is shown in **Figure 8-2** and broadly encompasses an area extending from the Parramatta River in the north to Sydney Airport in the south, and from the Eastern Distributor in the east to Haberfield and Marrickville in the west. The study area is predominantly focussed on the corridor between Haberfield and Rozelle, the corridor between Rozelle and St Peters, the corridor between Haberfield and St Peters, and the surface road networks around the Wattle Street, Rozelle and St Peters interchanges.

Changes on strategic roads outside of this study area are assessed in the Sydney metropolitan road network sections in this chapter, and those outside the operational model areas are assessed through a screenline analysis, presented in **section 8.3.3**. Further justification of the study area is contained in **Appendix H** (Technical working paper: Traffic and transport).

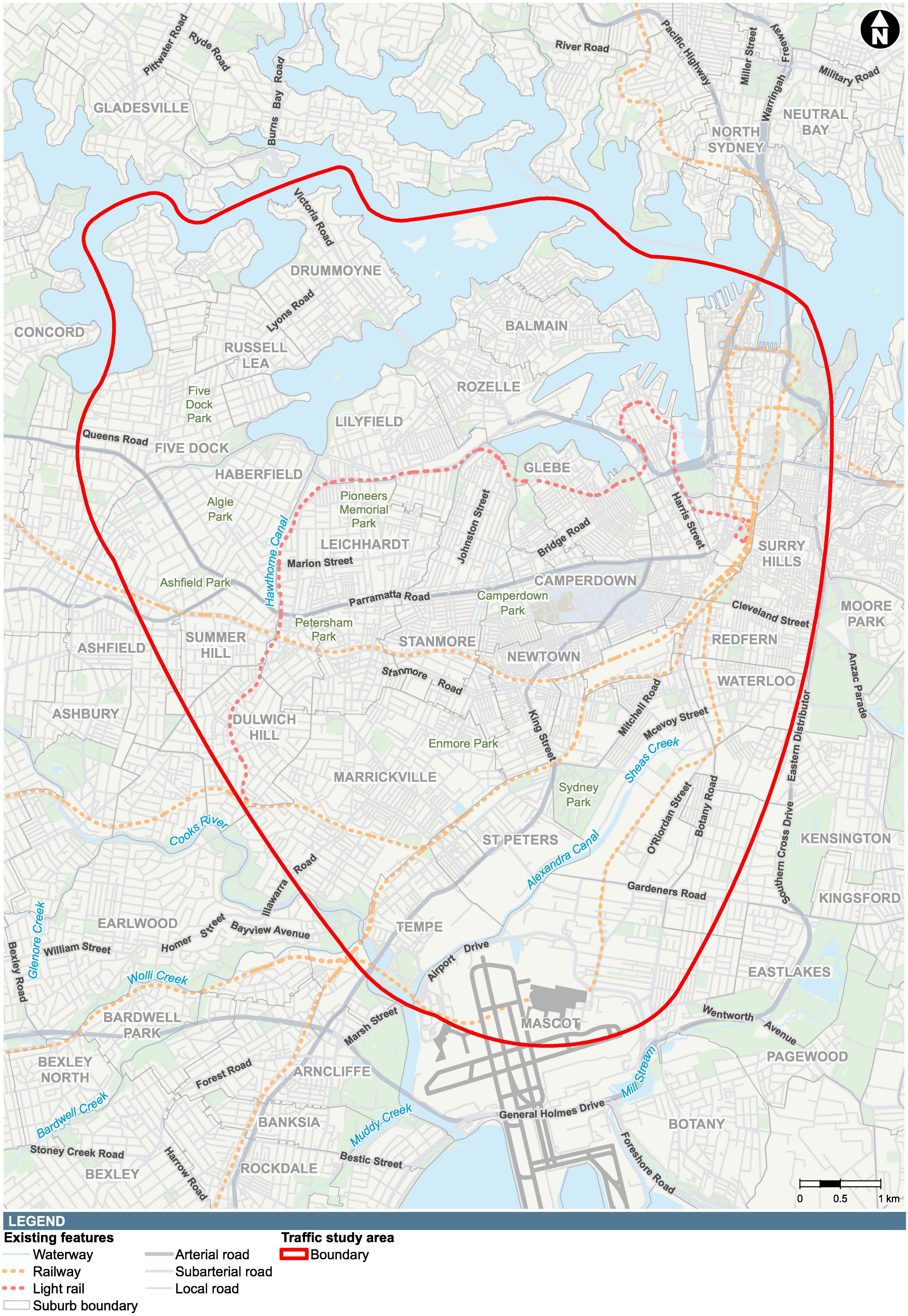


Figure 8-2 Study area for the traffic and transport assessment

8.1.5 Approach to traffic modelling

Overview of traffic modelling approach

Traffic modelling for the project aimed to make best use of available traffic count data and modelling software to determine base and future traffic conditions for the project and surrounding road network (in terms of estimating travel demand and traffic volumes). These traffic conditions were then used to assess the operational performance of the network, in scenarios with and without the project.

An overview of the traffic modelling approach is presented in **Figure 8-3**.

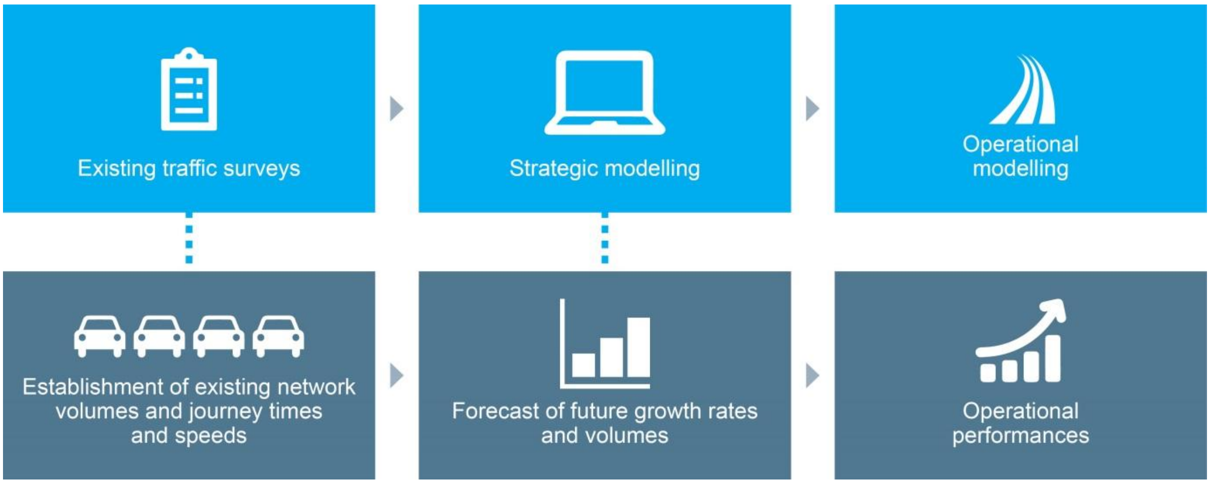


Figure 8-3 Overview of traffic modelling approach

Traffic models

Traffic modelling for the project included metropolitan area network modelling (strategic modelling) and local level operational modelling, which enabled existing and future traffic and transport conditions and road network performance to be characterised, with and without the project. This approach includes:

- Strategic modelling – an analysis of changes to traffic that may occur at a metropolitan or 'strategic' level, including as a result of the project, the broader WestConnex program of works, other major road network and public transport developments, and factors such as major developments and changes in land use patterns
- Operational traffic network performance modelling – a more detailed, localised analysis of changes to traffic conditions that occur on individual roads and intersections.

These two types of models are described in more detail in **section 8.1.6** and **section 8.1.7** respectively.

Traffic modelling scenarios

Traffic modelling for the project assessed eight scenarios:

- Three scenarios without the project:
  - The existing road network (2015)
  - The road network at the year of opening of the project (2023)
  - The road network 10 years after opening the project (2033)
- A construction scenario (2021)
- Two scenarios with the project:
  - At the year of opening of the project (2023)

  - 10 years after opening the project (2033)

- Two cumulative scenarios:
  - At the year of opening of the M4-M5 Link (2023) with NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade and New M5 and the proposed future Sydney Gateway and Western Harbour Tunnel operational. The proposed future Western Harbour Tunnel (a component of the proposed future Western Harbour Tunnel and Beaches Link project) has been tested without a surface connection at Rozelle
  - 10 years after opening of the M4-M5 Link (2033), with NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade and New M5 and the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension operational.

All future scenarios (with and without the project) assume that other on-going improvements would be made to the broader transport network including some new infrastructure and intersection improvements to improve capacity and to cater for traffic growth.

The traffic modelling scenarios used to inform the assessment of the traffic and transport related impacts of the project are summarised in **Table 8-2**. An additional scenario incorporating the M4-M5 Link mainline tunnels only was strategically assessed to determine the potential impacts on traffic volumes and patterns along the M4-M5 Link corridor under a staged opening (see **section 8.3.3**).

Changes from the M4 East and New M5 EIS assessments

While WRTM v2.3 was used for this EIS, WRTM v2.1 was used for the M4 East EIS and the New M5 EIS. Updates to the WRTM inputs have occurred, as well as enhancements to the WRTM zones and growth processing. These updates and enhancements include:

- Updated land use forecasts, including revised land use development along Parramatta Road, The Bays Precinct and in Mascot town centre
- Evolution and refinement of the M4-M5 Link design, with increases in the number of lanes in the mainline tunnels from three lanes to four lanes, revised layout for the refined Rozelle interchange, the addition of the Iron Cove Link and the removal of the previously proposed Camperdown interchange.

The future years assessed for the M4-M5 Link project are also different to those assessed for the M4 East and New M5 projects due to the delivery timeframe for the project. A direct comparison between the modelled results of the previous EIS and this EIS would therefore not be a like-for-like comparison.

Table 8-2 Traffic modelling scenarios

Model year	Without project	With project	Modelling scenario	Description	Impact measured
2015	ü		Base case	The existing road network with no new projects or upgrades.	N/A
2021	ü		Construction	The current road network with no new projects or upgrades, with construction traffic movements for the project. This considers the worst case construction traffic generating scenario and includes traffic movements associated with spoil removal.	Construction impacts on the existing road network.
2023	ü		Future case without the project	The future case ‘without project’ assumes the NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade and New M5 projects are complete and open to traffic, but the M4-M5 Link is not operational.	Consequence of not proceeding with the project on the existing network.
2023		ü	Future case with the project	The future case ‘with project’ assumes the NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic.	Operational impacts associated with the completion of the project as described in **Chapter 5** (Project description).
2023		ü	Cumulative case	Assumes NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic, and in addition, the proposed future Sydney Gateway and Western Harbour Tunnel are complete and open to traffic.	Operational impacts associated with the operation of the full WestConnex program of works as well as the proposed future Sydney Gateway and Western Harbour Tunnel projects.
2033	ü		Future case without the project	The future case ‘without project’ assumes NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade and New M5 projects are complete and open to traffic, but the M4-M5 Link is not operational.	Consequence of not proceeding with the project on the existing network.
2033		ü	Future case with the project	The future case ‘with project’ includes NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic, but the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension are not operational.	Operational impacts associated with the completion of the project as described in **Chapter 5** (Project description).
2033		ü	Cumulative case	The future Cumulative scenario assumes NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic and also assumes proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension are complete and open to traffic.	Operational impacts associated with the operation of the full WestConnex program of works as well as the proposed future motorway projects.

8.1.6 Strategic modelling

Strategic Travel Model

The key strategic transport planning model used in the Sydney greater metropolitan area is the Strategic Travel Model (STM), which is managed by Transport for NSW Transport Performance and Analytics.

The STM forecasts people's travel choices and behaviour under given land-use and transport infrastructure scenarios. It combines current understandings of travel behaviour with:

- Forecast population and employment size and distribution
- Forecast road and public transport networks and services.

This allows for an estimate of future travel patterns in Sydney under different strategic land use, transport and pricing scenarios. Inputs into the STM include:

- Household travel survey data
- Journey to work data
- Population and employment statistics (current and projected)
- Freight movement model data
- Parking survey data
- Road, rail, bus and ferry networks.

WestConnex Road Traffic Model

The STM was used as the basis for developing future growth in road traffic demands for a more detailed transport and pricing scenario traffic model specific to the WestConnex program of works. The WRTM was developed to simulate the route choices of anticipated future traffic volumes on the metropolitan road network. The model has been used to develop traffic forecasts and as the basis for the traffic impact assessment for the project.

The WRTM is not an operational model. Therefore, to assess detailed impacts of the project on the road network, further analysis using operational modelling software was carried out (see **section 8.1.7**). Traffic growth outputs extracted from the WRTM were applied to existing traffic counts (2015) for the traffic and transport study area to:

- Forecast future traffic volumes as a basis for the operational modelling
- Assess traffic impacts of the project during construction and operation.

The WRTM includes:

- Anticipated changes and upgrades to the road network
- Anticipated future land uses as a basis for estimating future travel demand for light and heavy vehicles
- Accommodation of different motorist behaviours, including willingness to pay a toll to save travel time
- Induced traffic.

Additional detail regarding induced traffic and land use projections incorporated into the WRTM is provided in the following section.

Induced demand

Traffic growth on new or upgraded roads is generally a result of:

- Regional increase in the number of trips due to population growth and increased economic activity

- Trips attracted from competing routes or modes as a result of improved travel times on the new or upgraded road
- Induced demand as a result of improved travel times between homes and destinations, such as workplaces, shopping centres and education facilities, which cause changes to region-wide trip patterns.

Even with no growth in regional population and/or economic activity, a new or substantially upgraded road has the potential to induce changes in travel patterns, which appear as induced traffic demand. The WRTM includes changes in traffic associated with all three abovementioned sources of traffic, with induced demand equating to about 0.3 per cent of additional daily trips in the Sydney metropolitan area in 2033.

Land use projections

Land use forecast data for use in modelling with the STM is developed by Transport for NSW Transport Performance and Analytics, based on population and employment forecasts produced by DP&E for greater Sydney.

These population and employment forecasts are based on land use data (version LU14v4), that has been projected from 2011 Census data and incorporates known major urban renewal projects and developments, including those around Green Square and Mascot town centres and the strategic directives contained in *A Plan for Growing Sydney* (NSW Government 2014). The resulting travel demand forecasts from STM are used as a basis for developing road traffic growth projections for the WRTM. The WRTM has also included planned future port activities and uses, for instance at Port Botany, Sydney Airport Freight terminal and intermodal terminals.

8.1.7 Operational modelling

M4-M5 Link motorway

The M4-M5 Link mainline tunnels between the M4 East at Haberfield and the New M5 at St Peters were modelled using microsimulation modelling software. The ability for this software to model individual vehicle behaviour and interaction with the road network and other road users enabled densities and level of service for the mainline tunnels to be reported. AM and PM peak period models were developed and the mainline tunnels divided into five sections:

- Section 1: Interface with M4 East, east of the Wattle Street interchange ramps
- Section 2: Wattle Street interchange ramps to Rozelle interchange ramps
- Section 3: Rozelle interchange bypass
- Section 4: Rozelle interchange ramps to the St Peters interchange ramps
- Section 5: Interface with the New M5, south of the St Peters interchange ramps.

Using future year travel demands, traffic density and levels of service were assessed at 200 metre intervals along the mainline for the 2023 and 2033 'with project' and 'cumulative' scenarios. See **section 8.1.8** for a description of measures of operational traffic performance.

Interchanges and surrounding road network

Operational modelling is used to provide a more detailed representation of queueing, congestion and delays in urban networks. Traditional analytical intersection assessment tools, eg SIDRA, do not provide a whole of network assessment and tend to work best at evaluating individual, isolated intersections or small networks of intersections. Microsimulation modelling software, which models individual vehicle behaviour, such as weaves and merges and interactions with the network and other road users, are better tools for evaluating network operation particularly in congested networks with motorway entry and exit ramps that would have weaving and merging movements.

To fully evaluate operational impacts of the project on the road network around the Wattle Street, Rozelle and St Peters interchanges, micro-simulation models were developed to assess localised road network effects using Vissim (Wattle Street interchange and Rozelle interchange) and Paramics (St Peters interchange, the same software as used as for the New M5) software.

Base year model development

Base year models were developed for the AM and PM peak periods to simulate the operation of the existing road network under present day traffic demands. The base year models were calibrated and validated as per Roads and Maritime modelling guidelines, to align with existing traffic conditions.

The areas modelled around each interchange were informed by the WRTM v2.3, which allows for analysis of changes to future traffic growth conditions around the interchanges as a result of the project. The base year model extents at each of the interchange locations are indicated in **Figure 8-4** to **Figure 8-6**.

Future year model development

Following the calibration and validation of the AM and PM peak period base year simulation models, future year networks and traffic demands were developed for 2023 and 2033 to assess the future performance of the study area.

The growth in WRTM forecasts was used to grow the demands from the base year to the relevant future year models. The forecast one hour volumes from WRTM were extrapolated across the full two to four hour simulation periods to reflect typical demand profiles on either side of the peak hours. This profile was based on observed count data across the relevant networks (eg the road networks surrounding the M4-M5 Link interchanges).

In some cases, the forecast one hour future demand would exceed the physical road capacity. Where this would be the case, calculated future excess demand was distributed into the hours before and after the peak hour to correspond with anticipated peak spreading.

Modelling construction impacts

Base year model development

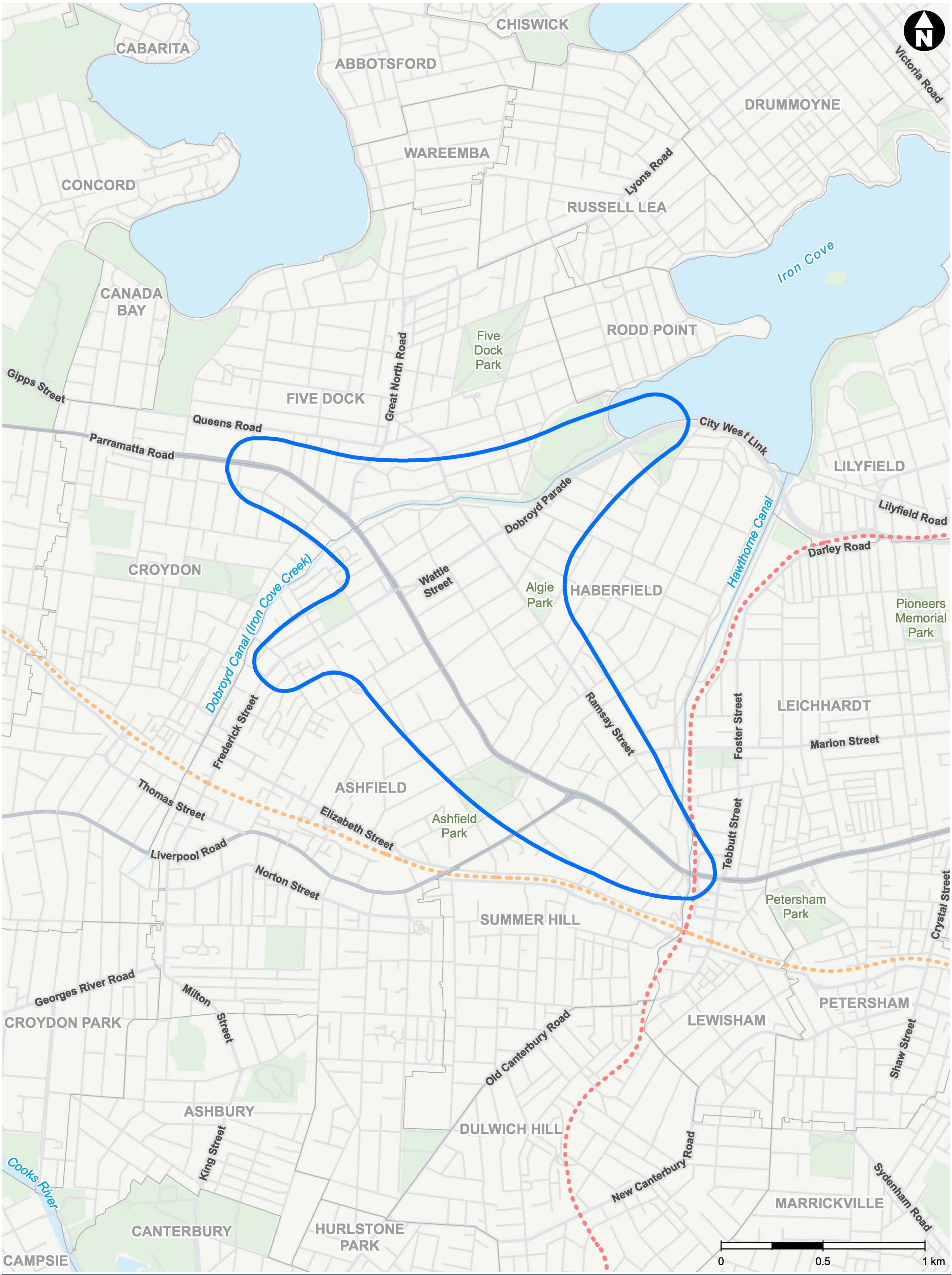
Similar to the operational assessment, the modelling methodology to assess the impact of construction related traffic included deriving base year traffic patterns and developing base and future year traffic models. To ensure an accurate representation of existing conditions, further network traffic counts were gathered across the study area in the locations of the proposed construction ancillary facilities.

Base year construction models were developed in LinSig as, unlike the interchanges assessed in the operational case, detailed interactions such as weaving and merging are not prevalent. The models were calibrated in a similar manner to that already described for the operational network models.

Future year model development

Based on the planned construction activities, a worst case construction traffic scenario was assumed to be the period of spoil removal from the tunnel construction during 2021. The current road network with the addition of the M4 East and New M5 was assumed for the road network in the construction scenario.

AM and PM peak hour models for 2021 were developed to assess the future performance of the road network during construction. In a similar way to the future operational demand volumes, the growth forecast by the WRTM was used to derive the background traffic demand for 2021. Construction traffic was then added to the background traffic. This was based on the proposed construction methodology as described in **Chapter 6** (Construction work) including vehicle types, volumes and construction traffic routes to and from the various construction ancillary facilities. The performances of the intersections in the vicinity of the constructions ancillary facilities were then calculated.



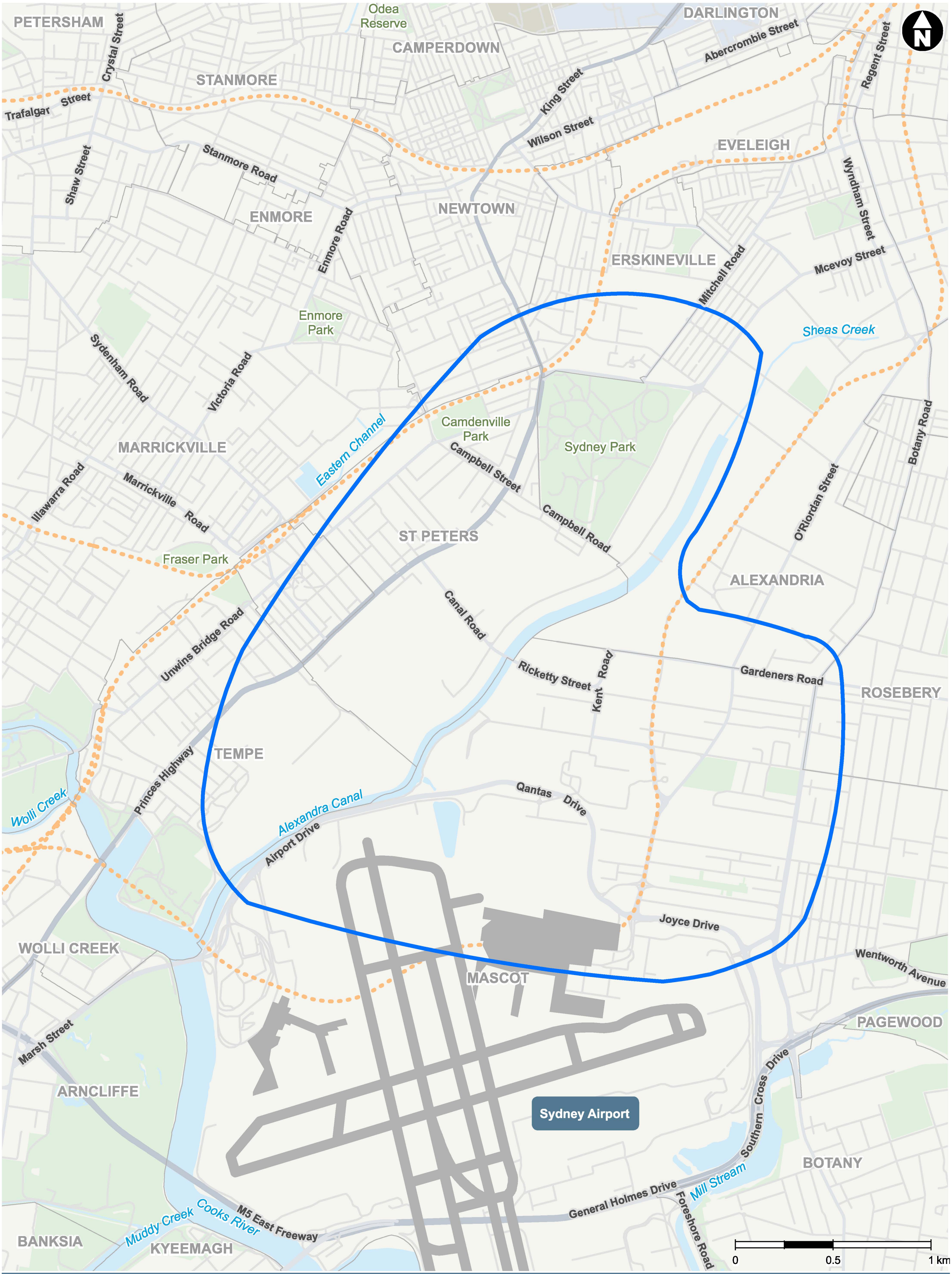
LEGEND

Existing features
- Waterway
- Railway
- Light rail
- Suburb boundary
- Arterial road
- Subarterial road
- Local road

Model boundary
- Microsimulation area

Figure 8-4 Wattle Street interchange operational model boundary

Figure 8-5 Rozelle interchange operational model boundary



LEGEND

Existing features

- Waterway
- Railway
- Suburb boundary
- Arterial road
- Subarterial road
- Local road

Model boundary

- Microsimulation area

Figure 8-6 St Peters interchange operational model boundary

8.1.8 Measures of network performance

Network performance

Given the congested nature of many of the main roads within the study area during peak periods, single-point assessment criteria do not present a complete picture of road network traffic operations. Traditional mid-block and intersection levels of service do not recognise that traffic is often constrained upstream, thus vehicles cannot get to the evaluation point giving an unrealistically low level of demand. Similarly, they do not recognise that traffic is constrained downstream; meaning vehicles are queued through the evaluation point. The measurements therefore reveal only throughput at that point, not realistic network performance.

The operation of the modelled road network is regarded as being of prime importance, recognising that there may be single locations where there may be improvement, while at others some deterioration. These should therefore not be considered in isolation but seen in the light of the total demand volumes in each scenario. The critical evaluation is that the project provides more efficient network operations as a whole.

From the microsimulation models, parameters collected and reported for the AM and PM peak hours in each scenario modelled were:

- Total vehicle demand – number of vehicles wanting to use the modelled network
- Vehicle kilometres travelled (VKT) – total distance travelled by vehicles travelling through the modelled network
- Vehicle time travelled approaching and in network – the total time taken by vehicles to enter and drive through the modelled network
- Total vehicles arrived – the number of vehicles completing their journey on the network
- Total stops made by vehicles in the network, either due to intersection controls or congestion – the number of stops that vehicles make while travelling through the modelled network. Generally, the fewer stops, the less congested the network is
- Average speed of vehicles – the average speed at which vehicles travel through the network. Calculated by dividing the VKT by the vehicle time travelled. Generally, the higher the speed, the better the network operates
- Travel time for typical cross-network trips – the time taken by vehicles to travel between two points in the network. Used as a comparison of how the network is performing, although with changes in the network, vehicles can take different routes between points
- Unreleased demand at the end of peak hour – the number of vehicles unable to enter the model due to congestion extending back to model entry points. The number of ‘unreleased’ vehicles is an indication of the effectiveness of the network. Generally, the lower the number of unreleased vehicles, the better the network is able to accommodate travel demand.

Levels of service

Level of service (LoS) is a measure to describe the operational conditions and efficiency of a road or intersection. The definition of LoS generally outlines the operating conditions in terms of speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and road safety. It is a qualitative measure describing operational conditions within a roadway or intersection, as perceived by motorists and/or passengers.

There are six levels of service; LoS A to LoS F. LoS A represents the best operating conditions and LoS F the poorest operating conditions. When the level of service of a road or intersection falls below LoS D, investigations are generally carried out to identify suitable remediation. However, constraints in built up urban areas mean that LoS E and LoS F are regularly experienced by motorists on the Sydney road network during traffic peak periods.

Intersection performance and level of service

Average delay is often used to assess the operational performance of intersections, with level of service used as an index. An assessment of performance of the intersection is undertaken to determine the average delay times experienced by traffic at the intersection. The intersection is then characterised into its corresponding level of service 'band' based on these delay times.

A description of the level of service scale for reporting intersection performance is provided in **Table 8-3**. For the purpose of analysing intersection performance in this traffic and transport assessment, all exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, were removed. This allows for an assessment of the intersections within the modelled network, irrespective of any downstream queueing that would mask the actual operation of the intersection.

Table 8-3 Level of service criteria for intersections

LoS	Average delay per vehicle (seconds)	Traffic signal / roundabouts	Give way and stop signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but crash study required
D	43 to 56	Operating near capacity	Near capacity and crash study required
E	57 to 70	At capacity; at signals incidents would cause excessive delays	At capacity; requires other control mode
F	More than 70	Roundabouts require other control mode	At capacity; requires other control mode

Source: Guide to Traffic Generating Developments (RTA, 2002)

Mid-block performance and level of service

Mid-block volume/capacity (v/c) ratios provide an indication of the saturation level of a segment of road, based on the theoretical design capacity of the road. Volume/capacity ratios can be used to provide a corresponding level of service for road operation, as detailed in *Guide to Traffic Management – Part 3 Traffic Studies and Analysis* (Austroads, 2013).

The level of service for freeways or motorways is calculated from the vehicle density, which is the traffic volume divided by the average passenger vehicle speed. Density is measured in passenger car units (PCU[1]) per kilometre per lane (PCU/km/ln). The assessment of level of service for the M4-M5 Link mainline tunnels uses these density measurements.

The definitions and criteria for the six levels of service for mid-blocks are provided in **Table 8-4**.

[1] PCU = passenger car unit. This accounts for the amount of road space differing types of vehicles use, with heavy vehicles or buses taking up more space than cars or light commercial vehicles.

Table 8-4 Mid-block level of service definitions and criteria – multi-lane roads and freeways

LoS	Definition	Multi-lane roads[1]	Freeways[2]
		V/C ratio	Density (PCU/km/ln)
A	A condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high.	Less than or equal to 0.26	Less than or equal to 7.0
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort is a little less than with level of service A.	0.27 to 0.41	7.1 to 11.0
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.	0.42 to 0.59	11.1 to 16.0
D	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow would generally cause operational problems.	0.60 to 0.81	16.1 to 22.0
E	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream would cause breakdown.	0.82 to 1.00	22.1 to 28.0
F	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.	Greater than 1.00	Greater than 28.0

Notes:

1 Where free flow speed is taken as 70 kilometres per hour

2 Where free flow speed is taken as 90 kilometres per hour

Source: *Austroads, Guide to Traffic Management – Part 3 Traffic Studies and Analysis*, Second Edition 2013

8.2 Existing environment

This section outlines the existing traffic and transport environment within the study area, including:

- The area around the Wattle Street and St Peters interchanges and the proposed Rozelle interchange
- The corridors between the:
  - Wattle Street and Rozelle interchanges
  - Rozelle and St Peters interchanges
  - Wattle Street and St Peters interchanges.

The existing traffic and transport environments of the areas around the Wattle Street and St Peters interchanges are derived from the Traffic and transport assessment of the M4 East EIS (AECOM 2015a) and the Technical working paper: Traffic and transport of the New M5 EIS (AECOM 2015b). Therefore, the existing conditions at the Wattle Street and St Peters interchanges reflect conditions prior to the commencement of construction of the M4 East and the New M5 projects.

8.2.1 Summary

The road network in the study area currently functions under high levels of traffic demand, which often exceeds the operational capacity, especially citybound during the AM peak period. The four main travel demand corridors shown in **Figure 8-1** include some of the most highly congested road corridors in Sydney, with demand already exceeding capacity during peak periods. This congestion increases travel time and variability and can cause typical morning and evening peak hours to spread over longer periods.

Major routes in the study area, such as Parramatta Road, City West Link, Victoria Road, Anzac Bridge/Western Distributor, Southern Cross Drive, Princes Highway and King Street all experience significant congestion with resultant increase in travel time and variability. Over the past five years, the majority of crashes on the major roads in the study area were rear-end crashes, which is consistent with roadways operating at or beyond capacity and on which significant queuing occurs.

8.2.2 Wattle Street interchange and surrounds

The existing travel behaviours and volumes in the study area are influenced by the function of Parramatta Road as a major east-west Sydney metropolitan road corridor.

Alternative east-west arterial roads within the study area include Frederick Street/Wattle Street/Dobroyd Parade/City West Link, Queens Road/Gipps Street/Patterson Street, Ramsay Street and the Hume Highway. The Frederick Street/Wattle Street/Dobroyd Parade/City West Link corridor is a major connector between Sydney's western and south-western suburbs and the Sydney central business district (CBD) as well as carrying high volumes of local traffic. The corridor is part of a north-east link which extends for about 13 kilometres from the intersection of Punchbowl Road and King Georges Road in Punchbowl, to join the Western Distributor at its intersection with Victoria Road. It provides an alternative route to Parramatta Road into the Sydney CBD from inner southern and inner western Sydney.

The Hume Highway, to the south of Parramatta Road, is an important metropolitan connection for both local and regional traffic. It extends from Liverpool in south western Sydney to join Parramatta Road near Summer Hill in the east.

Modes of travel

The Wattle Street interchange is within the Inner West local government area (LGA). Travel mode share for the Inner West LGA in comparison with the Sydney Greater Metropolitan Area (GMA) is shown in **Table 8-5**.

Table 8-5 shows that 49 per cent of trips (driver and passenger combined) on a typical weekday in the study area are car based compared to 69 per cent in the Sydney GMA. The lower proportion of residents who are dependent on car travel can be partly attributed to good public transport options in the Wattle Street interchange area and surrounds (shown in the slightly higher dependence on bus and rail travel) and the proximity of activities which are accessible by walking (32 per cent of trips in the Inner West LGA are walk only, compared to 18 per cent in the Sydney GMA).

Table 8-5 Average weekday travel mode share for Inner West LGA and the Sydney GMA

LGA	Private vehicles			Rail	Bus	Walk only	Other modes
	Driver	Passenger	Total				
Inner West LGA	36%	13%	49%	7%	8%	32%	5%
Sydney GMA	47%	22%	69%	5%	6%	18%	2%

Note:

Inner West Council data has been derived by combining data from the former Leichhardt, Ashfield and Marrickville LGA's

Source: NSW Bureau of Transport Statistics (BTS), Household Travel Survey Report: Sydney 2012/13, Nov 2014 Release

Public transport services

Rail services

The Wattle Street interchange area and surrounding suburbs are serviced by the Northern, Western, Inner West and South Rail Lines. Ashfield Station is the closest rail station and is around 1.5 kilometres to the south.

To the north, North Strathfield Station is serviced by the Northern Line which provides limited stops services to the Sydney CBD. To the south, up to 10 stations are serviced by one or more of the Inner West, South, Western or Northern Lines. Additionally, limited stop express services to the Sydney CBD can be boarded at Flemington, Strathfield, Burwood, and Ashfield stations. Homebush and Croydon stations are served exclusively by Inner West Line all stops services.

Bus services

The bus network close to the Wattle Street interchange and surrounds includes Metrobus M41: Hurstville to Macquarie Park strategic north–south bus corridor and Route 461: Burwood to the Sydney CBD strategic east–west bus route, which runs along Parramatta Road. There are several bus routes that operate within particular sections of the Wattle Street interchange and surrounds area via train station hubs, such as Strathfield, Burwood and Ashfield. Specifically, the following bus routes utilise sections of Parramatta Road between Homebush Bay Drive and Wattle Street:

- Routes 525 and 526 travel along Parramatta Road between Underwood Road and Concord Road
- Route 461, Burwood to The Domain, operates along Parramatta Road from Burwood Road to Broadway
- Route 415, Chiswick to Burwood, which runs along Parramatta Road between Burwood Road and Harris Road
- Routes 490 and 492, Drummoyne to Hurstville and Rockdale, utilises the section of Parramatta Road between Arlington Street and Great North Road
- Route 491, Five Dock to Hurstville, utilises the section of Parramatta Road between Great North Road and Frederick Street.

In addition, there are a further six Sydney metropolitan bus region routes that intersect Parramatta Road between Homebush Bay Drive and Wattle Street during peak periods.

Walking and cycling facilities

Details of existing walking and cycling facilities can be found in **Appendix N** (Technical working paper: Active transport strategy).

Existing traffic volumes and patterns

Automatic traffic count (ATC) surveys were completed between 2012 and 2014 to understand and analyse existing traffic volumes and patterns at the Wattle Street interchange and surrounds. Specifically, classified hourly traffic volumes at the following roadway locations were recorded over a one-week period:

- Parramatta Road west of Wattle Street
- Ramsay Road between Henley Marine Drive and Wolseley Street
- Dobroyd Parade east of Timbrell Drive
- Parramatta Road at Hawthorne Canal.

The AM peak hour, PM peak hour and average weekday traffic (AWT) volumes at each of these survey locations are summarised in **Table 8-6**.

Table 8-6 Average peak mid-block traffic volumes at key locations around the Wattle Street interchange and surrounds (2014 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/hr	HCV%
Parramatta Road, west of Wattle Street	Eastbound	2,530	6%	2,370	4%	43,500	7%
	Westbound	2,640	11%	2,790	2%	46,000	7%
Ramsay Road, between Henley Marine Drive and Wolseley Street	Eastbound	930	6%	840	2%	13,000	4%
	Westbound	830	3%	990	3%	13,000	3%
Dobroyd Parade, east of Timbrell Drive	Eastbound	1,670	9%	2,120	3%	32,500	7%
	Westbound	1,630	7%	1,820	5%	30,500	7%
Parramatta Road, at the Hawthorne Canal	Eastbound	2,380	10%	1,880	2%	33,000	7%
	Westbound	1,620	6%	2,280	5%	32,000	7%

Source: WestConnex Delivery Authority traffic surveys (2012 – 2014)

On Parramatta Road, peak period traffic volumes show similar trends to daily figures with a fairly 'flat' profile of traffic throughout the day between the AM peak and PM peak periods. At the Hawthorne Canal, there are clear changes in peak direction between the AM peak hour and the PM peak hour, with more vehicles travelling towards the city in the AM peak hour, and more vehicles travelling away from the city in the PM peak hour.

During the AM peak hour, the traffic volume on Dobroyd Parade is similar in both directions, while during the PM peak hour, the eastbound volume is indicated as higher. This was due to congested traffic conditions. The surveyed volumes therefore only represent the satisfied demand and, due to downstream congestion and queueing at this location, underestimate the actual demand.

Existing road network performance

Network performance

Table 8-7 presents the performance of the modelled road network for Wattle Street and surrounds during the AM and PM peak hours. The Parramatta Road corridor currently functions under high levels of traffic demand, with the demand often exceeding the capacity of the road, especially eastbound during the AM peak period. This results in congested conditions and long queues and delays during peak periods.

An exception is east of Bland Street, where citybound Parramatta Road volumes in the AM peak are lower due to congestion at the Wattle Street intersection holding back traffic flow. Northbound congestion is also evident on Dobroyd Parade, reflecting citybound demand in the AM peak.

A similar pattern is evidenced in the PM peak although congestion is recorded in both directions. East of Bland Street, westbound traffic flows relatively well due to an extra lane on Parramatta Road (west of Dalhousie Street), and congestion at the Hume Highway intersection that holds back westbound traffic.

Table 8-7 Wattle Street interchange modelled network performance – 2015 AM and PM peak hour

Network measure	AM peak hour	PM peak hour
All vehicles		
Total traffic demand (veh)	13,233	13,559
Total vehicle kilometres travelled in network (km)	25,663	27,377
Total time travelled approaching and in network (hr)	1,731	1,504
Total vehicles arrived	13,191	13,559
Total number of stops	244,016	183,725

Network measure	AM peak hour	PM peak hour
Average per vehicle		
Average vehicle kilometres travelled in network (km)	1.7	1.8
Average time travelled in network (mins)	7.0	5.9
Average number of stops	14.8	11.0
Average speed (km/h)	14.9	18.3
Unreleased vehicles		
Unreleased demand (veh)	41	0
% of total traffic demand	0%	0%

Intersection performance

For the purpose of assessing intersection performance, all exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, were removed. This allows for an assessment of intersections within the modelled network, irrespective of downstream queueing that masks the actual operation of the intersection. The assessment undertaken in the M4 East EIS used a different methodology; therefore intersection results at the Wattle Street interchange are not directly comparable.

Table 8-8 presents the modelled AM and PM peak hour LoS for key intersections in the vicinity of the Wattle Street interchange. The intersection performance analysis demonstrates that most of the key intersections perform acceptably in the AM peak hour, with the exception of the Parramatta Road and Wattle Street intersection. In the PM peak hour, results indicate that key intersections operate to an acceptable level under existing demand.

Table 8-8 Wattle Street interchange: key intersection performance (LOS) – 2015 AM and PM peak hour

Key intersections	AM peak hour	PM peak hour
Parramatta Road/Sloane Street	B	B
Parramatta Road/Liverpool Road	C	B
Parramatta Road/Dalhousie Street	B	B
Parramatta Road/Bland Street	B	B
Parramatta Road/Wattle Street	E	D
Parramatta Road/Great North Road	B	B
Parramatta Road/Arlington Street	B	B
Frederick Street/Church Street	B	B
Wattle Street/Ramsay Street	C	C
Dobroyd Parade/Waratah Street	A	A
City West Link/Timbrell Drive	C	D

Traffic crashes

An analysis of traffic crashes was carried out for Parramatta Road between Wattle Street and City Road. The crash analysis considered relies on data recorded, with all crashes conforming to the national guidelines for reporting and classifying road vehicle crashes. The main criteria for these crashes are:

- The crash was reported to police
- The crash occurred on a public road

- The crash involved at least one moving vehicle
- The crash involved at least one person being killed or injured or at least one motor vehicle being towed away.

Table 8-9 summarises the crash history for the past five years (01 January 2012 – 31 December 2016) on Parramatta Road between Wattle Street and City Road.

Table 8-9 Parramatta Road from Wattle Street to City Road: crash statistics (Jan 2012 to Dec 2016)

Road	Section from	Section to	Crashes			
			Total	Fatal	Injury	Tow-away
Parramatta Road	Wattle Street	Broadway	539	0	404	135

Source: Summarised from crash reports, 2017

The average crash severity index on Parramatta Road between Wattle Street and City Road is about 1.37, which is above the average for NSW (1.24) and the Sydney Metropolitan Area (1.22), as presented in **Table 8-10**.

Table 8-10 Parramatta Road from Wattle Street to City Road: crash severity indices (Jan 2012 to Dec 2016)

Road	Section from	Section to	Crash severity index
Parramatta Road	Wattle Street	City Road	1.37
NSW | Sydney Metropolitan Averages – all roads (2010–2014)			
NSW			1.24
Sydney Metropolitan Area			1.22

Source: Summarised from crash reports, 2017

The latest available data (for the 12 month period ending December 2013) show average fatality and injury rates across the Sydney Metropolitan Area of 0.2 and 29.4 per 100 million vehicle kilometres travelled (MVKT) respectively.

Table 8-11 indicates that the occurrence of injury crashes is higher on Parramatta Road from Wattle Street to City Road, compared to the Sydney Metropolitan Area average, while fatal and tow-away crashes are lower. In particular, tow-away crash rates are significantly lower, with a tow-away crash rate of about 18 crashes per 100 MVKT compared with about 39 crashes per 100 MVKT for the Sydney Metropolitan Area.

Table 8-11 Parramatta Road from Wattle Street to City Road: crash rates per 100 MVKT (Jan 2012 to Dec 2016)

Road	Section from	Section to	Section length (km)	ADT (veh)	Crash rates per 100 MVKT			
					Total	Fatal	Injury	Tow-away
Parramatta Road	Wattle Street	City Road	6.6	61,517	72.74	-	54.5	18.2
Sydney Metropolitan Area (1 Jan 2013 to 31 Dec 2013)					68.8	0.2	29.4	39.2

Source: Summarised from crash reports, 2017

Table 8-12 provides details of the crash costs for Parramatta Road between Wattle Street and City Road. Average crash costs based on crash severity have been calculated using the Roads and Maritime Economic Analysis Manual (Economic Parameters for 2009). The crash costs presented in this report are based on a ‘willingness to pay’ approach. Willingness to pay values for road safety reflect the accumulated value the NSW community is willing to pay or forgo in exchange for a reduction in the probability of crash related injuries and deaths on NSW roads.

Table 8-12 Parramatta Road from Wattle Street to City Road: crash costs (Jan 2012 to Dec 2016)

Road	Section from	Section to	Section length (km)	ADT (veh)	Total cost	Crash cost Average annual cost	Cost per 100 MVKT
Parramatta Road	Wattle Street	City Road	6.6	61,517	$58,207,728	$11,641,546	$7,891,440

Source: Summarised from crash reports, 2017

8.2.3 Wattle Street interchange to Rozelle interchange corridor

The Wattle Street interchange to Rozelle interchange corridor connects the M4 Motorway to the Sydney CBD and the north. East of the Wattle Street interchange, east–west traffic movement is focused on Dobroyd Parade/City West Link and Parramatta Road. City West Link then combines with Victoria Road and links to Anzac Bridge/Western Distributor to provide the main east-west movement to the east of the Rozelle interchange. Other routes from the Wattle Street interchange area to the Sydney CBD include along Great North Road/Lyons Road, Victoria Road and then Anzac Bridge.

Parramatta Road, as part of the corridor between the proposed Wattle Street interchange and the Sydney CBD, forms part of the Parramatta to Sydney CBD via Strathfield travel demand corridor.

Existing traffic volumes and patterns

Mid-block traffic volumes

ATC surveys presented in **Table 8-6** included locations on Parramatta Road within the Wattle Street interchange to Rozelle interchange corridor. The Parramatta Road corridor accommodates consistently high volumes of travel demand, with volumes consistent through an average weekday, both during and between the AM and PM peak periods. Victoria Road, in this area, also forms part of the Parramatta to Sydney CBD via Ryde travel demand corridor. This corridor is also one of the most congested road corridors in Sydney and one of Sydney's busiest bus corridors.

Table 8-13 provides the AM peak hour, PM peak hour and AWT flows for the key roads within the Wattle Street interchange to Rozelle interchange corridor. Count data was taken from 2014 to 2016 surveys. At some locations, only peak hour volumes were available.

Table 8-13 Average peak mid-block traffic volumes at key locations within the Wattle Street interchange to Rozelle interchange corridor (2014–2016 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/hr	HCV%
City West Link, west of The Crescent	Eastbound	2,470	8%	2,370	3%	36,000	6%
	Westbound	1,640	5%	1,930	3%	32,000	6%
Lyons Road, west of Victoria Road	Eastbound	390	12%	390	8%	–	–
	Westbound	200	12%	450	6%	–	–
Victoria Road, north of Wellington Street	Northbound	2,080	5%	3,230	3%	–	–
	Southbound	3,340	4%	2,440	3%	–	–
Parramatta Road, east of Mallet Street	Eastbound	2,320	7%	1,530	3%	25,500	7%
	Westbound	1,230	8%	1,920	5%	25,500	6%

Source: Roads and Maritime traffic surveys (2014 – 2016)

Existing road network performance

Average speed and travel times on Wattle Street/City West Link, Parramatta Road and Victoria Road are shown in **Table 8-14**. The low speeds and long travel times across both AM and PM peaks indicate the peak hour congestion currently experienced along the Wattle Street interchange to Rozelle interchange corridor.

