WestConnex

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NSW GOVERNMENT

# M4 East

## Environmental Impact Statement

Main Volume Chapters 1 to 11

## Volume 1A

September 2015

# WestConnex Delivery Authority

WestConnex M4 East

Environmental Impact Statement

September 2015

**Prepared for**

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# Executive summary

## What is proposed?

The WestConnex Delivery Authority (WDA), on behalf of the NSW Roads and Maritime Services (Roads and Maritime), is seeking approval to upgrade and extend the M4 Motorway from Homebush Bay Drive at Homebush to Parramatta Road and City West Link (Wattle Street) at Haberfield. This includes twin tunnels of 5.5 kilometres in length and associated surface works to connect to the existing road network. These proposed works are described as the M4 East project (the project).

The project is a component of WestConnex, which is a NSW Government initiative to provide a 33 kilometre motorway linking Sydney's west and south-west with Sydney Airport and the Port Botany precinct. The individual components of WestConnex are:

- M4 Widening – Pitt Street at Parramatta to Homebush Bay Drive at Homebush (planning approval granted and under construction)
- M4 East (the subject of this report)
- New M5 – King Georges Road at Beverly Hills to St Peters (planning application lodged and subject to planning approval)
- King Georges Road Interchange Upgrade (planning approval granted and work has commenced)
- M4–M5 Link – Haberfield to St Peters, including the Southern Gateway and Southern Extension (undergoing concept development and subject to planning approval).

Separate planning applications will be lodged for each individual component project. Each project will be assessed separately, but the impacts of each project will also be considered in the context of the wider WestConnex.

The project would comprise the construction and operation of the following key features:

- Widening, realignment and resurfacing of the M4 between Homebush Bay Drive and Underwood Road at Homebush
- Upgrade of the existing Homebush Bay Drive interchange to connect the western end of the new tunnels to the existing M4 and Homebush Bay Drive, while maintaining all current surface connections
- Two new three-lane tunnels (the mainline tunnels), one eastbound and one westbound, extending from west of Pomeroy Street at Homebush to near Alt Street at Haberfield, where they would terminate until the completion of the possible future M4–M5 Link (which is subject to planning approval). Each tunnel would be about 5.5 kilometres long and would have a minimum internal clearance (height) to in-tunnel services of 5.3 metres
- A new westbound on-ramp from Parramatta Road to the M4 at Powells Creek, west of George Street at North Strathfield
- An interchange at Concord Road, North Strathfield/Concord with on-ramps to the eastbound tunnel and off-ramps from the westbound tunnel. Access from the existing M4 to Concord Road would be maintained via Sydney Street. A new on-ramp would be provided from Concord Road southbound to the existing M4 westbound, and the existing on-ramp from Concord Road northbound to the existing M4 westbound would be removed
- Modification of the intersection of the existing M4 and Parramatta Road, to remove the left turn movement from Parramatta Road eastbound to the existing M4 westbound
- An interchange at Wattle Street (City West Link) at Haberfield, with an on-ramp to the westbound tunnel and an off-ramp from the eastbound tunnel. The project also includes on- and off-ramps at this interchange that would provide access to the M4–M5 Link. In addition, the westbound lanes of Wattle Street would be realigned

- An interchange at Parramatta Road at Ashfield/Haberfield, with an on-ramp to the westbound tunnel and an off-ramp from the eastbound tunnel. In addition, the westbound lanes of Parramatta Road would be realigned
- Installation of tunnel ventilation systems, including ventilation facilities within the existing M4 road reserve near Underwood Road at Homebush (western ventilation facility) and at the corner of Parramatta Road and Wattle Street at Haberfield (eastern ventilation facility). The eastern ventilation facility would serve both the M4 East and M4–M5 Link projects. Provision has also been made for a fresh air supply facility at Cintra Park at Concord
- Associated surface road work on the arterial and local road network, including reconfiguration of lanes, changes to traffic signalling and phasing, and permanent road closures at a small number of local roads
- Pedestrian and cycle facilities, including the permanent re-routing of part of the existing eastbound cycleway on the northern side of the M4 from west of Homebush Bay Drive to near Pomeroy Street, and a new westbound cycleway on-ramp connection from Queen Street at North Strathfield to the existing M4
- Tunnel support systems and services such as electricity substations, fire pump rooms and tanks, water treatment facilities, and fire and life safety systems including emergency evacuation infrastructure
- Motorway operations complex on the northern side of the existing M4, east of the Homebush Bay Drive interchange
- Provision of road infrastructure and services to support the future implementation of smart motorway operations (subject to separate planning approval)
- Installation of tolling gantries and traffic control systems along the length of the project
- Provision of new and modified noise walls
- Provision of low noise pavement for new and modified sections of the existing M4
- Temporary construction ancillary facilities and temporary works to facilitate the construction of the project.