Table 8-14 Average speed and travel times along key roads within the Wattle Street interchange to Rozelle interchange corridor (2016 survey data)

Location	Direction	Average speed (km/hr)		Average travel time (min:sec)	
		AM peak	PM peak	AM peak	PM peak
Wattle Street/City West Link (Parramatta Road – Victoria Road)	Eastbound	22	36	13:30	8:20
	Westbound	27	32	8:10	9:20
Parramatta Road (Wattle Street – City Road)	Eastbound	24	28	19:10	16:30
	Westbound	31	26	15:00	17:30
Victoria Road (Lyons Road – Anzac Bridge)	Eastbound	23	27	11:40	7:10
	Westbound	27	29	10:00	9:00

8.2.4 Rozelle interchange and surrounds

The proposed Rozelle interchange would be located in the vicinity of the Rozelle Rail Yards to the north of City West Link. Details on land use in the vicinity of the proposed Rozelle interchange are provided in **Chapter 12** (Land use and property) of this EIS. The key roads in the vicinity of the Rozelle interchange are shown in **Figure 8-7** and include (but are not limited to):

- City West Link (A4)
- Victoria Road (A40)
- Western Distributor/Anzac Bridge
- Lilyfield Road
- Catherine Street
- The Crescent/Minogue Crescent/Ross Street
- Johnston Street
- James Craig Road
- Robert Street
- Terry Street.

Detailed descriptions of these key roads are provided in **Appendix H** (Technical working paper: Traffic and transport).

Modes of travel

The Rozelle interchange is located primarily within the Inner West LGA. A small area within the City of Sydney is also located on the eastern side of The Crescent. Travel mode share for the Inner West LGA in comparison with the Sydney GMA is shown in **Table 8-15**.

The Inner West LGA has a higher share of public transport due to the area's proximity to the Sydney CBD and frequent bus, heavy and light rail services. The largest difference to the Sydney GMA data is in 'walk only' trips, which account for 32 per cent of all trips in the Inner West LGA compared to 18 per cent in the Sydney GMA. This could be attributed to factors including the walkability of many neighbourhoods in the area.

Table 8-15 Average weekday travel mode share for Inner West LGA

Area	Private vehicles			Rail	Bus	Walk only	Other modes
	Driver	Passenger	Total				
Inner West LGA	36%	13%	49%	7%	8%	32%	5%
Sydney GMA	47%	22%	69%	5%	6%	18%	2%

Note:

Inner West Council data has been derived by combining data from the former Leichhardt, Ashfield and Marrickville LGAs

Source: NSW Bureau of Transport Statistics (BTS), Household Travel Survey Report: Sydney 2012/13, Nov 2014 Release.

Public transport services

The Rozelle area has access to light rail and bus services that provide frequent connections to key centres and transport nodes, but does not have access to the heavy rail network.

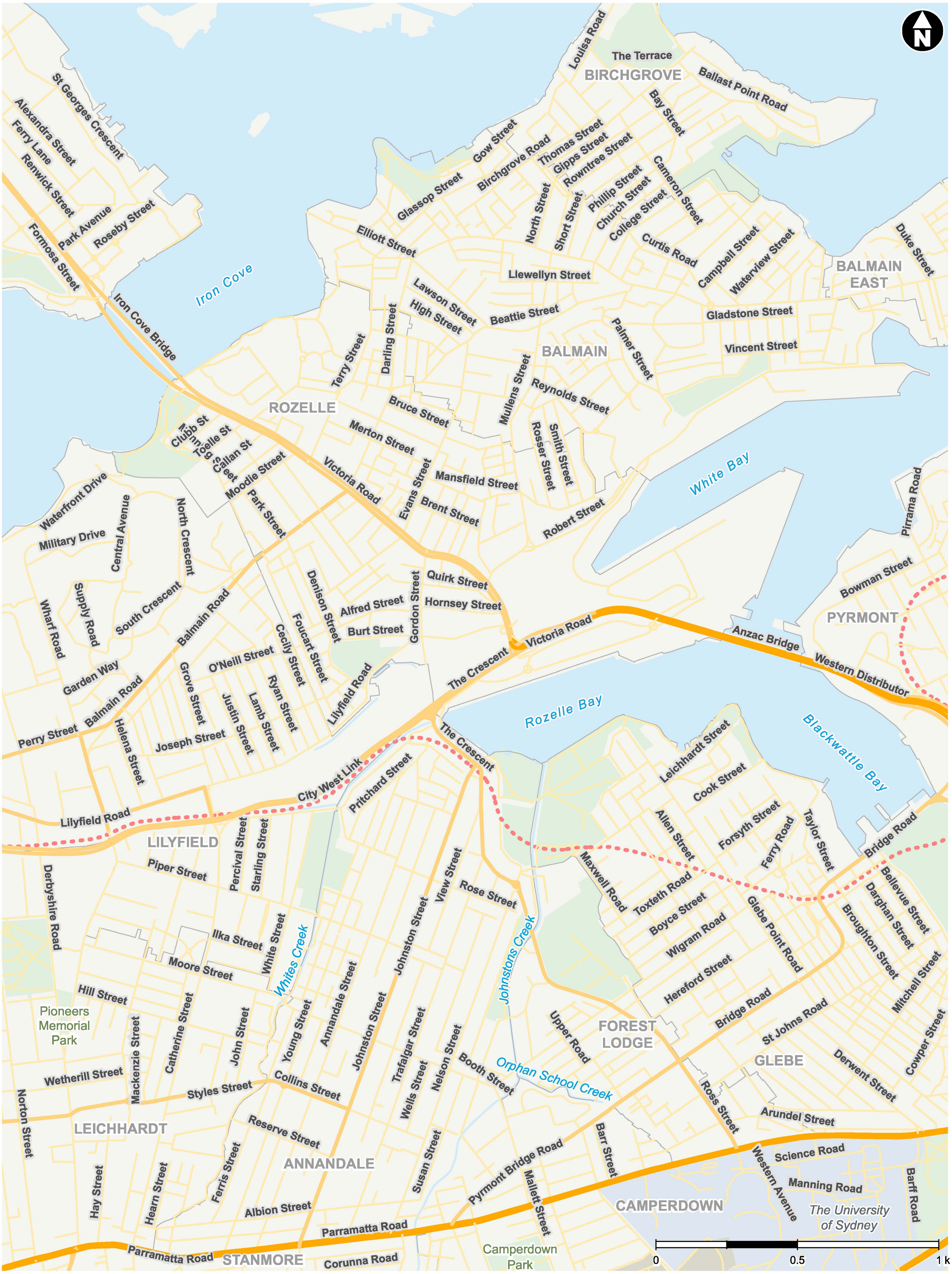
Light rail services

The L1 Dulwich Hill line runs from Central to Dulwich Hill via Pyrmont, Glebe, Lilyfield and Leichhardt. The closest stops are at Rozelle Bay and Lilyfield. The light rail line runs along a former freight railway corridor for most of its length, with a short on-street section in the southern part of the Sydney CBD between Darling Drive and Castlereagh Street. **Table 8-16** shows the existing service frequency on the Dulwich Hill line, with services every eight to 10 minutes during peak periods.

Table 8-16 Weekday light rail service frequency

Line	Early AM (6.00 – 7.00 am)	AM Peak (7.00 – 10.00 am)	Off peak (10.00 am – 3.00 pm)	PM peak (3.00 – 7.00 pm)	Late PM (7.00 – 11.00 pm)
L1 Dulwich Hill Line	15 min	8–10 min	15 min	8–10 min	15 min

Source: Transport for NSW 2016



LEGEND

Existing features

- Waterway
- Light rail
- Suburb boundary
- Arterial road
- Subarterial road
- Local road

Figure 8-7 Road network around the Rozelle interchange

Bus services

Table 8-17 presents the bus services and frequencies at Rozelle (all operated by Sydney Buses). Victoria Road serves as a major transit corridor between Sydney's north-western suburbs and the Sydney CBD. Balmain Road is also a key cross-regional bus corridor linking Balmain with Rozelle and Leichhardt.

Table 8-17 Bus services around Rozelle and surrounds

Route	AM peak[1] services	AM peak frequency	PM peak[2] services	PM peak frequency
502 Bayview Park to City	5	10–15 min	8	10–20 min
504 Chiswick to City	16	5 min	11	7–20 min
X04 City to Chiswick	–	–	4	15–20 min
M50 Drummoyne to Coogee via City	12	10 min	12	10 min
M52 Parramatta to City	24	5 min	15	8 min
431 Glebe Point to City	25	3–7 min	19	4–10 min
433 Balmain to Railway Square	18	9–12 min	13	5–12 min
444 Campsie to Balmain East	10	10 min	7	15 min
445 Campsie to Balmain East via Lilyfield Light Rail station	1	–	–	–
L37 Haberfield to City	5	11–20 min	4	25 min
441 Birchgrove to Art Gallery NSW	6	12–35 mi	6	15–25 min
442 Balmain East to City	29	4 min	24	5 min
440 Bronte to Rozelle via Central Station	21	3–10 min	14	6–10 min
500 Ryde to City	4	30 min	0	–
501 West Ryde to Central via Pyrmont and Ultimo	14	9 min	12	10 min
506 Macquarie University to City via East Ryde	18	7 min	9	13 min
507 Macquarie University to City via Putney	6	20 min	5	24 min
510 Ryde to City	15	8 min	3	40 min
515 Eastwood to City	5	24 min	1	–
518 Macquarie University to City	7	17 min	5	24 min
520 Parramatta to City via West Ryde (out of peak hours service)	1	–	–	–
X00 City to Ryde (Limited Stops)	–	–	5	24 min
X06 City to East Ryde (Express)	–	–	5	24 min
X15 City to Eastwood	–	–	3	40 min
X18 City to Denistone East (Express)	–	–	3	40 min

Notes:

[1]7.00 am–9.00 am (higher frequency direction)

[2]4.00 pm–6.00 pm (higher frequency direction)

Source: Sydney Buses 2016

Walking and cycling facilities

Details of existing walking and cycling infrastructure and facilities can be found in **Appendix N** (Technical working paper: Active transport strategy).

Existing traffic volumes and patterns

Mid-block traffic volumes

Table 8-18 provides the 2016 AM peak hour, PM peak hour and AWT flows for key roads in the vicinity of the Rozelle interchange. Count data was taken from 2014 and 2016 surveys. The table indicates higher traffic flows in the southbound and eastbound (citybound) directions during the AM peak and in the opposite directions during the PM peak. The proportion of heavy vehicles is not significantly high in this area compared to other arterial routes in Sydney.

Table 8-18 Average peak mid-block traffic volumes at key locations around Rozelle and surrounds (2014 and 2016 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV %	veh/hr	HCV %	veh/day	HCV %
City West Link, between The Crescent and James Craig Road	Eastbound	3,520	6%	3,080	3%	38,500	5%
	Westbound	2,260	5%	2,940	2%	36,000	5%
The Crescent, between City West Link and Johnston Street	Northbound	1,040	3%	870	2%	11,500	4%
	Southbound	880	5%	950	1%	12,500	4%
Victoria Road, north of The Crescent	Northbound	1,660	8%	2,790	4%	34,500	5%
	Southbound	3,400	5%	2,390	3%	38,500	5%
Victoria Road, south of Gordon Street	Northbound	1,250	7%	2,060	4%	25,000	5%
	Southbound	2,820	4%	1,920	3%	30,500	4%
Victoria Road, north of Gordon Street	Northbound	1,890	5%	2,040	4%	27,000	5%
	Southbound	2,660	5%	1,840	3%	28,000	4%
Anzac Bridge	Eastbound	5,890	–	4,400	–	71,500	–
	Westbound	2,900	–	4,950	–	63,500	–

Source: Roads and Maritime traffic surveys (2014 – 2016)

Rozelle interchange and surrounds existing performance

Network performance

Table 8-19 presents the performance of the modelled road network for Rozelle and surrounds in the 2015 base scenario for the AM and PM peak hours. The results indicate a similar level of demand in each peak hour. However, the AM peak hour results show longer average travel time, more stops and lower average speed per vehicle through the modelled network. This reflects more congestion in the AM peak hour compared to the PM peak hour.

During the AM peak hour, the capacity constraints at Bathurst Street and Sydney Harbour Bridge have the most significant impacts on the eastbound movement on the Western Distributor with extensive congestion extending back to or across Anzac Bridge.

Table 8-19 Rozelle interchange network performance – 2015 AM and PM peak hour

Network measure	AM peak hour	PM peak hour
All vehicles		
Total traffic demand (vehicles)	19,969	22,148
Total vehicle kilometres travelled in network (kilometre)	54,959	61,980
Total time travelled in network (hours)	4,016	3,276
Total vehicles arrived	20,298	20,714
Total number of stops	267,250	133,380
Average per vehicle in network		
Average vehicle kilometres travelled in network (kilometre)	2.7	3.0
Average time travelled in network (minutes)	9.6	8.2
Average number of stops	11.5	5.6
Average speed (kilometres per hour)	16.9	21.9
Unreleased vehicles		
Unreleased demand (vehicles)	357	823
% of total traffic demand	2%	4%

Intersection performance

Table 8-20 presents the modelled AM and PM peak hour LoS for key intersections in the existing situation at Rozelle. The intersection performance analysis demonstrates several intersections along Victoria Road at Rozelle experience poor levels of service during the PM peak hour. The poor level of service indicates that the intersections are at or close to capacity.

Table 8-20 Rozelle interchange: key intersection performance (LOS) – 2015 AM and PM peak hour

Key intersections	AM peak hour	PM peak hour
Victoria Road/Lyons Road	D	D
Victoria Road/Wellington Street	D	B
Victoria Road/Darling Street	F	F
Victoria Road/Robert Street	D	F
Victoria Road/The Crescent	B	F
The Crescent/James Craig Road	A	B
City West Link/The Crescent	B	D
The Crescent/Johnston Street	C	F

Travel times and speeds

Table 8-21 shows the average travel time on Victoria Road and Anzac Bridge between Darling Street at Rozelle and the Pyrmont Bridge ramps at Pyrmont, in the AM and PM peak periods. In the peak directions, eastbound travel time in the AM peak averages about six minutes with an average speed of about 21 kilometres per hour on a typical weekday; while the westbound travel time in the PM peak averages about eight minutes with an average speed of about 18 kilometres per hour. The speed limit on these roads is 60 kilometres per hour.

The eastbound direction in the AM peak and the westbound direction in the PM peak experience the most congested conditions. This is illustrated in the longer travel times and slower speeds compared to the reverse direction in these same peak periods. Notwithstanding this, average speed in the eastbound direction in the PM peak is also slow.

Table 8-21 Travel speed and travel time on Victoria Road and Anzac Bridge between Darling Street, Rozelle and Pyrmont Bridge entry/exit ramp at Pyrmont

Location	Direction	Average speed (km/hr)		Average travel time (min:sec)	
		AM peak	PM peak	AM peak	PM peak
Victoria Road/Anzac Bridge (Darling Street – Pyrmont Bridge entry and exit ramp)	Eastbound	21	23	6:20	5:40
	Westbound	35	18	3:50	7:40

Source: Based on Matrix survey data, AECOM 2016

Table 8-22 shows the average travel time on City West Link and Anzac Bridge between Catherine Street at Lilyfield and Pyrmont Bridge ramps at Pyrmont in the AM and PM peak periods. In the peak directions, eastbound travel time in the AM peak averages about 10 minutes, with an average speed of about 16 kilometres per hour on a typical weekday. The westbound travel time in the PM peak averages six minutes with an average speed of about 26 kilometres per hour. The speed limit on the road is 60 kilometres per hour.

The eastbound direction in the AM peak and the westbound direction in the PM peak show longer travel times and slower speeds compared to the reverse direction in these same peak periods. Compared to the Victoria Road surveys, the eastbound direction in the PM peak is less congested.

Table 8-22 Travel speed and travel time on City West Link and Anzac Bridge between Catherine Street, Lilyfield and Pyrmont Bridge on/off ramp at Pyrmont

Location	Direction	Average speed (km/hr)		Average travel time (min:sec)	
		AM peak	PM peak	AM peak	PM peak
City West Link/Anzac Bridge (Catherine Street – Pyrmont Bridge entry and exit ramp)	Eastbound	16	44	10:00	3:30
	Westbound	35	26	4:30	6:00

Source: Based on Matrix survey data, 2014

Traffic crashes

Table 8-23 summarises the crash history for five years (1 January 2011 – 31 December 2015) on the key roads around the Rozelle interchange. On key arterial roads, including Anzac Bridge and City West Link, about 60 per cent of crashes were rear-end, which is consistent with roadways approaching capacity and on which a high level of queuing occurs.

Table 8-23 Rozelle and surrounds: crash statistics (Jan 2011 to Dec 2015)

Road	Section from	Section to	Crashes			
			Total	Fatal	Injury	Tow-away
Anzac Bridge	Miller Street	Victoria Road	108	0	66	42
City West Link	James Street	Victoria Road	171	1	87	83
Victoria Road	Darling Street	The Crescent	95	1	51	43
Lilyfield Road	Victoria Road	Canal Road	41	0	28	13
The Crescent	City West Link	Wigram Road	62	0	35	27
Johnston Street	The Crescent	Parramatta Road	62	0	40	22

Source: Summarised from crash reports, 2016

The average crash severity index on key roads in Rozelle and surrounds is about 1.29 – above the average for NSW (1.24) and the Sydney Metropolitan Area (1.22), as presented in **Table 8-24**.

Table 8-24 Rozelle and surrounds: crash severity indices (Jan 2011 to Dec 2015)

Road	Section from	Section to	Crash Severity Index
Anzac Bridge	Victoria Road	Miller Street	1.31
City West Link	James Street	Victoria Road	1.27
Victoria Road	Darling Street	The Crescent	1.29
Lilyfield Road	Victoria Road	Canal Road	1.38
The Crescent	City West Link	Wigram Road	1.28
Johnston Street	The Crescent	Parramatta Road	1.32
NSW | Sydney Metropolitan averages – all roads (2010–2014)			
NSW			1.24
Sydney Metropolitan Area			1.22

Source: Summarised from crash reports, 2016 & 2014

Table 8-25 indicates that the occurrence of fatal crashes is higher on City West Link and Victoria Road compared to the Sydney Metropolitan Area average, while crashes causing injury on Victoria Road, Lilyfield Road, The Crescent and Johnston Street are higher than the Sydney Metropolitan Area average. Injury crashes on Anzac Bridge and City West Link are lower than the Sydney Metropolitan Area average.

Table 8-25 Rozelle and surrounds: crash rates per 100MVKT (Jan 2011 to Dec 2015)

Road	Section from	Section to	Section length (km)	ADT (veh)	Crash rates per 100MVKT			
					Total	Fatal	Injury	Tow-away
Anzac Bridge	Victoria Road	Miller Street	0.99	134,000	44.6	-	27.3	17.3
City West Link	James Street	Victoria Road	2.13	86,991	50.6	0.3	25.7	24.5
Victoria Road	Darling Street	The Crescent	0.85	83,648	73.2	0.8	39.3	33.1
Lilyfield Road	Victoria Road	Canal Road	2.48	4,301	205.5	-	143.8	66.8
The Crescent	City West Link	Wigram Road	1.32	28,010	91.9	-	51.9	40.0
Johnston Street	The Crescent	Parramatta Road	1.8	15,869	118.9	-	76.7	42.2
Sydney Metropolitan Area (1 Jan 2013 to 31 Dec 2013)					68.8	0.2	29.4	39.2

Source: Summarised from crash reports, 2016

Table 8-26 provides details of the crash costs for the key roads surrounding the Rozelle interchange. Average crash costs based on crash severity have been calculated using Roads and Maritime's Economic Analysis Manual (Economic Parameters for 2009).

Table 8-26 Rozelle and surrounds: crash costs (Jan 2011 to Dec 2015)

Road	Section from	Section to	Section length (km)	ADT (veh)	Total cost	Crash cost Average annual cost	Cost per 100MVKT
Anzac Bridge	Victoria Road	Miller Street	0.99	134,000	$27,402,300	$5,480,460	$11,318,380
City West Link	James Street	Victoria Road	2.13	86,991	$41,928,450	$8,385,690	$12,399,150
Victoria Road	Darling Street	The Crescent	0.85	83,648	$26,842,450	$5,368,490	$20,686,390
Lilyfield Road	Victoria Road	Canal Road	2.48	4,301	$11,585,950	$2,317,190	$59,517,910
The Crescent	City West Link	Wigram Road	1.32	28,010	$14,570,050	$2,914,010	$21,592,910
Johnston Street	The Crescent	Parramatta Road	1.8	15,869	$16,579,300	$3,315,860	$31,803,960

Source: Summarised from crash reports, 2016

8.2.5 Rozelle to St Peters interchange corridor

The Rozelle interchange to St Peters interchange corridor connects the Sydney CBD with the M5 motorway corridor. Southeast of the Rozelle interchange, north–south traffic movement is focused on the Eastern Distributor, with Abercrombie Street, Regent Street, Chalmers Street and Elizabeth Street providing supporting north–south routes. North of the St Peters interchange, north–south traffic is mainly focused on the Princes Highway and King Street, while traffic from the Sydney Airport and Port Botany precinct also uses O'Riordan Street and Botany Road.

Several of the roads identified above are within the Sydney Airport to Sydney CBD travel demand corridor, which experiences high levels of transport congestion. There are also heavy vehicle routes along this corridor, extending from the Sydney Airport and Port Botany precinct, through the city, to areas north of Sydney Harbour.

Existing traffic volumes and patterns

Table 8-27 provides 2014 AM peak hour, PM peak hour and AWT flows at key locations within the Rozelle to St Peters interchange corridor.

South-east of the Rozelle interchange, the main north–south movement is focused on the Eastern Distributor, with surrounding north–south links playing a supporting role. North of the St Peters interchange, traffic is mainly focused on Princes Highway and, to a lesser degree King Street, while O'Riordan Street and Botany Road also carry a significant amount of north–south traffic.

Table 8-27 Average peak mid-block traffic volumes at key locations within the Rozelle interchange to St Peters interchange corridor (2014 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/hr	HCV%
Southeast of Rozelle interchange							
Eastern Distributor, north of Cleveland Street	Northbound	3,230	6%	2,820	4%	41,500	5%
	Southbound	3,300	4%	3,310	4%	52,500	5%
Abercrombie Street, north of Cleveland Street	One-way northbound	1,560	7%	1,430	4%	21,000	7%
Regent Street, north of	Northbound	930	7%	740	2%	12,000	5%

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/hr	HCV%
Cleveland Street	Southbound	1,670	5%	1,930	3%	27,000	5%
Chalmers Street, north of Cleveland Street	One-way northbound	1,340	9%	1,100	7%	17,000	9%
Elizabeth Street, north of Cleveland Street	One-way southbound	980	11%	1,440	8%	18,500	9%
North of St Peters interchange							
Princes Highway, south of Railway Road	Northbound	3,500	5%	1,970	4%	37,500	8%
	Southbound	1,590	13%	3,680	6%	40,000	10%
King Street, south of Missenden Road	Eastbound	1,410	13%	890	8%	17,500	9%
	Westbound	610	11%	1,050	9%	16,000	9%
O'Riordan Street, north of Gardeners Road	Northbound	1,210	8%	1,040	6%	16,000	8%
	Southbound	890	8%	1,160	6%	15,000	8%
Botany Road, north of Gardeners Road	Northbound	1,380	11%	880	7%	14,000	13%
	Southbound	750	11%	1,180	10%	13,500	11%

Source: WDA traffic surveys (2014)

Existing road network performance

Average speeds and travel times on key roads within the Rozelle interchange to St Peters interchange corridor are shown in **Table 8-28**. Southern Cross Drive, posted at 80 kilometres per hour, exhibits slow speeds, especially in the peak directions. Traffic conditions on Botany Road and Princes Highway/King Street, posted at 50 or 60 kilometres per hour on different sections, indicate the congestion on the surface road network in this corridor.

Table 8-28 Average speed and travel times along key roads within the Rozelle to St Peters interchange corridor (2016 survey data)

Location	Direction	Average speed (km/hr)		Average travel time (min:sec)	
		AM peak	PM peak	AM peak	PM peak
Southern Cross Drive	Northbound	28	39	8:00	5:40
(Gardeners Road – Cleveland Street)	Southbound	50	32	4:30	7:00
Botany Road	Northbound	28	23	6:20	7:40
(Gardeners Road – Raglan Street)	Southbound	24	25	7:10	7:10
Princes Highway/King Street	Northbound	24	22	11:10	12:00
(Canal Road to Broadway)	Southbound	25	24	10:50	11:30

8.2.6 St Peters interchange and surrounds

Existing land uses in the vicinity of the St Peters interchange include an enterprise corridor along the Princes Highway, warehouses, limited residential lands, and Sydney Park to the north and Alexandra Canal to the east. Surrounding land uses include the residential neighbourhoods of St Peters, Sydenham and Newtown, as well as general residential and industrial areas of Alexandria to the east. Other significant areas include commercial activity around the Bourke Road/Bourke Street/Gardeners Road intersection associated with Sydney Airport, and residential development associated with Mascot Town Centre.

Modes of travel

The area around the St Peters interchange is located in parts of the Sydney, Inner West and Bayside LGAs. Travel mode shares for Sydney, Inner West and Bayside LGAs in comparison with the Sydney GMA are shown in **Table 8-29**.

As the Sydney LGA includes the Sydney CBD, and the Inner West LGA is located close to the Sydney CBD, these two LGAs have a significantly different mode share compared to the GMA, characterised by an extensive public transport network and a land use mix where residential developments are located closer to employment areas, thereby reducing the need for car travel. These two LGAs have a much lower mode share for private vehicles (30 and 49 per cent) and a high mode share for walking (49 and 30 per cent) compared to 69 per cent for private vehicles and 18 per cent for walk trips in the Sydney GMA.

The Bayside LGA, which is farther away from the Sydney CBD and where a number of industrial sites such as Sydney Airport and Port Botany are located, has more reliance on private vehicles compared to the Sydney and Inner West LGAs and a lower rail mode share of two per cent compared to the Sydney and Inner West LGAs.

Table 8-29 AWT mode share for Sydney, Inner West and Bayside LGAs and the Sydney GMA[1]

Area	Private Vehicles			Rail	Bus	Walk only	Other modes
	Driver	Passenger	Total				
Sydney LGA	21%	9%	30%	8%	9%	49%	4%
Inner West LGA	36%	13%	49%	7%	8%	32%	5%
Bayside LGA	46%	21%	67%	2%	11%	19%	1%
Sydney GMA	47%	22%	69%	5%	6%	18%	2%

Note:

Inner West Council LGA data has been derived by combining data from the former Leichhardt, Ashfield and Marrickville LGA's, while Bayside LGA data has been derived from data for the former Botany Bay LGA

Source: NSW Bureau of Transport Statistics (BTS), Household Travel Survey Report: Sydney 2012/13, Nov 2014 Release

Public transport services

Rail services

Sydney and Inner West LGAs are served by several rail services, while Bayside LGA has limited rail coverage. The closest stations to the St Peters interchange are Mascot Station on the T2 Airport Line and St Peters Station on the T3 Bankstown Line, located one kilometre to the south and 750 metres to the north of the St Peters interchange respectively.

Table 8-30 shows the train services at Mascot and St Peters stations. In the AM peak, there are 18 trains from Mascot Station and 14 trains from St Peters Station travelling to the Sydney CBD. In the PM peak, the train services from the city to Mascot Station and St Peters Station are 16 and 18 respectively. The duration between trains at Mascot Station is less than ten minutes at all times on a weekday including inter peak, AM and PM peak while the duration between trains at St Peters Station is six to 15 minutes and seven to 15 minutes during the AM and PM peak respectively. Outside of the peak periods, trains stop at St Peters Station at a frequency of 15 minutes.

Table 8-30 Weekday heavy rail service frequency

Station	Line	AM Peak[1] services	AM peak frequency	PM peak[2] services	PM peak frequency
Mascot	T2 Airport Line	18	6-9 min	16	6-9 min
St Peters	T3 Bankstown Line	14	6-15 min	18	7-15 min

Notes:

[1]7:00–9:00 am to city

[2]4:00–6:00 pm from city

Source: New M5 Technical working paper: Traffic and transport, AECOM 2015b

Bus services

The St Peters interchange and surrounds has a comprehensive bus network providing access to its surrounding activity and employment centres. The bus routes operating around the St Peters interchange (operated by Sydney Buses) are summarised in **Table 8-31**.

Table 8-31 Bus services around St Peters and surrounds

Route	AM Peak[1] services	AM peak frequency	PM peak[2] services	PM peak frequency
305 Stamford Plaza Hotel to Railway Square	5	20 min	5	20 min
308 Marrickville to City	8	20 min	4	30 min
309 Port Botany to City	13	7–14 min	18	2–14 min
348 Wolli Creek to Bondi Junction	4	30 min	4	30 min
370 Leichhardt to Coogee	14	8–9 min	11	10–11 min
400 Burwood to Bondi Junction	7	17–18 min	8	15 min
410 Burwood to Bondi Junction	4	30 min	7	17–18 min
418 Burwood to Bondi Junction	6	20 min	8	20 min
422 Kogarah to City	9	13–14 min	9	13–14 min
M20 Gore Hill to Botany Shops via City	12–17	7–10 min	12–17	7–10 min

Notes:

[1]7.00–9.00 am (higher frequency direction)

[2]4.00–6.00 pm (higher frequency direction)

Source: New M5 Technical working paper: Traffic and transport, AECOM 2015b

Walking and cycling facilities

Details of existing walking and cycling facilities can be found in **Appendix N** (Technical working paper: Active transport strategy).

Existing traffic volumes and performance

Mid-block traffic volumes

Table 8-32 provides the 2014 AM peak hour, PM peak hour and AWT flows for the key road corridors in the vicinity of the St Peters interchange. The shading in the table groups the locations into the King Street/Princes Highway corridor, the Euston Road corridor, the Campbell Street corridor and the Ricketty Street/Gardeners Road corridor. At some locations, only peak hour volumes were available.

The table indicates that roads running east-west experience higher traffic flows in the eastbound direction during the AM peak and in the westbound direction during the PM peak. The Princes Highway experiences higher traffic flows in the northbound direction during the AM peak and southbound direction during the PM peak. A number of locations have a high proportion of heavy vehicles including the Princes Highway south of Railway Road and Euston Road north of Campbell Road.

Table 8-32 Average peak mid-block traffic volumes at key locations around St Peters and surrounds (2014 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/day	HCV%
King Street, south of Alice Street	Northbound	1,020	5%	950	2%	–	–
	Southbound	780	7%	940	3%	–	–
Princes Highway, north of Campbell Street	Northbound	1,660	5%	980	3%	19,000	6%
	Southbound	560	9%	1,600	4%	17,500	7%
Princes Highway, south of Campbell Street	Northbound	1,720	11%	1,040	6%	19,500	9%
	Southbound	610	10%	1,550	9%	18,000	10%
Railway Road, west of Princes Highway	Eastbound	630	12%	640	4%	–	–
	Westbound	390	17%	550	5%	–	–
Princes Highway, south of Railway Road	Northbound	3,370	5%	1,590	5%	27,000	15%
	Southbound	780	10%	2,610	2%	25,500	17%
Euston Road, north of Campbell Road	Northbound	410	13%	190	7%	3,000	13%
	Southbound	200	23%	190	7%	2,500	16%
Euston Road, north of Sydney Park Road	Northbound	1,220	7%	600	5%	–	–
	Southbound	500	15%	1,330	5%	–	–
Campbell Road, west of Euston Road	Eastbound	860	9%	410	12%	7,500	11%
	Westbound	160	21%	320	13%	3,500	14%
Campbell Street, east of May Street	Eastbound	360	8%	320	8%	5,000	8%
	Westbound	140	16%	280	11%	3,000	12%
Edgeware Road, west of Edinburgh Road	Northbound	670	8%	810	3%	–	–
	Southbound	730	7%	780	1%	–	–
Ricketty Street	Eastbound	2,290	7%	1,160	9%	22,000	11%
	Westbound	960	17%	1,830	7%	20,500	12%
Gardeners Road, west of O'Riordan Street	Eastbound	1,090	13%	920	15%	14,000	14%
	Westbound	1,000	11%	1,120	12%	15,000	11%

Source: WDA traffic surveys (2014)

St Peters interchange existing performance

Network performance

Traffic conditions around the St Peters interchange are altered due to the construction of the New M5 project, which commenced construction in late 2016 and is expected to be open to motorists in 2020. The road network performance reported is for the situation prior to construction of the New M5 commencing to allow an assessment that reflects the unaltered road network.

Table 8-33 presents the performance of the modelled road network for St Peters and surrounds in the 2015 base scenario modelled for the AM and PM peak hours. The results indicate a similar level of demand and network performance in each peak hour.

Table 8-33 St Peters interchange network performance – 2015 AM and PM peak hour

Network measure	AM peak hour	PM peak hour
All vehicles		
Total traffic demand (veh)	22,080	21,390
Total vehicle kilometres travelled in network (km)	62,220	59,650
Total time travelled in network (hr)	2,350	2,370
Total vehicles arrived	21,840	21,160
Total number of stops	105,830	101,670
Average per vehicle		
Average vehicle kilometres travelled in network (km)	2.6	2.6
Average time travelled in network (mins)	5.8	5.9
Average number of stops	4.8	4.8
Average speed (km/h)	26.8	26.1
Unreleased vehicles		
Unreleased demand (veh)	90	250
% of total traffic demand	0%	1%

Intersection performance

Table 8-34 presents the AM and PM peak hour intersection average delays and LoS for the existing situation at St Peters. The intersection performance analysis demonstrates several intersections in the vicinity of the St Peters interchange experience congestion during the AM and PM peak hours.

Roads and Maritime is carrying out improvement works at the Princes Highway/Railway Road intersection as part of the Pinch Point Program. These works would be expected to improve the LoS of this intersection during the AM and PM peak periods.

Table 8-34 St Peters interchange: key intersection performance (LoS) – 2015 AM and PM peak hour

Key intersections	AM peak hour	PM peak hour
Princes Highway/Sydney Park Road	C	D
Princes Highway/May Street	D	F
Princes Highway/Canal Road	D	D
Princes Highway/Railway Road	F	D
Sydney Park Rd/Mitchell Road	C	D
Euston Road/Sydney Park Road	A	B
Unwins Bridge Road/Campbell Street	C	D
Campbell Road/Euston Road	A	A
Campbell Road/Bourke Road	C	D
Princes Highway/Campbell Street	C	C
Ricketty Street/Kent Road	A	A
Gardeners Road/Kent Road	C	D
Gardeners Road/Bourke Road	D	E

Traffic crashes

Table 8-35 summarises the crash history for a five year period (1 January 2009 to 31 December 2013) for key roads around the St Peters interchange.

Table 8-35 St Peters and surrounds: crash statistics (Jan 2009 to Dec 2013)

Road	Section from	Section to	Crashes			
			Total	Fatal	Injury	Tow-away
Princes Highway	Enmore Road	Gannon Street	407	2	189	216
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	248	1	100	147
Euston Road	Sydney Park Road	Campbell Road	21	0	13	12
Bourke Road	Wyndham Street	Gardeners Road	69	0	35	34

Source: New M5 Technical working paper: Traffic and transport, AECOM 2015b

The average crash severity indices in the St Peters area range from 1.21 to 1.50. The Princes Highway, Bourke Road and especially Euston Road have averages higher than the NSW and Sydney Metropolitan Area average, as presented in **Table 8-36**.

Table 8-36 St Peters and surrounds: crash severity indices (Jan 2009 to Dec 2013)

Road	Section from	Section to	Crash Severity index
Princes Highway	Enmore Road	Gannon Street	1.24
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	1.21
Euston Road	Sydney Park Road	Campbell Road	1.50
Bourke Road	Wyndham Street	Gardeners Road	1.25
NSW | Sydney Metropolitan Averages – all roads (2010–2014)			
NSW (2008-2012)			1.24
Sydney Metropolitan Area (2008–2012)			1.22

Source: New M5 Technical working paper: Traffic and transport, AECOM 2015b

Table 8-37 indicates the occurrence of fatal crashes and crashes causing injury on the Princes Highway, Canal Road, Ricketty Street and Gardeners Road is higher than the Sydney Metropolitan Area average, but the occurrence of crashes causing injury or tow-away on Euston Road is significantly higher than the Sydney Metropolitan Area average. Euston Road also has a very high crash rate compared to other roads in the area.

Table 8-37 St Peters and surrounds: crash rates per 100 MVKT (Jan 2009 to Dec 2013)

Road	Section from	Section to	Section length (km)	ADT (veh)	Crash rates per 100 MVKT			
					Total	Fatal	Injury	Tow-away
Princes Highway	Enmore Road	Gannon Street	3.8	50,981	115.1	0.6	53.5	61.1
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	39,599	143.0	0.6	57.7	84.8
Euston Road	Sydney Park	Campbell Road	0.9	4,810	265.8	-	164.5	151.9

Road	Section from	Section to	Section length	ADT (veh)	Crash rates per 100 MVKT			
	Road							
Bourke Road	Wyndham Street	Gardeners Road	2.1	11,430	157.5	-	79.9	77.6
Sydney Metropolitan Area (1 Jan 2013 to 31 Dec 2013)					68.8	0.2	29.4	39.2

Source: New M5 Technical working paper: Traffic and transport, AECOM 2015b

Table 8-38 provides details of the crash costs for roads in and around St Peters. Average crash costs, based on crash severity, have been calculated using Roads and Maritime's Economic Analysis Manual (Economic Parameters for 2009). Again, Euston Road stands out as a section of road with a very high crash cost compared to other roads in the area.

Table 8-38 St Peters and surrounds: crash costs (Jan 2009 to Dec 2013)

Road section	Section length (km)	ADT (veh)	Total cost	Crash cost Average annual cost	Cost per 100 MVKT
Princes Highway (Enmore Road – Gannon Street)	3.8	50,981	$90,414,400	$18,082,880	$25,573,070
Canal Road/ Ricketty Street/ Gardeners Road (Princes Highway – Botany Road)	2.4	39,599	$47,780,050	$9,556,010	$27,547,890
Euston Road (Sydney Park Road – Campbell Road)	0.9	4,810	$5,427,800	$1,085,560	$68,702,630
Bourke Road (Wyndham Street – Gardeners Road)	2.1	11,430	$14,627,100	$2,925,420	$33,391,030

Source: New M5 Technical working paper: Traffic and transport, AECOM 2015b

8.2.7 Wattle Street interchange to St Peters interchange corridor

The Wattle Street interchange to St Peters interchange corridor connects the M4 and M5 motorways. There is a primary freight route between these interchange sites that extends along Parramatta Road, Old Canterbury Road, Railway Terrace, Gordon Street, Livingstone Road, Sydenham Road, Gleeson Avenue and Railway Road before connecting to Princes Highway. While this classified as a primary freight route, its use is restricted to heavy vehicles under 19 metres. An alternative route runs along Parramatta Road, Stanmore Road and Edgeware Road.

Existing traffic volumes and patterns

Table 8-39 provides 2012 AM peak hour, PM peak hour and AWT flows on Sydenham Road in Marrickville, along the primary freight route. The table indicates clear changes in peak direction between the AM peak hour and the PM peak hour, with more vehicles travelling eastbound in the AM peak hour, and more vehicles travelling westbound in the PM peak hour. The survey data also indicates a high heavy vehicle percentage, which is high through the day. This is consistent with the use of this route by freight vehicles, which may try and travel outside of peak traffic periods.

Table 8-39 Average peak mid-block traffic volumes at key locations within the Wattle Street interchange to St Peters interchange corridor (2012 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/hr	HCV%
Sydenham Road, west of Victoria Road (Marrickville)	Westbound	390	12%	920	4%	9,500	8%
	Eastbound	840	7%	500	3%	10,000	7%

Source: Roads and Maritime traffic survey (2012)

Existing road network performance

Average speeds and travel times on the primary freight route, described above, within the Wattle Street interchange to St Peters interchange corridor are shown in **Table 8-40**. The low speeds and long travel times indicate the peak hour congestion currently experienced along this route.

Table 8-40 Average speed and average travel time along key roads within the Wattle Street interchange to St Peters interchange corridor (2016 survey data)

Location	Direction	Average speed (km/hr)		Average travel time (min:sec)	
		AM peak	PM peak	AM peak	PM peak
Railway Terrace/Livingstone Road/Sydenham Road/Railway Road (Old Canterbury Rd – Princes Highway)	Northbound	18	19	13:10	12:40
	Southbound	22	23	11:20	11:10

8.3 Assessment of potential impacts

8.3.1 Construction

During construction, the project may affect the surrounding road network as a result of:

- Construction vehicles using the surface road network, especially heavy vehicles transporting spoil
- Surface road works, requiring temporary traffic, cyclist and/or pedestrian diversions, road occupation and temporary road closures
- Temporary changes to speed limits.

Overview of construction traffic and vehicle routes

Construction of the project would result in additional heavy and light vehicle movements on the road network in three broad categories:

- Removal of spoil generated by construction activities
- Heavy vehicle deliveries and other heavy vehicles involved in construction activities
- Light vehicle movements associated with construction of the project.

Construction traffic routes for the project would use the existing motorway and arterial road network as much as possible, reducing traffic related impacts on local roads.

Spoil would be transported from construction ancillary facilities to spoil management locations, generally along arterial roads and the M4 East Motorway, the New M5 Motorway, the M5 East Motorway and the M5 South West Motorway.

Construction traffic management and access

Construction traffic generation and distribution

The project would generate around four million cubic metres of spoil, the majority of which would be generated from excavation of the tunnels. As such, the primary facilities for receipt and dispatch of spoil would be the tunnel construction sites.

The project would seek to reuse at least 95 per cent of uncontaminated spoil, either within the project or at other locations. Where reasonable and practicable, spoil would be managed according to the following hierarchy:

- Minimisation of spoil generation through design and management
- Reuse of spoil within the project
- Beneficial reuse of spoil outside the project
- Where reuse is not possible, disposal of spoil would be the last resort.

Five potential sites have been identified for receiving excess spoil from the project, as summarised in **Table 8-41**. Negotiations for the final destination(s) for excess spoil would be carried out during detailed design, and may include one or more of the sites listed in **Table 8-41** or other alternatives.

Table 8-41 Potential spoil management sites

Spoil management site	Location	Distance from the project (kilometres)	Capacity for site to accept spoil (m^3)
Horsley Park (manufacturing facility)	Wallgrove Road at Horsley Park	About 40	Capacity for all project spoil
Blacktown Waste Services (landfill)	920 Richmond Road at Marsden Park	About 45	250,000
Sakkara Development (industrial estate)	Riverstone Parade at Riverstone	About 45	3,500,00
Kurnell Landfill	330 Captain Cook Drive at Kurnell	About 20	7,000,000
Moorebank Intermodal Terminal Precinct	Moorebank Avenue, Moorebank	About 30	2,500,000

Note: The Horsley Park spoil management site is a manufacturing facility and currently does not have a definitive limit for the amount of spoil it can receive.

Indicative haulage routes from the construction ancillary facilities are shown in **Chapter 6** (Construction work) and in **Appendix H** (Technical working paper: Traffic and transport). Spoil haulage routes would be confirmed during detailed design. Delivery of concrete to support tunnel construction would originate from batching plants close to the project footprint, although other sources may also be required. Other materials required for construction would, where available, originate from within the Sydney region and surrounds and would be delivered by vehicles using the arterial road network to access the various construction sites.

Table 8-42 provides details of light and heavy vehicle volumes predicted to arrive and depart from construction ancillary facilities during a typical AM peak hour, PM peak hour and daily period. Light vehicles are comprised of passenger and commercial vehicles. The table shows that the highest volumes of heavy and light construction vehicles are forecast at the Rozelle civil and tunnel site (C5). Construction vehicles would use the M4 East and New M5 tunnels at Haberfield and St Peters rather than the surface road network, wherever possible.

The daily and peak hour volumes shown in **Table 8-42** are based around targeted spoil haulage between 7.00 am and 6.00 pm. However, 24 hour spoil haulage would be required during tunnelling at five construction ancillary facilities, and the table shows indicative heavy vehicle volumes for these sites. Spoil haulage would only occur during standard daytime construction hours at the Darley Road civil and tunnel site to minimise heavy vehicle movements at night at this location. The peak hour identified is representative of highest estimated construction volumes and falls within the broader peak periods experienced on the network.

Construction workforce parking

A number of the project's staff and labour force would be expected to drive to construction sites and would therefore require car parking. The number of construction personnel requiring parking would vary over the duration of the construction program.

It is anticipated that construction workforce parking would be primarily provided at the following sites:

- Northcote Street civil site (C3a) – around 150 car parking spaces (Option A)
- Parramatta Road East civil site (C3b) – around 140 car parking spaces (Option B)
- Rozelle civil and tunnel site (C5) – around 400 car parking spaces
- Campbell Road civil and tunnel site (C10) – around 150 car parking spaces.

These facilities would be used to provide worker parking and shuttle bus transfers to other nearby construction sites.

Due to the generally constrained nature of the other construction sites, only minimal car parking for construction workers would be provided at these locations. Typically, these sites would provide between four to 20 parking spaces intended to be used by engineers and other construction management staff. Parking of construction-related vehicles in adjacent local roads would occur, particularly during site establishment.

The construction workforce would be encouraged to use public transport. Victoria Road and Parramatta Road are major transport corridors that have multiple bus routes. The Inner West Light Rail Line runs along the southern side of City West Link with stops near the Rozelle Rail Yards at Rozelle Bay and Lilyfield; and at the Darley Road civil and tunnel site (Leichhardt North light rail stop). The T3 Bankstown Line stops at St Peters Station around 800 metres north of the Campbell Road civil and tunnel site. However, workers starting or ending shifts very early or very late would be more likely to use private vehicles.

A car parking strategy would be developed as part of the Construction Traffic and Access Management Plan (CTAMP) to limit impacts on parking for the surrounding communities. The strategy would be developed in consultation with local councils and stakeholders associated with public facilities adjacent to project sites, as well as with the M4 East and New M5 contractors (where relevant) to identify opportunities to access parking during their respective construction periods and once those periods are completed.

The car parking strategy would include items such as forecasting of construction parking demand, review of existing parking supply and use on local streets in the area, impact on existing parking, consultation activities and proposed mitigation measures, such as management of workforce parking and transport, alternative parking arrangements and communication and engagement. This would include the identification of areas where there are high levels of existing parking demand around the construction ancillary facilities and works sites and identifying alternative car parking sites for use by the construction workforce. Processes for monitoring, reporting and corrective actions would also be part of the strategy.

Table 8-42 Indicative daily and peak period construction traffic volumes

Location		Daily vehicles (one way)		AM peak hour (7.30–8.30 am)				PM peak hour (4:15–5:15 pm)			
		Heavy vehicles	Light vehicles	Heavy vehicles		Light vehicles		Heavy vehicles		Light vehicles	
				Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart
Option A											
C1a	Wattle Street civil and tunnel site[1]	133	50	7	7	10	-	7	7	-	50
C2a	Haberfield civil and tunnel site[1]	136	90	7	7	30	-	7	7	-	90
C3a	Northcote Street civil site	100	150	5	5	50	-	5	5	-	150
Option B											
C1b	Parramatta Road West civil and tunnel site[1]	140	10	7	7	10	-	7	7	-	10
C2b	Haberfield civil site	10	20	2	2	10	-	2	2	-	10
C3b	Parramatta Road East civil site	30	150	3	3	50	-	3	3	-	150
All options											
C4	Darley Road civil and tunnel site	100	70	7	7	10	-	7	7	-	70
C5	Rozelle civil and tunnel site[1]	517	350	23	23	100	-	23	23	-	350
C6	The Crescent civil site	10	20	2	2	0		2	2		5
C7	Victoria Road civil site	42	140	2	2	0	-	2	2	-	0
C8	Iron Cove Link civil site	42	140	2	2	15	-	2	2	-	140
C9	Pyrmont Bridge Road tunnel site[1]	133	70	7	7	20	-	7	7	-	70
C10	Campbell Road civil and tunnel site[1]	133	70	7	7	20	-	7	7	-	70
WHT[2]	Proposed future Western Harbour tunnel site[1] (cumulative impact assessment scenario only)	200	24	10	10	24	-	10	10	-	24

Notes:

1: Spoil haulage would occur 24 hours per day, seven days per week

2: Indicative daily, AM and PM peak hour construction traffic volumes for a cumulative impact scenario where a section of the Rozelle civil and tunnel site (C5) is handed over for use for construction of the proposed future Western Harbour Tunnel and Beaches Link project are included in **Table 8-42**. These indicative construction traffic volumes have been used to carry out the cumulative construction traffic impact assessment in **Chapter 26** (Cumulative impacts)

Access routes

The proposed access routes to the construction ancillary facilities are summarised in **Table 8-43** and shown in **Chapter 6** (Construction work). Wherever possible, access is proposed to be gained directly from major arterial roads. The project is also investigating the use of a marshalling area for spoil trucks to further assist in staggering the arrival of vehicles to site. This would be located in a non-residential area and in close proximity to the arterial road network and construction ancillary facilities where tunnelling would occur. This measure would assist in preventing queuing and parking of heavy vehicles on local roads in the vicinity of the project.

The distribution of light vehicles across the road network would be more varied. For the purposes of this assessment, light vehicle trips have been considered on top of background traffic and distributed accordingly. For all sites, except for the Campbell Road civil and tunnel site (C10), the distribution of access is assumed to be via the M4 Motorway, Victoria Road, Anzac Bridge and Parramatta Road, with the proportion via each varying for each site. For the Campbell Road civil and tunnel site (C10), access for light vehicles is assumed to be divided equally between access from the Princes Highway from the north and the south.

Table 8-43 Indicative access routes to and from construction ancillary facilities

Site	Access and egress points	
	Heavy vehicles[1]	Light vehicles
Wattle Street civil and tunnel site (C1a)	• Parramatta Road then Wattle Street via M4-M5 Link entry and exit ramps	• Parramatta Road then Wattle Street northern (eastbound) carriageway (right in, right out)
Haberfield civil and tunnel site (C2a)	• Below ground: via the WestConnex M4 East tunnels • Above ground: Wattle Street (left-in, left-out)	• Wattle Street southern westbound) carriageway (left-in, left-out) • Walker Avenue • Parramatta Road
Northcote Street civil site (C3a)	• Parramatta Road (left-in, left-out)	• Wolseley Street • Wattle Street (left-out)
Parramatta Road West civil and tunnel site (C1b)	• Parramatta Road (left-in, left-out) • Alt Street (crossover between sites only)	• Parramatta Road (left-in, left-out) • Alt Street
Haberfield civil site (C2b)	• Wattle Street (left-in, left-out) • Parramatta Road (left-in, left-out)	• Wattle Street (left-in, left-out) • Parramatta Road (left-in, left-out) • Walker Avenue (left-in, left-out)
Parramatta Road East civil site (C3b)	• Parramatta Road (left-in, left-out)	• Parramatta Road (left-in, left-out) • Alt Street • Bland Street
Darley Road civil and tunnel site (C4)	• City West Link then Darley Road[2]	• City West Link then Darley Road
Rozelle civil and tunnel site (C5)	• City West Link (left-in from eastbound carriageway, right-out to westbound carriageway)	• Lilyfield Road
The Crescent civil site (C6)	• The Crescent (left-in, right-out)	• The Crescent
Victoria Road civil site (C7)	• Victoria Road (left-in, left-out)	• Victoria Road (left in, left out) • Hornsey Street

Site	Access and egress points	
	Heavy vehicles[1]	Light vehicles
Iron Cove Link civil site (C8)	• Victoria Road (left-in, left-out)	• Victoria Road (left-in, left-out)
Pyrmont Bridge Road tunnel site (C9)	• Parramatta Road (left-in) • Pyrmont Bridge Road (left-out)	• Pyrmont Bridge Road
Campbell Road civil and tunnel site (C10)	• Albert Street via Campbell Road and Princes Highway	• Albert Street via Campbell Road

Notes:

1 Some use of local roads by heavy vehicles delivering materials and/or equipment may also be required, however this would be minimised as far as practicable.

2 Spoil haulage vehicles would enter and exit the Darley Road civil and tunnel site (C4) via City West Link.

Construction ancillary facilities

Twelve construction ancillary facilities are described and assessed in this EIS (see **Table 8-44**). The construction ancillary facilities would be used for a combination of civil surface works, tunnelling and tunnelling support, construction workforce parking and administrative purposes.

The number, location and layout of construction ancillary facilities would be finalised as part of detailed construction planning during detailed design and would meet the environmental performance outcomes stated in the EIS and the Submissions and Preferred Infrastructure Report and satisfy criteria identified in any relevant conditions of approval.

To assist in informing the development of a construction methodology that would manage constructability constraints and the need for construction to occur in a safe and efficient manner, while minimising impacts on local communities, the environment, and users of the surrounding road and other transport networks, two possible combinations of construction ancillary facilities at Haberfield and Ashfield have been assessed in this EIS. The construction ancillary facilities that comprise these options have been grouped together in this EIS and are denoted by the suffix *a* (for Option A) or *b* (for Option B) eg C1a Wattle Street civil and tunnel site. Although both of these options have been assessed in this EIS, only one of these options would be used during construction.

Table 8-44 Proposed construction ancillary facilities

Construction ancillary facility	
Option A	
C1a	Wattle Street civil and tunnel site
C2a	Haberfield civil and tunnel site*
C3a	Northcote Street civil site
Option B	
C1b	Parramatta Road West civil and tunnel site
C2b	Haberfield civil site*
C3b	Parramatta Road West civil and tunnel site
Both options	
C4	Darley Road civil and tunnel site
C5	Rozelle civil and tunnel site
C6	The Crescent civil site
C7	Victoria Road civil site
C8	Iron Cove Link civil site

C9	Pyrmont Bridge Road tunnel site
C10	Campbell Road civil and tunnel site

Surface construction, including road works, and the establishment of construction ancillary facilities may result in traffic related impacts, including:

- Alterations to:
  - Existing property access
  - Existing pedestrian and cyclist access and movements
  - Location of existing bus stops
  - Local traffic environment
- Temporary road closures
- Temporary impacts on bus stop locations
- Temporary changes to pedestrian and cyclist access and movements.

Where applicable, these impacts have been assessed for each of the areas where surface construction, including road works, would occur. Construction ancillary facility locations are shown in **Figure 8-8**.

Figure 8-8 Location of the construction ancillary facilities

Haberfield Option A – Wattle Street civil and tunnel site (C1a)

Location and construction activities

The Wattle Street civil and tunnel site (C1a) would be located above and below ground along Wattle Street at Haberfield between Parramatta Road and Ramsay Street. This construction ancillary facility would use land above ground that is currently being used as a construction site for the M4 East project.

Roadheaders would be launched below ground from the Wattle Street entry and exit ramps to excavate the tunnels that would connect the Wattle Street entry and exit ramps with the M4-M5 Link mainline tunnels. Works at this site would also be supported by the facilities at Haberfield civil and tunnel site (C2a) and car parking and laydown at Northcote Street civil site (C3a).

Spoil handling on the site would occur 24 hours a day, seven days a week. Where practical, spoil would be removed during the day, outside of peak periods. Reasonable and practicable management strategies would be investigated to minimise the volume of heavy vehicle movements at night. The construction activities at this location are expected to occur between 2019 and 2022.

Entry and exit

The Wattle Street interchange entry and exit ramps that will be constructed as part of the M4 East project would be used for spoil removal. Heavy vehicles would enter the site via the eastbound entry ramp, be loaded with spoil underground within the tunnels, and then exit the site to Wattle Street via the westbound exit ramp. Light vehicles would enter and exit the site via a left-in/left-out arrangement off the eastbound Wattle Street carriageway.

Local road impacts

No traffic or access impacts are expected on surrounding local roads with heavy and light vehicle access and egress taken directly to and from Wattle Street.

Haberfield Option A – Haberfield civil and tunnel site (C2a)

Location and construction activities

The Haberfield civil and tunnel site (C2a) would be located above and below ground around the south-eastern corner of the Parramatta Road and Wattle Street intersection, extending along Parramatta Road between Wattle Street and Walker Avenue. This construction ancillary facility would use land above ground that is currently being used as a construction ancillary facility for the M4 East project.

The below ground section of the Haberfield civil and tunnel site would be within the M4 East tunnel stubs being built by the M4 East project and would support tunnelling of the mainline tunnels. The above ground section of the site would be used to support civil construction of a substation, and fitout of permanent operational infrastructure including the Parramatta Road ventilation facility (being constructed as part of the M4 East project).

Roadheaders would be launched from this site below ground to excavate the mainline tunnels. Spoil handling on the site would occur 24 hours a day, seven days a week. Excavated spoil from tunnelling would only be stockpiled within the tunnels. The construction activities at this location are expected to occur between 2019 and 2022.

Entry and exit

Trucks would enter the eastbound stub tunnel from the M4 East mainline tunnels, be loaded with spoil, and exit to the westbound M4 East mainline tunnels. No tunnel spoil would be removed to the surface via the Haberfield civil and tunnel site – all spoil would be transported below ground via the M4 East mainline tunnels.

Heavy vehicles delivering materials and equipment would enter and exit the surface section of the Haberfield civil and tunnel site via the westbound Wattle Street carriageways. Light vehicles would enter and exit the site via the westbound Wattle Street carriageways, the southbound Parramatta Road carriageways, and via Walker Avenue.

Local road impacts

About 90 daily light vehicle trips are expected to access the site distributed between three access points. The impact on Walker Avenue is expected to be minor given light vehicle trips would be dispersed between the access points, and the alternative access points from this site are from the arterial road network. Workforce car parking for this site would also be located at the Northcote Street civil site (C3a).

Haberfield Option A – Northcote Street civil site (C3a)

Location and construction activities

The Northcote Street civil site (C3a) at Haberfield would be located between Wattle Street and Wolseley Street at Haberfield. This construction ancillary facility would use land that is currently being used as a construction ancillary facility for the M4 East project. The site would be used for construction workforce parking and to support construction activities at the nearby civil and tunnel sites, including laydown and storage of materials.

The use of the laydown area and light vehicle parking would occur 24 hours a day, seven days a week. Reasonable and practicable management strategies would be investigated to minimise the volume of heavy vehicles using the laydown area at night. The construction activities at this location are expected to occur between 2019 and 2022.

Entry and exit

Heavy vehicles would enter and exit the site to and from Parramatta Road. Light vehicles would enter the site via Wolseley Street and an egress only point for light vehicles would be provided on to Wattle Street. During construction, Northcote Street would be closed at the intersection with Parramatta Road and the site would occupy around 100 metres of Northcote Street east of Parramatta Road. Northcote Street would be reopened to Parramatta Road when construction is complete.

Local road impacts

Wolseley Street is a local road and around 150 daily light vehicle trips are expected to access the site. While these trips would only access the site from Wolseley Street with egress onto Wattle Street, there is likely to be a minor impact on Wolseley Street during construction as these trips would be dispersed to correspond with shift start and end times. No heavy vehicle impacts are expected on local roads with heavy vehicle access and egress taken directly to and from Parramatta Road.

Haberfield and Ashfield Option B – Parramatta Road West civil and tunnel site (C1b)

Location and construction activities

The Parramatta Road West civil and tunnel site (C1b) would be located west of Parramatta Road from around Alt Street to Bland Street at Ashfield. The site would be used for tunnelling support during construction and would include temporary site offices, a workshop and storage facilities, a laydown area, entry and exit points for construction traffic, a temporary substation, temporary ventilation for the tunnels, a temporary water treatment plant and sediment pond, workforce amenities and car parking. A construction site for the M4 East project is located south of Bland Street on the western side of Parramatta Road. The construction activities at this location are expected to occur between 2018 and 2022.

Entry and exit

Construction traffic would enter and exit the site to and from the western (northbound) carriageway of Parramatta Road via new driveways. There would also be a vehicle cross-over point on Alt Street to allow construction vehicles to move between the parts of this site that are on the northern and southern sides of Alt Street.

Local road impacts

Heavy vehicle impacts on local roads would be minimised with heavy vehicle access and egress taken directly to and from Parramatta Road. The cross-over on Alt Street is likely to cause minor impacts on motorists and pedestrians using Alt Street when construction vehicles are moving between the sites. These minor impacts would be minimised through construction traffic management measures (see **section 8.5**). Due to existing property driveways being able to be augmented for use during construction, there would be no loss of on-street parking on Alt Street or Bland Street, west of Parramatta Road.

Haberfield and Ashfield Option B – Haberfield civil site (C2b)

Location and construction activities

The Haberfield civil site would be located around the south-eastern corner of the Parramatta Road and Wattle Street intersection, extending along Parramatta Road between Wattle Street and Walker Avenue. This construction ancillary facility would use land that is currently being used as a construction ancillary facility for the M4 East project. The Haberfield civil site (C2b) would be used to support civil construction of a substation, and fitout of permanent operational infrastructure including the Parramatta Road ventilation facility (being constructed as part of the M4 East project). The site would include temporary site offices, workshop and storage facilities, laydown areas, ingress and egress for heavy and light vehicles, workforce amenities and car parking. The construction activities at this location are expected to occur between 2018 and 2022.

Entry and exit

Heavy vehicles delivering materials and equipment would enter and exit the site via the westbound Wattle Street carriageways. Light vehicles would enter and exit the site via Wattle Street and Walker Avenue.

Local road impacts

While Walker Avenue is a local road, around 90 daily light vehicle trips are expected to be accessing the site, and these trips are distributed between three access points. Therefore, the impact on Walker Avenue would be minor. The majority of workforce car parking for this area would be located at the Parramatta Road East civil site (C3b).

Haberfield and Ashfield Option B – Parramatta Road East civil site (C3b)

Location and construction activities

The Parramatta Road East civil site (C3b) would be located east of Parramatta Road at Haberfield between Alt Street and Bland Street. The Parramatta Road East civil site (C3b) would be used to support tunnelling construction activities that would occur at the Parramatta Road West civil site (C1b), and to provide construction workforce parking. The site would include temporary site offices, ingress and egress for light vehicles, workforce amenities and car parking. The construction activities at this location are expected to occur between 2018 and 2022.

Entry and exit

Heavy vehicles delivering materials and equipment would enter and exit via the southbound Parramatta Road carriageways. In addition to using the Parramatta Road access, light vehicles would also be able to enter and exit the site using the Alt Street and Bland Street access points.

Local road impacts

With about 150 daily light vehicle trips expected, split between the three access points, the potential impact on Alt Street and Bland Street would be minor. Due to existing property driveways, there would be no loss of on-street parking on Alt Street or Bland Street, east of Parramatta Road.

Darley Road civil and tunnel site (C4)

Location and construction activities

The Darley Road civil and tunnel site would be located between the Inner West Light Rail line corridor to the north and Darley Road to the south. The site is currently occupied by a commercial premise. Immediately adjacent in the northeast corner of the site is the Leichhardt North light rail stop.

Spoil handling on the site would occur 24 hours a day, seven days a week, within an acoustic shed. Spoil removal would occur between 7.00 am and 6.00 pm Monday to Friday, and between 8.00 am and 1.00 pm on Saturdays. Where practical, spoil would be removed during the day, outside of peak periods. Construction activities at this location are expected to occur between 2018 and 2022.

Entry and exit

It is anticipated that the majority of construction traffic would enter the site from the southern (westbound) carriageway of Darley Road via new driveways. Heavy vehicles associated with spoil haulage would travel eastbound on City West Link and turn right into Darley Road. A temporary right turn lane at the intersection of City West Link and Darley Road would be provided for use by construction vehicles. Heavy vehicles would exit the site by turning left onto Darley Road before turning left onto City West Link.

The southern approach of the City West Link/James Street intersection has a blind corner and a steep approach, which could cause difficulties for trucks departing the Darley Road civil and tunnel site and turning left onto City West Link westbound. Traffic signal phasing and timing to allow loaded trucks to safely traverse the intersection has been considered in the construction impact assessment. This includes consideration of changes to traffic signal and phasing on the operation of the intersection of City West Link and James Street/Darley Road at Leichhardt. Signal phasing and timing changes were included in the construction assessment.

Impacts on the surrounding road network

Temporary changes to Darley Road to enable access to and from the ancillary facility would likely be required, including changes to lane marking to provide a temporary turning lane for construction traffic and temporary diversions to the pedestrian path on the northern side of Darley Road. These would be confirmed following the appointment of a design and construction contractor.

Heavy vehicle movements associated with the removal of spoil from tunnelling would occur via access and egress directly to and from Darley Road and City West Link. Reasonable and practicable management strategies would be investigated to minimise the volume of heavy vehicle movements during peak periods.

On-street parking along the eastbound carriageway of Darley Road between around Francis Street and Charles Street would be removed (about 20 spaces) during construction. Impacts on the kiss and ride parking for the light rail stop will be considered in the Construction Traffic Access and Management Plan.

Rozelle civil and tunnel site (C5)

Location and construction activities

The Rozelle civil and tunnel site (C5) would be located within the Rozelle Rail Yards between Lilyfield Road to the north, City West Link to the south, Victoria Road to the east and the CBD and South East Light Rail Rozelle maintenance depot to the west.

Roadheaders would be launched from this site to excavate the Rozelle interchange, the Iron Cove Link and the stub tunnels that would enable connections to the proposed future Western Harbour Tunnel and Beaches Link project. Acoustic sheds would be built to minimise noise from out-of-hours tunnelling and spoil handling.

Tunnelling and spoil management would also be carried out within the cut-and-cover sections of the tunnels at the eastern end of the site. Tunnel spoil would be transported to a stockpile within the cut-and-cover structures, with sufficient space for about two heavy vehicles to be loaded with spoil.

Spoil handling on the site would occur 24 hours a day, seven days a week. The construction activities at this location are expected to occur between 2018 and 2023.

Entry and exit

Heavy vehicle access would be via City West Link. Vehicles would enter the site from the eastbound carriageway of City West Link via slip lanes and new driveways. A new temporary signalised intersection would be built along City West Link and a new northern leg added to the intersection with The Crescent to enable vehicles to exit the site and turn right at both these locations, to head westbound on City West Link. Around five light vehicle access points would be constructed along Lilyfield Road to enable light vehicle access and egress.

Local road impacts

The main local road impacts would be on Lilyfield Road. While 350 daily light vehicle trips are expected to access the site, the impact would be spread out through the use of five access and egress points along Lilyfield Road, depending on where the vehicles are required and where they are coming from. As a worst case, this would equate to an increase in two-way weekday daily vehicles of around 10 to 15 per cent depending on the location on Lilyfield Road.

The Crescent civil site (C6)

Location and construction activities

The Crescent civil site (C6) would be located between The Crescent and Rozelle Bay on land owned by Roads and Maritime. The site would be used to support the realignment of The Crescent, including the construction of a new bridge over Whites Creek, widening and improvement works to Whites Creek, and construction of the drainage outfall and culvert that would direct flows through and from the Rozelle Rail Yards to Rozelle Bay. The construction activities at this location are expected to occur between 2019 and 2021.

Entry and exit

It is anticipated that heavy vehicles would enter the site via a left-in from The Crescent (southbound). They would then travel through the site, turn around and exit back onto The Crescent northbound via a right hand turn. Temporary traffic management measures would be established to enable access and egress arrangements.

Heavy vehicle movements would be carried out during non-peak periods where feasible and reasonable. Light vehicles would enter via the same arrangement, but may also exit southbound along The Crescent towards Johnston Street.

Local road impacts

No impacts from construction vehicles are expected on local roads with heavy and light vehicle access and egress directly to and from The Crescent.

Victoria Road civil site (C7)

Location and construction activities

The Victoria Road civil site (C7) would be located on the western side of Victoria Road between Quirk Street and Lilyfield Road on land currently occupied by commercial and residential properties. The existing buildings and other structures on the site would be demolished to facilitate establishment of temporary site offices, a laydown area, workforce amenities and car parking. A portion of this site would be occupied by operational road infrastructure during operation. The construction activities at this location are expected to occur between 2019 and 2022.

Entry and exit

Heavy vehicles would enter and exit the site via left-in/left-out access points off the westbound Victoria Road carriageway.

Local road impacts

Minor impacts from construction vehicles are expected to the eastern end of Hornsey Street. On street parking along the eastbound carriageway would be removed (about four spaces) during construction, although this would be lessened by the removal of the traffic to and from the commercial properties that would be replaced by the Victoria Road civil site.

Iron Cove Link civil site (C8)

Location and construction activities

The Iron Cove Link civil site (C8) would be located along the southern side of Victoria Road at Rozelle between Byrnes Street and Springside Street. The site would be located on land currently occupied by Victoria Road and residential and commercial properties that are being acquired.

The site would be mainly used to support construction of the Iron Cove Link surface works, including tunnel entry and exit ramps and upgrades and modifications to the eastbound and westbound carriageways of Victoria Road. There is no provision at this site to operate roadheaders, however the site may be used to support limited excavation of the initial sections of the Iron Cove Link tunnels.

During operation, a portion of the site would be occupied by the Iron Cove Link motorway operations complex (MOC4) including the Iron Cove Link ventilation facility. The construction activities at this location are expected to occur between 2018 and 2023.

Entry and exit

Heavy and light vehicles would enter and exit the site via left-in/left-out accesses off the northbound Victoria Road carriageway.

Local road impacts

Temporary changes to the local road network would be required to enable construction of the permanent design and the operation of the Iron Cove Link civil and tunnel site during construction. The Clubb Street/Victoria Road intersection would also be permanently closed before the start of construction.

The Toelle Street and Callan Street intersections with Victoria Road would generally remain open during construction. There would be instances where one of these intersections would be closed temporarily to construct the permanent design, however these works would be short term and conducted during non-peak times, where practical, especially as these roads would be carrying additional traffic form the closure of Clubb Street. Regard would also be given to the peak periods of use of King George Park when considering temporary closures. When construction is complete, these intersections would be reopened in the same arrangement as existing (ie left-in, left-out).

There would be loss of limited on-street parking spaces on Clubb Street, Toelle Street and Callan Street, west of Victoria Road. This would be confirmed following the appointment of a design and construction contractor. These parking spaces are adjacent to properties being acquired and so the impact of their loss would be reduced.

Further detail on the temporary and permanent changes to the surface road network around the Iron Cove Link civil site are provided in **Chapter 5** (Project description) and **Chapter 6** (Construction work).

Pyrmont Bridge Road tunnel site (C9)

Location and construction activities

The Pyrmont Bridge Road tunnel site (C9) would be located between Parramatta Road and Pyrmont Bridge Road at Annandale on land currently occupied by commercial and light industrial premises. The construction ancillary facility would be mainly used to support tunnelling construction activities.

Roadheaders would be launched from this site and would excavate the temporary access tunnel and the mainline tunnels. Spoil handling on the site would occur 24 hours a day, seven days a week. Where practical, spoil would be removed during the day, outside of peak periods. Reasonable and practicable management strategies would be investigated to minimise the volume of heavy vehicle movements at night. The construction activities at this location are expected to occur between 2018 and 2022.

Entry and exit

Heavy vehicle access to the site would be from the northern (eastbound) carriageway of Parramatta Road. Vehicles would enter via a new driveway, travel in an anti-clockwise direction via an internal access road and exit onto Pyrmont Bridge Road via a new temporary signalised intersection. Light vehicle access would be from Pyrmont Bridge Road, either via the temporary signalised intersection or a separate give-way access.

Local road impacts

No impacts from construction vehicles are expected on local roads with heavy and light vehicle access and egress directly to and from Parramatta Road and Pyrmont Bridge Road.

Works would be carried out to realign Bignell Lane between Mallett Street and Pyrmont Bridge Road. Short-term, temporary closure of Bignell Lane would be required during construction to allow for the realignment works, but rear-access to commercial properties along Bignell Lane would be maintained during construction.

Campbell Road civil and tunnel site (C10)

Location and construction activities

The Campbell Road civil and tunnel site (C10) would be located within the St Peters interchange site on the southern side of Albert Street and Campbell Road at St Peters. The site would be used to support tunnelling of the mainline tunnels and the entry and exit ramps that would connect the St Peters interchange with the M4-M5 Link mainline tunnels. A portion of the site would be used for the Campbell Road motorway operations complex (MOC5) during operation, including the Campbell Road ventilation facility.

Roadheaders would be launched from this site and would excavate the entry and exit ramps and mainline tunnels, travelling in a northerly direction. Spoil handling would occur within the cut-and-cover structure below Campbell Road being built as part of the New M5 project and within an acoustic shed. Spoil handling on the site would occur 24 hours a day, seven days a week. Where practical, spoil would be removed during the day, outside of peak periods. Reasonable and practicable management strategies would be investigated to minimise the volume of heavy vehicle movements at night. Heavy vehicle movements outside of standard construction hours associated with the removal of spoil from tunnelling would only occur via access and egress directly to and from Campbell Road. The construction activities at this location are expected to occur between 2018 and 2022.

Entry and exit

Vehicles would enter and exit the site from Albert Street via the signalised intersection on Campbell Road that is being built as part of the New M5 project. Within the site, an access driveway would provide access between Albert Street and the acoustic shed and cut-and-cover structure.

Local road impacts

Negligible impacts on local roads are expected. Heavy and light vehicles would need to cross over Albert Street to access Campbell Road, however traffic volumes along this section of Albert Street are expected to be low, and standard construction traffic management and measures would be used to minimise potential disruptions.

Background traffic volumes and patterns

Based on the construction program, 2021 has been used as the assessment year for construction impacts, as this is when peak construction traffic volumes are expected. The M4 East and New M5 projects are expected to be operational by 2019 and 2020 respectively; hence their construction would not overlap in the 2021 assessment year. In overlapping years prior to this, it is expected that the main construction works for the M4 East and the New M5 projects would be completed and the main construction works for the M4-M5 Link project would not have commenced. Potential cumulative construction traffic impacts are assessed in **Chapter 26** (Cumulative impacts).

The background traffic used in the construction impact assessment is shown in **Table 8-45**. Between the 2015 base case and 2021 there are significant changes to forecast traffic volumes on some key arterial roads close to the construction ancillary facilities.

Close to the intersection of Parramatta Road and Wattle Street, traffic decreases by about 40 per cent in both the AM and PM peak periods as traffic shifts from Parramatta Road onto the M4 East. There are substantial increases in background traffic on Parramatta Road, east of the Wattle Street interchange. This increase reflects both the increase in background traffic growth from 2015 to 2021, and the increase in vehicles using the M4 East at Haberfield.

There are also substantial increases in forecast traffic near the St Peters interchange. These forecast changes are reflective of the increase in traffic accessing or exiting the operational New M5 as well as the forecast population and land use changes in the area.

Table 8-45 Construction year (2021) background traffic growth

Roadway location and direction		AM peak hour (veh/hr)[1]			PM peak hour (veh/hr)[1]		
		2015 Base	2021	% Change	2015 Base	2021	% Change
Parramatta Road north of Wattle Street – Haberfield	Eastbound	2,670	1,840	-31%	3,170	2,080	-34%
	Westbound	2,410	1,310	-46%	2,440	1,310	-46%
Wattle Street east of Parramatta Road – Haberfield	Eastbound	1,260	740	-41%	1,610	1,110	-31%
	Westbound	1,280	860	-33%	1,380	730	-47%
City West Link west of Darley Road – Rozelle	Eastbound	2,090	2,120	1%	2,170	2,230	3%
	Westbound	1,810	1,940	7%	2,040	2,110	3%
Darley Road west of James Street – Haberfield	Eastbound	670	680	1%	530	540	1%
	Westbound	350	480	37%	650	660	0%
City West Link west of The Crescent – Rozelle	Eastbound	2,470	2,520	2%	2,340	2,440	4%
	Westbound	1,640	1,800	10%	1,930	1,850	-4%
City West Link east of The Crescent – Rozelle	Eastbound	3,520	3,520	0%	3,080	3,210	4%
	Westbound	2,260	2,560	13%	2,940	3,000	2%
Victoria Road east of Darling Street – Rozelle	Eastbound	3,260	3,570	10%	2,420	2,470	2%
	Westbound	1,580	1,740	10%	2,770	3,010	9%
Parramatta Road west of Pyrmont Bridge Road – Camperdown	Eastbound	2,720	2,860	5%	1,740	2,060	18%
	Westbound	1,490	1,800	21%	2,470	2,670	8%
Pyrmont Bridge Road, east of Parramatta Road – Camperdown	Eastbound	490	540	10%	280	310	9%
	Westbound	290	360	24%	660	730	11%
Princes Highway south of Campbell Street – St Peters	Northbound	1,800	2,270	26%	1,050	1,100	5%
	Southbound	570	890	56%	1,750	1,890	8%

Notes:

[1] Traffic volume rounded to nearest 10

Source: Based on WRTM v2.3 outputs

Construction impact assessment - Option A

Road level of service

An analysis of roadway service levels was carried out to determine the impact of construction traffic in 2021, and includes consideration of the spoil reuse sites. Theoretical mid-block roadway capacities were based on Austroads *Guide to Traffic Management* and these capacities and assessment results are shown in **Table 8-46** for the AM peak and PM peak hours. In reality, some roads may carry more traffic than the theoretical capacity. If a link is over capacity, this would result in queueing further back in the network, reducing the capacity of the links. However, this assessment provides a high level indication of the level of impact of the construction vehicles compared to the background traffic.

Mid-block traffic level of service demonstrates the impact of construction traffic in 2021 for all construction activities (see **section 8.1.8** for further details on measures of network performance).

Several locations on arterial roads connecting to the construction ancillary facilities are forecast to exceed the theoretical roadway capacity with the increased background traffic and construction traffic in the 2021 AM and PM peak hours. However, the majority of these would exceed their theoretical capacity due to forecast growth in background traffic.

Construction traffic is forecast to change the mid-block level of service at four locations:

- At two locations – Wattle Street, east of Parramatta Road, and Darley Road, west of James Street – the mid-block level of service drops but remains at an acceptable LoS C or LoS D
- On City West Link, west of Darley Road, the eastbound mid-block level of service is forecast to decrease from LoS E to LoS F in the PM peak hour
- On City West Link, west of The Crescent, the westbound mid-block level of service is forecast to decrease from LoS D to LoS E in the PM peak hour.

A CTAMP will be prepared as part of the Construction Environmental Management Plan (CEMP). The CTAMP will include the guidelines, general requirements and principles of traffic management to be implemented during construction and will seek to minimise delays and disruptions and identify and respond to any changes in road safety as a result of highway construction works. Further details on the management of construction impacts are provided in **section 8.5**.

Table 8-46 Option A – Construction year (2021) mid-block operational performance summary

Location and direction		Mid-block capacity	2021 AM peak hour (veh/hr)[1]						2021 PM peak hour (veh/hr)[1]					
			Without construction			With construction			Without construction			With construction		
			Flow	V/C	LoS	Flow	V/C	LoS	Flow	V/C	LoS	Flow	V/C	LoS
Parramatta Road north of Wattle Street – Haberfield	EB	3,300	1,840	0.56	C	1,890	0.57	C	2,080	0.63	D	2,240	0.68	D
	WB	3,300	1,310	0.40	C	1,330	0.40	C	1,310	0.40	C	1,370	0.41	C
Wattle Street east of Parramatta Road – Haberfield	EB	2,000	740	0.37	B	760	0.38	B	1,110	0.55	C	1,260	0.63	D
	WB	2,000	860	0.43	C	880	0.44	C	730	0.37	B	790	0.39	C
City West Link west of Darley Road – Rozelle	EB	2,300	2,120	0.92	E	2,180	0.95	E	2,230	0.97	E	2,320	1.01	F
	WB	2,300	1,940	0.84	E	1,990	0.86	E	2,110	0.92	E	2,240	0.97	E
Darley Road west of James Street – Haberfield	EB	1,000	680	0.68	D	680	0.68	D	540	0.54	C	610	0.61	D
	WB	1,000	480	0.48	C	490	0.49	C	660	0.66	D	660	0.66	D
City West Link west of The Crescent – Rozelle	EB	2,300	2,520	1.10	F	2,560	1.11	F	2,440	1.06	F	2,460	1.07	F
	WB	2,300	1,800	0.78	D	1,810	0.79	D	1,850	0.80	D	2,030	0.88	E
City West Link east of The Crescent – Rozelle	EB	3,400	3,520	1.04	F	3,530	1.04	F	3,210	0.94	E	3,210	0.95	E
	WB	3,400	2,560	0.75	D	2,580	0.76	D	3,000	0.88	E	3,010	0.89	E
Victoria Road east of Darling Street – Rozelle	EB	3,250	3,570	1.10	F	3,570	1.10	F	2,470	0.76	D	2,510	0.77	D
	WB	3,200	1,740	0.54	C	1,740	0.54	C	3,010	0.94	E	3,040	0.95	E
Parramatta Road west of Pyrmont Bridge Road – Camperdown	EB	2,300	2,860	>1.2	F	2,870	>1.2	F	2,060	0.90	E	2,070	0.90	E
	WB	2,300	1,800	0.78	E	1,810	0.78	E	2,670	1.16	F	2,710	1.18	F
Pyrmont Bridge Road, east of Parramatta Road – Camperdown	EB	1,800	540	0.30	B	550	0.31	B	310	0.17	A	310	0.17	A
	WB	1,800	360	0.20	A	370	0.21	A	730	0.41	C	780	0.43	C
Princes Highway south of Campbell Street – St Peters	EB	2,200	2,270	1.03	F	2,290	1.04	F	1,100	0.50	C	1,100	0.50	C
	WB	3,300	890	0.27	B	890	0.27	B	1,890	0.57	D	1,930	0.59	D

Notes: [1]Rounded to nearest 10, [2] V/C is an abbreviation for volume to capacity ratio, [3] EB is an abbreviation for eastbound, [4] WB is an abbreviation for westbound

Intersection level of service

The intersection performance results for the road network under the 2021 ‘without construction’ and ‘with construction’ forecast traffic volumes for the AM and PM peak are summarised in **Table 8-47** and **Table 8-48**. These intersection levels of service are not directly comparable to those presented in the operational modelling results, as those had exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, removed.

The intersections assessed were grouped into six corridors (or clusters). A summary of the construction traffic impacts within each of these clusters is provided in the following sections. Detailed discussion on the potential impacts within each cluster is provided in **Appendix H** (Technical working paper: Traffic and transport).

Cluster 1: Parramatta Road and Wattle Street corridors at Haberfield

Cluster 1 consists of the following intersections:

- Parramatta Road/Harris Road
- Parramatta Road/Croydon Road/Arlington Street
- Parramatta Road/Great North Road
- Parramatta Road/Frederick Street/Wattle Street
- Parramatta Road/Bland Street
- Wattle Street/Ramsay Street
- Dobroyd Parade/Waratah Street
- Dobroyd Parade/Timbrell Drive/Mortley Avenue.

The construction modelling forecasts a number of intersections to operate with high levels of delay (LoS E or F) in the ‘without construction’ scenario. In the ‘with construction’ scenario, the performance at most intersections along Parramatta Road is impacted, with larger impacts forecast to occur at the intersections along Wattle Street and Dobroyd Parade. Management and mitigation measures for construction traffic impacts are outlined in **section 8.5**.

Cluster 2: City West Link at Leichhardt

Cluster 2 consists of the following intersections:

- City West Link/James Street
- City West Link/Norton Street
- Darley Road/ Darley Road civil and tunnel site (C4) access.

The modelling indicates that City West Link/James Street intersection is forecast to operate at LoS F in the ‘without construction’ scenario and City West Link Road/Norton Street intersection is forecast to operate at LoS C during both peaks.

In the ‘with construction’ scenario, the rightmost through lane from City West Link eastbound would be temporarily converted into a turning lane to allow construction vehicles to turn right into James Street. A new traffic signal phase is required to operate this movement safely, which would impact the performance of this intersection. This phase would only be required to run once every two cycles. The level of service is forecast to remain at LoS F and average delays at the intersection are expected to increase during the AM and PM peak hours in the ‘with construction’ scenario.

The left turn movement from James Street into City West Link westbound is allocated a green time of at least 30 seconds in each cycle in both peaks, to accommodate what may be a difficult turn for construction heavy vehicles to make, given the obscured corner and steep approach on James Street (as noted in **section 8.2.4**).

Cluster 3: City West Link and The Crescent at Lilyfield

Cluster 3 consists of the following intersections:

- City West Link/The Crescent
- The Crescent/James Craig Road
- City West Link/Rozelle civil and tunnel site (C5) western access.

The construction modelling indicates that in the 'without construction' scenario, City West Link/The Crescent and The Crescent/James Craig Road intersections are forecast to operate satisfactorily at LoS D or better in both peaks. With about 135 PCU and 325 PCU added to the network in the AM and PM peaks respectively in the 'with construction' scenario, the operational performance at the intersections is forecast to worsen.

In the 'with construction' scenario, the new eastern access road to the Rozelle civil and tunnel site (C5) is accommodated as the northern approach to City West Link/The Crescent intersection. Construction vehicles are only permitted to turn right out of this access road onto City West Link westbound. However, safe operation requires a new traffic signal phase. It is expected that this phase would only be required to run once every three cycles. In the AM peak, City West Link/The Crescent intersection level of service is forecast to drop from LoS D to LoS E with an increase in average delay of about 15 seconds. In the PM peak, the level of service is forecast to remain at LoS C.

A new temporary signalised intersection is also proposed on City West Link about 400 metres west of The Crescent, accommodating a second (western) site access to the Rozelle civil and tunnel site (C5). Construction vehicles are similarly only permitted to turn right out of this access road, with a traffic signal phase required to safely accommodate this movement. This intersection is forecast to operate at LoS A in both AM and PM peak hours.

There is no adverse impact expected on The Crescent/James Craig Road intersection, with LoS B forecast in both 'without construction' and 'with construction' scenarios in both peaks.

Cluster 4: Victoria Road at Rozelle

Cluster 4 consists of the following intersections:

- Victoria Road/Wellington Street
- Victoria Road/Darling Street
- Victoria Road/Evans Street.

The modelling indicates the Victoria Road/Wellington Street intersection in the AM peak and the Victoria Road/Darling Street intersection in the PM peak are forecast to operate at LoS F in the 'without construction' scenario.

About 60 PCU and 200 PCU are added to the networks in the AM and PM peak hours respectively in the 'with construction' scenario. The performance of the intersections would be impacted in Cluster 4, however levels of service are expected to remain at the same level as in the 'without construction' scenario, except for the Victoria Road/Wellington Street intersection, which is forecast to worsen slightly from LoS B to LoS C in the PM peak hour. The impact on the Victoria Road/Evans Street intersection is expected to be minimal in the AM peak hour; however, the level of service is forecast to worsen from LoS C to LoS E in the PM peak hour.

Cluster 5: Parramatta Road at Camperdown

Cluster 5 consists of the following intersections:

- Parramatta Road/Pyrmont Bridge Road
- Pyrmont Bridge Road/ Pyrmont Bridge Road tunnel site (C9) access
- Pyrmont Bridge Road/Booth Street/Mallett Street.

About 60 PCU and 100 PCU are added to the network in the AM and PM peaks respectively in the 'with construction' scenario. This is shown to have minimal impact on the operation of the intersections, with levels of service at both the Parramatta Road/Pyrmont Bridge Road and Pyrmont Bridge Road/Booth Street/Mallett Street intersections forecast to operate at the same level of service as the 'without construction' scenario.

The Pyrmont Bridge Road/C8 site access intersection is forecast to operate at LoS A in both peaks.

Cluster 6: Princes Highway at St Peters

Cluster 6 consists of the following intersections:

- Princes Highway/Campbell Street
- Princes Highway/Mary Street/Canal Road
- Princes Highway/Railway Road
- Campbell Street/Albert Street.

The analysis is based on the upgrade of the Princes Highway/Campbell Street intersection, as part of the New M5 project. The upgrade involves widening the Campbell Street south-east leg to three lanes in each direction and the Campbell Street north-west leg to two lanes in each direction, as well as localised widening to accommodate turn pockets. The upgrade will be operational by 2021.

The modelling shows significant congestion on the Princes Highway corridor with all three Princes Highway intersections forecast to operate at LoS F in the 'without construction' scenario during the AM and PM peak hours.

In the 'with construction' scenario, 50 PCU and 75 PCU are added to the network in the AM and PM peaks respectively. The average level of delay at the intersections is forecast to increase, but the level of service is forecast to remain the same as in the 'without construction' scenario, except at the Princes Highway/Mary Street/Canal Road intersection in the PM peak, which would operate at LoS F in the AM peak 'with construction' scenario.

At some intersections, stable or minor improvements in performance (with the addition of construction volumes) can occur as a result of upstream intersections operating over capacity and/or cluster optimisation effects which distribute delay. When capacity is reached, upstream intersections can behave as bottlenecks, reducing traffic flow at downstream intersections, though delays are increased at the upstream intersections.

Summary

The construction impact assessment found that the most substantial impacts are forecast to be at the western end of the project footprint, as spoil trucks travel to the potential spoil management sites to the west of the project from the construction ancillary facilities and back. Light construction vehicle traffic would also contribute to these impacts, although these would use more dispersed routes.

Mitigation measures to manage these impacts would be developed as part of the CTAMP, and could include:

- Restriction of heavy vehicle right turns at City West Link/James Street and City West Link/The Crescent intersections during peak hours
- Staggering or rescheduling shift times to avoid a large generation of light vehicles during peak hours.

The assessment of potential construction traffic and transport impacts is a worst-case assessment based on peak construction traffic levels. Adverse impacts would be expected to reduce once peak construction is complete. A CTAMP will be prepared as part of the CEMP. The CTAMP will include the guidelines, general requirements and principles of traffic management to be implemented during construction and will seek to minimise delays and disruptions and identify and respond to any changes in road safety as a result of highway construction works. Further details on the management of construction impacts are provided in **section 8.5**.

Table 8-47 Option A – 2021 AM peak hour intersection operational performance summary

Cluster	Intersection	Without construction		With construction	
		Volume (PCU)[1]	LoS	Volume (PCU)[1]	LoS
1	Parramatta Road | Harris Road	2,550	B	2,650	C
	Parramatta Road | Croydon Road | Arlington Street	3,280	B	3,370	B
	Parramatta Road | Great North Road	3,810	C	3,940	C
	Parramatta Road | Frederick Street | Wattle Street	4,880	D	4,940	D
	Parramatta Road | Bland Street	2,870	F	2,870	F
	Wattle Street | Ramsay Street	3,260	C	3,280	C
	Dobroyd Parade | Waratah Street	3,470	B	3,650	B
	Dobroyd Parade | Timbrell Drive | Mortley Avenue	5,530	F	5,720	F
2	City West Link | James Street	5,530	F	5,720	F
	City West Link | Norton Street	5,290	C	5,450	C
	Darley Road | C4 site access	–	–	1,200	A
3	The Crescent | James Craig Road	6,730	B	6,760	B
	City West Link | The Crescent	6,800	D	6,880	E
	City West Link | C5 site access	–	–	4,780	A
4	Victoria Road | Wellington Street	6,510	F	6,600	F
	Victoria Road | Darling Street	6,980	E	7,030	E
	Victoria Road | Evans Street	5,850	B	5,870	B
5	Parramatta Road | Pyrmont Bridge Road	5,050	C	5,090	C
	Pyrmont Bridge Road | Booth Street | Mallett Street	1,970	B	1,990	B
	Pyrmont Bridge Road | C9 site access	–	–	950	A
6	Princes Highway | Railway Road	5,370	F	5,400	F
	Princes Highway | Mary Street | Canal Road	4,910	F	4,940	F
	Princes Highway | Campbell Street	5,260	F	5,290	F
	Campbell Street | Albert Street	5,090	A	5,130	A

Notes: [1]Traffic volume rounded to nearest 10

Table 8-48 Option A – 2021 PM peak hour intersection operational performance summary

Cluster	Intersection	Without construction		With construction	
		Volume (PCU)[1]	LoS	Volume (PCU)[1]	LoS
1	Parramatta Road | Harris Road	3,040	B	3,240	C
	Parramatta Road | Croydon Road | Arlington Street	3,610	D	3,710	E
	Parramatta Road | Great North Road	3,820	F	3,920	F
	Parramatta Road | Frederick Street | Wattle Street	4,950	E	5,200	E
	Parramatta Road | Bland Street	2,500	B	2,520	B
	Wattle Street | Ramsay Street	3,080	D	3,330	E
	Dobroyd Parade | Waratah Street	2,960	B	3,240	B
	Dobroyd Parade | Timbrell Drive | Mortley Avenue	5,450	F	5,770	F
2	City West Link | James Street	5,640	F	5,990	F
	City West Link | Norton Street	5,700	C	5,970	C
	Darley Road | C4 site access	–	–	1,210	A
3	The Crescent | James Craig Road	6,500	B	6,720	B
	City West Link | The Crescent	6,690	C	6,970	C
	City West Link | C5 site access	–	–	4,740	A
4	Victoria Road | Wellington Street	6,780	B	6,980	C
	Victoria Road | Darling Street	7,180	F	7,380	F
	Victoria Road | Evans Street	6,210	C	6,280	E
5	Parramatta Road | Pyrmont Bridge Road	4,970	F	5,040	F
	Pyrmont Bridge Road | Booth Street | Mallett Street	2,110	B	2,150	B
	Pyrmont Bridge Road | C9 site access	–	–	1,120	A
6	Princes Highway | Railway Road	5,730	F	5,780	F
	Princes Highway | Mary Street | Canal Road	5,090	E	5,140	F
	Princes Highway | Campbell Street	5,510	F	5,590	F
	Campbell Street | Albert Street	5,110	A	5,100	A

Notes: [1]Traffic volume rounded to nearest 10

Temporary road network changes, closures and diversions

It is anticipated that road network modifications would be required to facilitate construction of the project. Indicative modifications are outlined in **Table 8-49**.

Road network modifications and traffic staging would be reviewed during the preparation of CTAMP, with the objective of minimising disruptions to the road network. At all locations where road closures would be required, access to properties would be maintained during construction. Appropriate signage for road closures or detours would be installed.

Table 8-49 Indicative temporary road network modifications during construction – Option A

Location	Indicative road network modifications	Indicative duration	Road reinstatement
Wattle Street interchange	• Northcote Street would be closed at the intersection with Parramatta Road for the duration of construction. This would be a continuation of the current closure of this section of Northcote Street to facilitate construction of the M4 East project	• Until completion of tunnel works in 2022	Once construction is complete, the Northcote Street/Parramatta Road intersection would be reinstated
Darley Road civil and tunnel site (C4)	• Works would be carried out to facilitate access to the Darley Road civil and tunnel site (C4) including establishment of a temporary right hand turn lane for construction traffic to access Darley Road from City West Link • Temporary diversions along Darley Road may be required during construction (to enable establishment of construction vehicle access provisions) • One lane in each direction along Darley Road (between around Francis Street and Charles Street at Leichhardt) would generally be maintained, with temporary closures of one lane required for establishment of construction vehicle access provisions including installation of driveways and associated construction activities. Traffic management, that could include temporary diversions, would be implemented during temporary closures • Kerbside parking along the northern (eastbound) carriageway of Darley Road between around Francis Street and Charles Street would be removed (around 20 spaces) during construction	• Q3 2018 to Q1 2019 to complete road modifications • Q3 2018 to Q4 2022 including construction duration and reinstatement of roads	Once road modification works are complete, Darley Road would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the existing arrangement Kerbside parking along Darley Road would be reinstated at the end of construction
City West Link and The Crescent at Lilyfield and Rozelle	• Works would be carried out to facilitate ingress and egress for the Rozelle civil and tunnel site (C5) including establishment temporary intersections, slip lanes and driveways • Works would be carried out to upgrade and improve the eastbound and westbound carriageways of City West Link and The Crescent • Temporary diversions would be put in place to allow for construction along the existing alignment • Under existing and diverted	• Q4 2018 to Q2 2019 to complete road modifications • Q4 2018 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads	When construction is complete, the road would be reinstated as per the permanent design shown in **Chapter 5** (Project description)

Location	Indicative road network modifications	Indicative duration	Road reinstatement
	arrangements, all traffic lanes in each direction would generally be maintained with some short-term lane closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences		
The Crescent at Annandale and Rozelle	• Works would be carried out to establish a new driveway for ingress and egress for The Crescent civil site (C6) • Works would be carried out to realign The Crescent and reconstruct the intersection with City West Link • The new alignment of The Crescent would be constructed 'offline' (that is, next to the existing alignment). Traffic would be switched onto the new alignment when ready, and the old alignment of The Crescent would be demolished • All traffic lanes in each direction would generally be maintained with some short-term lane closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences • Temporary changes to the intersection of The Crescent/Chapman Road may be required. Access to the commercial premises, including the Multihull Central Marina, that use Chapman Road as well as the Glebe Foreshore Parklands would be protected and maintained at all times • Traffic signal modifications at the intersection with City West Link in line with the temporary and permanent design	• Q4 2018 to Q2 2019 to complete road modifications • Q4 2018 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads	Once road modification works are complete, the road would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the permanent design
Victoria Road at Rozelle	• All traffic lanes in each direction would generally be maintained with some short-term lane closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences • Traffic signal modifications at the intersection with The Crescent in line with the permanent design • Temporary diversions would be put in place at the intersection with The Crescent to allow for construction of the new bridge in line with the	• Q4 2018 to Q2 2019 to complete road modifications • Q4 2018 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads	Once road modification works are complete, the road would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the permanent design

Location	Indicative road network modifications	Indicative duration	Road reinstatement
	permanent design. This could include the construction a temporary bridge next to the existing bridge, onto which traffic would be switched during construction of the new bridge. When complete, traffic would be switched onto the new bridge and the temporary bridge would be removed		
Gordon Street south of Lilyfield Road at Rozelle	• Gordon Street between Lilyfield Road and the Rozelle Rail Yards would be permanently closed as part of the project	• N/A	Gordon Street would be permanently closed.
Lilyfield Road at Rozelle	• Temporary closures to one lane would be required for short periods of time to allow for construction of the construction access driveways, utility works and construction of the cut-and-cover structures • Access to Lilyfield Road from Victoria Road may be temporarily restricted to allow for integration with the revised Victoria Road alignment. Closures would be outside of peak periods where feasible and reasonable. During these periods, alternative access to Lilyfield Road would be available from Hornsey Street and Gordon Street	• Q4 2018 to Q2 2019 to complete road modifications • Q2 2019 to Q4 2019 for utility relocations • Q4 2018 to Q3 2023 including construction duration staging and reinstatement of roads	Once works are completed, the road would be reopened in line with permanent design
Hornsey Street at Rozelle	• One lane in each direction would generally be maintained during construction • Access to Hornsey Street from Victoria Road would require full closure for short periods of time during realignment and upgrade works to Victoria Road • Alternative access to Hornsey Street would be available from Lilyfield Road and Gordon Street	• Q4 2018 to Q2 2019 to complete road modification • Q4 2018 to Q3 2023 including construction duration staging and reinstatement of roads	Once works during the stage are completed, the road would be reopened in line with permanent design
Quirk Street at Rozelle	• One lane in each direction would generally be maintained during construction • Access to Quirk Street from Victoria Road would require full closure for short periods of time during realignment and upgrade works to Victoria Road • Alternative access to Quirk Street would be available from Hornsey Street and Gordon Street	• Q4 2018 to Q2 2019 to complete road modifications • Q4 2018 to Q3 2023 including construction duration staging and reinstatement of roads	Once works during the stage are completed, the road would be reopened in line with permanent design
Iron Cove Link civil site (C8) and Victoria Road	• Works would be carried out along Victoria Road to facilitate ingress and egress for the Iron Cove Link civil site (C8)	• Q4 2018 to Q2 2019 to complete road modifications for	Once works are complete, the road would be reopened in line with

Location	Indicative road network modifications	Indicative duration	Road reinstatement
	• All traffic lanes in each direction would generally be maintained with some short-term lanes closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences • Temporary diversions would be put in place to allow for construction along the existing alignment	ingress and egress • Q4 2018 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads	temporary design. When construction is complete, the road would be reinstated as per the permanent design
Moodie Street at Rozelle	• Short-term, temporary closure of one lane of Moodie Street may be required during construction to facilitate utility works	• Q4 2018 to Q3 2023	Once construction is completed, Moodie Street would be reopened as per the existing design
Callan Street at Rozelle	• Access to Callan Street from Victoria Road would generally remain open during construction • Temporary closures at the intersection with Victoria Road to allow for integration with the revised Victoria Road alignment may occur. Closures would be outside of peak periods where feasible and reasonable subject to road occupancy licences • During these periods, alternative access to Callan Street would be available from Springside Street and McCleer Street at Rozelle	• Q4 2018 to Q3 2023	Once works are completed, the road would be reopened in line with permanent design
Toelle Street at Rozelle	• Access to Toelle Street from Victoria Road would generally remain open during construction • Temporary closures at the intersection with Victoria Road to allow for integration with the revised Victoria Road alignment may occur. Closures would be outside of peak periods where feasible and reasonable subject to road occupancy licences • During these periods, alternative access to Toelle Street would be available from Springside Street, McCleer Street, Callan Street and Manning Street at Rozelle	• Q4 2018 to Q3 2023	Once works are completed, the road would be reopened in line with permanent design
Clubb Street at Rozelle	• Access between Clubb Street and Victoria Road would be permanently closed and a cul de sac established to accommodate the revised alignment of Victoria Road • Access to Clubb Street would be available from Springside Street, McCleer Street, Callan Street and Manning Street	• N/A (closed at the start of construction)	Access to Clubb Street from Victoria Road would be permanently closed

Location	Indicative road network modifications	Indicative duration	Road reinstatement
Byrnes Street at Rozelle	• Short-term, temporary closure of one lane of Byrnes Street may be required during construction to facilitate utility works • Works would also be carried out to move the terminus near Victoria Road south to accommodate the revised design	• Q1 2019 to Q4 2019	Once utility works are completed, Byrnes Street would be reopened as per the existing layout. Once works on the cul de sac of Byrnes Street are complete, this section of the road would be reopened in line with the permanent design
Pyrmont Bridge Road tunnel site (C9)	• Works would be carried out along Parramatta Road and Pyrmont Bridge Road to facilitate ingress and egress for construction traffic • Works would be carried out to realign Bignell Lane between Mallett Street and Pyrmont Bridge Road at Annandale • Short-term, temporary closure of Bignell Lane would be required during construction to allow for the realignment works • Rear-access to commercial properties along Bignell Lane would be maintained during construction	• Q3 2018 to Q4 2018 to complete road modifications • Q3 2018 to Q3 2022 including construction duration and reinstatement of roads	Once construction is completed, roads would be reopened in line with the permanent design (ie realigned Bignell Lane)

The construction of major infrastructure in constrained urban environments requires detailed consideration of the staging of construction works. There are three key areas of the project which will require the preparation of detailed traffic staging plans during construction:

- **Victoria Road/City West Link/Anzac Bridge approach intersection** – reconstructing the intersection to accommodate existing connectivity, the new M4 East Motorway/Iron Cove Link to Anzac Bridge connections and construction of a new bridge at Victoria Road
- **City West Link/The Crescent intersection** – realigning The Crescent to the west, building a new bridge over Whites Creek and modifying the intersection
- **Victoria Road at Iron Cove** – realigning the westbound (southern) carriageway of Victoria Road to create sufficient space to build new tunnel portals and entry and exit ramps for the Iron Cove Link.

These works would be undertaken on parts of the arterial road network that are heavily trafficked and which provide important network connectivity. To construct these works would require the implementation of multiple traffic stages that meet the requirements of the construction contractor, Roads and Maritime, Transport Management Centre (TMC) and other key stakeholders. The traffic staging would likely require the creation of temporary carriageways, intersections and bridges offline from the existing road infrastructure to enable the construction of the new works and the switching of traffic.

Temporary closures and diversions, outside of peak hours would be required and would be undertaken following consultation with the TMC. Staging arrangements would be confirmed by the construction contractor during detailed design.

In preparing the traffic staging plans during construction the key considerations would include:

- Maintaining a safe environment for the public and the construction workforce
- Maintaining traffic and lane capacity, including bus or transit lane capacity, on the arterial road network particularly during peak periods
- Minimising delays to motorists utilising the affected parts of the arterial road network
- Undertaking the works efficiently to minimise the duration of traffic impacts
- Maintaining the safety of motorists, members of the public and construction personnel
- Minimising impacts on public transport services and providing alternative arrangements where necessary
- Minimising impacts on key active transport links and providing alternative arrangements where necessary.

Traffic crashes

Construction traffic volumes are expected to be low when compared to existing traffic volumes on key arterial roads connecting to the construction ancillary facility locations. The greatest increase is forecast to occur on City West Link west of the City West Link/James Street intersection where, as a worst-case scenario, construction would generate around 110 vehicles during the AM peak hour and around 220 vehicles in the PM peak hour. Compared to existing traffic volumes, total construction traffic would be the equivalent of around three per cent of peak hour traffic on City West Link at this location during the AM peak hour and five per cent of existing peak hour volumes in the PM peak hour.

The volume of traffic generated by construction is expected to be low compared to existing traffic. The effects of this short-term increase on the existing road network is not expected to substantially impact road safety in and around the study area, although there is still a risk with construction traffic interacting with general traffic, with elevated risk when construction-related vehicles are entering and leaving construction sites.

Foreseen impacts on road safety for all users during construction would be mitigated as much as possible through the provision of a CTAMP and would include the development of construction staging and temporary works that minimises conflicts with the existing road network and maximises spatial separation between work areas and travel lanes. Further management measures that would be incorporated in the CTAMP are detailed in **section 8.5.3**.

Public transport services

An increase in vehicles on the road network during the construction period is forecast to result in some increased delays at certain intersections. Heavy vehicle volumes would increase along major roads. The following impacts on public transport services in these areas would potentially be experienced:

Buses:

- Similar to general traffic, there would be an increase in bus travel times due to slower travel speeds and increased intersection delays. This would be partially mitigated by the presence of bus lanes along Victoria Road and Parramatta Road to be installed as part of the M4 East project (refer to condition of approval B34 for the M4 East project for details on the provision of bus lanes along Parramatta Road)
- Longer travel times to and from bus stops by supplementary travel modes (eg car passenger, walking to/from bus stops) due to an increase in traffic volumes, slower travel speeds and increased intersection delays
- Reduced amenity for bus users waiting at stops.

The traffic assessment has identified bus stops that would require relocation during construction for safety reasons, comprising

- The bus stops on The Crescent (northbound and southbound) at Annandale near the intersection with City West Link would be moved south towards Johnston Street to allow for construction along The Crescent. The northbound bus stop would be permanently moved south to accommodate the new alignment. The southbound bus stop would be reinstated in generally the same location. Alternative access from The Crescent to the Rozelle Bay light rail stop would also be provided during construction
- Three bus stops on Victoria Road (two on the northbound side and one on the southbound side) near the intersection with The Crescent would be relocated north to accommodate the reconstruction of Victoria Road. These bus stops would be reinstated in generally the same location at the completion of construction
- Two bus stops on Victoria Road near Iron Cove Bridge would be temporarily relocated (further east of the bridge) to allow for the widening works along Victoria Road. These bus stops would be reinstated in generally the same location at the completion of construction.

The modifications to bus stops would be reviewed during detailed design with the objective of minimising disruptions to public transport services. Bus stop relocations would be agreed with Transport for NSW and all affected bus operators.

Rail services

Bus service connections to railway stations may be affected due to a reduction in the reliability of bus services during the construction period. The project would have no direct impact on heavy rail services.

Light rail

Bus service connections to light rail stops may be affected due to a reduction in the reliability of bus services during the construction period. Pedestrian access to the Leichhardt North light rail stop adjacent to the Darley Road civil and tunnel site (C4) and the Rozelle Bay light rail stop next to The Crescent, would be maintained during construction. The project would not directly impact on operation of light rail services.

Walking and cycling

The construction impacts on pedestrians and cyclists have been assessed using the criteria outlined in **Table 8-50**. An increase in the number of vehicles during the construction period would potentially impact walking and cycling amenity. Pedestrian footways and cycle paths would also need to be diverted during construction.

Table 8-50 Active transport – impact severity criteria

Severity	Impact criteria
Negligible	• The impacts result in an imperceptible change (ie a very minor increase in traffic volumes) and do not require any mitigation
Minor	• Diversion of less than 200 metres on key routes and no new at-grade crossing • Negligible safety impact
Moderate	• Diversion of more than 200 metres but less than 500 metres on key routes • Negligible safety impact
High	• Diversion of more than 500 metres on key routes • Potential safety impact

Construction activities would be carried out in stages resulting in changing impacts over the course of the construction program. Further information on the staged construction of the project is provided in **Chapter 6** (Construction work). A key objective of the construction program would be to minimise disruption to pedestrians and cyclists and enable the use of the active transport links that would be provided as part of the project as soon as possible. Details about the active transport infrastructure that would be provided by the project are included in **Appendix N** (Technical working paper: Active transport strategy).

Wattle Street interchange construction ancillary facilities (C1a, C2a and C3a)

Construction is planned between 2018 and 2022 at these sites. There are limited changes to the surface network proposed at the Wattle Street interchange. Construction-related activity at the interchange would include civil and tunnelling work associated with the mainline tunnel and the Wattle Street entry and exit ramps, fit-out of the Parramatta Road ventilation facility that is being constructed as part of the M4 East project, and provision of parking for construction workers.

The east-facing portals to the M4 East tunnels would also provide an effective bypass of the Wattle Street/Parramatta Road intersection for construction vehicles from other construction sites (such as the Rozelle civil and tunnel site (C5)).

These factors, combined with relatively limited use of the interchange by cyclists due to it not being part of key commuter routes (refer to **Appendix N** (Technical working paper: Active transport strategy)), and no required diversions would mean that impacts on active transport would be negligible.

Darley Road civil and tunnel site (C4)

Temporary closure of the footpath on the northern side of Darley Road at Leichhardt, between around Canal Road and Darley Road, may be required. This would be most likely to occur during site establishment, when access to the Darley Road civil and tunnel site (C4) is being established. The footpath along the southern side of Darley Road would remain open at all times, and would act as an alternative to the northern footpath during temporary closures.

There is an on-road cyclist route on Darley Road at Leichhardt that connects to the Lilyfield Road commuter route via the City West Link/James Street intersection. No diversions of this on-road cyclist route would be required. However, traffic management measures would be implemented at the entry and exit driveways to manage potential interactions between construction traffic and pedestrians and cyclists.

The project would not affect the existing pedestrian path that runs along the southern side of City West Link and connects the Leichhardt North light rail stop with Charles Street at Lilyfield (via the bridge over City West Link).

Rozelle interchange construction ancillary facilities (C5, C6 and C7)

Construction at these sites is planned to occur between 2018 and 2023. Key regional active transport routes pass through the Rozelle interchange area.

Anticipated temporary pedestrian and cyclist diversions around the Rozelle interchange during construction are shown in **Table 8-9**. The permanent pedestrian and cyclist infrastructure that would be provided around the Rozelle interchange is described in **Chapter 5** (Project description) and **Appendix N** (Technical working paper: Active transport strategy).

<u>Lilyfield Road to Anzac Bridge (east–west)</u>

This route provides an east-west active transport link for pedestrians and cyclists between Lilyfield Road and Anzac Bridge including a crossing over Victoria Road at Rozelle via the existing Victoria Road pedestrian bridge. This bridge has limited width relative to demand and steep gradients with sharp 180 degree bends. It is therefore of low quality relative to its use and importance.

The Victoria Road pedestrian bridge would be demolished and removed at the start of construction. Prior to this occurring, an alternative connection to the western side of Victoria Road and the Lilyfield Road commuter route would be established via an underpass below Victoria Road into the Rozelle Rail Yards, and a ramp connection to Victoria Road and Lilyfield Road. This underpass would enable east-west trips to continue and it is anticipated that it will be converted into a portion of the permanent connection at the completion of construction. Although this would mean a permanent change to the alignment of this route, the impact of this alignment change would be negligible as the distance of the route would be similar and the quality of the connection would be equivalent to the existing route.

Temporary realignment of the section of this connection between Anzac Bridge and the western side of Victoria Road may also be required. Connections to the shared path on either side of Victoria Road would be retained. Temporary closures of the shared path along Victoria Road may be periodically required. Works would be staged so that the shared path on either the eastern or western side of Victoria Road at Rozelle would remain open at all times.

Johnston Street to Victoria Road and Anzac Bridge

The pedestrian and cycle bridge that spans City West Link and connects Anzac Bridge and Victoria Road with The Crescent and Johnston Street would be removed at the start of construction. Potential alternatives and diversions being considered for implementation include:

- The existing at-grade crossing between The Crescent and the western side of Victoria Road. This route would also allow for onward connection to the eastern side of Victoria Road and Anzac Bridge via the new pedestrian and cyclist underpass that would be provided below Victoria Road (see description of this underpass above). The diversion would be less than 200 metres and there would be negligible safety impact. However, there could be a minor increase in travel times due to delays waiting for the traffic signals to change. The impact of this change would therefore be Minor
- From Anzac Bridge to Somerville Road at Rozelle via the existing pedestrian and cycle ramp, then south west along Somerville Road and James Craig Road (using the shared path) towards the footpath on the southern side of The Crescent. This would result in a similar travel distance to the current route and would be a negligible impact.

Periodic, short-term closures of the footpath on one side of James Craig Road at Rozelle may be required during construction. During these instances, the footpath on the other side of James Craig Road would be used as an alternative route. Periodic, temporary closures of the footpath on the eastern and western side of The Crescent at Annandale between City West Link and Johnston Street at Annandale would also be required during construction. Works would be staged so that the shared path on one side of The Crescent would remain open at all times.

The project would also require permanent closure of the shared path through Buruwan Park connecting The Crescent with Bayview Crescent at Annandale (see **Table 8-9**). Alternative access for pedestrians to the Rozelle Bay light rail stop from The Crescent, Johnston Street and Bayview Crescent at Annandale would be provided at all times during construction. Cyclists travelling between The Crescent and Bayview Crescent/Railway Parade at Annandale would be diverted via Johnston Street.

Iron Cove Link civil site (C8)

Key temporary pedestrian and cyclist diversions around the Iron Cove Link civil site (C8) during construction are shown in **Figure 8-10**. The permanent pedestrian and cyclist infrastructure that would be provided around the Iron Cove Link tunnel portals is shown in **Chapter 5** (Project description) and **Appendix N** (Technical working paper: Active transport strategy).

Construction at this site is planned between 2018 and 2023. The key pedestrian and cycle route in this area connects Iron Cove Bridge shared path (on the southern side of Victoria Road), the shared paths on either side of Victoria Road and the Bay Run south of Victoria Road, which extends around Iron Cove.

A detour route would be provided for cyclists on the southern side of Victoria Road via Springside Street, McCleer Street, Callan Street, Manning Street and Byrnes Street. This would represent a travel distance of about 700 metres, 400 metres longer than the existing 300 metre section along Victoria Road. Given the length of the diversion and the corresponding increase in travel times for pedestrians and cyclists, the impact would be classed as Moderate.

A temporary link would be provided that would connect the Bay Run and Iron Cove Bridge. To minimise potential disruption to pedestrians and cyclists that use this link, a temporary ramp to Iron Cove Bridge shared path would be provided, to connect the Bay Run and Iron Cove Bridge (westbound) and Byrnes Street (eastbound, to connect with the diversion described above). This temporary diversion would not change the distance or travel times for users of the Bay Run and Iron Cove Bridge and would not result in additional safety impacts, and would therefore have a negligible impact.

Pyrmont Bridge Road civil and tunnel site (C9)

Construction at this site is planned for 2018–2022. The Pyrmont Bridge tunnel site is generally bound by Parramatta Road to the south, Pyrmont Bridge Road to the north and Mallett Street to the east. No significant changes to the surrounding road network are proposed with heavy vehicle ingress via Parramatta Road and egress via Pyrmont Bridge Road, and all light vehicle ingress and egress via Pyrmont Bridge Road.

The Inner City Regional Route for cyclists runs along Pyrmont Bridge Road at this location (identified as a 'bicycle friendly road') with connections via Parramatta Road (west) and Booth Street (northern continuation of Mallett Street). There are pedestrian footpaths on both sides of Parramatta Road and Pyrmont Bridge Road.

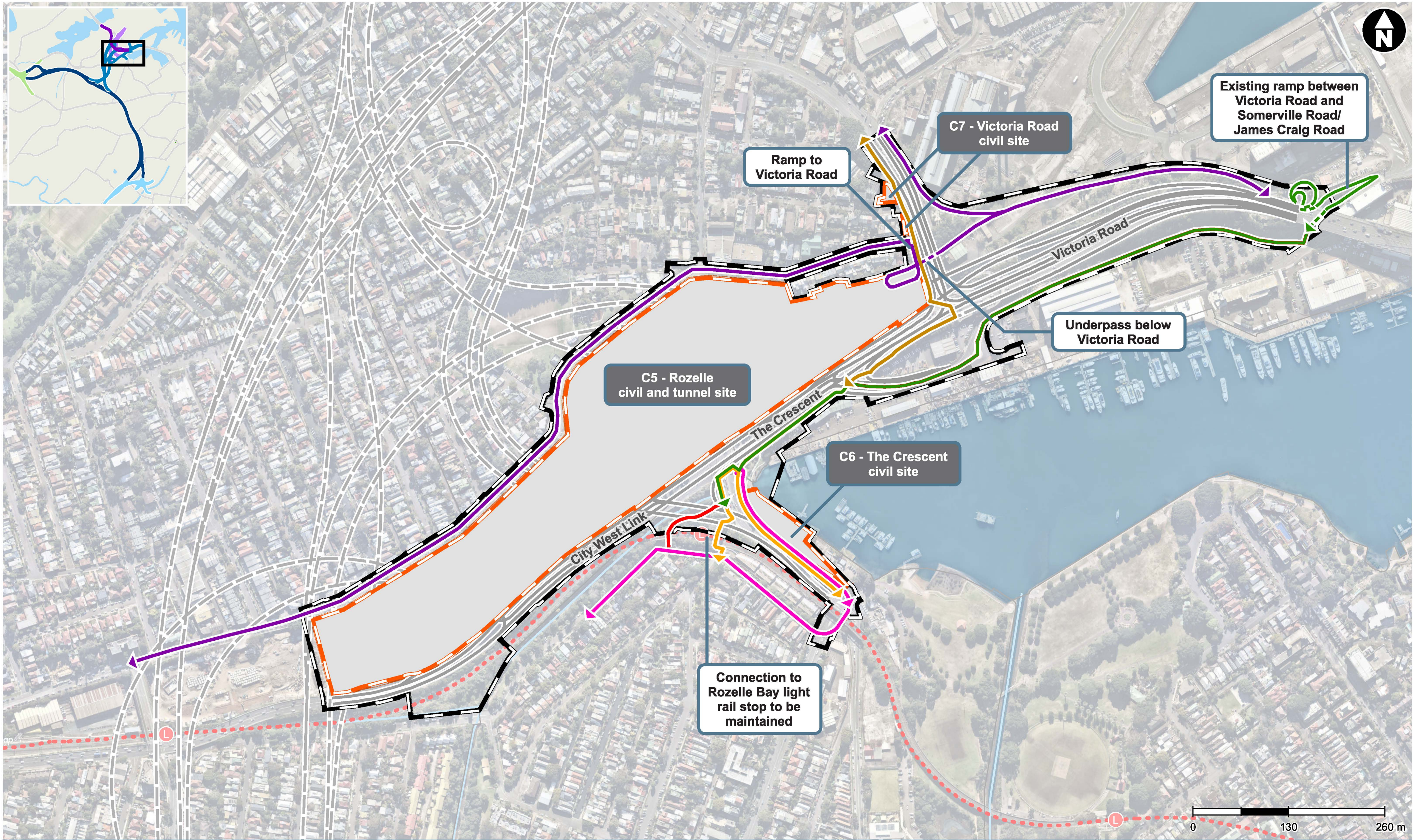
Minor impact is anticipated for pedestrians and cyclists at this location. Although there would be no requirement for diversions, there is the potential for interactions with construction vehicles, particularly where heavy vehicles enter the site from Parramatta Road and leave the site on to Pyrmont Bridge Road. Traffic management measures would be implemented at the entry and exit driveways on Parramatta Road and Pyrmont Bridge Road to manage potential interactions between construction traffic and pedestrians and cyclists.

Campbell Road civil and tunnel site (C10)

Construction at this site is planned for 2018–2023. The Campbell Road civil and tunnel site would be accessed from Albert Street, via the new signalised intersection on Campbell Road near Barwon Park Road (being constructed as part of the New M5 project). This intersection would provide signalised crossing for pedestrians and cyclists using the pedestrian and cycle paths along the southern side of Campbell Road at St Peters.

Campbell Road is currently used as a local route by cyclists due to low traffic volumes. The New M5 project would upgrade Campbell Road, and there is a forecast increase in traffic volumes. Delivery of the New M5 project would also include construction of a separated cycle path along Campbell Road (forming part of the Bourke Street Link), connecting Newtown to the Bourke Street Cycleway, Green Square and the Sydney CBD.

For pedestrians and cyclists using the new separated cycle path along Campbell Road, there would be the potential for interactions with construction vehicles entering and leaving the Campbell Road civil and tunnel site (C10). However, as part of the New M5 project, the Campbell Road/Albert Street intersection would be upgraded to a signalised intersection to cater for M4-M5 Link construction traffic entering and leaving the Campbell Road civil and tunnel site (C10), This signalised intersection would provide signalised crossing for pedestrians and cyclists using the new pedestrian and cyclist paths along the southern side of Campbell Road at St Peters. No diversions would be required. The impact on pedestrians and cyclists at this location would therefore be negligible.



LEGEND

Existing features
- Light rail
- Light rail stop

M4-M5 Link Rozelle interchange
- Surface road
- Tunnel

Boundaries
- Project footprint
- Ancillary facility

Active transport
- Catherine Street to Anzac Bridge
- The Crescent to Victoria Road
- The Crescent to Anzac Bridge
- Pedestrian diversion via The Crescent/Johnston Street/Bayview Crescent
- Cyclist diversion to Bayview Crescent via The Crescent
- Existing route to be removed

Figure 8-9 Pedestrian and cycle diversions at Rozelle

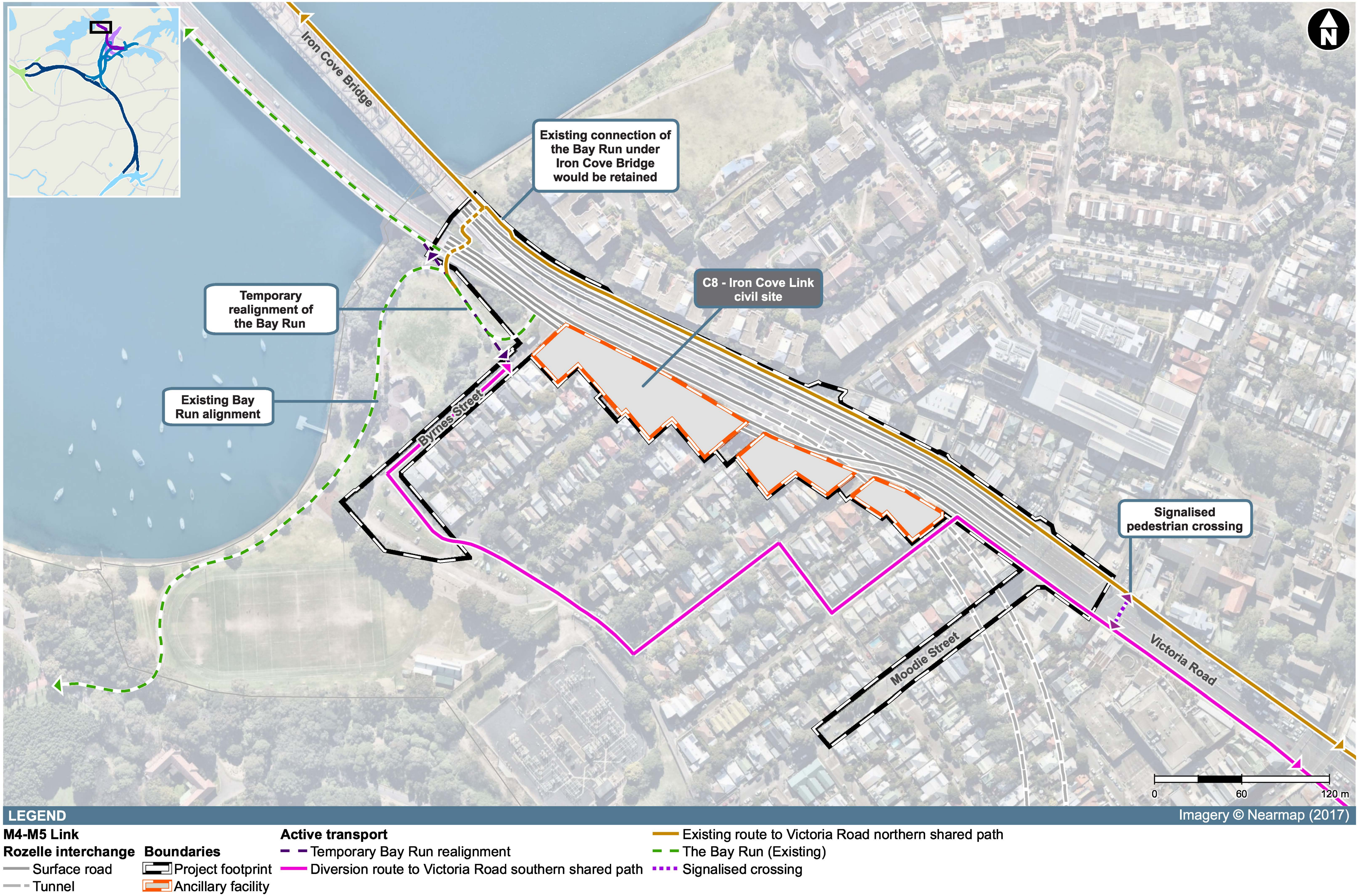


Figure 8-10 Pedestrian and cycle diversion at Iron Cove

Construction impact assessment - Option B

The results of the construction impact assessment for Option B presented in this section refer to impacts around the Parramatta Road and Wattle Street corridors at Haberfield, the City West Link corridor at Leichhardt and City West Link and The Crescent at Lilyfield. The construction impacts at other locations assessed as part of the Option A assessment would also apply (including impacts on public and active transport).

Road level of service

An analysis of roadway service levels was carried out to determine the impact of construction traffic in 2021, and includes consideration of the spoil reuse sites.

Mid-block traffic level of service demonstrates the impact of construction traffic in 2021 for all construction activities (see **section 8.1.8** for further details on measures of network performance). Theoretical mid-block roadway capacities were based on Austroads *Guide to Traffic Management* and these capacities and assessment results are shown in **Table 8-51** for the AM peak and PM peak hours. In reality, if a link is over capacity, this would result in queueing further back in the network. However, this assessment provides a high level indication of the level of impact of the construction vehicles compared to the background traffic.

The analysis shows that construction traffic generated by Option B has a minimal impact on roadway service levels, with one change in the mid-block level of service between the 'without construction' and 'with construction' scenarios to less than LoS D, with City West Link, west of The Crescent, forecast to decrease from LoS D to LoS E in the westbound direction in the PM peak hour.

As previously noted, in highly congested networks, singe-point assessment criteria, such as mid-block levels of service, do not present a complete picture of traffic operations. In reality, if a link is over capacity, this would result in queueing further back in the network. However, this assessment provides a high-level indication of the level of impact of the construction vehicles compared to the background traffic.

Table 8-51 Option B – 2021 mid-block operational performance summary

Location and direction		Mid-block capacity	2021 AM peak hour (veh/hr)[1] Without construction			2021 AM peak hour (veh/hr)[1] With construction			2021 PM peak hour (veh/hr)[1] Without construction			2021 PM peak hour (veh/hr)[1] With construction		
			Flow	V/C	LoS	Flow	V/C	LoS	Flow	V/C	LoS	Flow	V/C	LoS
Parramatta Road north of Wattle Street – Haberfield	EB	3,300	1,840	0.56	C	1,890	0.57	D	2,080	0.63	D	2,090	0.63	D
	WB	3,300	1,310	0.40	C	1,330	0.40	C	1,310	0.40	C	1,410	0.43	C
Wattle Street east of Parramatta Road – Haberfield	EB	2,000	740	0.37	B	740	0.37	B	1,110	0.55	C	1,110	0.56	C
	WB	2,000	860	0.43	C	870	0.43	C	730	0.37	B	740	0.37	B
City West Link west of Darley Road – Rozelle	EB	2,300	2,120	0.92	E	2,180	0.95	E	2,230	0.97	E	2,300	1.00	E
	WB	2,300	1,940	0.84	E	1,980	0.86	E	2,110	0.92	E	2,240	0.97	E
City West Link west of The Crescent – Rozelle	EB	2,300	2,520	1.10	F	2,550	1.11	F	2,440	1.06	F	2,460	1.07	F
	WB	2,300	1,800	0.78	D	1,810	0.79	D	1,850	0.80	D	2,000	0.87	E
City West Link east of The Crescent – Rozelle	EB	3,400	3,520	1.04	F	3,530	1.04	F	3,210	0.94	E	3,210	0.95	E
	WB	3,400	2,560	0.75	D	2,570	0.76	D	3,000	0.88	E	3,010	0.89	E

Notes: [1]Rounded to nearest 10

Intersection level of service

The Option B construction impact assessment is the same as Option A for Cluster 4: Victoria Road in Rozelle, Cluster 5: Parramatta Road in Camperdown, and Cluster 6: Princes Highway in St Peters. The analysis for the Option B construction impact assessment is therefore only Cluster 1: Parramatta Road and Wattle Street corridors in Haberfield, Cluster 2: City West Link corridor in Leichhardt, and Cluster 3: City West Link and The Crescent in Lilyfield.

Cluster 1

Cluster 1 consists of the following intersections:

- Parramatta Road/Harris Road
- Parramatta Road/Croydon Road/Arlington Street
- Parramatta Road/Great North Road
- Parramatta Road/Frederick Street/Wattle Street
- Parramatta Road/Bland Street
- Wattle Street/Ramsay Street
- Dobroyd Parade/Waratah Street
- Dobroyd Parade/Timbrell Drive/Mortley Avenue.

During the AM peak hour, the Parramatta Road/Bland Street and Dobroyd Parade/Timbrell Drive intersections are forecast to both operate at LoS F. High levels of delay at the Parramatta Road/Bland Street intersection can be attributed to the downstream exit blocking along Parramatta Road, resulting in significant exit blocking for the southbound movement. During the PM peak hour, the Parramatta Road/Frederick Street/Wattle Street intersection is forecast to operate at LoS E, while the Parramatta Road/Great North Road and Dobroyd Parade/Timbrell Drive intersections are forecast to operate at LoS F.

In the 'with construction' scenario, about 320 PCU and 510 PCU would be added to the network in the AM and PM peaks respectively. During both the AM and PM peak hours, about 50 per cent of this additional traffic is via the M4 East tunnels east of Ramsay Street, to access construction sites along City West Link and Victoria Road. The additional traffic due to construction is predominantly eastbound in the AM peak hour and westbound in the PM peak hour. As a result, the performance at most intersections along Parramatta Road would likely be impacted, with larger impacts at the intersections along Wattle Street and Dobroyd Parade.

During the AM peak hour, there would be an increase in traffic of up to about 105 PCU along Parramatta Road, resulting in relatively small impacts – the level of service is not forecast to worsen at modelled intersections in Cluster 1 for this option. At the eastern end of Cluster 1, it is estimated that an additional 100 PCU would emerge from the M4 East eastbound tunnels, and 65 PCU would enter the M4 East westbound tunnels. This would impact mostly on the Dobroyd Parade/Timbrell Drive intersection, which is already forecast to operate at LoS F in the 'without construction' scenario.

During the PM peak hour, there would be an increase in traffic of up to about 145 PCU along Parramatta Road. However, the impacts on intersections along Parramatta Road are forecast to be small. The level of service at two intersections are forecast to worsen compared to the 'without construction' scenario – the Parramatta Road/Harris Road intersection is forecast to worsen slightly from LoS B to LoS C and the Parramatta Road/Croydon Road/Arlington Street intersection from LoS D to LoS E.

The M4 East tunnels are forecast to accommodate an additional 75 PCU eastbound and 185 PCU westbound. This would subsequently impact on the Dobroyd Parade/Timbrell Drive intersection, however this intersection is forecast to operate at LoS F in the 'without construction' scenario.

Cluster 2

Cluster 2 consists of the following intersections:

- City West Link/James Street
- City West Link/Norton Street
- Darley Road/C4 site access.

The construction traffic modelling indicates City West Link/James Street intersection is forecast to operate at LoS F in the ‘without construction’ scenario and City West Link Road/Norton Street intersection is forecast to operate at LoS C during both peaks.

In the ‘with construction’ scenario, in addition to about 190 PCU and 320 PCU being added to the network in the AM and PM peak hours respectively, the rightmost through lane from City West Link eastbound would be temporarily converted into a turning lane to allow construction vehicles to turn right into James Street. A new traffic signal phase would be required to operate this movement safely, which would impact the performance of this intersection. The forecast volume is not large therefore this phase will only be required to run once every two cycles. The level of service is forecast to remain at LoS F, and average delays at the intersection are forecast to increase in the AM and PM peak hours in the ‘with construction’ scenario.

The left turn movement from James Street into City West Link westbound is allocated a green time of at least 30 seconds in each cycle in both peaks, to accommodate what may be a difficult turn for construction heavy vehicles to make, given the blind corner and steep approach on James Street. The impact on City West Link Road/Norton Street intersection is not forecast to be significant, with the level of service forecast to remain at LoS C in both peaks in both ‘without construction’ and ‘with construction’ scenarios.

The Darley Road/Charles Street intersection located on the southwest corner of the Darley Road tunnel site (C4) construction ancillary facility is proposed to be upgraded to a signalised intersection. It is also proposed to signalise the right turn for heavy vehicles entering the site off Darley Road about 30 metres east of this intersection. The phasing and timing of this signalised right turn would be coordinated with the corresponding right turn at the Darley Road/Charles Street intersection, to minimise delays to eastbound through traffic on Darley Road. This intersection is forecast to operate satisfactorily at LoS A in both AM and PM peak hours.

Cluster 3

Cluster 3 consists of the following intersections:

- City West Link/The Crescent
- The Crescent/James Craig Road
- City West Link/Rozelle civil and tunnel site (C5) western access.

The modelling indicates that in the ‘without construction’ scenario, City West Link/The Crescent and The Crescent/James Craig Road intersections are forecast to operate satisfactorily at LoS D or better in both AM and PM peak hours.

With about 130 PCU and 300 PCU added to the network in the AM and PM peak hours respectively in the ‘with construction’ scenario, the operational performance at the intersections is forecast to worsen.

In the ‘with construction’ scenario, the new eastern access road to the Rozelle civil and tunnel site (C5) would be accommodated as the northern approach to City West Link/The Crescent intersection. Construction vehicles would only be permitted to turn right out of this access road onto City West Link westbound; however safe operation would require a new traffic signal phase. It is forecast that this phase will only be required to run once every three cycles.

During the AM peak hour, City West Link/The Crescent intersection level of service is forecast to deteriorate from LoS D to LoS E with an increase in average delay of about 15 seconds. It is noted that the forecast increase in traffic due to construction is only about one per cent. During the PM peak hour, the level of service is forecast to remain at LoS C.

A new temporary signalised intersection is also proposed on City West Link about 400 metres west of The Crescent, accommodating a second (western) site access to the Rozelle civil and tunnel site (C5). Construction vehicles would similarly only be permitted to turn right out of this access road, with a traffic signal phase required to safely accommodate this movement. This intersection is forecast to operate at LoS A in both peaks.

There is no adverse impact expected on The Crescent/James Craig Road intersection, with LoS B forecast in both ‘without construction’ and ‘with construction’ scenarios in both peaks.

The intersection performance results for the road network under the 2021 ‘without construction’ and ‘with construction’ forecast volumes for the Option B scenario at Haberfield are summarised in **Table 8-52** and **Table 8-53** for the AM peak and PM peak respectively.

Table 8-52 Option B – 2021 AM peak hour intersection operational performance summary

Cluster	Intersection	Without construction		With construction	
		Volume (PCU)[1]	LoS	Volume (PCU)[1]	LoS
1	Parramatta Road | Harris Road	2,550	B	2,640	B
	Parramatta Road | Croydon Road | Arlington Street	3,280	B	3,360	B
	Parramatta Road | Great North Road	3,810	C	3,900	C
	Parramatta Road | Frederick Street | Wattle Street	4,880	D	4,970	D
	Parramatta Road | Bland Street	2,870	F	2,930	F
	Wattle Street | Ramsay Street	3,260	C	3,300	C
	Dobroyd Parade | Waratah Street	3,470	B	3,650	B
	Dobroyd Parade | Timbrell Drive | Mortley Avenue	5,530	F	5,720	F
2	City West Link | James Street	5,530	F	5,720	F
	City West Link | Norton Street	5,290	C	5,440	C
	Darley Road | C4 site access	–	–	1,200	A
3	The Crescent | James Craig Road	6,730	B	6,760	B
	City West Link | The Crescent	6,800	D	6,880	E
	City West Link | C5 site access	–	–	4,770	A

Notes:

[1] Rounded to nearest 10

Table 8-53 Option B – 2021 PM peak hour intersection operational performance summary

Cluster	Intersection	Without construction		With construction	
		Volume (PCU)[1]	LoS	Volume (PCU)[1]	LoS
1	Parramatta Road | Harris Road	3,040	B	3,180	C
	Parramatta Road | Croydon Road | Arlington Street	3,610	D	3,750	E
	Parramatta Road | Great North Road	3,820	F	3,960	F
	Parramatta Road | Frederick Street | Wattle Street	4,950	E	5,090	E
	Parramatta Road | Bland Street	2,500	B	2,640	B
	Wattle Street | Ramsay Street	3,080	D	3,120	D

Cluster	Intersection	Without construction		With construction	
		Volume (PCU)[1]	LoS	Volume (PCU)[1]	LoS
	Dobroyd Parade | Waratah Street	2,960	B	3,260	B
	Dobroyd Parade | Timbrell Drive | Mortley Avenue	5,450	F	5,750	F
2	City West Link | James Street	5,640	F	5,960	F
	City West Link | Norton Street	5,700	C	5,940	C
	Darley Road | C4 site access	–	–	1,210	A
3	The Crescent | James Craig Road	6,500	B	6,700	B
	City West Link | The Crescent	6,690	C	6,950	C
	City West Link | C5 site access	–	–	4,710	A

Notes:
[1] Rounded to nearest 10

Temporary closures and diversions during construction

In addition to the temporary road network modifications outlined in **Table 8-49**, additional modifications outlined in **Table 8-54** would be required as part of construction option B. Impacts from construction traffic and associated temporary network changes are considered above.

Table 8-54 Indicative temporary road network modifications during construction – Option B

Location	Indicative road network modifications	Indicative duration	Road reinstatement
Parramatta Road West civil and tunnel site (C1b) and Parramatta Road East civil site (C3b)	• Works would be carried out on Alt Street and Bland Street to facilitate access via new driveways to the Parramatta Road West civil and tunnel site (C1b) and the Parramatta Road East civil site (C3b) • Temporary closures of one lane of Alt Street and Bland Street (either side of Parramatta Road) may be required for establishment of construction vehicle access provisions including installation of driveways and associated construction activities. Traffic management, that could include temporary diversions, would be implemented during temporary closures • Due to existing property driveways, there would be no loss of on-street parking on Alt Street or Bland Street	Q3 2018 to Q1 2019 to complete road modification. Q3 2018 to Q4 2022 including construction duration and reinstatement of roads	Once road modification works are complete, both lanes along Alt Street and/or Bland Street would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the existing arrangement

Traffic crashes

Construction traffic volumes are expected to be low when compared to existing traffic volumes on key arterial roads connecting to the construction ancillary facility locations. The greatest increase occurs on City West Link west of City West Link/James Street intersection where, as a worst-case scenario, construction generates around 110 vehicles in the AM peak and around 190 vehicles in the PM peak. When compared to existing traffic volumes, total construction traffic would be the equivalent of around four per cent of peak hour traffic on City West Link at this location in the AM peak and six per cent of existing peak hour volumes in the PM peak.

As the volume of traffic generated by construction is expected to be low compared to existing traffic, the effects of this short-term increase on the existing road network is not expected to significantly impact road safety in and around the project footprint. There is still a risk with construction traffic interacting with general traffic, with elevated risk when construction-related vehicles are entering and leaving construction sites. Foreseen impacts on road safety for all users during construction would be mitigated as much as possible through tailored provisions in the CTAMP and other measures detailed in **section 8.5**.

Public transport services

As for the Option A construction scenario at Haberfield, an increase in vehicles on the existing road network during the construction period using the Option B sites would likely result in increased delays at certain intersections along the Parramatta Road corridor and in surrounding areas. Heavy vehicle volumes would increase along major roads. The same impacts on public transport services in these areas would potentially be experienced. Any bus stop relocations would be agreed with Transport for NSW and all affected bus operators, and would need to consider proposed pedestrian diversions during construction.

Walking and cycling

An increase in heavy vehicle volumes during the construction period in the project footprint and surrounding areas would potentially impact walking and cycling amenity. There are no planned diversions to pedestrian footways and cycling paths during construction for the three Option B construction sites.

The Parramatta Road West civil and tunnel site (C1b) has a proposed heavy and light vehicle cross-over on Alt Street and the Parramatta Road East civil site (3b) has proposed light vehicle entries and exits on Alt Street and Bland Street. Although this section of Alt Street is not a designated on-road cycle route, cycle logos are painted on Alt Street close to Parramatta Road.

Periodic, short-term closures of footpaths on both sides of Alt Street on the eastern and western sides of Parramatta Road may be required. These would be most likely to occur during site establishment, when access to these sites is being established. Where a footpath is temporarily closed, the corresponding footpath on the other side of the road would remain open.

While the volume of vehicles forecast to use these are low, minor impacts are anticipated during construction at these two sites as, while no diversions are required, there may be a safety impact. Traffic management measures would be implemented at the entry and exit driveways on Parramatta Road, Alt Street and Bland Street to manage potential interactions between construction traffic and pedestrians and cyclists.

8.3.2 Operational impacts without the project

In the future, there is a forecast growth in travel demand for both traffic and public transport, due to a forecast increase in population and employment. This causes increased congestion levels on the road network.

This section details the forecast traffic changes and performance in a ‘without project’ (or ‘do minimum’) scenario using forecast AM and PM peak traffic volumes for 2023 and 2033. Full details of this assessment can be found in **Appendix H** (Technical working paper: Traffic and transport).

Sydney metropolitan road network

‘Do minimum’ (2023)

The 2023 ‘do minimum’ scenario is described in **Table 8-2**. It is called ‘do minimum’ rather than ‘do nothing’ as it assumes on-going improvements would be made to the broader transport network, including some new infrastructure and intersection improvements to improve capacity and cater for traffic growth.

Figure 8-11 shows the forecast change in daily traffic volumes between the 2023 ‘do minimum’ and the 2015 ‘base’ scenarios. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2023 ‘do minimum’ scenario are shown in green and roads where volumes are predicted to increase are shown in red. The line thickness is indicative of the magnitude of this change.

General traffic

A reduction in daily traffic is forecast along Parramatta Road (west of the M4 East Parramatta Road ramps) as a result of the M4 East project, and along the M5 East Motorway, as a result of the New M5 project. Forecast traffic on the M4 East and the New M5 Motorway corridors, which will open to traffic in the period between the base year (2015) and 2023, are illustrated by the red bands on these links (as shown in **Figure 8-11**).

Increased daily traffic is forecast along Parramatta Road (east of the M4 East Parramatta Road ramps), Southern Cross Drive, Sydney Harbour Tunnel, Sydney Harbour Bridge and Anzac Bridge, as well as other urban arterials in the study area including Victoria Road, City West Link, Hume Highway, Canterbury Road, Stoney Creek Road, Olympic Drive, Centennial Drive and Anzac Parade approaching the Sydney CBD. The main cause of this is increased traffic as a result of population and employment growth from areas accessing these roads.

Table 8-55 compares the 2023 'do minimum' scenario with the 2015 'base case' scenario (which represents road conditions prior to the commencement of the M4 East and New M5), an increase in both VKT and vehicle hours travelled (VHT) on an average weekday on the Sydney road network is forecast.

Table 8-55 Comparison of daily VKT and VHT for metropolitan Sydney in 2023 'without project' and 2015 'base case' scenarios

Scenario	Year	Daily VKT ('000 km)			Daily VHT ('000 hours)		
		Motorway	Other	Total	Motorway	Other	Total
Base case	2015	23,940	74,810	98,750	400	2,520	2,920
Do minimum (without project)	2023	26,880	86,520	113,400	470	3,160	3,630

Source: WRTM v2.3, 2017

On-road freight

Forecast changes in daily road-based freight or heavy vehicle movements predominantly follow the same pattern as the general traffic movements, with more pronounced reductions in daily heavy vehicle movements on Parramatta Road (west of the M4 East Parramatta Road ramps) and the M5 East, as a result of heavy vehicles shifting to the M4 East and the New M5 projects.

On-road public transport

The increases in traffic volumes and congestion on roads that are also key bus corridors would impact negatively on the reliability and the trip times of on-road public transport. These include Parramatta Road (east of the M4 East Parramatta ramps), which is a key bus corridor for services running between the inner west and the Sydney CBD, Sydney Harbour Bridge, which allows buses north of the harbour to access the Sydney CBD, Anzac Bridge and Victoria Road, which links northwest bus services with the Sydney CBD, and Anzac Parade, which is a key corridor for bus services from the southeast to the Sydney CBD and beyond.

Figure 8-11 Difference in AWT between 2023 'do minimum' and 2015 base year scenarios

Source: WRTM v2.3, 2017

'Do minimum' (2033)

A description of the 2033 'do minimum' scenario is provided in **Table 8-2**. **Figure 8-12** shows the forecast change in daily traffic volumes between the 2033 'do minimum' and the 2015 'base' scenarios. As with the 2023 'do minimum' scenario, roads that are expected to carry less traffic in the future 2033 'do minimum' scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red.

General traffic

Reductions in daily traffic are forecast along Parramatta Road (west of the M4 East Parramatta ramps) and the M5 East, as a result of the M4 East and the New M5 projects. Increases in daily traffic movements in 2033 follow a similar pattern forecast for 2023 but with larger volumes. As in 2023, changes in population and employment distribution are the main cause of the forecast traffic increases. Traffic increases are forecast along Parramatta Road (east of the M4 East Parramatta ramps), Southern Cross Drive, Sydney Harbour Tunnel, Sydney Harbour Bridge and Anzac Bridge, as well as most other urban arterials.

Figure 8-12 shows the forecast change in daily traffic volumes between the 2033 'do minimum' and the 2015 'base case' scenarios. Roads that are expected to carry less traffic in the future 2033 'do minimum' scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red.

Table 8-56 compares the 2033 'do minimum' scenario with the 2015 base scenario (which represents road conditions prior to the commencement of the M4 East and New M5). A further increase in both VKT and VHT on an average weekday on the Sydney road network would be experienced. This indicates that the network is becoming so congested that an increase in traffic on the network is causing substantial increases in travel time.

Table 8-56 Comparison of daily VKT and VHT for metropolitan Sydney in 2033 'without project' and 2015 'base case' scenarios

Scenario	Year	Daily VKT ('000 km)			Daily VHT ('000 hours)		
		Motorway	Other	Total	Motorway	Other	Total
Base case	2015	23,940	74,810	98,750	400	2,520	2,920
Do minimum (without project)	2033	31,030	101,900	132,930	590	4,670	5,560

Source: WRTM v2.3, 2017

On-road freight

As in 2023, forecast changes in daily road-based freight or heavy vehicle movements follow the same pattern as the general traffic movements, with more pronounced reductions in daily heavy vehicle movements on Parramatta Road (west of the M4 East Parramatta ramps) and the M5 East, as a result of the M4 East and the New M5 projects respectively.

On-road public transport

In accordance with the changes forecast for traffic volumes in 2033 compared with 2023, trip times would increase and the reliability of bus services would decrease in 2033 due to larger increases in general traffic. Similar to the 2023 'do minimum' case, key bus corridors where service reliability would be impacted would include Parramatta Road (east of the M4 East Parramatta Road ramps), Sydney Harbour Bridge, Anzac Bridge and Victoria Road, as well as Anzac Parade.

Figure 8-12 Difference in AWT between 2033 'do minimum' and 2015 base year scenarios

Source: WRTM v2.3, 2017

Operational performance – Wattle Street interchange

Changes to the road network in 'do minimum' scenario

The Wattle Street interchange is at the eastern end of the M4 East project and, as such, associated M4 East road network infrastructure was included in the 'do minimum' or 'without project' scenario models, including:

- M4 East entry and exit ramps to accommodate at-grade network access and egress at two locations:
  - Wattle Street (between the intersections of Ramsay Street and Waratah Street)
  - Parramatta Road (between the intersections of Bland Street and Dalhousie Street)
- Adjustments to the at-grade network to facilitate the entry and exit ramp infrastructure
- A second right turn bay on Parramatta Road northbound approach to Great North Road in accordance with planned Pinch Point works by Roads and Maritime
- Parramatta Road kerbside lanes converted to bus lanes between the western end of the modelled network (west of Arlington Street) and east of Bland Street. This is consistent with Condition B34 of the M4 East Conditions of Approval, which requires at least two lanes of Parramatta Road, from Burwood Road to Haberfield, to be solely dedicated for the use of public transport. In the model, vehicles turning left are allowed to enter kerbside lanes about 100 metres in advance of intersections to accommodate left turns.

A more detailed description of these inclusions from the M4 East project is provided in **Appendix H** (Technical working paper: Traffic and transport).

Network performance

2015 base and 2023 'do minimum' scenario

Table 8-57 and **Table 8-58** present a comparison of the performance of the modelled road network between the 2015 base scenario and 2023 'without project' scenario for the AM and PM peak periods.

During the AM peak hour, the average travel time per vehicle through the modelled road network around the Wattle Street interchange shows a moderate increase compared to the 2015 base year. However, average speeds would be similar. Substantial delays are also observed at the M4 East Parramatta Road exit ramp, south of Bland Street. This results from the merge upstream of the Dalhousie Street intersection, existing congestion at Liverpool Road and the merge from three lanes to two lanes downstream of Sloane Street. Queuing is forecast to extend along the M4 East Parramatta Road exit ramp, reaching the M4 East Wattle Street exit ramp diverge.

During the PM peak hour, average time travelled per vehicle in the core modelled road network would increase by around 38 per cent compared with the 2015 base year and average speed would decrease (by around 26 per cent). The increase in average travel time and decrease in average speeds during the PM peak indicates an increase in congestion during this peak period.

Table 8-57 Wattle Street interchange network performance – AM peak hour (2015 Base vs 2023 'without project' scenario)

Network measure	2015 base case	2023 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	13,233	15,279	15%
Total vehicle kilometres travelled in network (km)	25,663	31,474	23%
Total time travelled approaching and in network (hr)	1,732	2,153	23%
Total vehicles arrived	13,191	14,483	10%
Total number of stops	244,016	242,127	-1%

Network measure	2015 base case	2023 'without project'	Percentage change
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.7	2.0	14%
Average time travelled in network (mins)	7.0	8.0	15%
Average number of stops	14.8	13.4	-9%
Average speed (km/h)	14.9	14.8	-1%
Unreleased vehicles			
Unreleased demand (veh)	41	796	–
% of total traffic demand	0%	5%	–

Table 8-58 Wattle Street interchange network performance – PM peak hour (2015 Base vs 2023 'without project' scenario)

Network measure	2015 base case	2023 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	13,559	15,209	12%
Total vehicle kilometres travelled in network (km)	27,377	29,075	6%
Total time travelled approaching and in network (hr)	1,504	2,176	44%
Total vehicles arrived	13,559	14,702	8%
Total number of stops	183,725	318,512	73%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.8	1.8	2%
Average time travelled in network (mins)	5.9	8.1	38%
Average number of stops	11.0	17.4	59%
Average speed (km/h)	18.3	13.5	-26%
Unreleased vehicles			
Unreleased demand (veh)	0	507	–
% of total traffic demand	0%	3%	–

2023 'do minimum' and 2033 'do minimum' scenario

Table 8-59 and **Table 8-60** present a comparison of the performance of the modelled road network between the 2023 and 2033 'without project' scenarios for the AM and PM peak hours.

Road network traffic performance is forecast to deteriorate by 2033 compared to 2023 as a result of increased demand. Congestion from both the M4 East Wattle Street and Parramatta Road portals blocks past the M4 East exit ramp diverge, resulting in large delays to vehicles from the M4 accessing the surface road network in the peak hour. Average network conditions experienced by vehicles in the network are similar in 2033 to those in 2023, however more vehicles are not able to enter the modelled network in the peak hour.

Table 8-59 Wattle Street interchange network performance – AM peak hour (2023 'without project' vs 2033 'without project' scenario)

Network measure	2023 'without project'	2033 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	15,279	16,553	8%
Total vehicle kilometres travelled in network (km)	31,506	32,470	3%
Total time travelled approaching and in network (hr)	2,143	2,316	7%
Total vehicles arrived	14,497	15,505	7%
Total number of stops	236,008	272,807	13%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.0	2.0	-1%
Average time travelled in network (mins)	8.0	8.3	3%
Average number of stops	13.1	14.5	8%
Average speed (km/h)	14.9	14.2	-4%
Unreleased vehicles			
Unreleased demand (veh)	782	1,048	–
% of total traffic demand	5%	6%	–

Table 8-60 Wattle Street interchange network performance – PM peak hour (2023 'without project' vs 2033 'without project' scenario)

Network measure	2023 'without project'	2033 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	15,209	16,665	10%
Total vehicle kilometres travelled in network (km)	29,171	29,461	1%
Total time travelled approaching and in network (hr)	2,157	2,557	17%
Total vehicles arrived	14,726	15,451	5%
Total number of stops	320,111	387,426	22%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.8	1.8	-4%
Average time travelled in network (mins)	8.1	9.0	11%
Average number of stops	17.4	20.0	15%
Average speed (km/h)	13.6	11.7	-13%
Unreleased vehicles			
Unreleased demand (veh)	483	1,214	–
% of total traffic demand	3%	7%	–

Intersection performance

Table 8-61 presents a comparison of intersection performance between the 2015 base scenario and 2023 and 2033 'without project' scenarios for the AM and PM peak periods.

The AM peak comparison suggests that under 'without project' conditions, the intersection performance in the future years is forecast to be similar to the base scenario; with the exception of the intersections of Parramatta Road/Wattle Street, at which performance is forecast to improve from LoS E to LoS C. The performance of the City West Link/Timbrell Drive intersection is forecast to worsen over time, given the increased eastbound demand for City West Link that causes queuing along Wattle Street, with minor impacts at the upstream intersection of Waratah Street as a result.

In the PM peak hour, Sloane Street and Liverpool Road intersection performances are predicted to worsen as a result of increased demand for Liverpool Road from Parramatta Road eastbound, causing congestion on all approaches, with queues in 2033 extending back along the M4 Parramatta Road ramps. City West Link/Timbrell Drive intersection is unable to accommodate the forecast increased demand along City West Link and Timbrell Drive in the future years, performing at LoS F in both 2023 and 2033.

Table 8-61 Wattle Street interchange: key intersection performance – 2023 and 2033 'without project' scenarios

Key intersections	2015 base case	2023 'without project	2033 'without project
AM peak hour			
Parramatta Road/Sloane Street	B	B	B
Parramatta Road/Liverpool Road	C	C	C
Parramatta Road/Dalhousie Street	B	B	C
Parramatta Road/Bland Street	B	B	C
Parramatta Road/Wattle Street	E	C	C
Parramatta Road/Great North Road	B	B	B
Parramatta Road/Arlington Street	B	C	C
Frederick Street/Church Street	B	B	B
Wattle Street/Ramsay Street	C	C	C
Dobroyd Parade/Waratah Street	A	A	B
City West Link/Timbrell Drive	C	D	F
PM peak hour			
Parramatta Road/Sloane Street	B	B	F
Parramatta Road/Liverpool Road	B	F	F
Parramatta Road/Dalhousie Street	B	B	B
Parramatta Road/Bland Street	B	B	B
Parramatta Road/Wattle Street	D	D	D
Parramatta Road/Great North Road	B	B	B
Parramatta Road/Arlington Street	B	C	C
Frederick Street/Church Street	B	B	B
Wattle Street/Ramsay Street	C	C	C
Dobroyd Parade/Waratah Street	A	B	B
City West Link/Timbrell Drive	D	F	F

Travel times

During the AM peak, forecast 2033 travel times generally remain consistent with 2023 forecast conditions. This is predominantly because a substantial amount of the increased demand is on roads which are either relatively free flowing in both scenarios (therefore volume increases do not result in significant travel time differences) or are already over capacity in the 2023 scenario (therefore additional demand is unreleased, with little impact on the travel times of vehicles within the network). The consistent travel times align with the network performance metrics, which forecast average speed in the network is relatively consistent between the 2023 and 2033 'without project' scenarios.

Travel times also remain generally similar in the PM peak, with minor increases in travel times across the network, in line with the forecast increased demand. A substantial amount of the additional demand in the 2033 scenario is unreleased and so impacts on travel times for vehicles that are able to enter the network are reduced.

Traffic crashes

Traffic crash analysis comparing existing traffic conditions to 2033 'without project' conditions suggests that by 2033, an increase in traffic volumes would create a proportional increase in crash frequencies and costs along Parramatta Road in the vicinity of the Wattle Street interchange.

On Parramatta Road (Wattle Street to City Road) crashes would be expected to increase from an average of 108 to 130 per annum. The corresponding cost of crashes would rise from $11.6 million to $14.1 million per annum.

Public transport services

As part of Condition B34 of the M4 East Conditions of Approval, at least two lanes of Parramatta Road from Burwood Road to Haberfield are to be solely dedicated for the use of public transport.

Because the details of these planned bus lanes (eg kerbside or centre-running) were unknown at the time of carrying out the traffic and transport assessment for the project, Parramatta Road kerbside lanes were converted to bus lanes in the modelled network from the western model extent to east of Bland Street. Vehicles turning left were allowed to enter kerbside lanes 100 metres in advance of intersections to accommodate left turns.

Future year bus frequencies were supplied by Transport for NSW and consist of an additional 40 buses per hour in each direction along Parramatta Road.

Active transport facilities

Details of planned walking and cycling facilities in the absence of the project can be found in **Appendix N** (Technical working paper: Active transport strategy).

Operational performance - Rozelle interchange

Changes to the road network in 'do minimum' scenario

The road network within the Rozelle interchange operational model would not change from existing conditions in the 'do minimum' or 'without project' scenario.

Network performance

2015 base and 2023 'do minimum' scenario

In the 2023 AM and PM peak hour periods, total traffic demand would increase by around 11 per cent. Average time travelled in the network per vehicle is the same or similar to the 2015 base scenario, however average speed per vehicle would decrease by around nine per cent in the PM peak period.

In terms of the overall network performance, there would be a minor improvement in flow on the Western Distributor. However, there would be increased congestion on Victoria Road. The overall network performance in 2023 'do minimum' scenario would be slightly worse compared to the 2015 base scenario in terms of average travel times, number of stops and vehicle speeds.

Table 8-62 and **Table 8-63** present a comparison of the performance of the modelled road network around the Rozelle interchange between the 2015 base scenario and 2023 'do minimum' scenario for the AM and PM peak periods. The benefits of the slight improvement in flow on Western Distributor are more or less negated by the increased congestion on Victoria Road, which means that the overall network performance in 2023 'without project' is slightly worse compared to the 2015 'base case' scenario in terms of average travel times, number of stops and vehicle speeds.

In the 2023 AM and PM peak hour periods, total traffic demand would increase by around 11 per cent. Average time travelled in the network per vehicle is the same or similar to the 2015 base scenario, however average speed per vehicle would decrease by around nine per cent in the PM peak period.

In terms of the overall network performance, there would be a minor improvement in flow on the Western Distributor. However, there would be increased congestion on Victoria Road. The overall network performance in 2023 'do minimum' scenario would be slightly worse compared to the 2015 base scenario in terms of average travel times, number of stops and vehicle speeds.

Table 8-62 Rozelle interchange network performance – AM peak hour (2015 Base vs 2023 'without project' scenario)

Network measure	2015 'base case'	2023 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	19,969	22,087	11%
Total vehicle kilometres travelled in network (km)	54,959	57,775	5%
Total time travelled approaching and in network (hr)	4,016	5,355	33%
Total vehicles arrived	20,298	21,621	7%
Total number of stops	267,250	302,654	13%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.7	2.7	0%
Average time travelled in network (mins)	9.6	10.1	5%
Average number of stops	11.5	12.3	7%
Average speed (km/h)	16.9	15.9	-6%
Unreleased vehicles			
Unreleased demand (veh)	357	1,278	–
% of total traffic demand	2%	6%	–

Table 8-63 Rozelle interchange network performance – PM peak hour (2015 Base vs 2023 'without project' scenario)

Network measure	2015 Base	2023 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	22,148	24,694	11%
Total vehicle kilometres travelled in network (km)	61,980	61,136	-1%
Total time travelled approaching and in network (hr)	3,276	4,896	49%
Total vehicles arrived	20,714	21,854	6%
Total number of stops	133,380	146,986	10%

Network measure	2015 Base	2023 'without project'	Percentage change
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.0	2.8	-7%
Average time travelled in network (mins)	8.2	8.3	1%
Average number of stops	5.6	5.9	5%
Average speed (km/h)	21.9	20.3	-7%
Unreleased vehicles			
Unreleased demand (veh)	823	2,684	–
% of total traffic demand	4%	11%	–

2023 'do minimum' and 2033 'do minimum' scenario

Table 8-64 and **Table 8-65** present a comparison of the performance of the modelled road network between the 2023 and 2033 'do minimum' (or 'without project') scenarios for the AM and PM peak hours. Total traffic demand would increase by around 10 per cent and seven per cent during the AM and PM peak periods respectively. The overall performance is forecast to deteriorate between 2023 and 2033, with longer travel times, lower average speeds and higher average number of stops. The number of unreleased vehicles would also increase, indicating increasing congestion in the network.

Table 8-64 Rozelle interchange network performance – AM peak hour (2023 'without project' vs 2033 'without project' scenario)

Network measure	2023 'without project'	2033 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	22,087	24,307	10%
Total vehicle kilometres travelled in network (km)	57,775	59,866	4%
Total time travelled approaching and in network (hr)	5,355	7,041	31%
Total vehicles arrived	21,621	22,682	5%
Total number of stops	302,654	314,527	4%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.7	2.6	-4%
Average time travelled in network (mins)	10.1	10.3	2%
Average number of stops	12.3	12.0	-2%
Average speed (km/h)	15.9	15.4	-3%
Unreleased vehicles			
Unreleased demand (veh)	1,278	2,233	–
% of total traffic demand	6%	9%	–

Table 8-65 Rozelle interchange network performance – PM peak hour (2023 'without project' vs 2033 'without project' scenario)

Network measure	2023 'without project'	2033 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	24,694	26,528	7%
Total vehicle kilometres travelled in network (km)	61,136	60,908	0%
Total time travelled approaching and in network (hr)	4,896	6,146	26%
Total vehicles arrived	21,854	22,679	4%
Total number of stops	146,986	151,862	3%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	2.7	-4%
Average time travelled in network (mins)	8.3	8.2	-1%
Average number of stops	5.9	5.9	0%
Average speed (km/h)	20.3	19.7	-3%
Unreleased vehicles			
Unreleased demand (veh)	2,684	3,591	–
% of total traffic demand	11%	14%	–

Intersection performance

Table 8-66 presents a comparison of intersection performance between the 2015 base scenario and 2023 and 2033 'without project' scenarios for the AM and PM peak periods.

The intersection performance results demonstrate the following intersections would experience significant congestion during the AM and PM peak hours in the 'without project' case by 2033:

- Victoria Road/Lyons Road
- Victoria Road/Darling Street
- Victoria Road/Robert Street
- Victoria Road/The Crescent
- The Crescent/Johnston Street.

Table 8-66 Rozelle interchange: key intersection performance (LoS) – 2023 and 2033 'without project' scenarios

Key intersections	2015 'base case	2023 'without project	2033 'without project
AM peak hour			
Victoria Road/Lyons Road	D	F	F
Victoria Road/Wellington Street	D	D	D
Victoria Road/Darling Street	F	F	F
Victoria Road/Robert Street	D	D	D

Key intersections	2015 'base case	2023 'without project	2033 'without project
Victoria Road/The Crescent	B	B	C
The Crescent/James Craig Road	A	A	B
City West Link/The Crescent	B	B	B
The Crescent/Johnston Street	C	C	D
PM peak hour			
Victoria Road/Lyons Road	D	F	F
Victoria Road/Wellington Street	B	D	D
Victoria Road/Darling Street	F	F	F
Victoria Road/Robert Street	F	F	F
Victoria Road/The Crescent	F	F	E
The Crescent/James Craig Road	B	C	B
City West Link/The Crescent	D	F	D
The Crescent/Johnston Street	F	F	E

Higher traffic demands in the 2033 'without project' PM peak hour would mean that westbound traffic would be constrained by the capacity of Anzac Bridge, which limits the flows that reach Victoria Road, The Crescent and City West Link. Therefore, improved levels of service at Victoria Road/The Crescent, City West Link/James Craig Road, City West Link/The Crescent and The Crescent/Johnston Street intersections are forecast in the 2033 PM peak hour.

Travel times

Due to the difference in trip distribution with fewer vehicles heading to Bathurst Street and more to Sussex Street in the AM peak hour, traffic flow on the Western Distributor is forecast to improve, resulting in less queueing back on Anzac Bridge. Therefore, slightly better travel times are forecast to be achieved in the eastbound direction. In the westbound direction, especially towards Iron Cove Bridge, travel times worsened due to increases in both the forecast demands and number of bus movements.

In the PM peak hour, differences in trip distribution at different times resulted in travel time changes along each route. In 2023, northbound bus volumes on Victoria Road increase, which worsens congestion and northbound travel times. However, by 2033 increased congestion on Anzac Bridge due to forecast growth in traffic to The Crescent results in fewer vehicles northbound on Victoria Road and faster journey times on this route.

Traffic crashes

The frequency of crashes on the roads in the vicinity of the Rozelle interchange would be expected to increase in proportion to forecast traffic growth in the future. By 2033, the growth in traffic volumes would create a proportional rise in crash frequencies and costs. On this basis the forecast growth in traffic would be expected to result in both the total number and cost of crashes increasing.

Public transport services

Increased bus frequencies are planned along Victoria Road. Bus movement and frequency forecasts have been provided by Transport for NSW, which indicate more than two buses per minute in the peak direction along most of Victoria Road and more than three buses per minute on the southern section of Victoria Road. They would continue to run in kerbside bus lanes as currently demarcated.

Active transport facilities

Details of planned walking and cycling facilities in the absence of the project can be found in the **Appendix N** (Technical working paper: Active transport strategy).

Operational performance – St Peters interchange

Changes to the road network in 'do minimum' scenario

The St Peters interchange is at the eastern end of the New M5 project and, as such, associated New M5 road network infrastructure was included in the 'do minimum' or 'without project' scenario models. Since the New M5 EIS assessment, changes to the road network have been planned and have also been included in the 'do minimum' or 'without project' scenario, including:

- Improvements to the intersection of the Princes Highway and Railway Road in accordance with the Pinch Point Program being carried out by Roads and Maritime
- The Airport North Precinct project
- Changes to the layout of the Gardeners Road/Kent Road intersection
- Changes to the layout of the Campbell Road/Bourke Road intersection.

The King Street Gateway project has not been included in the operational modelling around the St Peters interchange. The King Street Gateway project is not impeded by the M4-M5 Link project.

Further detail about these changes to the road network is included in **Appendix H** (Technical working paper: Traffic and transport).

Network performance

2015 base and 2023 'without project' scenario

Table 8-67 and **Table 8-68** present a comparison of the performance of the modelled road network around the St Peters interchange between the 2015 base scenario and 2023 'without project' scenario for the AM and PM peak periods.

In the AM peak periods, there would be an overall decrease in performance, which is reflected in higher total time travelled in the network and higher number of stops. There is a 19 per cent increase in forecast total traffic demand which results in more vehicles arriving at their destination, but this also affects all average measures per vehicle, which are worse in the 2023 'without project' scenario. Average speed in the network drops by 34 per cent and there are noticeably more unreleased vehicles (eight per cent of total peak hour demand).

In the PM peak periods, despite 18 per cent more demand in the 2023 'without project' scenario, the modelled network performs similarly to the base case in the PM peak. The number of vehicles arriving at their destination increased by the same proportion as the total demand and average speed in the network is comparable with the base case. The increase in average speed in the 'without project' is due to the ramps leading to and from the New M5 project. These ramps allow vehicles to travel faster, which increase the overall average speed in the network, and also remove a proportion of traffic from the surface network freeing up some capacity for the remaining surface traffic. The result is that despite higher overall demands, the overall network performance is similar to the 2015 base network performance.

Table 8-67 St Peters interchange network performance – AM peak hour (2015 Base vs 2023 'without project' scenario)

Network measure	2015 'base case'	2023 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	22,080	26,060	18%
Total vehicle kilometres travelled in network (km)	62,220	77,500	25%
Total time travelled approaching and in network (hr)	2,350	5,150	119%
Total vehicles arrived	21,840	23,710	9%
Total number of stops	105,830	201,290	90%

Network measure	2015 ‘base case’	2023 ‘without project’	Percentage change
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.6	2.8	7%
Average time travelled in network (mins)	5.8	9.5	63%
Average number of stops	4.8	8.5	75%
Average speed (km/h)	26.8	17.6	-34%
Unreleased vehicles			
Unreleased demand (veh)	90	2,120	–
% of total traffic demand	0%	8%	–
Demand reduction to/from Sydney Airport precinct (veh)	–	640	–

Table 8-68 St Peters interchange network performance – PM peak hour (2015 Base vs 2023 ‘without project’ scenario)

Network measure	2015 ‘base case’	2023 ‘without project’	Percentage change
All vehicles			
Total traffic demand (veh)	21,390	25,210	18%
Total vehicle kilometres travelled in network (km)	59,650	78,920	32%
Total time travelled approaching and in network (hr)	2,370	2,850	20%
Total vehicles arrived	21,160	24,960	18%
Total number of stops	101,670	127,390	25%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.6	2.9	10%
Average time travelled in network (mins)	5.9	6.1	2%
Average number of stops	4.8	5.1	6%
Average speed (km/h)	26.1	28.2	8%
Unreleased vehicles			
Unreleased demand (veh)	250	220	–
% of total traffic demand	1%	1%	–
Demand reduction to/from Sydney Airport precinct (veh)	–	230	–

2023 ‘do minimum’ and 2033 ‘do minimum’ scenario

Table 8-69 and **Table 8-70** present a comparison of the performance of the modelled road network between the 2023 and 2033 ‘without project’ scenarios for the AM and PM peak hours.

The AM peak hour network performance indicates an increase in demand in the 2033 ‘without project’ scenario compared to the 2023 ‘without project’ scenario, with corresponding declines in network performance. With 12 per cent higher demand than the 2023 ‘without project’ scenario, the number of vehicles arriving at their destination drops by 13 per cent and total time travelled in the network more than doubles. All average vehicle performance metrics worsen. Average speed in the network decreases to nine kilometres per hour and the number of unreleased vehicles increases to 24 per cent of the total demand. This indicates that by 2033 the network is performing inefficiently.

The PM peak hour network performance results show that, similar to the AM peak hour, the network is forecast to be more congested by 2033. All average vehicle performance indicators deteriorate and the average speed of around 18 kilometres per hour indicates a road network with decreased performance.

Table 8-69 St Peters interchange network performance – AM peak hour (2023 ‘without project’ vs 2033 ‘without project’ scenario)

Network measure	2023 ‘without project’	2033 ‘without project’	Percentage change
All vehicles			
Total traffic demand (veh)	26,060	29,160	12%
Total vehicle kilometres travelled in network (km)	77,500	72,830	-6%
Total time travelled approaching and in network (hr)	5,150	12,360	140%
Total vehicles arrived	23,710	20,720	-13%
Total number of stops	201,290	274,310	36%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	2.6	-8%
Average time travelled in network (mins)	9.5	17.0	80%
Average number of stops	8.5	13.2	56%
Average speed (km/h)	17.6	9.0	-49%
Unreleased vehicles			
Unreleased demand (veh)	2,120	6,950	–
% of total traffic demand	8%	24%	–
Demand reduction to/from Sydney Airport precinct (veh)	640	690	–

Table 8-70 St Peters interchange network performance – PM peak hour (2023 ‘without project’ vs 2033 ‘without project’ scenario)

Network measure	2023 ‘without project’	2033 ‘without project’	Percentage change
All vehicles			
Total traffic demand (veh)	25,210	27,610	10%
Total vehicle kilometres travelled in network (km)	78,920	84,570	7%
Total time travelled approaching and in network (hr)	2,850	4,970	74%
Total vehicles arrived	24,960	26,350	6%
Total number of stops	127,390	195,250	53%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.9	2.8	-3%
Average time travelled in network (mins)	6.1	9.2	51%
Average number of stops	5.1	7.4	45%
Average speed (km/h)	28.2	18.0	-36%

Network measure	2023 'without project'	2033 'without project'	Percentage change
Unreleased vehicles			
Unreleased demand (veh)	220	1,150	–
% of total traffic demand	1%	4%	–
Unreleased demand (demand reduction) (veh)	230	320	–

Intersection performance

Table 8-71 presents the modelled AM and PM peak hour LoS for key intersections at St Peters. The level of service for each intersection is forecast to consistently worsen when compared with the 2015 'base case' scenario. By 2033, the network is forecast to not be able to accommodate the forecast traffic demand, especially in the AM peak hour.

Table 8-71 St Peters interchange: key intersection performance (LoS) – 2023 and 2033 'without project' scenarios

Key intersections	2015 'base case'	2023 'without project'	2033 'without project
AM peak hour			
Princes Highway/Sydney Park Road	C	C	F
Princes Highway/May Street	D	C	F
Princes Highway/Canal Road	D	F	F
Princes Highway/Railway Road	F	F	F
Sydney Park Rd/Mitchell Road	C	B	F
Euston Road/Sydney Park Road	A	C	F
Unwins Bridge Road/Campbell Street	C	D	F
Campbell Road/Euston Road	A	C	F
Campbell Road/Bourke Road	-	B	B
Princes Highway/Campbell Street	C	F	F
Ricketty Street/Kent Road	C	E	F
Gardeners Road/Kent Road	A	C	F
Gardeners Road/Bourke Road	C	F	F
Gardeners Rd/O'Riordan Street	D	F	F
PM peak hour			
Princes Highway/Sydney Park Road	D	B	D
Princes Highway/May Street	F	C	B
Princes Highway/Canal Road	D	D	F
Princes Highway/Railway Road	D	D	F
Sydney Park Rd/Mitchell Road	D	C	D
Euston Road/Sydney Park Road	B	D	D
Unwins Bridge Road/Campbell Street	D	E	F

Key intersections	2015 'base case'	2023 'without project'	2033 'without project
Campbell Road/Euston Road	A	E	E
Campbell Road/Bourke Road	-	B	B
Princes Highway/Campbell Street	D	F	F
Ricketty Street/Kent Road	C	C	F
Gardeners Road/Kent Road	A	B	D
Gardeners Road/Bourke Road	D	D	F
Gardeners Rd/O'Riordan Street	E	F	F

Travel times

In addition to network performance statistics, travel times for selected routes within the modelled area were compared for the 2023 and 2033 'without project' scenarios. Travel times were measured for the following routes:

- Princes Highway, near Bellevue Street, to Euston Road, north of Maddox Street (and in the opposite direction)
- WestConnex South (New M5 northbound exit ramp) to Euston Road, north of Maddox Street (and in the opposite direction)
- King Street, north of Sydney Park Road, to Domestic Airport Terminals (and in the opposite direction)
- Railway Road, near Unwins Bridge Road, to Gardeners Road, east of Botany Road (and in the opposite direction).

In both peak hours, each section has consistently longer travel times in 2033, with the highest increase in travel time on the route between King Street and the Sydney Airport Domestic Terminals.

Traffic crashes

The frequency of crashes on surface roads in the St Peters area would be expected to change relative to the forecast traffic changes, as well as the intersection upgrades planned as part of the New M5 project. This is described in detail in the Traffic and Transport Technical working paper of the New M5 EIS (AECOM 2015b).

Traffic crash analysis comparing existing traffic conditions to 2033 'without project' conditions suggests that by 2033, the growth in traffic volumes would create a proportional change in crash frequencies and costs in the vicinity of the St Peters area.

The frequency of crashes on the combined M5 East and New M5 Motorways would also be expected to increase in proportion to forecast traffic growth on these roads in the future. The potential for crashes on the M5 East Motorway has been assumed to remain at the crash rates per vehicle kilometre travelled as calculated from data recorded during the period from January 2009 to December 2013. The potential for crashes in the New M5 tunnel has been undertaken using the crash rates on the existing Sydney motorway tunnels (Lane Cove, Eastern Distributor, Cross City and Sydney Harbour tunnels).

Traffic crash analysis of the M5 Motorway corridor, comparing existing traffic conditions, to 2033 'without project' conditions, suggests that in 2033, there would be a small decrease in the total number and cost of crashes on the M5 Motorway corridor despite a large increase in traffic volumes.

Public transport services

Sydney's Bus Future (Transport for NSW 2013) was developed to complement the *Transport Master Plan* by redesigning the city's bus network to meet current and future customer needs through identifying short and longer term priorities for bus services across Sydney. Transport for NSW has identified the following planned suburban routes, which have target average speeds, including dwell times, of 18–25 kilometres per hour (Transport for NSW 2013), that would travel through the St Peters interchange area:

- Chatswood to Sydney Airport via Sydney CBD and Botany Road (new route replacing the M20)
- Lane Cove to Eastgardens via Sydney CBD, Surry Hills and Botany Rd (new route)
- Hurstville to Sydney CBD via Earlwood and Newtown (current route 423)
- Bondi Junction to Miranda via Airport and Eastgardens (new route)
- Bondi Junction to Burwood via Airport and Eastgardens (current route 400)
- Bondi Junction to Burwood via Sydenham (current route 418).

Sydney's Rail Future: Modernising Sydney's Trains (Transport for NSW 2012) was developed to complement the Transport Master Plan with a particular focus on improving Sydney's rail system. In particular, *Sydney's Rail Future* highlighted the need to improve the East Hills, Airport and Inner West railway line, which runs generally parallel to the project, and also highlights the introduction of a Rapid Transit line, as an extension of the North West Rail Link. Now called Sydney Metro, this rapid transit line would primarily serve north-western Sydney and the Lower North Shore through the Sydney CBD to Bankstown, via Sydenham.

Sydney Metro Northwest is programmed to open in 2019, while Sydney Metro City and South West (the extension through the Sydney CBD to Bankstown) is programmed to open from 2024. Sydney Metro would not serve the two closest stations to the study area – St Peters and Mascot stations. The closest Metro station would be Sydenham Station.

Active transport facilities

Details of planned walking and cycling facilities in the absence of the project can be found in the **Appendix N** (Technical working paper: Active transport strategy) and includes the network of shared paths that would be provided around the St Peters interchange as part of the New M5 project.

8.3.3 Assessment of operational impacts of the project

This section details the forecast traffic performance during the 'with project' scenarios carried out using forecast traffic volumes for the following scenarios:

- **'With project' (2023)**: including NorthConnex, M4 Widening, M4 East, New M5 and the M4-M5 Link are complete and open to traffic
- **'With project' (2033)**: including the same road network as the 'with project' (2023) scenario is and assumes no proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link or F6 Extension.

Summary

A number of key benefits and improvements are forecast as a result of the project:

- Non-motorway roads in the Inner West LGA are forecast to experience faster trips with the daily average speed increasing by about 10 per cent. Similarly, the vehicle distance travelled on non-motorway roads is forecast to reduce by about 12 per cent. This indicates that on average, these trips are fewer in number and faster
- Improved network productivity on the metropolitan network, with more trips forecast to be made or longer distances travelled on the network in a shorter time. The forecast increase in VKT and reduction in vehicle hours travelled (VHT) is mainly due to traffic using the new motorway, with reductions in daily VKT and VHT forecast on non-motorway roads
- The project, along with investment in other road, public transport and active transport projects, would help to accommodate the forecast growth in population and travel demand in the Sydney metropolitan area

- Reduced travel times are forecast on key corridors, such as between the M4 Motorway corridor and the Sydney Airport/Port Botany precinct
- Reduced traffic forecast on sections of major arterial roads including City West Link, Parramatta Road, Victoria Road, King Street, Princes Highway, Southern Cross Drive and Sydenham Road
- Almost 2,000 heavy vehicles are forecast to be removed from Parramatta Road, east of the M4 East Parramatta Road ramps, each weekday.

Where the project would connect to the existing road network, increased congestion is forecast in parts of Mascot, along Frederick Street at Haberfield, Victoria Road north of Iron Cove Bridge, Johnston Street at Annandale and on the Western Distributor. The performance of the road network at a number of these areas would be improved when the proposed future Sydney Gateway and Western Harbour Tunnel and Beaches Link projects are completed.

Sydney metropolitan road network

'With project' (2023)

Figure 8-13 shows the forecast change in daily traffic volumes between the 2023 'with project' and 'without project' scenarios. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2023 'with project' scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red. The band thickness is indicative of the magnitude of this change. These forecast traffic volumes include both fixed and induced traffic demand.

The project provides a key link in the Sydney motorway network, connecting the M4 East Motorway to the New M5 Motorway, as well as to the Western Distributor, Cross City Tunnel and the M1 Motorway. With the inclusion of the project, a large volume of traffic is forecast to shift to the M4-M5 Link, including the Iron Cove Link, with significant reductions in daily traffic volumes forecast on Parramatta Road (east of the M4 East Parramatta Road ramps), City West Link and Victoria Road (east of Iron Cove Bridge).

Increases in daily traffic are forecast on the M4 East Motorway and Anzac Bridge/Western Distributor, as traffic accesses the M4-M5 Link. This is shown by the thick red lines on the motorway network and the corresponding reduction in traffic on the surface network as illustrated by the green lines.

As a consequence of traffic using the project, reductions in daily traffic are forecast for the existing M5 East Motorway, Southern Cross Drive and King Georges Road, north of the existing M5 East Motorway. Traffic reductions are also forecast on roads through the Inner West, such as Stanmore Road and Sydenham Road, which link Parramatta Road to the St Peters and Mascot areas, as traffic shifts to the M4-M5 Link instead.

Increases in daily traffic on surface roads between the St Peters interchange and Sydney Airport are forecast. Reductions are forecast on sections of Princes Highway and Canal Road. With the inclusion of the M4-M5 Link, reductions in peak period travel times between the M4 corridor and the Sydney Airport/Port Botany precinct in 2023, with traffic shifting from the A3 (King Georges Road) corridor to the M4-M5 Link. Changes in peak period travel times as a result of the project include:

- Between Parramatta and Sydney Airport, average peak period travel times are forecast to reduce by about 10 minutes. This saving is part of a 25 minute saving comparing the 2023 'with project' scenario to a scenario without WestConnex
- Between Burwood and Sydney Airport, average peak period travel times are forecast to reduce by about five minutes. This saving is part of a 15 minute saving comparing the 2023 'with project' scenario to a scenario without WestConnex
- Between Silverwater and Port Botany, average peak period travel times are forecast to reduce by about 10 minutes. This saving is part of a 15 minute saving comparing the 2023 'with project' scenario to a scenario without WestConnex.

In 2023, with the inclusion of the project, road network productivity would improve as indicated by a drop in daily VKT and VHT on the arterial (non-motorway) network, with an increase in kilometres and hours travelled along the motorway and highway routes. Overall, the road network would accommodate more or longer trips in a shorter time. As shown in **Table 8-72**, the increase in daily VKT and drop in VHT is mainly due to traffic using the new motorway, with reductions in daily VKT and VHT forecast on non-motorway roads.

Table 8-72 Comparison of daily 2023 VKT and VHT for metropolitan Sydney in the 'without project' and 'with project' scenarios

Scenario	Daily VKT ('000 km)			Daily VHT ('000 hours)		
	Motorway	Other	Total	Motorway	Other	Total
Do minimum (without project)	26,880	86,520	113,400	470	3,160	3,630
With project	27,730	86,050	113,780	480	3,120	3,600

Source: WRTM v2.3, 2017

On-road freight

Forecast changes in daily road-based freight or heavy vehicle movements follow the same pattern as the general traffic movements, with significant reductions in daily heavy vehicle traffic volumes focused on Parramatta Road (east of the M4 East Parramatta Road ramps), City West Link, Victoria Road (east of Iron Cove Bridge), King Georges Road and the existing M5 East Motorway. There are also reductions forecast along Stanmore Road and Sydenham Road in the inner west.

Increases in daily heavy vehicle traffic on surface roads between the St Peters interchange and Sydney Airport are forecast, with reductions in daily heavy vehicle volumes forecast on sections of Princes Highway and Canal Road.

On-road public transport

Changes in traffic volumes on roads that are also key bus corridors would be expected to impact on the reliability and the journey times of on-road public transport. Reduced traffic volumes on key bus corridors would improve public transport journey times and reliability. While bus journey times would benefit from reduced traffic on Victoria Road (east of Iron Cove Bridge), this would be offset by the forecast increase in traffic and congestion on Anzac Bridge/Western Distributor.

A large forecast decrease in traffic on Parramatta Road, east of the M4 East Parramatta Road ramps, would improve reliability and trip times of bus services on Parramatta Road.

Changes by LGA on non-motorway links

Table 8-73 presents the percentage changes in daily VKT, VHT and average speed in 2023 with the project on non-motorway links in the LGAs closest to the project. The average speed would vary by time of day and by road type. The forecast percentage changes indicate that, apart from Bayside, all other LGAs either benefit from reduced traffic on surface roads or there is no forecast change. The increase in VKT and VHT in Bayside LGA is due to forecast increases in daily traffic on surface roads between the St Peters interchange and Sydney Airport, in the absence of Sydney Gateway.

Table 8-73 Percentage change in daily travel distance, time and average speed on non-motorway links by LGA in 2023

Local Government Area	Daily VKT	Daily VHT	Daily average speed
Bayside	1%	3%	-2%
Burwood	-2%	-2%	0%
Canada Bay	0%	0%	0%
Canterbury-Bankstown	-1%	-3%	2%
Inner West	-12%	-20%	10%
Strathfield	-2%	-4%	2%
Sydney	-2%	-2%	0%

Source: WRTM v2.3, 2017

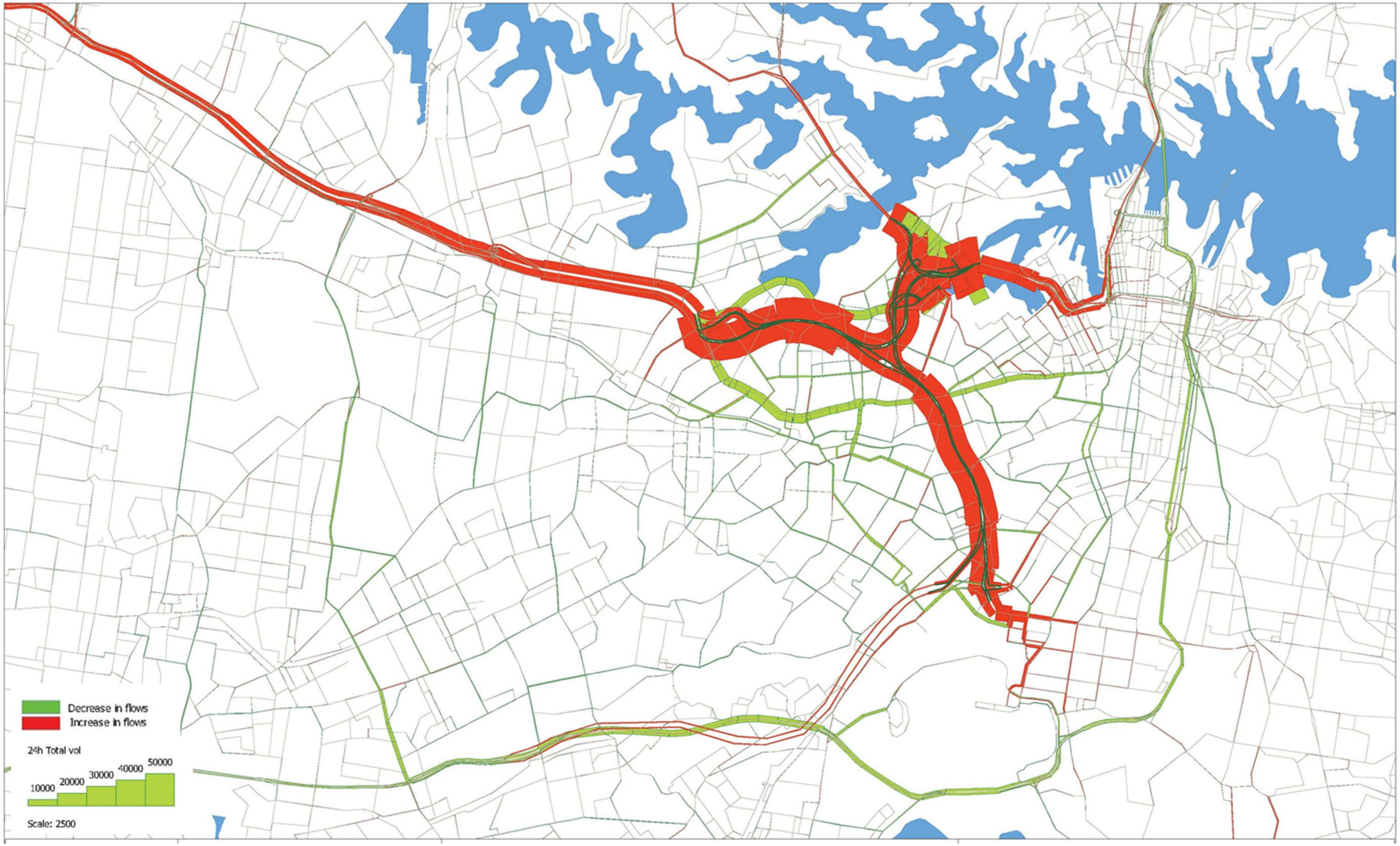


Figure 8-13 Difference in AWT between 2023 'with project' and 'without project' scenarios

Source: WRTM v2.3, 2016

'With project' (2033)

Figure 8-14 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2033 'with project' and 'without project' scenarios.

General traffic

The pattern of change in the 2033 comparison is generally the same as in the 2023 comparison, however, on some roads the forecast increases in daily traffic volumes are less pronounced due to the growth in background traffic by 2033.

With the inclusion of the M4-M5 Link, the WRTM is forecasting reductions in peak period travel times between the M4 corridor and the Sydney Airport/Port Botany precinct in 2033, with traffic shifting from the A3 (King Georges Road) corridor to the M4-M5 Link. For example:

- Between Parramatta and Sydney Airport, average peak period travel times are forecast to reduce by about 10 minutes. This saving is part of a 30 minute saving comparing the 2033 'with project' scenario to a scenario without WestConnex
- Between Burwood and Sydney Airport, average peak period travel times are forecast to reduce by about five minutes. This saving is part of a 20 minute saving comparing the 2033 'with project' scenario to a scenario without WestConnex
- Between Silverwater and Port Botany, average peak period travel times are forecast to reduce by about 10 minutes. This saving is part of a 20 minute saving comparing the 2033 'with project' scenario to a scenario without WestConnex.

With the inclusion of the project there is a drop in the daily VKT and VHT on the arterial (non-motorway) network and a corresponding increase in kilometres and hours travelled along the motorway and highway routes. The addition of the M4-M5 Link provides a substantial overall benefit to the network where more or longer trips could be made on the road network in a shorter time.

Table 8-74 Comparison of daily 2033 VKT and VHT for metropolitan Sydney in 'without project' and 'with project' scenarios

Scenario	Daily VKT ('000 km)			Daily VHT ('000 hours)		
	Motorway	Other	Total	Motorway	Other	Total
Do minimum (without project)	31,030	101,900	132,930	590	4,670	5,560
With project	32,010	101,410	133,430	600	4,610	5,220

Source: WRTM v2.3, 2017

On-road freight

Forecast changes in daily road-based freight or heavy vehicle movements would generally follow the same pattern as the 2023 comparison. Significant reductions in daily heavy vehicle traffic are forecast on Parramatta Road (east of the M4 East Parramatta Road ramps), City West Link, Victoria Road (east of Iron Cove Bridge), King Georges Road and the M5 East Motorway.

On-road public transport

The anticipated impacts of the project on on-road public transport in 2023 and 2033 are similar. Changes in traffic volumes on roads that are also key bus corridors would be expected to impact on the reliability and the trip times of on-road public transport. Reduced traffic on key bus corridors would improve journey times and reliability. Reduced traffic is forecast on Victoria Road (east of Iron Cove Bridge), however this is offset by the forecast increase on Anzac Bridge/Western Distributor. A large forecast decrease in traffic on Parramatta Road, east of the M4 East Parramatta Road ramps, would improve reliability and trip times of bus services on Parramatta Road.

Changes by LGA on non-motorway links

Table 8-75 presents the percentage changes in daily VKT, VHT and average speed in 2033 with the project on non-motorway links in the LGAs that are closest to the project. The average speed would vary by time of day and by road type. The changes are similar to the 2023 comparison. Apart from Bayside, all other LGAs benefit from reduced traffic on surface roads. Again, the increase in VKT and VHT in Bayside LGA is due to forecast increases in daily traffic on surface roads between the St Peters interchange and Sydney Airport, in the absence of Sydney Gateway.

Table 8-75 Percentage change in daily travel distance, time and average speed by LGA in 2033

Local Government Area	Daily VKT	Daily VHT	Daily average speed
Bayside	1%	4%	-3%
Burwood	-2%	-3%	1%
Canada Bay	-1%	-1%	0%
Canterbury-Bankstown	-1%	-4%	3%
Inner West	-11%	-21%	14%
Strathfield	-1%	-4%	3%
Sydney	-2%	-2%	0%

Source: WRTM v2.3, 2017

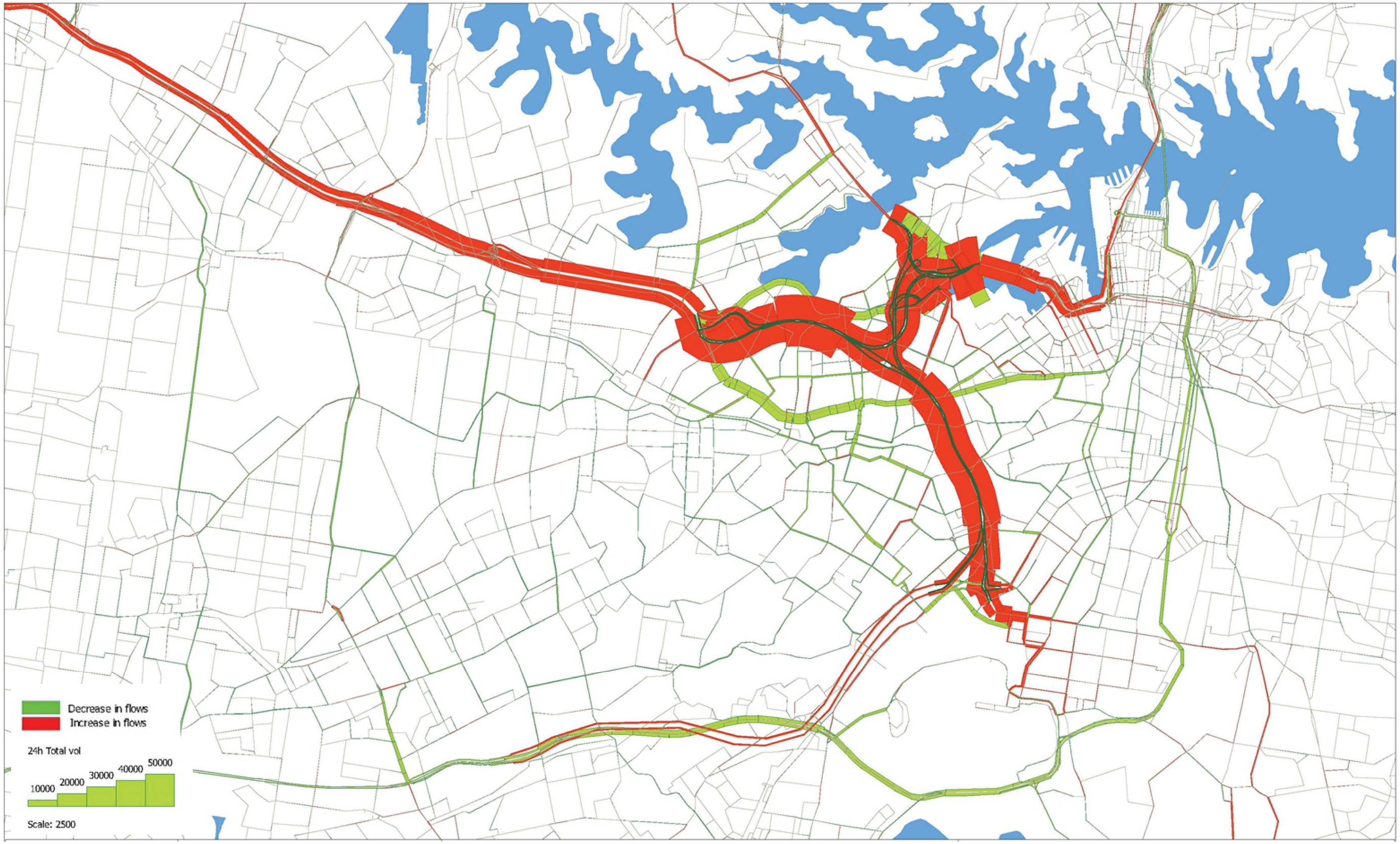


Figure 8-14 Difference in AWT between 2033 'with project' and 'without project' scenarios

Source: WRTM v2.3, 2016

Screenline/parallel route analysis

A screenline analysis has been carried out to examine how traffic patterns along and adjacent to the arterial road network may change as a result of the operation of the project (in 2023 and 2033). Analysis of the operation of the WestConnex program of works, as well as the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension projects was also undertaken.

Four screenlines, which represent theoretical boundaries specifically designed to collectively analyse directional and two-way traffic volume outputs from the different modelling scenarios have been established:

- The east–west screenline captures changes in east–west traffic movement and includes a location on the M4-M5 Link mainline tunnels between the Wattle Street and Rozelle interchanges, as well as on four parallel corridors (City West Link, Darley Road, Marion Street and Parramatta Road). This screenline also includes a location on Lyons Road, which would reflect any changes in traffic using Lyons Road to travel to and from Victoria Road
- The upper north–south screenline captures changes in vehicle travel patterns on north–south links north of Parramatta Road, including Norton Street, Balmain Road, Catherine Street, Johnston Street, Booth Street (north of Pyrmont Bridge Road) and Ross Street (north of Bridge Road). These roads are close to the Rozelle interchange and would display changes in traffic on surface roads as a result of the new road connections at the Rozelle interchange
- The lower north–south screenline includes a location on the M4-M5 Link mainline tunnels between the Rozelle interchange and the St Peters interchange, as well as locations on 10 north–south regional connector roads (Stanmore Road, Addison Road, Sydenham Road, Marrickville Road, King Street, Wyndham Street, Botany Road, Elizabeth Street, South Dowling Street and the Southern Cross Drive)
- The cross-harbour screenline looks at changes in cross-harbour traffic flow on the Sydney Harbour Bridge, Sydney Harbour Tunnel and the Gladesville Bridge. It also includes a location on the proposed future Western Harbour Tunnel in the 2023 and 2033 'cumulative' scenarios.

The screenline analysis also included an analysis of impacts during peak hours to see how the M4-M5 Link may impact on the wider road network during these periods. A summary of the screenline and peak hour analyses is provided in the following sections. Screenline locations are shown in **Figure 8-15**.

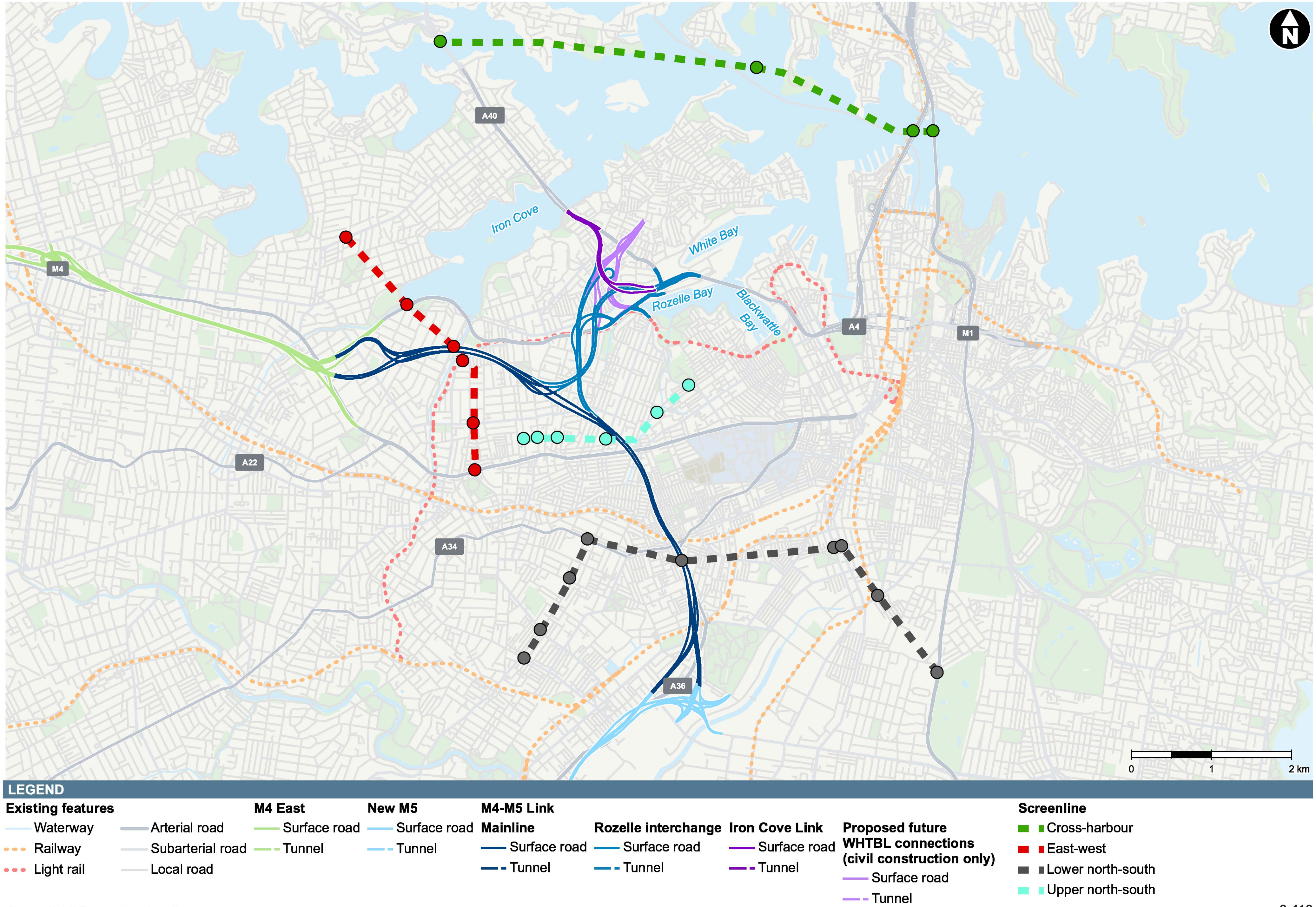


Figure 8-15 Screenline locations

Summary

As a result of the new roadway links provided by the project, the two-way future year AWT traffic demand compared to a 'without project' scenario is predicted to significantly decrease on:

- City West Link and Parramatta Road, east of the M4 East Wattle Street and Parramatta Road ramps respectively, by about 25 per cent in 2023 and 2033 'with project' and 'cumulative' scenarios
- King Street in St Peters by about 20 per cent in the 2023 and 2033 'with project' scenarios
- Stanmore Road in Stanmore by about 15 per cent in 2023 and 2033 'with project' and 'cumulative' scenarios
- Lyons Road in Russell Lea by about 15 per cent in the 2023 and 2033 'with project' scenarios, and about 20 per cent in the 2023 and 2033 'cumulative' scenarios
- Southern Cross Drive and the Sydney Harbour Tunnel by about 20 per cent and 25 per cent respectively in the 2023 and 2033 'cumulative' scenarios.

The reduction in traffic demand on these major traffic routes is likely to improve speed, journey reliability and safety on these corridors compared to a 'without project' scenario.

The following sections provide additional detail on the key observations for each of the screenlines. Further detail is provided in **Appendix H** (Technical working paper: Traffic and transport).

East-west screenline

Average weekday traffic analysis

- Key observations comparing the 2023 'without project' and 'with project' scenarios are:
  - The average weekday traffic volumes would increase by about 28 per cent in the 'with project' scenario
  - The average weekday traffic volumes on surface arterial roads is forecast to decrease by around 20 per cent in the 'with project' scenario
  - The largest decreases in average weekday traffic occur on Parramatta Road (about 25 per cent or more than 15,000 vehicles), on Marion Street at Leichhardt (around 40 per cent or more than 2,000 vehicles) and on City West Link (about 23 per cent or more than 14,000 vehicles)
  - The average weekday traffic volumes on Lyons Road would fall by around 14 per cent as a result of the Iron Cove Link and the M4-M5 Link providing an alternative route
- Key observations comparing the 2033 'without project' and 'with project' scenarios are:
  - The average weekday traffic volumes on surface roads and in the tunnels would increase by around 30 per cent in the 'with project' scenario
  - A substantial shift in traffic away from surface roads and onto the M4-M5 mainline tunnels between the Wattle Street and Rozelle interchanges, with almost 40 per cent of the average weekday traffic volumes forecast to use the M4-M5 Link in 2033
- Key observations comparing the 'cumulative' to the 'without project' scenarios for 2023 and 2033 are:
  - The average weekday traffic volumes crossing the east-west screenline would increase by around 36 per cent in 2023 and 41 per cent in 2033
  - Average weekday traffic volumes on surface roads would decrease by about 22 per cent in both 2023 and 2033.

Peak hour analysis

The forecasts indicate that the impact of the project on two-way peak hour traffic volumes are similar to the impacts forecast for average weekday traffic volumes, with traffic shifting off surface roads and onto the M4-M5 Link. However, traffic volume decreases on City West Link and Parramatta Road are much smaller in the peak hours compared to the total daily decrease.

Upper north–south screenline

Average weekday traffic analysis

- Key observations comparing the 2023 ‘without project’ and ‘with project’ scenarios are:
  - Decreases on Parramatta Road results in average weekday traffic decreases on some north-south roads connecting to Parramatta Road, including Norton Street (southbound) and Balmain Road (northbound)
  - Increase in average weekday traffic volumes (around four per cent) on Johnston Street and Ross Street as traffic moves between the surface road network and the M4-M5 Link
- Key observations comparing the 2033 ‘without project’ and ‘with project’ scenarios are:
  - Decreases on Parramatta Road results in further average weekday traffic decreases on some north-south roads connecting to Parramatta Road, including Norton Street (southbound) and Balmain Road (northbound)
  - Again, an increase in average weekday traffic volumes is forecast for Johnston Street and Ross Street, as traffic moves between the surface road network and new road links at the Rozelle interchange
- Key observations comparing the ‘cumulative’ to the ‘without project’ scenarios for 2023 and 2033 are:
  - Forecast decreases on some north-south roads connecting to Parramatta Road, with large decreases forecast for southbound average weekday traffic on Norton Street (around 25 per cent in 2023 and about 28 per cent in 2033) and for northbound average weekday traffic volumes on Balmain Road (around 17 per cent in 2023 and about 19 per cent in 2033)
  - An increase in average weekday traffic volumes on Johnston Street (around 15 per cent in 2023 and around 12 per cent in 2033), and Ross Street (around 16 per cent in 2023 and about 20 per cent in 2033). As a percentage of traffic crossing the screenline, this represents an increase of about three per cent or less.

Peak hour analysis

Similar to the AWT forecasts, the AM peak and PM peak forecasts show changes in traffic volumes on north-south links, with increases on some roads and decreases on others as vehicles shift from Parramatta Road to use the M4-M5 Link.

Lower north–south screenline

Average weekday traffic analysis

- Key observations comparing the 2023 ‘without project’ and ‘with project’ scenarios are:
  - Two-way average weekday traffic volumes on the M4-M5 Link is forecast to be around 16 per cent of total two-way average weekday traffic volumes crossing the screenline, with average weekday traffic crossing the screenline on existing surface roads forecast to decrease by around seven per cent
  - The greatest forecast reductions in traffic volume occur on Stanmore Road and Southern Cross Drive. Total two-way average weekday traffic is forecast to fall by around 16 per cent on Stanmore Road and by about three per cent on Southern Cross Drive
  - There are also forecast reductions on King Street, where two-way average weekday traffic volumes decreases by around 19 per cent (around 4,000 vehicles per day), and on Sydenham Road where two-way average weekday traffic volumes decrease by about 10 per cent (about 3,000 vehicles per day).
- Key observations comparing the 2033 ‘without project’ and ‘with project’ scenarios are:
  - Two-way traffic on the M4-M5 Link is forecast to be around 17 per cent of total two-way

average weekday traffic crossing the screenline, while average weekday traffic crossing the screenline on existing surface roads is forecast to decrease by about seven per cent

  - Forecast average weekday traffic reductions on Southern Cross Drive and Stanmore Road, with reductions also forecast for King Street and Sydenham Road

- Key observations comparing the ‘cumulative’ to ‘without project’ scenarios for 2023 and 2033 are:
  - In the 2023 and 2033 ‘cumulative’ scenarios, two-way average weekday traffic volumes crossing the screenline are forecast to increase. Traffic on the M4-M5 Link is forecast to be about 24 per cent and around 27 per cent of total two-way average weekday traffic crossing the screenline in 2023 and 2033 respectively
  - Two-way average weekday traffic on Southern Cross Drive is forecast to fall by about 14 per cent in 2023, and by about 16 per cent in 2033. This is due to vehicles travelling from areas north of Sydney Harbour to areas around Sydney Airport, or to the M5 Motorway, with the M4-M5 Link and proposed future Western Harbour Tunnel and Sydney Gateway projects providing a new parallel route
  - As in the ‘with project’ scenario, there are significant forecast reductions on Stanmore Road, King Street, and Sydenham Road. Under the ‘cumulative‘ scenario, there is also a significant forecast reduction in northbound average weekday traffic on Botany Road of about 3,000 vehicles daily or about nine per cent, due to the presence of Sydney Gateway providing an alternative route from the Sydney Airport and Port Botany precinct to the St Peters interchange
  - There are slight forecast increases in southbound average weekday traffic volumes on Wyndham Street, Botany Road, Elizabeth Street and King Street in the ‘cumulative’ scenario. However, in terms of total southbound average weekday traffic crossing the screenline, the forecast increase of traffic on these roads in 2023 and 2033 represents an increase of about two per cent.

Peak hour analysis

The peak hour forecasts indicate traffic volume changes are similar to those in the average weekday traffic forecasts, with traffic shifting from surface roads onto the M4-M5 Link. However, road network capacity constraints limit the shifts in traffic in the peak hours, and hence reductions in traffic on surface roads crossing the screenline are not as high in the peak hours compared to across the day.

Cross-harbour screenline

Average weekday traffic analysis

- Key observations comparing the 2023 ‘without project’ and ‘with project’ scenarios are:
  - Minimal forecast changes to total daily traffic crossing Sydney Harbour on the Gladesville Bridge, the Sydney Harbour Bridge and the Sydney Harbour Tunnel in the ‘with project’ scenario
  - Two-way average weekday traffic is forecast to increase by around six per cent in the ‘with project’ scenario on the Gladesville Bridge. This reflects the increase in traffic along Victoria Road due to vehicles using the Iron Cove Link and the M4-M5 Link mainline tunnels, via the Rozelle interchange
- Key observations comparing the 2033 ‘without project’ and ‘with project’ scenarios are:
  - Minimal forecast changes in two-way average weekday traffic volumes crossing the screenline in the ‘with project’ scenario
  - Two-way average weekday traffic on the Gladesville Bridge is forecast to increase by about seven per cent in the ‘with project’ scenario due to vehicles using the Iron Cove Link and the M4-M5 Link mainline tunnels, via the Rozelle interchange

- Key observations comparing the 2023 ‘without project and ‘cumulative’ scenarios are:
  - Forecast two-way average weekday traffic crossing the screenline increases by about three per cent in the ‘cumulative’ scenario due in part to traffic induced by the proposed future Western Harbour Tunnel and Beaches Link project connection
  - A forecast shift in traffic from the Sydney Harbour Bridge and the Sydney Harbour Tunnel onto the proposed future Western Harbour Tunnel tunnels. Two-way average weekday traffic is forecast to decrease by around six per cent on the Sydney Harbour Bridge and by around 23 per cent in the Sydney Harbour Tunnel under the ‘cumulative’ scenario
  - Two-way average weekday traffic is forecast to increase by around 13 per cent on the Gladesville Bridge in the ‘cumulative’ scenario, reflecting the increase in traffic forecast to access the M4-M5 Link mainline tunnels and the Iron Cove Link
- Key observations comparing the 2033 ‘without project’ and ‘cumulative’ scenarios are:
  - Forecast two-way average weekday traffic crossing the screenline increases by about seven per cent in the ‘cumulative’ scenario due in part to traffic induced by the proposed future Western Harbour Tunnel and Beaches Link connection. The Western Harbour Tunnel and Beaches Link is forecast to carry about 12 per cent of two-way average weekday traffic crossing the screenline (without a surface connection at Rozelle)
  - The forecast changes in two-way average weekday traffic on the Sydney Harbour Bridge, Sydney Harbour Tunnel and on Gladesville Bridge are similar to that forecast in 2023.

Peak hour analysis

The changes in peak hour volumes at the cross-harbour screenline indicate project impacts on peak hour traffic volumes similar to those forecast for AWT, with only minor changes in traffic volume crossing the harbour on the Gladesville Bridge, the Sydney Harbour Bridge and the Sydney Harbour Tunnel in the ‘with project’ scenario.

Heavy vehicle analysis

A separate analysis of only heavy vehicles was carried out for the east–west, upper north–south and lower north–south screenlines to confirm if there were any different traffic pattern shifts forecast for heavy vehicles. The results of this analysis indicate:

- A decrease in the daily volume of heavy vehicles on surface roads is generally forecast across all screenlines, as heavy vehicles shift onto the M4-M5 Link
- Daily heavy vehicle volumes on Parramatta Road and City West Link are forecast to drop by around 40–50 per cent
- Daily heavy vehicle volumes on roads in the inner west, such as Stanmore Road, Sydenham Road, Marrickville Road and King Street, are forecast to drop by about 20–50 per cent
- Forecast increases on Johnston Street and Ross Street as heavy vehicles move between the surface road network and the M4-M5 Link tunnels. However, in the peak hours, these increases are generally less than around 80 heavy vehicle movements per hour, and in some cases are directional, with an increase in one peak hour forecast changing to a decrease in the other peak hour.

Operational performance – M4-M5 Link Motorway

Forecast traffic in the mainline tunnels **Table 8-76** presents the two-way daily AWT volumes that are forecast on the mainline tunnel sections of the project.

Table 8-76 Two-way daily AWT forecast in the M4-M5 Link mainline tunnels

Scenario	Year	Location Between Wattle Street interchange and Rozelle interchange	Between Rozelle interchange and St Peters interchange
With project	2023	89,000	61,500
Cumulative		107,000	96,000
With project	2033	99,500	70,000
Cumulative		126,000	119,500

Source: WRTM v2.3, 2017

Mid-block level of service

Table 8-77 and **Table 8-78** presents peak hour mid-block traffic volumes and levels of service under the 'with project' scenarios for 2023 and 2033. The results indicate that the new M4-M5 Link motorway would operate at a good level of service in the 2023 and 2033 'with project' scenarios.

Table 8-77 M4-M5 Link motorway mid-block LoS – 2023 'with project' scenario

Section	Location and direction	No. of lanes	Modelled flow (PCU)	Speed (km/h)	Density (PCU/km/ln)	LOS
Southbound – AM peak						
1	Interface with M4 East	3	3,470	80	14.5	C
2	Wattle Street interchange to Rozelle interchange	4	4,340	80	13.6	C
3	Rozelle interchange bypass	2	1,970	80	12.3	C
4	Rozelle interchange to St Peters interchange	4	2,950	80	9.2	B
5	Interface with New M5	2	340	80	2.1	A
Southbound – PM peak						
1	Interface with M4 East	3	2,610	80	10.9	B
2	Wattle Street interchange to Rozelle interchange	4	3,190	80	10.0	B
3	Rozelle interchange bypass	2	1,750	80	10.9	B
4	Rozelle interchange to St Peters interchange	4	2,550	80	8.0	B
5	Interface with New M5	2	750	80	4.7	A
Northbound – AM peak						
1	Interface with New M5	2	1,180	80	7.4	B
2	St Peters interchange to Rozelle interchange	4	3,230	80	10.1	B
3	Rozelle interchange bypass	2	2,460	80	15.4	C
4	Rozelle interchange to Wattle Street interchange	4	4,060	80	12.7	C
5	Interface with M4 East	3	3,560	77	14.8	C
Northbound – PM peak						
1	Interface with New M5	2	410	80	2.6	A
2	St Peters interchange to Rozelle interchange	4	3,490	80	10.9	B
3	Rozelle interchange bypass	2	2,380	80	14.8	C
4	Rozelle interchange to Wattle Street interchange	4	4,810	80	15.0	C
5	Interface with M4 East	3	4,100	77	17.1	D

Table 8-78 M4-M5 Link motorway LoS – 2033 'with project' scenario

Section	Location and direction	No. of lanes	Modelled flow (PCU)	Speed (km/h)	Density (PCU/km/ln)	LOS
Southbound – AM peak						
1	Interface with M4 East	3	3,760	80	15.7	C
2	Wattle Street interchange to Rozelle interchange	4	4,750	80	14.8	C
3	Rozelle interchange bypass	2	1,940	80	12.2	C
4	Rozelle interchange to St Peters interchange	4	3,060	80	9.6	B
5	Interface with New M5	2	450	80	2.8	A
Southbound – PM peak						
1	Interface with M4 East	3	3,150	80	13.1	C
2	Wattle Street interchange to Rozelle interchange	4	3,840	80	12.0	C
3	Rozelle interchange bypass	2	2,250	80	14.0	C
4	Rozelle interchange to St Peters interchange	4	3,290	80	10.3	B
5	Interface with New M5	2	1,110	80	6.9	A
Northbound – AM peak						
1	Interface with New M5	2	1,740	80	10.9	B
2	St Peters interchange to Rozelle interchange	4	3,920	80	12.3	C
3	Rozelle interchange bypass	2	3,010	80	18.8	D
4	Rozelle interchange to Wattle Street interchange	4	4,700	75	15.7	C
5	Interface with M4 East	3	4,150	80	17.3	D
Northbound – PM peak						
1	Interface with New M5	2	560	80	3.5	A
2	St Peters interchange to Rozelle interchange	4	3,950	80	12.3	C
3	Rozelle interchange bypass	2	2,730	80	17.1	D
4	Rozelle interchange to Wattle Street interchange	4	5,200	79	16.5	D
5	Interface with M4 East	3	4,450	80	18.5	D

Note:

The reported speed has been capped at the posted 80 kilometres per hour. The microsimulation models allow vehicle speeds slightly higher than the posted speed, which models reality, especially in uncongested, free flow conditions.

Traffic crashes

Table 8-79 presents the crash analysis for the M4-M5 Link. The analysis has been carried out using crash rates from existing motorway tunnels in Sydney (Lane Cove, Eastern Distributor, Cross City and Sydney Harbour tunnels). These crashes would be balanced against the reduction in crashes forecast by the reduction in traffic volumes on the surface roads. Crash rates on motorways are much lower than on surface arterial roads and there would therefore be expected to be a reduction in the number of accidents.

Table 8-79 M4-M5 Link: Crash analysis for 2023 and 2033 'with project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'with project'						
M4-M5 Link	Wattle Street interchange	Rozelle interchange	1.25	87,470	23	$264,300
M4-M5 Link	Rozelle interchange bypass		1.36	39,620	11	$130,300
M4-M5 Link	Rozelle interchange	St Peters interchange	2.24	60,500	29	$327,600
2033 'with project'						
M4-M5 Link	Wattle Street interchange	Rozelle interchange	1.25	97,910	26	$295,900
M4-M5 Link	Rozelle interchange bypass		1.36	45,370	13	$149,200
M4-M5 Link	Rozelle interchange	St Peters interchange	2.24	68,910	33	$373,200

Operational performance – Wattle Street interchange

Changes to the road network in 'with project' scenario

Under the 'with project' scenario, traffic can travel between the M4 East and M4-M5 Link as well as use the M4-M5 Link entry and exit ramps to and from Wattle Street (between Parramatta Road and Ramsay Street).

Network performance

The performance of roads around the Wattle Street interchange in 2023 and 2033 with and without the project were modelled and the results are presented in **Table 8-80**.

The 'with project' scenario introduces more tunnelled motorway links, and while the forecast traffic demand significantly increases after the opening of the M4-M5 Link, the new links contribute to a substantial increase in the average vehicle speed. In 2023, a substantial increase in traffic is accommodated through the network in the 'with project' scenario, and overall average speeds increase due to the new M4-M5 Link reducing congestion on the surface road network. These improvements would be experienced during the AM and PM peak periods.

In the 2023 'with project' scenario in the AM peak, congestion is forecast along Wattle Street northbound, with queues extending through the Ramsay Street intersection, as a result of increases in surface network traffic demand to City West Link between the two scenarios. Queueing is not forecast to prevent entry to or exit from the project.

In the 2023 PM peak for the 'with project' scenario, the introduction of the project Wattle Street exit ramp requires a change in layout at the Wattle Street approach to the Parramatta Road/Wattle Street intersection, which reduces the number of surface through lanes from two to one, with the second through lane used by the M4-M5 Link exit ramp. Westbound queues extending along Wattle Street/Dobroyd Parade are therefore forecast to increase in the 'with project' scenario, despite a slight reduction in surface demand from City West Link. This results in forecast queueing back and unreleased demand at the westbound City West Link network entry. The westbound queueing is also forecast to cause side road queueing at the Ramsay Street intersection with Wattle Street, resulting in unreleased demand on the Ramsay Street westbound approach. The westbound queueing is also forecast to inhibit access into the M4 East Wattle Street entry ramp.

Increased demand to Frederick Street is forecast to cause queueing back along Frederick Street and inhibit the Parramatta Road eastbound right turn movement into Frederick Street, which in turn is forecast to cause delay to the Parramatta Road left turn movement into Wattle Street and into the project Wattle Street entry ramp.

Forecast demand along Parramatta Road is reduced following the M4-M5 Link opening, with fewer vehicles resulting in improved performance of the 'with project' scenario along this corridor when compared to 'without project' conditions.

In the 'with project' scenario in 2033, total traffic demand would increase by around 43 per cent in the AM peak periods and about 37 per cent in the PM peak period compared to the 2033 'without project' scenario. Average time travelled per vehicle in the network would decrease by around 46 per cent and 33 per cent and average speeds per vehicle would increase by around 47 per cent and 38 per cent respectively during the AM and PM peak periods.

In the AM peak, as per the 2023 scenario, forecast traffic demand to City West Link and Parramatta Road eastbound from the M4 East is lower than the 'without project' scenario, with much shorter queues on the M4 East exit ramp and on Wattle Street, due to the availability of the M4-M5 Link. This in turn accounts for the large increase in average speed within the network. Queueing is still observed to extend from the eastern end of the modelled road network; with queuing blocking through the Liverpool Road intersection. However, this is not forecast to extend beyond the Dalhousie Street intersection or to the M4 East Parramatta Road exit ramp. Queueing is not forecast to prevent entry to or exit from the project.

In the PM peak, the 2033 'with project' scenario results show an increase in average speed as a result of significantly reduced delay on the M4 East Parramatta Road exit ramp. This exit ramp was heavily congested in the 2033 'without project' scenario, with queueing back that extends to the M4 East mainline. The reduction in delay to this movement is greater than the increase in delay on the Wattle Street approach to Parramatta Road (caused by increased demand to Frederick Street), and therefore average speeds increase.

Increased demand to Frederick Street is forecast to cause queueing back along Frederick Street and inhibit the Parramatta Road eastbound right turn movement into Frederick Street. This is forecast to cause delay to the Parramatta Road left turn movement into Wattle Street and into the project Wattle Street entry ramp. Eastbound queueing is forecast from the City West Link/Timbrell Drive intersection back to the Parramatta Road/Wattle Street intersection.

Table 8-80 Wattle Street interchange network performance – AM and PM peak hours (2023 'without project' scenario vs 2023 'with project' scenario and 2033 'without project' scenario vs 2033 'with project' scenario)

Network measure	2023 'without project'	2023 'with project'	Percentage change	2033 'without project'	2033 'with project'	Percentage change
AM peak						
All vehicles						
Total traffic demand (veh)	15,279	21,410	40%	16,553	23,609	43%
Total vehicle kilometres travelled in network (km)	31,474	34,696	10%	32,470	37,632	16%
Total time travelled approaching and in network (hr)	2,153	1,667	-22%	2,316	1,821	-21%
Total vehicles arrived	14,483	21,113	46%	15,505	23,114	49%
Total number of stops	242,127	166,849	-31%	272,807	213,460	-22%
Average per vehicle in network						
Average vehicle kilometres travelled in network (km)	2.0	1.6	-20%	2.0	1.6	-20%
Average time travelled in network (mins)	8.0	4.5	-44%	8.3	4.5	-46%
Average number of stops	13.4	7.1	-48%	14.5	8.3	-43%
Average speed (km/h)	14.8	21.0	42%	14.2	20.9	47%
Unreleased vehicles						
Unreleased demand (veh)	796	297	–	1,048	495	–
% of total traffic demand	5%	1%	–	6%	2%	–
PM peak						
All vehicles						
Total traffic demand (veh)	15,209	20,825	37%	16,665	22,866	37%

Network measure	2023 ‘without project’	2023 ‘with project’	Percentage change	2033 ‘without project’	2033 ‘with project’	Percentage change
Total vehicle kilometres travelled in network (km)	29,075	33,968	17%	29,461	36,878	25%
Total time travelled approaching and in network (hr)	2,176	1,907	-13%	2,557	2,316	-9%
Total vehicles arrived	14,702	20,049	36%	15,451	21,917	42%
Total number of stops	318,512	201,602	-37%	387,426	265,136	-32%
Average per vehicle in network						
Average vehicle kilometres travelled in network (km)	1.8	1.6	-12%	1.8	1.6	-8%
Average time travelled in network (mins)	8.1	5.3	-34%	9.0	6.0	-33%
Average number of stops	17.4	8.7	-50%	20.0	10.5	-47%
Average speed (km/h)	13.5	18.0	34%	11.7	16.1	38%
Unreleased vehicles						
Unreleased demand (veh)	507	776	–	1,214	949	–
% of total traffic demand	3%	4%	–	7%	4%	–

Intersection performance

A summary of the modelled intersection performance on roads around the Wattle Street interchange in 2023 and 2033 'with project' and 'without project' scenarios is shown in **Table 8-81**.

During the 2023 and 2033 AM peak hour, the performance at the Parramatta Road/Wattle Street intersection is forecast to worsen in the 'with project' scenario, despite vehicle volumes using the surface road network reducing. The reduction in through lanes for surface traffic from Wattle Street to Frederick Street causes queuing on the southbound approach and increases the overall intersection delay. Elsewhere, intersection performance is forecast to be similar to the 'without project' scenario.

During the 2033 AM peak, the City West Link/Timbrell Drive intersection is forecast to improve in 'with project' scenario as a result of reduced demand for City West Link from the M4 East Wattle Street exit ramp (with corresponding increased demand for the M4-M5 Link Motorway). During the 2023 PM peak hour, the performance of the Parramatta Road/Liverpool Road intersection is forecast to improve in the 'with project' scenario, as a result of reduced demand for the intersection as traffic shifts to the M4-M5 Link. Elsewhere, performance remains similar to the 'without project' scenario.

Table 8-81 Wattle Street interchange: key intersection performance (LoS) – 2015 Base, 2023 and 2033 'without project' and 'with project' scenarios

Key intersections	2015 'base case'	2023 'without project'	2023 'with project'	2033 'without project'	2033 'with project'
AM peak hour					
Parramatta Road/Sloane Street	B	B	B	B	C
Parramatta Road/Liverpool Road	C	C	C	C	C
Parramatta Road/Dalhousie Street	B	B	B	C	B
Parramatta Road/Bland Street	B	B	B	C	B
Parramatta Road/Wattle Street	E	C	E	C	E
Parramatta Road/Great North Road	B	B	B	B	B
Parramatta Road/Arlington Street	B	C	C	C	D
Frederick Street/Church Street	B	B	C	B	C
Wattle Street/Ramsay Street	C	C	C	C	C
Dobroyd Parade/Waratah Street	A	A	A	B	B
City West Link/Timbrell Drive	C	D	D	F	D
PM peak hour					
Parramatta Road/Sloane Street	B	B	B	F	C
Parramatta Road/Liverpool Road	B	F	C	F	E
Parramatta Road/Dalhousie Street	B	B	B	B	B
Parramatta Road/Bland Street	B	B	B	B	B
Parramatta Road/Wattle Street	D	D	D	D	D
Parramatta Road/Great North Road	B	B	B	B	B
Parramatta Road/Arlington Street	B	C	C	C	D
Frederick Street/Church Street	B	B	B	B	B
Wattle Street/Ramsay Street	C	C	C	C	C
Dobroyd Parade/Waratah Street	A	B	A	B	A
City West Link/Timbrell Drive	D	F	E	F	F

Travel times

Figure 8-16 and **Figure 8-17** provide a comparison of travel times through the network modelled around the Wattle Street interchange in 2023 and 2033 'without project' and 'with project' scenarios.

In the AM peak hour, Parramatta Road eastbound travel times reduce slightly as a result of forecast reductions in the surface road network traffic. Westbound travel times in the AM peak hour remain fairly constant due to forecast decreased congestion in that direction. While total demand for City West Link reduces or remains at a similar level with the project, the forecast increase in surface traffic demand to City West Link and northbound demand from Frederick Street causes congestion northbound/eastbound along Wattle Street and City West Link, resulting in increased travel times on the Frederick Street to City West Link movement. Large reductions in travel time are forecast between the M4 East and Parramatta Road (E), as fewer vehicles make this movement, with traffic shifting to the M4-M5 Link.

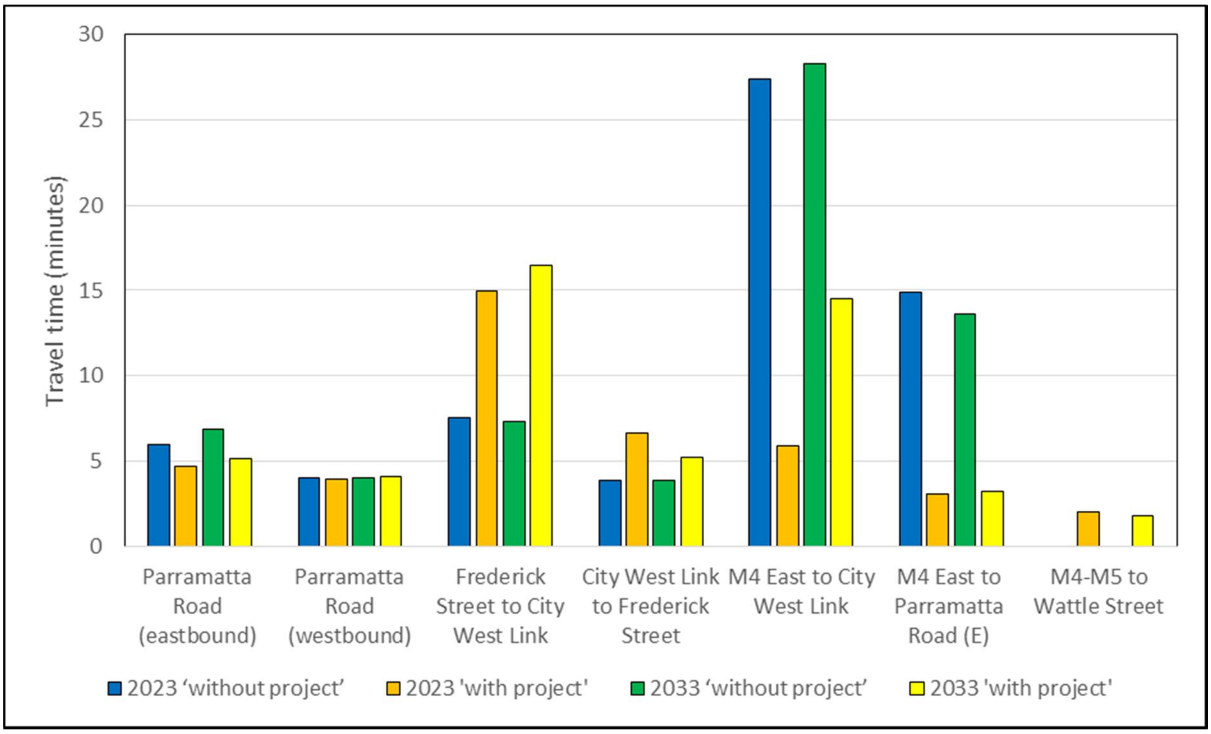


Figure 8-16 Wattle Street interchange: Average travel time (mins) – AM peak hour 'with project' scenarios

Figure 8-16 presents the travel times in the PM peak hour 'with project' scenarios, which demonstrates that the project would result in reduced travel times along Parramatta Road eastbound, as a result of the forecast reduction in traffic demand. Travel time benefits are also seen in travelling from Frederick Street to City West Link; however this is attributed more to traffic signal phasing changes, where this approach receives more green time in the 'with project' scenario.

Travel time benefits are also seen in the M4 East exit ramp movements to both City West Link and Parramatta Road, as a result of a forecast reduction in traffic as traffic shifts onto the M4-M5 Link.

Travel time increases are predicted along City West Link on the southbound approach to Parramatta Road, mainly as a result of the reduction in through lanes for surface traffic to Frederick Street.

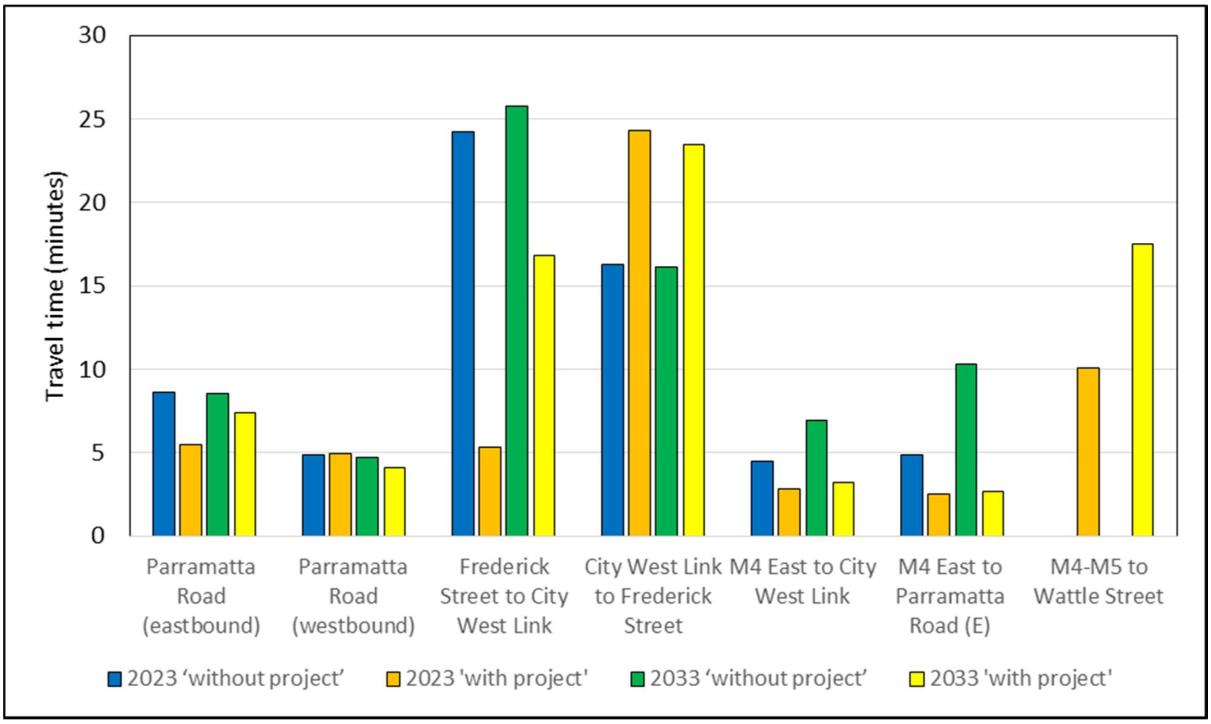


Figure 8-17 Wattle Street interchange: Average travel time (mins) – PM peak hour 'with project' scenarios

Traffic crashes

Table 8-82 and **Table 8-83** present the crash forecast under the 2023 and 2033 'with project' scenarios compared to the 'without project' scenarios.

Daily traffic on Parramatta Road is forecast to decrease in the 2023 'with project' scenario compared to the 'without project' scenario, resulting in a decrease in the total number and cost of crashes. Average annual crashes are forecast to decrease from 120 to 96, with the average annual cost of crashes falling from $12.9 million to $10.4 million.

Similarly, in 2033, forecasts indicate that a decrease in daily traffic on Parramatta Road between Wattle Street and City Road in the 2033 'with project' scenario compared to the 'without project' scenario would result in a decrease in the total number and cost of crashes. Average annual crashes decrease from 130 to 104 and the average annual cost of crashes decreases from $14.1 million to $11.2 million.

Table 8-82 Parramatta Road between Wattle Street and City Road: Crash comparison between 2023 'with project' and 'without project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'without project'						
Parramatta Road	Wattle Street	City Road	6.6	68,200	120	$12,905,600
2023 'with project'						
Parramatta Road	Wattle Street	City Road	6.6	54,760	96	$10,363,200

Table 8-83 Parramatta Road between Wattle Street and City Road: Crash comparison between 2033 'with project' and 'without project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 'without project'						
Parramatta Road	Wattle Street	City Road	6.6	74,340	130	$14,068,700
2033 'with project'						
Parramatta Road	Wattle Street	City Road	6.6	59,100	104	$11,184,200

Public transport services

Table 8-18 and **Figure 8-19** shows the comparison in travel times for buses between the 2023 and 2033 'without project' and 'with project' scenarios for the AM and PM peak.

Eastbound Parramatta Road bus travel times during the AM peak and PM peak hours are forecast to improve. This is primarily due to the reduction in general traffic demand along this same section. The westbound direction is less congested in the modelled scenarios, and so bus travel times remain relatively unchanged from the 'without project' scenario.

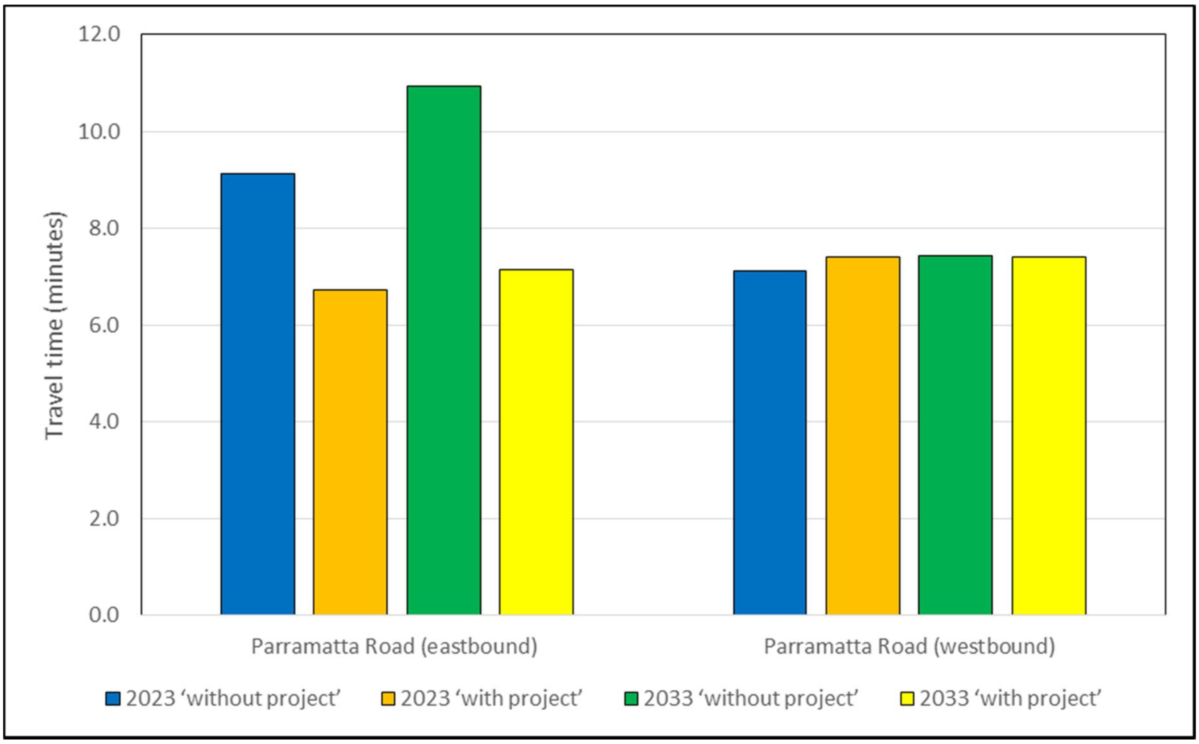


Figure 8-18 Wattle Street interchange: AM peak hour average travel time for buses – 'with project' comparison

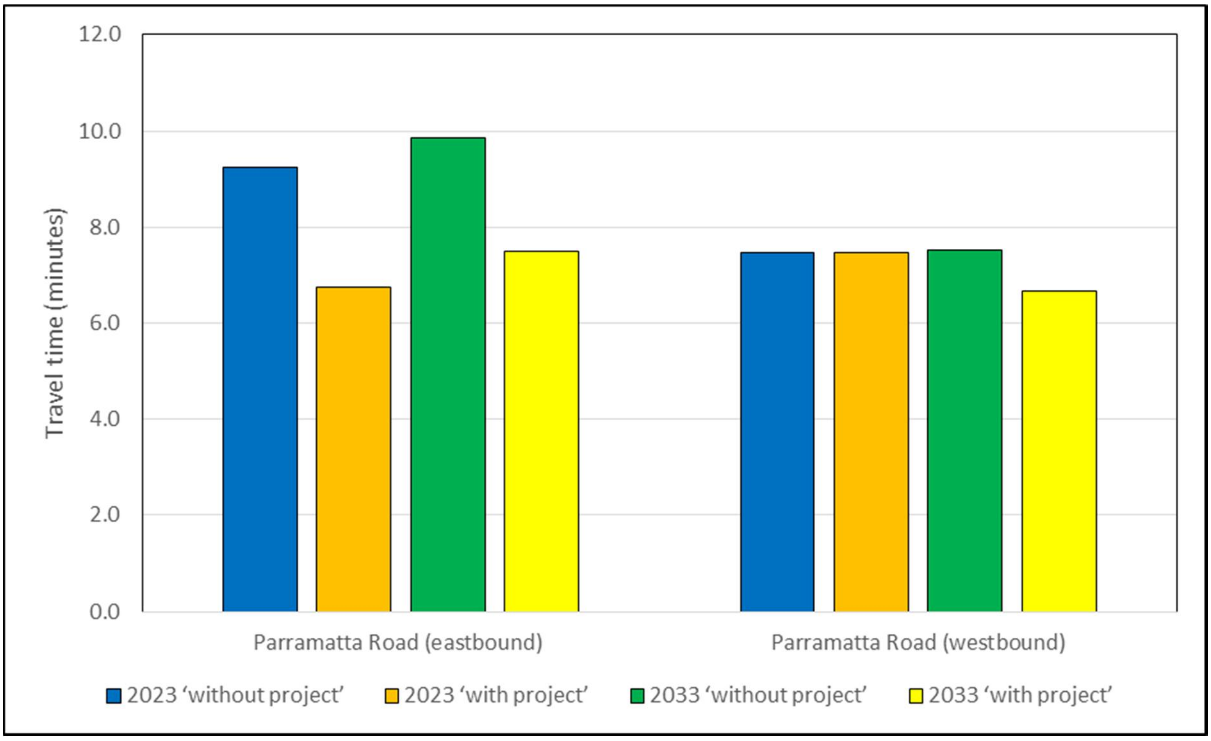


Figure 8-19 Wattle Street interchange: PM peak hour average travel time for buses – 'with project' comparison

Active transport facilities

Details of planned walking and cycling facilities can be found in **Annexure N** (Technical working paper: Active transport).

Impact on local property access and on-street parking

There is no planned impact on local property access or on-street residential or business parking in the Wattle Street interchange area as part of the M4-M5 Link project. The southern end of Northcote Street is to remain closed during construction as per the existing arrangement for construction of the M4 East project. Once construction of the M4-M5 Link is completed, this would be permanently re-opened.

Operational performance – Rozelle interchange

Changes to road network in 'with project' scenario

In addition to the Rozelle surface works, the 'with project' scenario includes the following new links added to the road network for the Rozelle interchange:

- Iron Cove Link, which provides a direct link between Victoria Road just east of Iron Cove Bridge and Anzac Bridge via a tunnel under Rozelle
- A new tunnel link between the M4 in the west and Anzac Bridge in the east. This link merges with the Iron Cove Link before connecting with Anzac Bridge
- A new tunnel link between the M5 and City West Link at a new intersection, west of the City West Link/The Crescent intersection
- A new tunnel link between M5 and Victoria Road, just east of Iron Cove Bridge. This link joins the Iron Cove Link to/from Anzac Bridge.

Network performance

The performance of the modelled road network around the Rozelle interchange in 2023 and 2033 with and without the project is presented in **Table 8-84**.

A 15 per cent increase in traffic demand is forecast in the 2023 AM peak 'with project' scenario compared to the 'without project' scenario. However, improved network performance metrics are forecast with decreased average vehicle travel times, fewer stops and increased average speeds, with ten per cent more vehicles arriving at their destination. This improvement is primarily due to the 'with project' network changes and a shift in traffic to the new motorways, which provide higher speeds and less congestion compared to the surface road network.

The AM peak citybound movements are forecast to continue to be affected by the queues back from the Bathurst Street/Cross City Tunnel off-ramp. In addition, the downstream exit blocking from Sydney Harbour Bridge on the Western Distributor also contributes to decreased performance and increased eastbound congestion on the Western Distributor. As a result, in spite of the improvement in network performance metrics, the number of unreleased vehicles almost doubles when compared with the 2023 'without project' network. The congestion on the Western Distributor and Anzac Bridge is forecast to cause some queueing in the Iron Cove Link, and to a lesser extent on the M4 exit ramp. This is not forecast to extend back to the M4-M5 Link mainline tunnels.

With the forecast traffic demand, the merge of two lanes from City West Link and two lanes from Victoria Road into two lanes on the eastbound approach to Anzac Bridge is forecast to cause significant queuing on City West Link.

In the PM peak hour, the overall network performance of the 'with project' scenario shows a significant improvement compared to the 2023 'without project' network, in spite of a forecast 15 per cent increase in demand. This improvement is partially attributed to the changed road network and a shift in traffic to the motorway. This is particularly true for the peak traffic direction, (outbound or westbound direction leaving the city). Once these vehicles reach the ramp entries to the M4 East and to the Iron Cove Link, they are forecast to operate in free flow conditions.

However, in the eastbound direction, the forecast demands increase significantly compared to the 'without project' scenario. As a result, the downstream capacity constraint at Sydney Harbour Bridge would cause eastbound congestion on Western Distributor and Anzac Bridge. This is expected to cause significant delays across Anzac Bridge, with queuing extending back onto Victoria Road and City West Link. This eastbound congestion partially offsets the improvements in the westbound direction; however, the overall network performance is expected to improve in the 'with project' scenario.

Similar to the 2023 'with project' scenario, the 2033 'with project' scenario is expected to provide significant improvements to overall road network performance when compared to the 'without project' scenario, with shorter average travel times, fewer number of stops and higher average speed, even with the forecast 15 per cent increase in demand. As before this can be attributed to the introduction of the project, and the significant demand shifting to motorway links with higher speeds and less congestion.

In the 'with project' scenario, the Western Distributor would be more congested compared to the 'without project' scenario due to the increase in forecast traffic demand. The citybound movements are likely to be affected by the queues from the Bathurst Street/Cross City Tunnel exit ramp and the downstream exit blocking from the Sydney Harbour Bridge, which cause congestion on Anzac Bridge and Western Distributor. This congestion is forecast to cause queueing in the Iron Cove Link, and to a lesser extent on the M4 exit ramp. This queuing is not forecast to extend back to the M4-M5 Link mainline tunnels.

While the eastbound direction is more congested, with a resultant increase in unreleased vehicles, the westbound traffic movement is forecast to improve significantly, primarily due to the additional westbound capacity provided by the M4 and the Iron Cove Link. As in 2023, with the forecast traffic demand the merge of two lanes from City West Link and two lanes from Victoria Road into two lanes on the eastbound approach to Anzac Bridge causes queuing along City West Link.

Roads and Maritime will develop a strategy to ensure appropriate network integration in the areas surrounding the Rozelle interchange. The strategy will include a review of:

- Capacity improvement measures
- Project staging options

- Demand management measures.

Further details about measures to manage traffic and transport impacts from the project are provided in **section 8.5**.

Table 8-84 Rozelle interchange network performance – AM and PM peak hours (2023 ‘without project’ scenario vs 2023 ‘with project’ scenario and 2033 ‘without project’ scenario vs 2033 ‘with project’ scenario)

Network measure	2023 ‘without project’	2023 ‘with project’	Percentage change	2033 ‘without project’	2033 ‘with project’	Percentage change
AM peak						
All vehicles						
Total traffic demand (veh)	22,087	25,327	15%	24,307	28,023	15%
Total vehicle kilometres travelled in network (km)	57,775	73,188	27%	59,866	77,690	30%
Total time travelled approaching and in network (hr)	5,355	6,308	18%	7,041	7,221	3%
Total vehicles arrived	21,621	23,799	10%	22,682	25,794	14%
Total number of stops	302,654	274,030	-9%	314,527	272,544	-13%
Average per vehicle in network						
Average vehicle kilometres travelled in network (km)	2.7	3.1	15%	2.6	3.0	14%
Average time travelled in network (mins)	10.1	9.8	-2%	10.3	9.3	-9%
Average number of stops	12.3	10.1	-18%	12.0	9.2	-23%
Average speed (km/h)	15.9	18,8	18%	15.4	19.4	26%
Unreleased vehicles						
Unreleased demand (veh)	1,278	2,309	–	2,233	2,719	–
% of total traffic demand	6%	9%	–	9%	10%	–

Network measure	2023 ‘without project’	2023 ‘with project’	Percentage change	2033 ‘without project’	2033 ‘with project’	Percentage change
PM peak						
All vehicles						
Total traffic demand (veh)	24,694	28,109	14%	26,528	30,259	14%
Total vehicle kilometres travelled in network (km)	61,136	80,108	31%	60,908	86,924	43%
Total time travelled approaching and in network (hr)	4,896	5,091	4%	6,146	5,286	-14%
Total vehicles arrived	21,854	24,261	11%	22,679	27,082	19%
Total number of stops	146,986	179,138	22%	151,862	92,817	-39%
Average per vehicle in network						
Average vehicle kilometres travelled in network (km)	2.8	3.3	18%	2.7	3.2	20%
Average time travelled in network (mins)	8.3	7.9	-4%	8.2	6.1	-25%
Average number of stops	5.9	6.4	8%	5.9	3.1	-47%
Average speed (km/h)	20.3	25.1	23%	19.7	31.3	59%
Unreleased vehicles						
Unreleased demand (veh)	2,684	2,655	–	3,591	2,974	–
% of total traffic demand	11%	9%	–	14%	10%	–

Intersection performance

A summary of the modelled intersection performance on roads around the Rozelle interchange in 2023 and 2033 with and without the project is shown in **Table 8-85**. In the 2023 AM peak hour, the forecast intersection performances are similar in the 'without project' and 'with project' scenarios. However, in the 2033 AM peak hour, due to forecast demand from Victoria Road to The Crescent, delays are forecast at the Victoria Road/The Crescent intersection in the 'with project' scenario. The southbound queuing at this intersection is forecast to also result in a poor level of service at the Victoria Road/Robert Street intersection.

In the PM peak hour 'with project' scenario, the intersections along Victoria Road and City West Link are forecast to operate at an improved level of service compared to the 'without project' scenario, due to the direct link from Anzac Bridge to the M4 and Iron Cove Link.

The Victoria Road/Lyons Road intersection in both peak hours, the Victoria Road/Darling Street and Victoria Road/Robert Street intersections in the AM peak hour and The Crescent/Johnston Street intersection in the PM peak hour remain at or over capacity due to the forecast demands. Upgrades are proposed as part of the project at The Crescent/Johnston Street intersection (see **section 8.5.1**), however further upgrades at this intersection to improve performance are constrained by the existing light rail bridge.

Table 8-85 Rozelle interchange: key intersection performance (LoS) – 2015 Base, 2023 and 2033 'without project' and 'with project' scenarios

Key intersections	2015 Base	2023 'without project	2023 'with project	2033 'without project	2033 'with project
AM peak hour					
Victoria Road/Lyons Road	D	F	F	F	F
Victoria Road/Wellington Street	D	D	C	D	D
Victoria Road/Darling Street	F	F	F	F	F
Victoria Road/Robert Street	D	D	C	D	F
Victoria Road/The Crescent	B	B	C	C	D
The Crescent/James Craig Road	A	A	B	B	B
City West Link/The Crescent	B	B	C	B	D
The Crescent/Johnston Street	C	C	C	D	C
The Crescent/M5 ramps	–	–	B	–	B
PM peak hour					
Victoria Road/Lyons Road	D	F	F	F	F
Victoria Road/Wellington Street	B	D	B	D	C
Victoria Road/Darling Street	F	F	D	F	D
Victoria Road/Robert Street	F	F	C	F	C
Victoria Road/The Crescent	F	F	C	E	C
The Crescent/James Craig Road	B	C	A	B	A
City West Link/The Crescent	D	F	B	D	C
The Crescent/Johnston Street	F	F	F	E	F
The Crescent/M5 ramps	–	–	B	–	B

Travel times

Figure 8-20 and **Figure 8-21** provide a comparison of travel times for journeys through the modelled network around the Rozelle interchange in the 2023 and 2033 'without project' and 'with project' scenarios.

In the AM peak in the 'with project' scenario, increased travel times in the peak direction (inbound to the city) would occur on Victoria Road and City West Link due primarily to congestion on the Western Distributor and Anzac Bridge, which causes queuing back onto City West Link, the Iron Cove Link and Victoria Road. Significant improvement is reported in the westbound direction due to the direct link provided by the project from Anzac Bridge to the M4 and Iron Cove Link.

In the PM peak travel times would decrease in the peak direction (westbound out of the city) compared to the 'without project' scenario. The average travel time from Anzac Bridge to Iron Cove Bridge is forecast to reduce by about six minutes in the 'with project' scenario, from about 10 minutes via Victoria Road to about four minutes via the Iron Cove link. However, the eastbound journey time is forecast to increase due to increased demand and capacity constraints at Sydney Harbour Bridge, resulting in queuing back along Western Distributor and Anzac Bridge.

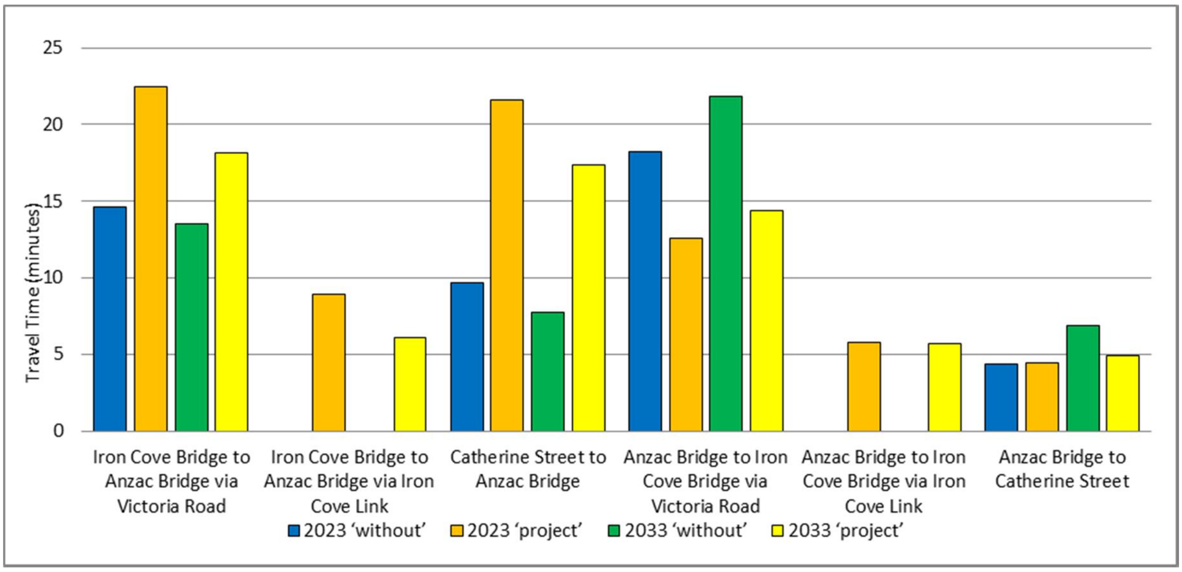


Figure 8-20 Rozelle interchange: Average travel time (mins) – AM peak hour 'with project' scenarios

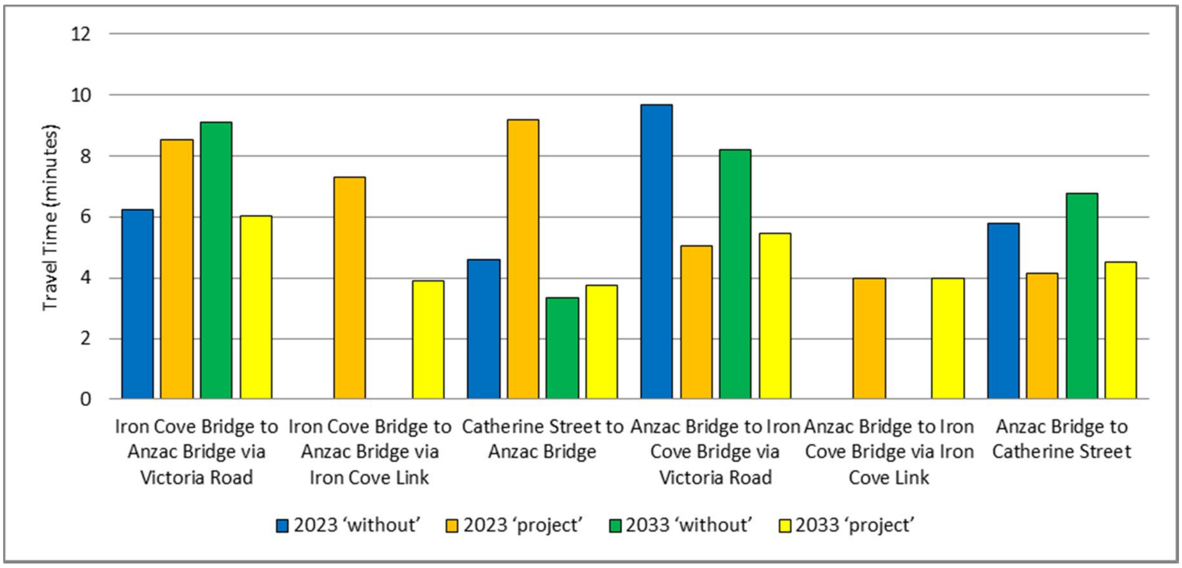


Figure 8-21 Rozelle interchange: Average travel time (mins) – PM peak hour 'with project' scenarios

Traffic crashes

Table 8-86 presents the crash forecast under the 2023 'with project' scenario compared to the 'without project' scenario. Daily traffic on Anzac Bridge is forecast to increase in the 2023 'with project' scenario compared to the 'without project' scenario, resulting in an increase in the total number and cost of crashes. However, forecast decreases in daily traffic on other roads in the vicinity, especially City West Link and Victoria Road, result in a decrease in the total number and cost of crashes at these locations compared to the 'with project' scenario.

Table 8-86 Rozelle and surrounds: Crash comparison between 2023 'with project' and 'without project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'without project'						
Anzac Bridge	Miller Street	Victoria Road	0.99	157,170	25	$6,428,100
City West Link	James Street	Victoria Road	2.13	89,390	35	$8,616,900
Victoria Road	Darling Street	The Crescent	0.85	100,520	23	$6,451,300
Lilyfield Road	Victoria Road	Canal Road	2.48	9,202	18	$4,957,700
The Crescent	City West Link	Wigram Road	1.32	26,960	12	$2,804,800
Johnston Street	The Crescent	Parramatta Road	1.80	18,311	14	$3,826,100
2023 'with project'						
Anzac Bridge	Miller Street	Victoria Road	0.99	193,310	31	$7,906,200
City West Link	James Street	Victoria Road	2.13	69,810	27	$6,729,500
Victoria Road	Darling Street	The Crescent	0.85	61,640	14	$3,956,000
Lilyfield Road	Victoria Road	Canal Road	2.48	9,644	18	$5,196,000
The Crescent	City West Link	Wigram Road	1.32	32,600	14	$3,391,500
Johnston Street	The Crescent	Parramatta Road	1.80	20,621	16	$4,308,800

Table 8-87 compares the crashes forecast under the 2033 scenarios. Similar to 2023, forecast decreases in daily traffic in the 2033 'with project' scenario compared to the 'without project' scenario on roads such as City West Link and Victoria Road result in a decrease in the total number and cost of crashes at these locations, but daily traffic on Anzac Bridge, The Crescent and Johnston Street is forecast to increase, resulting in an increase in total number and cost of crashes.

Compared to the 2033 'without project' scenario, there is a small change in the forecast number and cost of annual crashes at these locations.

Table 8-87 Rozelle and surrounds: Crash comparison between 2033 'with project' and 'without project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 'without project'						
Anzac Bridge	Miller Street	Victoria Road	0.99	167,260	27	$6,840,800
City West Link	James Street	Victoria Road	2.13	100,440	39	$9,682,100
Victoria Road	Darling Street	The Crescent	0.85	106,730	24	$6,849,900
Lilyfield Road	Victoria Road	Canal Road	2.48	11,743	22	$6,326,700
The Crescent	City West Link	Wigram Road	1.32	29,230	13	$3,040,900
Johnston Street	The Crescent	Parramatta Road	1.80	20,545	16	$4,293,000
2033 'with project'						
Anzac Bridge	Miller Street	Victoria Road	0.99	210,110	34	$8,593,300
City West Link	James Street	Victoria Road	2.13	88,450	35	$8,526,300
Victoria Road	Darling Street	The Crescent	0.85	72,340	16	$4,642,700
Lilyfield Road	Victoria Road	Canal Road	2.48	10,855	21	$5,848,100
The Crescent	City West Link	Wigram Road	1.32	40,650	18	$4,229,000
Johnston Street	The Crescent	Parramatta Road	1.80	24,716	19	$5,164,400

Public transport services

Figure 8-22 and **Figure 8-23** show the comparison in travel times for buses between the 'without project' and 'with project' scenarios for the AM peak hour. A representative assessment has been carried out for the main bus route along Victoria Road and over Anzac Bridge to the city-bound bus-only lane on the Druitt Street ramp.

The results show longer city-bound bus journey times in the AM peak, due to the congested traffic conditions on Western Distributor and Anzac Bridge combined with the increased demands to Bathurst Street and Sydney Harbour Bridge, compared to the 'without project' case.

In the outbound direction, the Iron Cove Link significantly improves the congestion over Anzac Bridge. As a result, bus journey times reduce in the 'with project' scenario. The forecast reduction in general traffic demand on Victoria Road between Iron Cove Link and Anzac Bridge would provide the opportunity to investigate improving public transport operations, such as extending the existing bus lanes on Victoria Road.

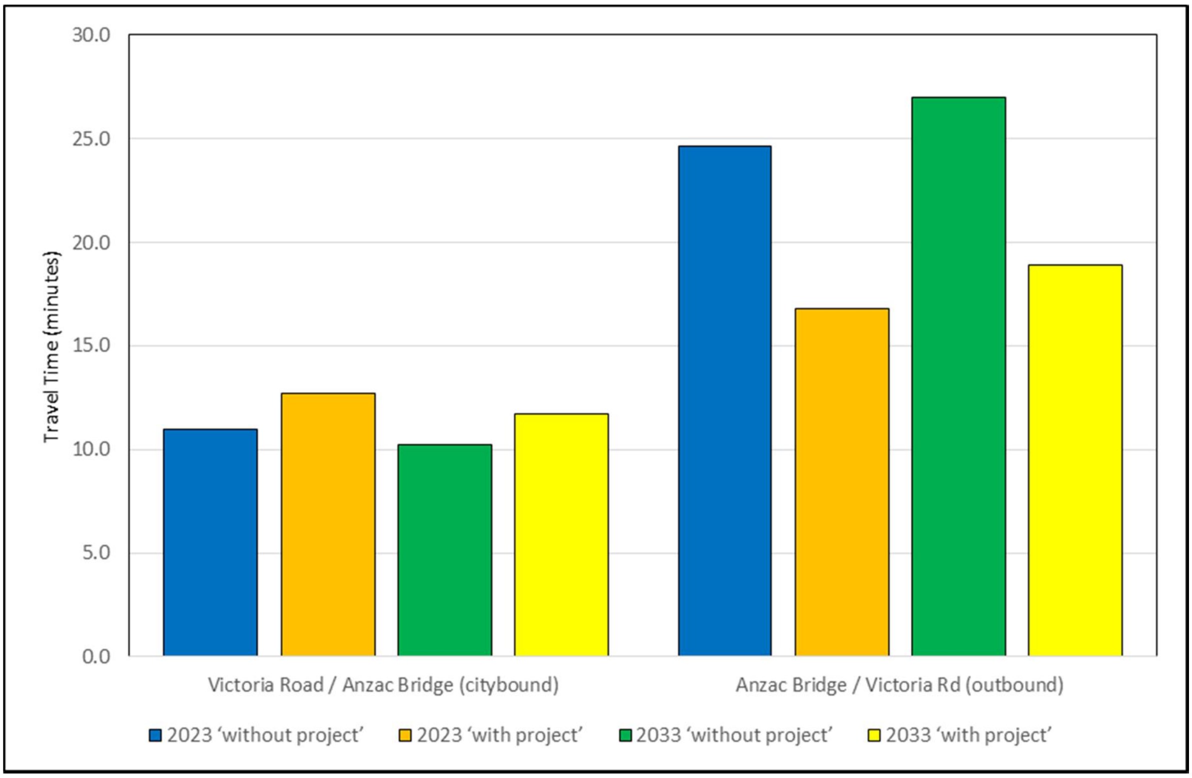


Figure 8-22 Rozelle interchange: Average travel time for buses – AM peak hour 'with project' comparison

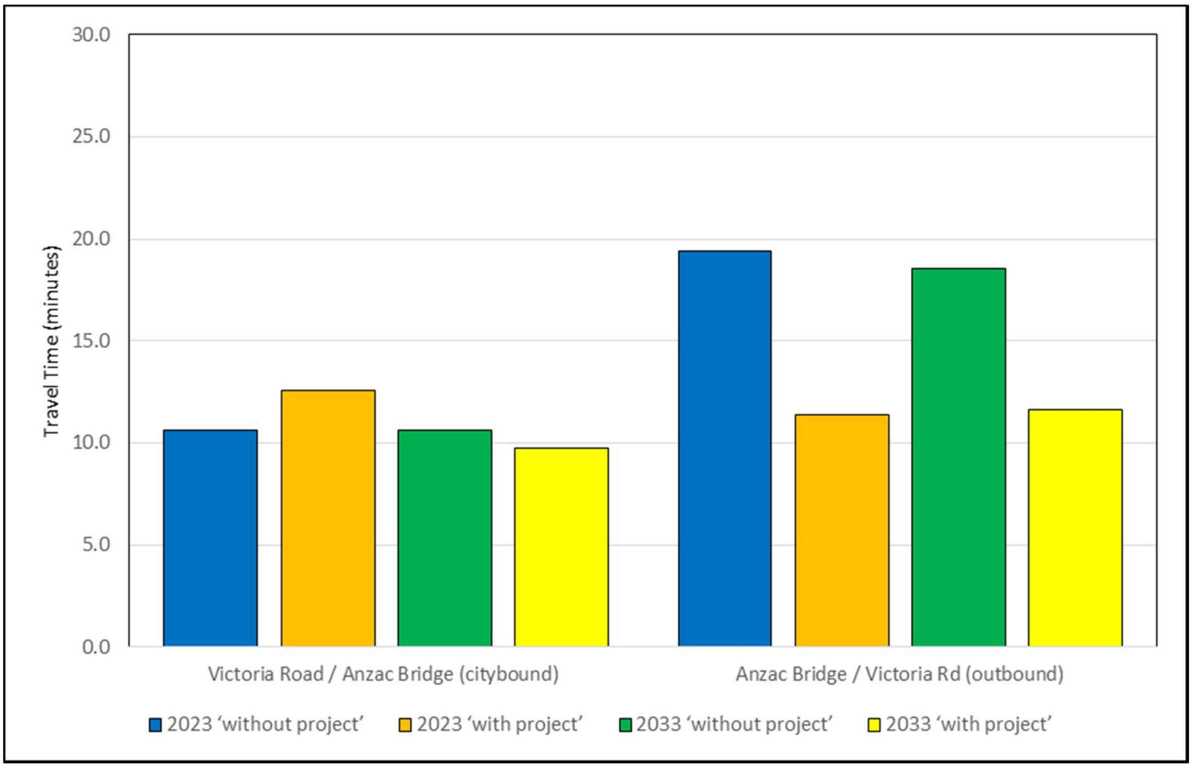


Figure 8-23 Rozelle interchange: Average travel time for buses – PM peak hour 'with project' comparison

Active transport facilities

The project would deliver new pedestrian and cycle infrastructure in Lilyfield and Rozelle. This infrastructure has been designed to maintain and enhance pedestrian and cyclist accessibility and connectivity, providing new and upgraded east–west connections linking Lilyfield and Rozelle with Anzac Bridge, the future Bays Precinct and Balmain, and north–south connections linking Lilyfield and Rozelle with Annandale and Glebe. Details of planned walking and cycling facilities can be found in **Annexure N** (Technical working paper: Active transport).

Impacts on local property access and on-street parking

As part of the Iron Cove Link surface works, modifications to the intersections between Victoria Road and Clubb Street, Toelle Street and Callan Street would be carried out associated with widening of Victoria Road to accommodate the Iron Cove Link tunnel portals. Toelle Street and Callan Street would be reopened in the same traffic operational arrangement as existing. Clubb Street would be converted into a permanent cul-de-sac. Residents accessing Clubb Street could use Toelle Street or Callan Street via Manning Street to access from Victoria Road. The Byrnes Street cul-de-sac would also move south-west.

As a result of these road layout changes, there would be permanent impacts on residential and business on-street parking provision. This is shown in **Table 8-88.** Most of these parking spaces are adjacent to properties being acquired. The final numbers would be confirmed during detailed design.

Table 8-88 Indicative permanent impact on on-street parking spaces

Road section	Indicative impact
Byrnes Street, at the northeast end	Loss of around five spaces
Clubb Street, at the northeast end	Loss of around nine spaces
Toelle Street, at the northeast end	Loss of around seven spaces
Callan Street, at the northeast end	Loss of around two spaces

Operational performance – St Peters interchange

Changes to the road network in the 'with project' scenario

In the 'with project' scenario, ramps providing connectivity to the M4-M5 Link are introduced to the modelled road network. Not all of the forecast demand to and from the Sydney Airport precinct could be accommodated in the peak hour without the proposed future Sydney Gateway project. This reduction in forecast demand is reported in the network performance tables.

Even with this demand reduction, the surface road network in the model is unable to accommodate the forecast peak hour demands without the additional road capacity provided by the proposed future Sydney Gateway. The proposed future Sydney Gateway introduces a bypass to Mascot town centre and, in its absence, it would be necessary to introduce a number of upgrades at the following intersections to accommodate the forecast traffic:

- Gardeners Road/Kent Road
- Gardeners Road/O'Riordan Street
- Kent Road/Coward Street
- Bourke Road/Coward Street
- Kent Road/Ricketty Street.

These upgrades would not be required once the proposed future Sydney Gateway is operational, but have been included in the 'with project' scenario to enable network performance statistics to be generated.

Network performance

The performance of the modelled road network around the St Peters interchange, in the 2023 and 2033 'with project' and 'without project' scenarios, is presented in **Table 8-89**. The surface network in the 'without project' and 'with project' scenarios is not the same. The additions in the 'with project' scenario are the M4-M5 Link entry and exit ramps at St Peters interchange and the surface road intersection upgrades required to accommodate the additional forecast traffic demand, in the absence of the proposed future Sydney Gateway.

2023 'with project' scenario

In the AM peak hour, the 2023 'with project' scenario network performance is similar to the 'without project' scenario performance. The average vehicle performance metrics are slightly improved compared to the 'without project' scenario, but there is a slight increase in the number of unreleased vehicles. The 'with project' scenario shows that trips are forecast to take less time, with vehicles travelling slightly more quickly due to less congestion than the 'without project' scenario. Queuing in the network is not forecast to prevent entry to or from the project.

In the PM peak hour, the network performance measures suggest that the 2023 'with project' case is more congested, which is reflected in longer average trip times, and average speed in the network dropping by about 28 per cent. Queueing in the network is not forecast to prevent entry to or exit from the project. However, congestion in the Mascot area limits vehicles able to travel through the network in the peak hour to enter the motorway.

2033 'with project' scenario

The 2033 AM peak hour network performance results show that the 'with project' scenario is forecast to provide improved network operation when compared to the 'without project' scenario. The 'with project' scenario introduces more tunnelled motorway links, and while there is a ten per cent increase in forecast traffic demand after the opening of the project, the new links contribute to a substantial increase in the average vehicle speed.

In the 2033 PM peak hour, the network performance results show that the 'with project' scenario is more congested than the 'without project' scenario. Demand was reduced by about 400 trips to and from Sydney Airport, with those trips not being served by the network in the peak hour. However, the total demand still increases by 12 per cent and all indicators show that the network is performing inefficiently.

Queueing in the network is not forecast to prevent entry to or exit from the project. However, congestion in the Mascot area limits vehicles able to travel through the network in the peak hour to enter the motorway.

Even with a reduction in forecast demand to and from the Sydney Airport precinct, a number of intersection upgrades were required in the absence of the proposed future Sydney Gateway to accommodate the forecast growth in traffic demand in the 'with project' scenarios. This indicates that the proposed future Sydney Gateway project is required to accommodate the forecast traffic demands at the St Peters interchange and surrounds.

Table 8-89 St Peters interchange network performance – AM and PM peak hours (2023 ‘without project’ scenario vs 2023 ‘with project’ scenario and 2033 ‘without project’ scenario vs 2033 ‘with project’ scenario)

Network measure	2023 ‘without project’	2023 ‘with project’	Percentage change	2033 ‘without project’	2033 ‘with project’	Percentage change
AM peak						
All vehicles						
Total traffic demand (veh)	26,060	28,470	9%	29,160	30,990	10%
Total vehicle kilometres travelled in network (km)	77,500	89,120	15%	72,830	92,690	27%
Total time travelled approaching and in network (hr)	5,150	5,350	4%	12,360	7,890	-36%
Total vehicles arrived	23,710	26,190	10%	20,720	27,130	31%
Total number of stops	201,290	205,570	2%	274,310	250,290	-9%
Average per vehicle in network						
Average vehicle kilometres travelled in network (km)	2.8	2.9	6%	2.6	2.8	11%
Average time travelled in network (mins)	9.5	8.9	-6%	17.0	10.9	-36%
Average number of stops	8.5	7.9	-8%	13.2	9.2	-30%
Average speed (km/h)	17.6	19.9	13%	9.0	15.7	73%
Unreleased vehicles						
Unreleased demand	2,120	2,470	–	6,950	4,310	–

Network measure	2023 'without project'	2023 'with project'	Percentage change	2033 'without project'	2033 'with project'	Percentage change
(veh)						
% of total traffic demand	8%	9%	–	24%	13%	–
Unreleased demand (demand reduction) (veh)	640	720	–	690	830	–
PM peak						
Total traffic demand (veh)	25,210	27,920	11%	27,610	31,040	12%
Total vehicle kilometres travelled in network (km)	78,920	90,610	15%	84,570	84,000	-1%
Total time travelled approaching and in network (hr)	2,850	4,710	65%	4,970	9,700	95%
Total vehicles arrived	24,960	26,600	7%	26,350	24,120	-8%
Total number of stops	127,390	186,400	46%	195,250	248,790	27%
Average per vehicle in network						
Average vehicle kilometres travelled in network (km)	2.9	2.9	3%	2.8	2.7	-1%
Average time travelled in network (mins)	6.1	8.6	42%	9.2	14.5	58%
Average number of stops	5.1	7.0	37%	7.4	10.3	39%
Average speed (km/h)	28.2	20.4	-28%	18.0	11.2	-38%

Network measure	2023 ‘without project’	2023 ‘with project’	Percentage change	2033 ‘without project’	2033 ‘with project’	Percentage change
Unreleased vehicles						
Unreleased demand (veh)	220	1,030	–	1,150	6,340	–
% of total traffic demand	1%	4%	–	4%	20%	–
Unreleased demand (demand reduction) (veh)	230	360	–	320	420	–

Intersection performance

Table 8-90 shows the modelled AM and PM peak hour LoS for key intersections at St Peters area in the 2023 and 2033 'with project' scenarios compared to the 'without project' scenarios.

Table 8-90 St Peters interchange: key intersection performance (LoS) – 2023 and 2033 'with project' scenarios

Key intersections	2015 Base	2023 'without project'	2023 'with project'	2033 'without project'	2033 'with project'
AM peak hour					
Princes Highway/Sydney Park Road	C	C	C	F	C
Princes Highway/May Street	D	C	C	F	D
Princes Highway/Canal Road	D	F	F	F	F
Princes Highway/Railway Road	F	F	F	F	F
Sydney Park Rd/Mitchell Road	C	B	C	F	C
Euston Road/Sydney Park Road	A	C	C	F	D
Unwins Bridge Road/Campbell Street	C	D	D	F	F
Campbell Road/Euston Road	A	C	C	F	D
Campbell Road/Bourke Road	-	B	D	B	F
Princes Highway/Campbell Street	C	F	F	F	F
Ricketty Street/Kent Road*	C	E	D	F	F
Gardeners Road/Kent Road*	A	C	D	F	F
Gardeners Road/Bourke Road	C	F	E	F	F
Gardeners Rd/O'Riordan Street*	D	F	F	F	F
PM peak hour					
Princes Highway/Sydney Park Road	D	B	B	C	C
Princes Highway/May Street	F	C	C	B	B
Princes Highway/Canal Road	D	D	C	F	E
Princes Highway/Railway Road	D	D	F	F	F
Sydney Park Rd/Mitchell Road	D	C	C	D	D
Euston Road/Sydney Park Road	B	D	D	D	D
Unwins Bridge Road/Campbell Street	D	E	E	F	F
Campbell Road/Euston Road	A	E	D	E	F
Campbell Road/Bourke Road	-	B	C	B	F
Princes Highway/Campbell Street	D	F	E	F	E
Ricketty Street/Kent Road*	C	C	D	F	F
Gardeners Road/Kent Road*	A	B	D	D	F
Gardeners Road/Bourke Road	D	D	F	F	F
Gardeners Rd/O'Riordan Street*	E	F	F	F	F

Note: *These intersections have upgrades in the 'with project' scenarios

In the AM peak hour, under the 2023 'with project' scenario, the intersections generally forecast similar LoS compared with the 'without project' scenario, except for the Campbell Road/Bourke Road, Ricketty Street/Kent Road and Gardeners Road/Kent Road intersections. In 2033, most of the intersections perform similar or better in the 'with project' scenario, with the exception of the Campbell Road/Bourke Road intersection.

In the 2023 PM peak hour, the intersections generally forecast similar LoS compared with the 'without project' scenario, except for the Campbell Road/Euston Road, Princes Highway/Campbell Street and Gardeners Road/Bourke Road intersections. In the 2033 PM peak hour, most intersections are forecast to operate poorly.

Travel times

Figure 8-24 and **Figure 8-25** show a comparison of travel times in 2023 and 2033 under the 'without project' and 'with project' scenarios in the AM and PM peak hours.

In the AM peak hour, 2023 travel times for all journeys assessed are similar between the two scenarios. In the 2033 'without project' scenario, the AM peak hour network is very congested and all travel time journeys assessed increase. Travel times show considerable improvement in the 2033 'with project' scenario.

In the PM peak hour, routes that do not run through Mascot, such as Princes Highway to Euston Road, have comparable travel times between scenarios. However, the Railway Road to Gardeners Road and King Street to Sydney Airport Domestic Terminals routes are affected by Mascot congestion and travel times recorded in the 'with project' scenarios are consistently longer than the ones recorded in 'without project' scenarios.

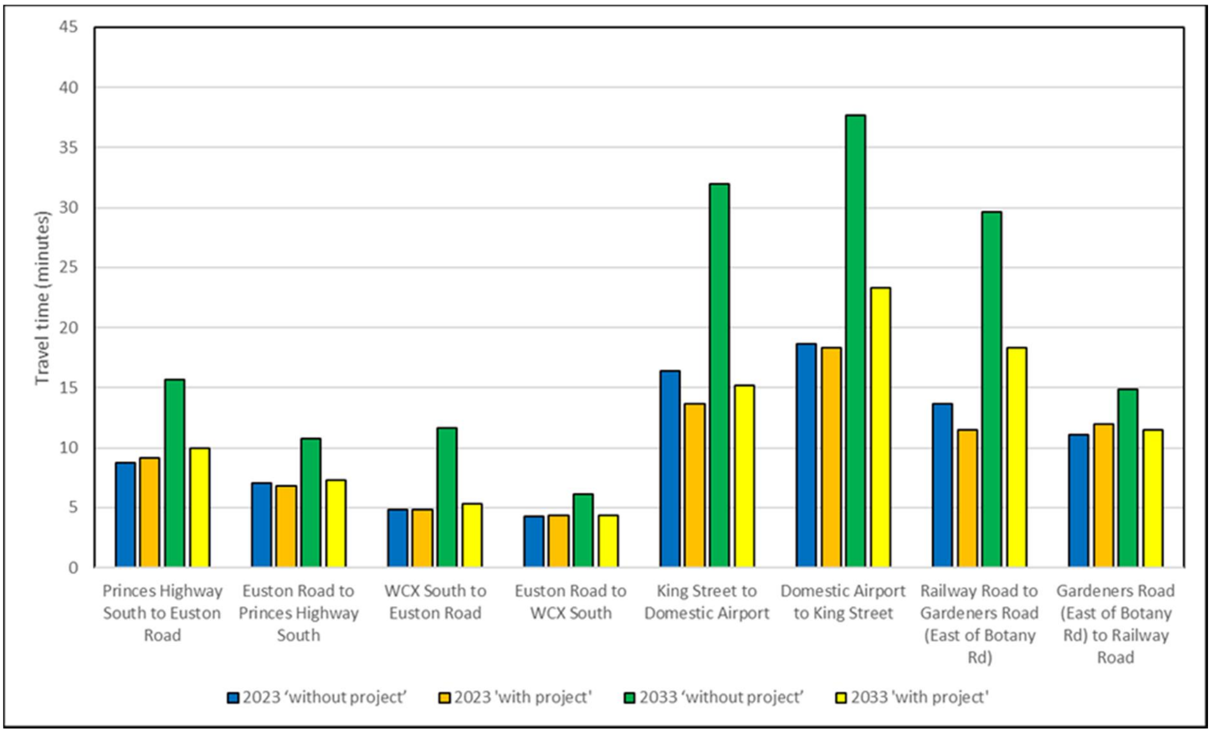


Figure 8-24 St Peters interchange: Average travel time (mins) – AM peak hour 'with project' scenarios

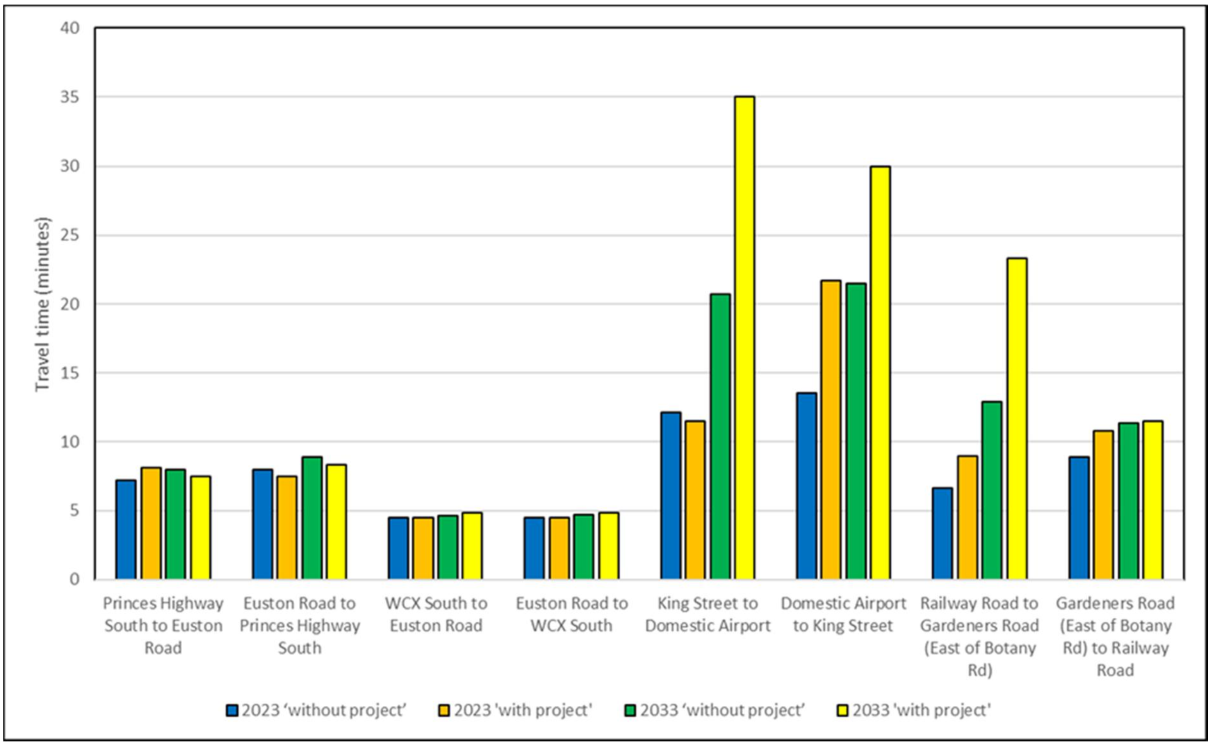


Figure 8-25 St Peters interchange: Average travel time (mins) – PM peak hour 'with project' scenarios

Traffic crashes

The frequency of crashes on surface roads in the vicinity of the St Peters area, on the M5 East and on the New M5 forecast under the 'with project' scenarios would change relative to forecast traffic changes and historical crash rates for these roads. Traffic crash analysis on surface roads in the vicinity of the St Peters area have also taken into account crash reductions resultant from intersection upgrades planned as part of the New M5 project.

Table 8-91 presents the crashes forecast under the 2023 'with project' scenario compared to the 'without project' scenario. The forecast change in daily traffic on the surface roads in the vicinity of the St Peters area varies. There are increases of less than 10 per cent forecast for Princes Highway and Euston Road, a decrease of just over 10 per cent forecast for Bourke Road, and a more significant decrease of about 25 per cent forecast for Canal Road/Ricketty Street/Gardeners Road.

Table 8-91 shows that there is an overall decrease in the number of cost of annual crashes on surface roads in the vicinity of the St Peters area with the project.

Table 8-91 St Peters and surrounds: Crash comparison between 2023 'without project' and 'with project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'without project'						
Princes Highway	Enmore Road	Gannon Street	3.8	54,630	87	$9,013,400
Canal Road / Ricketty Street / Gardeners Road	Princes Highway	Botany Road	2.4	28,150	34	$3,075,200
Euston Road	Sydney Park Road	Campbell Road	0.9	42,490	31	$2,447,600

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
Bourke Road	Wyndham Street	Gardeners Road	2.1	28,340	31	$2,326,600
2023 ‘with project’						
Princes Highway	Enmore Road	Gannon Street	3.8	57,230	91	$9,442,400
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	21,820	27	$2,383,700
Euston Road	Sydney Park Road	Campbell Road	0.9	45,330	34	$2,611,200
Bourke Road	Wyndham Street	Gardeners Road	2.1	25,250	27	$2,072,900

Table 8-92 compares the crashes forecast under the 2033 scenarios. In the 2033 ‘with project’ scenario, the forecast increase in traffic on Euston Road would cause an increase in the total number and cost of crashes on Euston Road, south of Sydney Park Road. A forecast increase in traffic on Princes Highway between Enmore Road and Gannon Street also causes an increase in the number and cost of crashes at this location. However, the significant decrease in daily traffic forecast on the Canal Road/Ricketty Street/Gardeners Road, and Bourke Road between Wyndham Street and Gardeners Road, in combination with the intersection upgrades, would result in a reduction in the total number and cost of crashes on these roads. **Table 8-92** shows that there is a benefit in the reduction in number and cost of crashes at these locations of about four per cent compared to the ‘without project’ scenario.

Table 8-92 St Peters and surrounds: Crash comparison between 2033 ‘without project’ and ‘with project’ scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 ‘without project’						
Princes Highway	Enmore Road	Gannon Street	3.8	59,220	95	$9,770,700
Canal Road/Ricketty Street/Gardeners Road	Princes Highway	Botany Road	2.4	32,230	39	$3,520,900
Euston Road	Sydney Park Road	Campbell Road	0.9	47,120	35	$2,714,300
Bourke Road	Wyndham Street	Gardeners Road	2.1	29,460	32	$2,418,600
2033 ‘with project’						
Princes Highway	Enmore Road	Gannon Street	3.8	61,780	99	$10,193,100
Canal Road/Ricketty Street/Gardeners Road	Princes Highway	Botany Road	2.4	24,000	29	$2,621,900
Euston Road	Sydney Park Road	Campbell Road	0.9	49,540	37	$2,853,700
Bourke Road	Wyndham Street	Gardeners Road	2.1	26,450	29	$2,171,500

Public transport services

Table 8-26 shows the comparison in average bus travel time across the St Peters modelled road network between the 'without project' and 'with project' scenarios for the AM and PM peak hours. As there are not one or two dominant bus corridors in the modelled network, an average of all bus travel times has been reported.

In the AM peak hour, the average bus travel time is similar across the scenarios, with small increases in the 2023 'with project' scenario compared to the 2023 'without project' scenario, and similar times in the 2033 comparison. In the PM peak hour, there is an increase in the average bus travel time in the 2023 'with project' scenarios compared to the 2023 'without project' scenario, and again in the 2033 comparison.

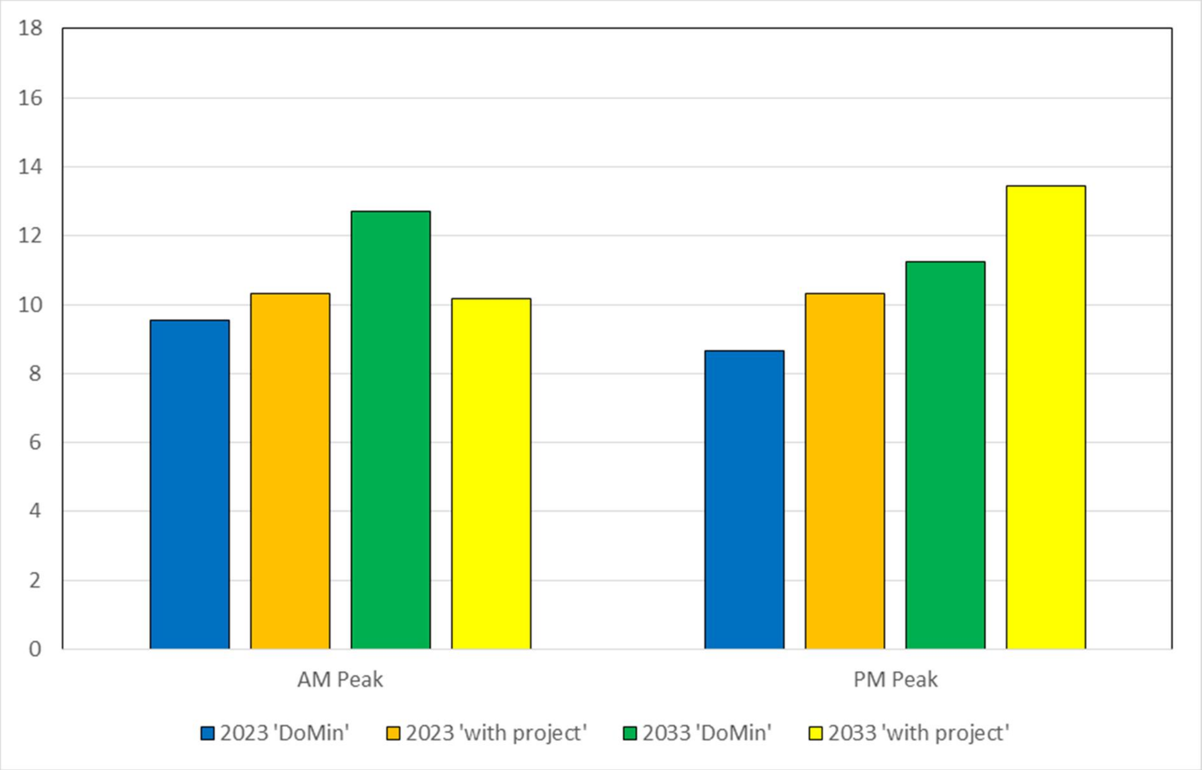


Figure 8-26 St Peters interchange: Average travel time for buses – 'with project' comparison

Active transport facilities

Details of planned walking and cycling facilities can be found in in **Annexure N** (Technical working paper: Active transport).

Impact on local property access and on-street parking

There is no planned impact on local property access or on-street residential or business parking in the St Peters interchange area as part of the project.

Operations under staged opening

The mainline tunnels between the M4 East at Haberfield and the New M5 at St Peters are planned for completion in 2022, while the Rozelle interchange is planned for completion in 2023.There is a period of around 12 months during which the mainline tunnels would be operational without the Rozelle interchange, although at a reduced lane capacity of only two lanes in each direction in the mainline. Constructing the project in two stages would allow the mainline tunnels to operate independently before the completion of the Rozelle interchange and the Iron Cove Link and allow the benefits to the Sydney metropolitan road network of linking the M4 East and the New M5 component projects to be realised as soon as possible.

Under the staged opening, a two-way AWT of about 49,500 vehicles per day is forecast to use the mainline tunnels. Operational modelling indicates that the forecast peak hour volumes would be within the capacity of the two lanes and LoS D or better is forecast.

Table 8-93 compares the AM peak, PM peak and 24 hour two-way traffic volumes in a 2023 'mainline only' scenario to the corresponding traffic volumes in the 2023 and 2033 'with project' scenario around the Wattle Street and St Peters interchanges.

In a 'mainline only' scenario, the Wattle Street and St Peters interchanges are the only entry and exit points for M4-M5 Link traffic. A comparison was made of the forecast traffic volumes at the Wattle Street interchange area and the St Peters interchange area in this 'mainline only' scenario with the other scenarios tested in this EIS. This comparison found that the forecast two-way traffic in a 'mainline only' scenario for the AM peak, PM peak and daily time periods was less than forecast traffic in at least one of the other scenarios tested in the EIS. Therefore, it is not considered necessary to model the temporary 'mainline only' scenario as the impact of higher forecast traffic volumes was tested in other scenarios in this EIS.

Table 8-93 Comparison of two-way traffic under a 2023 'mainline only' scenario

Key criteria locations	2023 'mainline only'			2023 'with project' (mainline, Rozelle interchange and Iron Cove Link)			2033 'with project' (mainline, Rozelle interchange and Iron Cove Link)		
	AM	PM	AWT	AM	PM	AWT	AM	PM	AWT
Wattle Street interchange and surrounds									
Wattle Street M4-M5 Link entry and exit ramps	920	950	9,500	1,560	1,360	19,000	1,770	1,540	21,000
Parramatta Road (west of Wattle St)	2,860	3,330	44,500	3,180	3,520	47,500	3,380	3,820	52,000
St Peters interchange and surrounds									
St Peters M4-M5 Link entry and exit ramps	5,450	5,800	66,500	5,290	5,640	70,000	5,700	6,230	76,500
Euston Road (south of Sydney Park Rd)	4,140	3,530	56,000	3,940	3,410	54,500	4,470	3,740	59,500
Gardeners Road (east of Bourke St)	4,270	3,950	46,000	4,280	3,950	47,000	4,340	4,150	48,500
Campbell Street (west of Princes Highway)	1,530	1,550	24,500	1,550	1,530	24,500	1,570	1,580	25,000

8.3.4 Assessment of cumulative impacts

Cumulative projects

This section details the forecast traffic performance of the study area during the following 'cumulative' scenarios:

- **Operation 'cumulative' (2023)**: With the 2023 'do minimum' projects completed, the M4-M5 Link complete and open to traffic, and in addition, the proposed future Sydney Gateway and Western Harbour Tunnel operational
- **Operation 'cumulative' (2033)**: With the 2033 'do minimum' projects completed, the M4-M5 Link complete and open to traffic, and in addition, the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension operational.

The proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension projects would be subject to separate assessment and do not form part of this project.

Sydney metropolitan road network

2023 'Cumulative' scenario

General traffic

In the 2023 'cumulative' scenario, the project enables the development of the future Sydney motorway network, connecting the proposed future Western Harbour Tunnel to the M5 Motorway corridor, creating a western bypass of the Sydney CBD. With the inclusion of the proposed future Sydney Gateway and Western Harbour Tunnel, increases in traffic on the M4-M5 Link are forecast, particularly between the Rozelle and St Peters interchanges due to the extended motorway network. A decrease in daily traffic is forecast on the M4 exit ramp to Anzac Bridge, Anzac Bridge/Western Distributor and the Sydney Harbour Bridge due to the inclusion of the proposed future Western Harbour Tunnel.

Decreased traffic is forecast on the Sydney Harbour Bridge, Sydney Harbour Tunnel, Southern Cross Drive and the existing M5 East due to the introduction of the proposed future Sydney Gateway and Western Harbour Tunnel.

With the inclusion of the proposed future Sydney Gateway, decreases in daily traffic on surface roads between the St Peters interchange and Sydney Airport and the Princes Highway are forecast. Further reductions in peak period travel times compared to the 'with project' scenario are also forecast between the M4 corridor and the Sydney Airport/Port Botany.

Road network productivity is forecast to improve in the 2023 'cumulative' scenario compared to the 2023 'with project' scenario with the inclusion of the proposed future Sydney Gateway and Western Harbour Tunnel. There is a drop in the VKT and VHT on the arterial (non-motorway) network with an increase in kilometres and hours travelled along the motorway routes, as shown in **Table 8-94**. Therefore, greater distance could be travelled on the road network in a shorter time.

Table 8-94 Comparison of daily 2023 VKT and VHT for metropolitan Sydney in 2023 'with project' and 'cumulative' scenarios

Scenario	Daily VKT ('000 km)			Daily VHT ('000 hours)		
	Motorway	Other	Total	Motorway	Other	Total
With project	27,730	86,050	113,780	480	3,120	3,600
Cumulative	27,980	85,970	113,950	470	3,110	3,570

On-road freight

Forecast changes in daily road-based freight or heavy vehicle movements generally follow the same pattern as the general traffic movements. There are significant reductions in daily heavy vehicle traffic focused on the new M4 East exit ramp to Anzac Bridge, Anzac Bridge/Western Distributor and the Sydney Harbour Bridge (especially northbound), and on Southern Cross Drive and Sydney Harbour Tunnel (especially southbound). Decreases in daily heavy vehicle traffic on surface roads between the St Peters interchange and Sydney Airport are also forecast due to the proposed future Sydney Gateway.

On-road public transport

Reductions in forecast traffic volume changes as a result of the inclusion of the proposed future Sydney Gateway and the Western Harbour Tunnel would be expected to improve the reliability and trip times for public transport bus services on those roads. The decrease in daily traffic forecast for Anzac Bridge/Western Distributor could improve reliability and trip times for bus services travelling between the north-west and the Sydney CBD via Victoria Road. Forecast decreases in traffic for the

Sydney Harbour Bridge could improve trip times and reliability for bus services travelling between the north and the Sydney CBD on the Warringah Freeway and Pacific Highway.

2033 ‘Cumulative’ scenario

Analysis was undertaken of the impact of the project under the cumulative 2033 scenario.

General traffic

In a 2033 ‘cumulative’ scenario, the project enables the further development of the future Sydney motorway network, connecting the proposed future Beaches Link (a component of the proposed future Western Harbour Tunnel and Beaches Link) and the F6 Extension, creating a north–south motorway link. The pattern of change highlighted in 2023 is generally the same for 2033, with the scale of increases or decreases larger due to the growth in forecast traffic. However, with the inclusion of the F6 Extension, decreases in daily traffic on the Princes Highway (especially south of the M5 East) are forecast due to traffic switching to use the motorway links.

With the inclusion of the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension, reductions in peak period travel times are forecast between the M4 corridor and the Sydney Airport/Port Botany precinct in 2033.

Road network productivity is forecast to improve in the 2033 ‘cumulative’ scenario with the inclusion of the proposed future Western Harbour Tunnel, Sydney Gateway, Beaches Link and the F6 Extension. There is a forecast drop in VKT and VHT on the arterial (non-motorway) network, and an increase in kilometres travelled along the motorway routes, as shown in **Table 8-95**. Overall, a greater distance could be travelled on the road network in a shorter time.

Table 8-95 Comparison of daily 2033 VKT and VHT for metropolitan Sydney in 2033 ‘with project’ and ‘cumulative’ scenarios

Scenario	Daily VKT (‘000 km)			Daily VHT (‘000 hours)		
	Motorway	Other	Total	Motorway	Other	Total
With project	32,010	101,410	133,430	600	4,610	5,220
Cumulative	33,780	100,650	134,420	600	4,500	5,100

On-road freight

Forecast changes in daily road-based freight or heavy vehicle movements would generally follow the same pattern as 2023 cumulative scenarios, with a larger decrease on General Holmes Drive (south of the M5 East) forecast due to the inclusion of the F6 Extension.

On-road public transport

The impacts for on-road public transport in 2033 are similar to those forecast in 2023. Reductions in traffic on Anzac Bridge/Western Distributor would be expected to improve the reliability and trip times of bus services that travel between the north-west and the Sydney CBD via Victoria Road. Reductions in forecast traffic volumes on the Sydney Harbour Bridge would be expected to improve the reliability and trip times of buses travelling between the north and the Sydney CBD via the Pacific Highway and Warringah Freeway.

Operational performance – M4-M5 Link Motorway

Mid-block level of service

The mid-block levels of service on the M4-M5 Link motorway under the 2023 ‘cumulative’ and 2033 ‘cumulative’ scenarios in peak hours are provided in **Table 8-96** and **Table 8-97** respectively. Compared to the 2023 ‘with project’ scenario, the 2023 ‘cumulative’ scenario analysis indicates traffic flows on the motorway would generally be denser with a corresponding reduction in level of service in the peak hours. However, it is still forecast to generally operate at an acceptable level of service.

The 2033 ‘cumulative’ scenario analysis indicates forecast traffic flows on the motorway would be denser compared to the 2033 ‘with project’ scenario, with a corresponding reduction in level of service in the peak hours. This is due to the additional motorway links in the ‘cumulative’ scenario (the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension), resulting in more traffic on the M4-M5 Link. There are sections of the motorway forecast to operate at LoS E in the peak hours, particularly around the merge and diverge locations on the M4-M5 Link, such as where the Wattle Street interchange ramps and the mainline connect. Even with this increased density, average motorway speeds are still forecast to be 60 km/h or above.

Provision has been made for ramp signalling and Smart (or Managed) Motorway infrastructure in the M4-M5 Link design. A Smart Motorway uses technology to monitor, provide intelligence and control the motorway to ease congestion and keep traffic flowing more effectively. Technology, including lane use management signs, vehicle detection equipment, closed-circuit television (CCTV) cameras and on-ramp signals, allows road operators to manage, in real-time, traffic entering, exiting and traversing the motorway. A comprehensive network-wide strategy could have significant benefits in maintaining acceptable operating conditions on the motorway in the future.

Table 8-96 M4-M5 Link motorway LOS – 2023 ‘cumulative’ scenario

Section	Location and direction	No. of lanes	Modelled flow (PCU)	Speed (km/h)	Density (PCU/km/ln)	LOS
Southbound – AM peak hour						
1	Interface with M4 East	3	4,920	76	21.7	D
2	Wattle Street interchange to Rozelle interchange	4	6,110	70	21.9	D
3	Rozelle interchange bypass	2	2,580	80	16.1	D
4	Rozelle interchange to St Peters interchange	4	5,660	80	17.7	D
5	Interface with New M5	2	380	80	2.4	A
Southbound – PM peak hour						
1	Interface with M4 East	3	3,020	80	12.6	C
2	Wattle Street interchange to Rozelle interchange	4	3,660	80	11.4	C
3	Rozelle interchange bypass	2	2,100	80	13.1	C
4	Rozelle interchange to St Peters interchange	4	4,190	80	13.1	C
5	Interface with New M5	2	990	80	6.2	A
Northbound – AM peak hour						
1	Interface with New M5	2	1,190	80	7.4	B
2	St Peters interchange to Rozelle interchange	4	5,050	80	15.8	C
3	Rozelle interchange bypass	2	2,680	80	16.7	D
4	Rozelle interchange to Wattle Street interchange	4	4,850	80	15.2	C
5	Interface with M4 East	3	4,310	80	17.9	D
Northbound – PM peak hour						
1	Interface with New M5	2	330	80	2.1	A
2	St Peters interchange to Rozelle interchange	4	4,620	80	14.5	C
3	Rozelle interchange bypass	2	2,550	80	16.0	C
4	Rozelle interchange to Wattle Street interchange	4	6,350	80	19.8	D
5	Interface with M4 East	3	5,600	80	23.3	E

Note:

The reported speed has been capped at the posted 80 kilometres per hour. The microsimulation models allow vehicle speeds slightly higher than the posted speed, which models reality, especially in uncongested, free flow conditions.

Table 8-97 M4-M5 Link motorway LOS – 2033 'cumulative' scenario

Section	Location and direction	No. of lanes	Modelled flow (PCU)	Speed (km/h)	Density (PCU/km/ln)	LOS
Southbound – AM peak hour						
1	Interface with M4 East	3	5,310	71	25.0	E
2	Wattle Street interchange to Rozelle interchange	4	6,830	63	27.0	E
3	Rozelle interchange bypass	2	2,400	80	15.0	C
4	Rozelle interchange to St Peters interchange	4	6,520	77	21.1	D
5	Interface with New M5	2	880	80	5.5	A
Southbound – PM peak hour						
1	Interface with M4 East	3	4,160	78	17.7	D
2	Wattle Street interchange to Rozelle interchange	4	5,030	76	16.5	D
3	Rozelle interchange bypass	2	3,050	79	19.2	D
4	Rozelle interchange to St Peters interchange	4	6,030	75	20.0	D
5	Interface with New M5	2	2,340	80	14.7	C
Northbound – AM peak hour						
1	Interface with New M5	2	2,600	75	17.2	D
2	St Peters interchange to Rozelle interchange	4	7,080	69	25.5	E
3	Rozelle interchange bypass	2	3,320	78	21.4	D
4	Rozelle interchange to Wattle Street interchange	4	5,930	70	21.1	D
5	Interface with M4 East	3	5,360	80	22.3	E
Northbound – PM peak hour						
1	Interface with New M5	2	780	80	4.9	A
2	St Peters interchange to Rozelle interchange	4	5,530	77	18.0	D
3	Rozelle interchange bypass	2	2,780	80	17.4	D
4	Rozelle interchange to Wattle Street interchange	4	6,720	75	22.3	E
5	Interface with M4 East	3	5,920	80	24.7	E

Note:

The reported speed has been capped at the posted 80 kilometres per hour. The microsimulation models allow vehicle speeds slightly higher than the posted speed, which models reality, especially in uncongested, free flow conditions.

Traffic crashes

A comparison between the crash forecast under the 2023 'cumulative' scenario was undertaken against the 'with project' scenario and is shown in **Table 8-98**. The increase in forecast traffic in the cumulative scenario is reflected in an increase in forecast crashes, especially on the section between the Rozelle and St Peters interchanges. Once again, these crashes would be balanced against the reduction in crashes forecast by the reduction in traffic volumes on the surface roads. With crash rates on motorways much lower than on surface arterial roads, a general reduction in accidents would be expected.

Table 8-98 M4-M5 Link: Crash comparison between 2023 'with project' and 'cumulative' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'with project'						
M4-M5 Link	Wattle Street interchange	Rozelle interchange	1.25	87,470	23	$264,300
M4-M5 Link	Rozelle interchange bypass		1.36	39,620	11	$130,300
M4-M5 Link	Rozelle interchange	St Peters interchange	2.24	60,500	29	$327,600
2023 'cumulative'						
M4-M5 Link	Wattle Street interchange	Rozelle interchange	1.25	105,600	28	$319,100
M4-M5 Link	Rozelle interchange bypass		1.36	47,690	14	$156,800
M4-M5 Link	Rozelle interchange	St Peters interchange	2.24	94,510	45	$511,800

A comparison between the crash forecast under the 2033 'cumulative' scenario was undertaken against the 'with project' scenario and is shown in **Table 8-99**. The comparison is similar to the 2023 comparison. The increase in forecast traffic in the cumulative scenario, especially on the section between the Rozelle and St Peters interchanges, is reflected in an increase in forecast crashes.

Table 8-99 M4-M5 Link: Crash comparison between 2033 'with project' and 'cumulative' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 'with project'						
M4-M5 Link	Wattle Street interchange	Rozelle interchange	1.25	97,910	26	$295,900
M4-M5 Link	Rozelle interchange bypass		1.36	45,370	13	$149,200
M4-M5 Link	Rozelle interchange	St Peters interchange	2.24	68,910	33	$373,200
2033 'cumulative'						
M4-M5 Link	Wattle Street interchange	Rozelle interchange	1.25	124,190	33	$375,300
M4-M5 Link	Rozelle interchange bypass		1.36	56,870	16	$187,000
M4-M5 Link	Rozelle interchange	St Peters interchange	2.24	117,530	56	$636,400

Operational performance - Wattle Street Interchange

Changes to road network in 'cumulative' scenarios

There are no road network differences between 'with project' and 'cumulative' scenarios at the Wattle Street interchange.

Network performance

2023 'cumulative' scenario

A comparison of the performance of the modelled road network between the 2023 'with project' and 'cumulative' scenarios for the AM and PM peak hours was undertaken.

<u>AM peak hour</u>

The 2023 AM peak hour 'cumulative' scenario network performance are similar to the 'with project' scenario performance, with the main cause of congestion being excess demand for City West Link which is forecast to occasionally block back beyond the Ramsay Street intersection. This impacts Ramsay Street (W), Waratah Street and Timbrell Drive, which are forecast to all experience heavy queueing. Queuing at the eastbound M4 East Parramatta Road ramps merge is minimal, however the models forecast extensive queuing at Liverpool Road. There is an increase in average speed due to the higher proportion of vehicles using the M4-M5 Link in the 'cumulative' scenario.

<u>PM peak hour</u>

The 2023 PM peak hour 'cumulative' scenario network performance is similar to the 'with project' scenario performance, with the main cause of congestion remaining the increased forecast demand to Frederick Street. This traffic cannot be accommodated because of downstream congestion blocking back from south west of the modelled network extents. As with the 'with project' scenario, significant queues are predicted to occur on the Parramatta Road eastbound approach to Wattle Street and on Wattle Street. The forecast increase in total demand in the 'cumulative' scenario results in an increase in average speed, as much of this additional demand is along the M4-M5 Link, which is free flowing at relatively high speeds.

2033 'cumulative' scenario

A comparison of the network performance of the modelled road network between the 2033 'with project' and 'cumulative' scenarios for the AM and PM peak hours was undertaken.

<u>AM peak hour</u>

The 2033 AM peak hour 'cumulative' scenario forecasts a minor increase in overall average speed due to an increase in forecast demand for the M4-M5 Link mainline when compared to the 'with project'; similar to the 2023 comparisons. The same issues as in the 'with project' scenario remain, with there still being significant Wattle Street/Dobroyd Parade congestion impacting side road approaches. One notable difference is that forecast demand from the M4 Motorway to City West Link reduces in the 'cumulative' scenario and thus blocking from the Wattle Street merge does not extend as far back along Wattle Street to Parramatta Road, as it does in the 2033 'with project' scenario.

In the 'cumulative' scenario, the modelling forecasts a significant increase in demand to and from the surface road network from M4-M5 Link ramps, and reduced demand to and from the M4 East ramps.

<u>PM peak hour</u>

The 2033 PM peak hour 'cumulative' network performance are similar to the 2023 'with project' conditions, with the forecast demand for Frederick Street remaining the main cause of congestion. As in the 'with project' scenario, with the capacity constraints at the Wattle Street intersection and the increase in westbound demand, queuing on the Parramatta Road westbound approach to Wattle Street extends through the Bland Street intersection. Minor road approaches within the network are seen to have large queues as a result of congestion on Parramatta Road and Wattle Street. This occurs at Bland Street, Great North Road, Croydon Road, Liverpool Road and Sloane Street.

Intersection performance

Performance across the majority of the network is consistent between 'with project' and 'cumulative' scenarios, with intersections performing at the same or better levels of service. Performance improvements are noted in the 2033 PM peak hour 'cumulative' scenario when compared to the 'with project' scenario, as a result of reduced demand to and from Parramatta Road to the east.

Travel times

The difference in network travel times between 'with project' and 'cumulative' scenarios was assessed for the AM and PM peak hours.

In the AM peak hour, delay of vehicles destined for City West Link is reduced in the 'cumulative' scenario as a result of reduced forecast demand, particularly from the M4 East Wattle Street exit ramp Elsewhere, travel times remain relatively consistent between 'with project' and 'cumulative' scenarios.

Travel times in the PM peak hour also remain similar to the 'with project' scenario outputs, highlighting the relatively minor difference in traffic flow patterns within the network between the two scenarios. The impact of Frederick Street blocking back is again prevalent, with significant travel times on the City West Link to Frederick Street and M4-M5 Link to Wattle Street sections.

Traffic crashes

Daily traffic on Parramatta Road is forecast to increase slightly in the 2023 'cumulative' scenario compared to the 'with project' scenario, resulting in no change to the total number of crashes, and a minimal increase in the cost of crashes of less than one per cent.

Similar to the 2023 comparison, daily traffic on Parramatta Road in the 2033 'cumulative' scenario is forecast to increase slightly, resulting in no change to the total number of crashes, and a minimal increase in cost of crashes of less than one per cent.

Public transport services

There is no change to public transport provision in the 'cumulative' scenario compared to the 'with project' scenario in 2033. A comparison in bus journey times between 'with project' and 'cumulative' scenarios indicates that the travel times are similar between the two scenarios.

Operational performance – Rozelle interchange

Changes to road network in 'cumulative' scenarios

The 'cumulative' scenarios include the proposed future Western Harbour Tunnel (a component of the proposed future Western Harbour Tunnel and Beaches Link project) in the 2023 'cumulative' scenario, and the addition of the Beaches Link component in the 2033 'cumulative' scenario. The 'cumulative' models include the following links which were added to the 'with project' networks:

- The proposed future Western Harbour Tunnel and Beaches Link, which connects to the M5 Motorway to the south providing a north-south through route
- A new link joining the proposed future Western Harbour Tunnel and Beaches Link to the M4 to the west.

The operational assessment does not assume there are surface ramps between the proposed future Western Harbour Tunnel and Beaches Link and City West Link at Rozelle.

Network performance

2023 'cumulative' scenario

A comparison of the performance of the modelled road network was undertaken, between the 2023 'with project' and 'cumulative' scenarios for the AM and PM peak hours. The 'cumulative scenario introduces more tunnelled motorway links in the modelled area, and while the forecast traffic demand significantly increases after the opening of the proposed future Western Harbour Tunnel, the new links result in a substantial increase in the average vehicle speed in the network.

AM peak hour

In the AM peak hour, a 17 per cent increase is demand is forecast for the 'cumulative' scenario compared to the 'with project' scenario. In spite of this increase, compared with the 'with project' scenario, the 'cumulative' network is forecast to provide benefits to the Western Distributor and Anzac Bridge operation. This is primarily because of the reassignment of traffic from the Sydney Harbour Bridge to the proposed future Western Harbour Tunnel that results in a significant improvement in overall network performance, with higher average speed, fewer stops and fewer unreleased vehicles. However, without mitigation, queueing from the Bathurst Street exit ramp is forecast to remain an issue and is likely to extend up the exit ramp and impact eastbound flow on the Western Distributor and Anzac Bridge.

PM peak hour

In the PM peak hour, the forecast demand for the cumulative scenario increases by about 10 per cent more than the 'with project' scenario. In spite of this increase, the modelled network is forecast to perform better in the 'cumulative' case compared to the 'with project' case. This is due to less traffic forecast to use the Western Distributor to head west across Anzac Bridge.

2033 'cumulative' scenario

A comparison of the performance of the modelled road network between the 2033 'with project' and 'cumulative' scenarios for the AM and PM peak hours was undertaken.

AM peak hour

As in the 2023 'cumulative' scenario, the 2033 'cumulative' scenario provides some benefit to the Western Distributor and Anzac Bridge compared to the 'with project case', due to the shift in traffic to the proposed future Western Harbour Tunnel instead of Anzac Bridge and Sydney Harbour Bridge. This reassignment results in better flow for northbound traffic on Western Distributor towards Sydney Harbour Bridge in the AM peak. The result is that the network performance indicators all show significant improvements, despite a 24 per cent increase in forecast demand. However, the queue from the Bathurst Street off-ramp still has the potential to queue back to the Western Distributor and negatively impact eastbound traffic on Anzac Bridge.

PM peak hour

As in 2023, the 2033 'cumulative' network is forecast to perform better compared to the 'with project' case, despite a 15 per cent increase in forecast demand. Again, this is due to lower forecast volumes on the Western Distributor heading west across Anzac Bridge. As a result, the network performance is slightly better than the 'with project' network.

Intersection performance

The forecast intersection performances in the 'cumulative' scenario are similar to the 'with project' scenario at most intersections in both peak hours. Improved performance is forecast at the critical Victoria Road/The Crescent intersection, as a result of traffic forecast to reassign to Western Harbour Tunnel.

However, as in the 'with project' scenario, the Victoria Road/Lyons Road intersection in both peak hours, the Victoria Road / Darling Street and Victoria Road – Robert Street intersections in the AM peak hour and The Crescent/Johnston Street intersection in both peak hours remain at or over capacity due to the forecast demands.

Travel times

Travel times on Victoria Road/Iron Cove Link and City West Link, including Anzac Bridge in the AM and PM peak periods were assessed.

In the AM peak hour, travel times in the peak eastbound direction are forecast to reduce in the cumulative case for both 2023 and 2033. In the westbound direction, there are forecast increases in travel times to Iron Cove Bridge via Victoria Road due to the combination of forecast increase in demand to Victoria Road and the congestion on Victoria Road to the north (through Drummoyne) causing traffic to queue back on Victoria Road.

In the PM peak hour, the westbound travel time is forecast to remain similar between the ‘project’ and ‘cumulative’ scenarios.

Traffic crashes

Daily traffic on Anzac Bridge is forecast to decrease in the 2023 ‘cumulative’ scenario compared to the ‘with project’ scenario, resulting in a decrease in total number and cost of crashes. However, forecast increases in daily traffic on other roads in the vicinity, especially The Crescent and Johnston Street, result in an increase in the total number and cost of crashes at these locations compared to the ‘with project’ scenario of about six per cent.

Compared to the 2023 ‘without project’ scenario, there is a small change in the forecast number and cost of annual crashes at these locations (with less than one per cent increase).

Similar to the 2023 comparison, daily traffic on Anzac Bridge is forecast to decrease, resulting in a decrease in total number and cost of crashes, while forecast increases in daily traffic on other roads in the vicinity, especially The Crescent and Johnston Street, result in an increase in the total number and cost of crashes at these locations.

Public transport services

A comparison in travel times for buses between the ‘cumulative’ and ‘with project’ scenarios for the AM and PM peak was undertaken. The main bus route along Victoria Road and over Anzac Bridge to the citybound bus-only lane on the Druitt Street ramp was the assessed route.

With the reduction in demand over Anzac Bridge, citybound bus journey times are forecast to improve in AM and PM peak hours. However, with the combination of the increase in demand to Victoria Road and the congestion on Victoria Road to the north causing traffic to queue back along Victoria Road, outbound bus journey times are forecast to increase during the AM peak hour. During the PM peak hour, the outbound bus journey times remain similar to the ‘with project’ scenario.

Cumulative scenario with proposed future Western Harbour Tunnel surface ramps at City West Link

While the construction impact of the proposed future Western Harbour Tunnel and Beaches Link entry and exit ramps connecting to City West Link is included in this EIS, the operational traffic impact of these ramps have not been included in this EIS. A preliminary assessment with these ramps operational has been carried out. This assessment identified that there is likely to be some reduction in traffic on the Western Distributor and Sydney Harbour Bridge, as more traffic would be able to access the proposed future Western Harbour Tunnel, but there is likely to be increased traffic on City West Link, The Crescent and Johnston Street. The impacts of these surface ramps would be assessed in detail as part of future environmental assessment for the proposed future Western Harbour Tunnel and Beaches Link to be carried out by others.

Operational performance – St Peters interchange

Changes to road network in ‘cumulative’ scenarios

In the 2023 and 2033 ‘cumulative’ scenarios, the proposed future Sydney Gateway is included in the St Peters modelled road network. This provides a new link from the St Peters interchange to the Sydney Airport/Port Botany precinct. The proposed future Sydney Gateway also connects to a realigned Airport Drive and Coward Street extension. The realigned Airport Drive connects to Princes Highway via existing Bellevue Street. The full forecast demand to and from the Sydney Airport precinct is used in the models of the ‘cumulative’ scenarios.

As part of the proposed future Sydney Gateway project, in the vicinity of the Domestic Airport, a new fly-over bypasses Airport Drive intersections with Robey Street and O’Riordan Street. This new fly-over means Airport Drive/Robey Street and Airport Drive/O’Riordan Street intersection layout adjustments, as follows:

- Airport Drive/Robey Street intersection: westbound through movement removed as a result of the fly-over and a free flow left turn from Domestic Airport

- Airport Drive/O'Riordan Street intersection: due to reduced demand for right turn, lane configuration on O'Riordan Street southbound changed to provide three through lanes for Domestic Airport access, one bus lane and one right turn lane.

While investigations into the King Street Gateway project are underway, no confirmed road layout changes are available, and so this project has not been included in the operational modelling around the St Peters interchange.

Network performance

2023 'cumulative' scenario

A comparison of the performance of the modelled road network, between the 2023 'with project' and 'cumulative' scenarios for the AM and PM peak hours was undertaken. This network performance improvement is mainly attributable to improved connectivity between the airport area and St Peters Interchange, with vehicles not having to travel through the Mascot area, thereby bypassing a number of signalised intersections with limited capacity.

<u>AM peak hour</u>

The AM peak hour network performance results for the 2023 'cumulative scenario' show an overall improvement compared to the 'with project' scenario. Despite the total demand being eight per cent higher, total travel time is shorter and more vehicles are able to reach their destination. In addition, vehicles experience fewer stops on average. There is also a significant improvement in network speed. The 'cumulative' scenario network is able to manage more demand, which is reflected in fewer unreleased vehicles, without the need to cap demand.

<u>PM peak hour</u>

The PM peak hour network performance results for the 2023 'cumulative scenario' show a similar trend to the AM peak hour. When compared to the 'with project' scenario total demand increases but total travel time drops, with more vehicles reaching their destination. All measures per vehicle indicate improved network operation with average speed in the network increasing by almost 30 per cent. In addition, the number of unreleased vehicles is comparable to the 'with project' scenario without the need to cap growth.

2033 'cumulative' scenario

A comparison of the performance of the modelled road network between the 2033 'with project' and 'cumulative' scenarios for the AM and PM peak hours was undertaken.

<u>AM peak hour</u>

The 2033 AM peak network performance for the 2033 'cumulative' scenario results show an overall improvement, although not as significant as in 2023. Even though the total forecast demand is higher than the 'with project' forecast demand, more vehicles would reach their destination. Average measures per vehicle show improvement and there are fewer unreleased vehicles.

<u>PM peak hour</u>

The 2033 PM peak network performance for the 2033 'cumulative' scenario results show a significantly better network operation in 'cumulative' scenario. With total forecast demand increasing there is a shorter total travel time and the number of vehicles arriving at their destination increased by more than 35 per cent. In the 'with project' scenario, the network performs poorly, with an average speed of about 11 kilometres per hour. In the 'cumulative' scenario, the average speed in the network is forecast to improve significantly. In addition, the number of unreleased vehicles is substantially reduced without the need to cap demand.

Overall, the network around St Peters in the 'cumulative' scenario performs better in both future forecast years during both peak hours, with the most improvement occurring in the 2033 PM peak hour 'cumulative' scenario. Despite higher total demand, each 'cumulative' scenario records higher average vehicle speed in the network and has more vehicles arriving at their destination than the corresponding 'with project' case. The proposed future Sydney Gateway connection to and from the

St Peters interchange takes a considerable amount of traffic from the Mascot area, contributing to the better operation of the network.

Intersection performance

AM and PM peak hour LoS for key intersections was modelled at St Peters in the 2023 and 2033 'cumulative' scenarios compared to the 'with project' scenarios.

The results show that in both future forecast years in both peak hours, many intersections operate at similar or better LoS in the 'cumulative' scenario' compared to the 'with project' scenario, mainly as a result of the proposed future Sydney Gateway.

Travel times

A comparison of travel times on routes in 2023 and 2033 under 'with project' and 'cumulative' scenarios was undertaken.

In the 2023 AM peak hour, travel times for routes that do not run through Mascot are very comparable between scenarios. However, the Domestic Airport to King Street and Railway Road to Gardeners Road routes are forecast to have reductions in travel times in the 'cumulative' scenario. The 2033 AM peak hour travel times show a similar trend, with the exception of Gardeners Road to Railway Road route.

The PM peak hour travel times generally follow the same trend as the AM peak hour. In both forecast years, travel times on routes not running through Mascot are comparable. The Domestic Airport to King Street (and reverse) and Railway Road to Gardeners Road routes are forecast to benefit from the proposed future Sydney Gateway and are forecast to have large reductions in travel times in the 'cumulative' scenario.

The 'cumulative' scenario takes a considerable amount of traffic from the Mascot area, which generally cases results in travel time reduction for corresponding travel time routes.

Traffic crashes

An assessment was made of crashes forecast under the 2023 and 2033 'cumulative' scenarios compared to the 'with project' scenario.

In the 2023 'cumulative' scenario, there are increases of around five per cent forecast for Euston Road and Bourke Road. A significant decrease of almost 60 per cent is forecast for Prince Highway between Enmore Road and Gannon Street, and for Canal Road/Ricketty Street/Gardeners Road. The comparison shows that there is an overall decrease in the number of cost of annual crashes on surface roads in the vicinity of the St Peters area in the 'cumulative' scenario. The forecast traffic on the M5 corridor is similar to those forecast for the 'with project' scenario, and there are no changes forecast regarding the number of crashes on the M5 corridor

In the 2033 'cumulative' scenario, the forecast increase in traffic flow on Euston Road would cause an increase in the total number and cost of crashes on Euston Road, south of Sydney Park Road. However, the significant decrease in daily traffic forecast on Princes Highway, between Gannon Street and Enmore Road, and on Canal Road/Ricketty Street/Gardeners Road, would result in a reduction in the total number and cost of crashes on these roads. This assessment shows that there is a significant reduction in number and cost of crashes at these locations of about 37 per cent compared to the 'with project' scenario.

In the 2033 'cumulative' scenario, while there is a forecast shift in traffic to use the F6 Extension, overall, the volume of vehicles on the M5 corridor is similar when compared to the 2033 'with project' scenario. As a result, there is no change in traffic accidents forecast for the M5 corridor in the 'cumulative' scenario.

Public transport services

A comparison was made in average bus travel time across the St Peters modelled road network between the 'cumulative' and 'with project' scenarios for the AM and PM peak hours. In the AM peak hour, the average bus travel time is similar across the scenarios. In the PM peak hour, the average bus travel times increase slightly in 2023 and 2033 in the 'cumulative' scenarios.

8.4 Road network optimisation

Management of network assets is a key function of Roads and Maritime, which uses network and corridor planning strategies to best manage and enhance these assets to maximise community benefits.

The process to prepare network and corridor planning strategies includes:

- Setting network and corridor objectives in line with NSW and Australian Government strategies and community expectations
- Analysing anticipated performance against appropriate safety, traffic and asset measures
- Identifying strategic priorities to achieve appropriate safety, traffic and asset performance over the longer term within the context of limited funding.

Together with the ongoing delivery of the Pinch Point Program through Roads and Maritime's Easing Sydney's Congestion office, which targets peak hour traffic hotspots, network optimisation facilitates the management of impacts identified to ensure travel time savings are maintained to the greatest possible extent by minimising congestion.

In addition to an optimisation strategy and potential infrastructure provision, the maintenance of the existing traffic control system is a key ingredient in providing Roads and Maritime with the tools to appropriately manage congestion on the network. A review of existing Sydney coordinated adaptive traffic system (SCATS) infrastructure at key intersections in the study area, including detectors, would be undertaken and upgrades implemented where appropriate.

8.5 Management of impacts

8.5.1 Project design features that would manage impacts

Changes to the surface road network are proposed within the M4-M5 Link project design to complement and/or mitigate the impacts of the project. These include:

- Minor physical integration works with the surface road network at the Wattle Street interchange including road pavement and line marking
- Minor physical integration works with the surface road network at the St Peters interchange including road pavement and line marking
- The Rozelle interchange surface works, including:
  - Widening and realignment of City West Link, The Crescent and Victoria Road at Lilyfield and Rozelle
  - Realigning The Crescent at Annandale, including a new bridge for The Crescent to pass over Whites Creek and modifications to the intersections with City West Link and Johnston Street
  - Reconstructing the intersection of The Crescent and Victoria Road at Rozelle, including construction of a new bridge at Victoria Road. The eastbound through movement along City West Link/The Crescent to Anzac Bridge would also be maintained
  - New active transport network infrastructure connecting the Rozelle Rail Yards with the wider pedestrian and cyclist network, including two north–south pedestrian and cycle bridges over City West Link, and an east – west underpass below Victoria Road
- The Iron Cove Link surface works, including:
  - Realignment of the westbound (southern) carriageway of Victoria Road between Springside Street and the eastern abutment of Iron Cove Bridge
  - Permanent closure of Clubb Street south of Victoria Road at the start of construction
  - Minor modifications to other intersections along the southern side of Victoria Road including Toelle Street, Callan Street and Springside Street. These streets would generally remain open during construction and would provide the same turning movements as the existing arrangement once works are complete

- Minor changes to the right hand turn movement from Victoria Road into Terry Street in line with the permanent design
- Upgrades and modifications to the shared pedestrian and cycle paths along the westbound (southern) carriageway of Victoria Road.

8.5.2 Cumulative scenario mitigation

While specific mitigation measures for the cumulative scenarios assessed in this report are beyond the scope of this EIS, the issues identified would be examined as part of the design development for the proposed future Western Harbour Tunnel and Beaches Link and the proposed future Sydney Gateway projects, and as part of Roads and Maritime network mitigation strategies.

On-going consultation with the design teams for these projects is occurring with the objective of minimising cumulative traffic impacts.

8.5.3 Environmental management measures

Where possible, the project has planned to avoid and minimise traffic and transport impacts during the construction (includes detailed design and pre-construction) and operational phases. Despite this, the project will result in impacts on the road network during construction and operation. Mitigation and management measures will be implemented to avoid, minimise and/or manage these impacts on the road network. These environmental management measures are outlined in **Table 8-100**.

Table 8-100 Environmental management measures – traffic and transport

Impact	No.	Environmental management measure	Timing
Construction			
Delays and disruptions to the road network during construction	TT01	A CTAMP will be prepared as part of the CEMP. The CTAMP will include the guidelines, general requirements and principles of traffic management to be implemented during construction. It will be prepared in accordance with *Austroads Guide to Road Design* (with appropriate Roads and Maritime supplements), the RTA Traffic Control at Work Sites manual and AS1742.3: Manual of uniform traffic control devices – Part 3: Traffic control for works on roads, and any other relevant standard, guide or manual. The overarching strategy of the CTAMP will be to: • Ensure all stakeholders are considered during all stages of the project • Provide safe routes for pedestrians and cyclists during construction • Design the permanent works and develop construction methodologies so that interaction with existing road users is minimised thereby creating a safer work and road user environment • Plan and stage works to minimise the need for road occupancy, where possible • Develop project staging plans in consultation with relevant traffic and transport stakeholders • Minimise the number of changes to the road users' travel paths and, where changes are required, implement a high standard of traffic controls which effectively warn, inform and	Construction

Impact	No.	Environmental management measure	Timing
		guide. This would minimise confusion by providing clear and concise traffic management schemes • Comprehensively communicate changes to roads or paths to emergency services, public transport operators, other road user groups and any other affected stakeholders • Identify measures to manage the movements of construction-related traffic to minimise traffic and access disruptions in the public road network • Propose a car parking strategy for construction staff at the various worksites, in consultation with local councils and stakeholders associated with any facilities adjacent to the project site. This would include the promotion of public transport and carpooling to reduce worksite-related vehicle movements. The strategy will be developed to limit impacts on the surrounding communities and would include the parking management measures that would be implemented on adjacent local streets. The strategy will also be developed in consultation with the M4 East and New M5 contractors to identify opportunities to use existing parking arrangements associated with those projects during their respective construction periods and once those periods are completed.	
Delays and disruptions to the road network during construction	TT02	Identify potential road user delays during the planning and consultation phases.	Construction
Impacts on road network performance (delays) and safety	TT03	Develop construction staging and temporary works that minimises conflicts with the existing road network and maximises spatial separation between work areas and travel lanes.	Construction
Parking on local streets around construction sites	TT04	Investigate potential offsite areas that could be used for construction workforce parking, including government owned land and other potential areas near to the construction ancillary facilities, and secure them for use during construction where required and possible.	Construction
Impacts on road network performance (delays) and safety	TT05	Isolate work areas from general traffic.	Construction
Impacts on road network performance (delays) and safety	TT06	Develop alternative work methods to minimise delays and road user impacts, for example utilising more efficient plant and equipment, and applying different design solutions.	Construction
Impacts on road network performance	TT07	Provide temporary CCTV and Variable Message Signs (VMS) to link with the existing Transport Management Centre network to	Construction

Impact	No.	Environmental management measure	Timing
(delays) and safety		facilitate monitoring and management of impacts and traffic safety.	
Impacts on road network performance (delays) and safety	TT08	During construction, work with the TMC to observe traffic flows and incidents from CCTV footage and modify sites and activities where possible to address any identified issues.	Construction
Impacts on road network performance (delays) and safety	TT09	Provide a mechanism for the community to report incidents and delays, for example a project phone number. Advertise details along the construction site's interface with the road network.	Construction
Impacts on road network performance (delays) and safety	TT10	Schedule construction-related transport movements to avoid peak traffic periods and adversely affecting congestion, where possible.	Construction
Impacts on road network performance (delays) and safety	TT11	Develop and adopt robust community and stakeholder communication protocols regarding altered traffic conditions.	Construction
Impacts on pedestrian and cycle paths	TT12	Minimise impacts on the pedestrian paths and cycle lanes, and provide timely alternatives during construction where practical and safe to do so.	Construction
Impacts on public transport	TT13	Identify impacts on bus stops and provide alternative locations and access in consultation with Transport for NSW.	Construction
Impact on property access	TT14	Manage local road closures and maintain adequate property access. This will be undertaken in consultation with Roads and Maritime, local councils and property owners likely to be impacted.	Construction
Impacts on road network from spoil transport	TT15	Identify haulage routes and communicate, along with site access requirements and restrictions, to all relevant drivers.	Construction
Impacts on road network from spoil transport	TT16	Identify potential truck marshalling areas and use where possible, to minimise potential queueing and traffic and access disruptions in the local area.	Construction
Impacts on receivers from spoil transport during night time periods	TT17	Monitor heavy vehicle movements to and from sites to ensure compliance with road traffic noise criteria at night.	Construction
Impacts on road infrastructure	TT18	Prepare a road dilapidation report, in consultation with relevant councils and road owners, identifying existing conditions of local roads and mechanisms to repair damage to the road network caused by heavy vehicle movements associated with the project.	Construction

Impact	No.	Environmental management measure	Timing
Operation			
Confirmation of assessed impacts	OTT1	A review of operational network performance will be undertaken 12 months and five years from the opening of the project to confirm the operational impacts of the project on surrounding arterial roads and major intersections in proximity to the Wattle Street interchange, Rozelle interchange and St Peters interchange. The assessment will be based on updated traffic surveys at the time and the methodology used will be comparable with that used in this assessment.	Operation
Road network performance constraints	OTT2	To manage potential performance constraints at the Wattle Street interchange, Roads and Maritime will investigate the implementation of the following in consultation with local councils: • Queuing and capacity monitoring and management on the Frederick Street/Milton Street corridor • Managing lane use and utilisation to improve the operation of the corridor.	Operation
Road network performance constraints	OTT3	Roads and Maritime will develop a strategy to ensure appropriate network integration in the areas surrounding the Rozelle interchange. The strategy will include a review of: • Capacity improvement measures • Project staging options • Demand management measures.	Operation