## Why is the M4 East and WestConnex needed?

Parramatta Road is Sydney's main east−west route, and the only continuous route between Parramatta and the Sydney CBD. The section of Parramatta Road between Burwood and the Sydney CBD is identified in the *NSW Long Term Transport Master Plan* (Transport for NSW 2012a) (Transport Master Plan) as the most important Sydney transport corridor, due largely to it having the highest public transport movements of any corridor in Sydney.

Parramatta Road east of Concord Road carries more than 90,000 vehicles each day, with up to 6,000 of these being heavy vehicles. This is similar to the traffic volume on both the M4 and the M5 motorways, and means that Parramatta Road, an urban arterial road, currently carries a similar traffic volume to two of Sydney's busiest motorways.

Parramatta Road is now one of the six most congested transport corridors in Sydney, with high travel demand and average travel speeds of private vehicles during the morning peak of about 30 kilometres an hour. The Parramatta Road corridor is also one of Sydney's busiest corridors for public transport. It has one of the highest number of bus passengers during the morning peak of any major bus route in Metropolitan Sydney. Congestion on Parramatta Road has led to bus services using the road being delayed and unreliable.

The pressure on the road corridor is predicted to continue to increase, with greater Sydney's population set to increase by another million people in the next 10 years and Western Sydney alone expecting an increase in population of up to 900,000 people by 2031. An increase in transport demand from and to Western Sydney will continue to rise in parallel.

While rail and public transport do provide for efficient travel between major centres, there will continue to be a need for travel by road to jobs that are dispersed across the metropolitan area and not easily accessed by public transport. In addition, public transport alone cannot provide sufficient point-to-point access to the diverse range of employment and educational hubs, shopping centres or recreational centres, nor can it provide for the safe and efficient delivery of goods and services to Sydney's growing population.

There is also a need to provide a link between Western Sydney and other work and freight centres such as the Sydney Airport and Port Botany, which generate about $10.5 billion of economic activity for Sydney each year and both locations are heavily dependent on road vehicles for the movement of people and freight. Investment in additional road infrastructure such as the M4 East and other WestConnex projects would increase connections to Sydney's west, where the majority of airport and port freight traffic originates or ends.

This two-way flow between the international gateways and Western Sydney is necessary for centres such as Parramatta and Sydney Olympic Park to continue to experience development, urban renewal and economic benefit.

## What are the M4 East project objectives?

The core objectives of the project, which are consistent with the core objectives of WestConnex, are to:

- Support Sydney's long-term economic growth through improved motorway access and connections linking Sydney's international gateways (Sydney Airport and Port Botany), Western Sydney and places of business across the city
- Relieve road congestion so as to improve the speed, reliability and safety of travel in the M4 corridor, including parallel arterial roads
- Cater for the diverse travel demands along these corridors that are best met by road infrastructure
- Create opportunities for urban revitalisation, improved liveability, and public and active transport (walking and cycling) improvements along and around Parramatta Road
- Enhance the productivity of commercial and freight generating land uses strategically located near transport infrastructure
- Enhance movements across the Parramatta Road corridor which are currently restricted
- Fit within the financial capacity of the State and Federal Governments, in partnership with the private sector
- Optimise user-pays contributions to support funding in a way that is affordable and equitable
- Integrate with the preceding and proposed future stages of WestConnex, without creating significant impacts on the surrounding environment or duplicating any potential issues across the construction periods
- Protect natural and cultural resources and enhance the environment.

## How would the M4 East and WestConnex meet the project objectives?

Once completed, the project would provide immediate operational benefits along the M4 and Parramatta Road, including a reduction in travel times and improvements in the level of road safety.

The project is being developed as part of the first stage of WestConnex which also includes the M4 Widening project. Completion of both projects would provide a full motorway connection between the Blue Mountains in the west and Haberfield in the east. Future stages of WestConnex would link the project with Sydney's south-west, as well as integral freight centres at Sydney Airport and the Port Botany precinct.

As such, the project would support NSW's key economic generators and provide a strategic response to currently inadequate and highly congested transport routes. Critically, this includes providing the missing link in the motorway network which supports Sydney's global economic corridor.

Integrated land use and transport planning initiatives are key factors in developing a future in which Sydney's growing population can reliably access jobs and services. To fulfil this need, the integrated package of transport improvements delivered by WestConnex would include complementary enhancements to the existing road network, a redesign of bus services and facilities, improved access to rail stations, and upgrades to cyclist and pedestrian facilities.

The project complements a number of other transport and freight-based infrastructure initiatives identified in the Transport Master Plan. Ultimately, it is the combination of these initiatives that will best address Sydney's needs.

To protect natural and cultural resources and enhance the environment, design, construction and operation of the project would be undertaken in accordance with environmental management commitments identified in this environmental impact statement (EIS), as well as any additional measures identified in conditions of approval for the project.

## What is the approval process for the project?

Clause 94 of *State Environmental Planning Policy (Infrastructure) 2007* permits development for the purpose of a road or road infrastructure facilities to be carried out on any land by or on behalf of a public authority without consent. The project is therefore permissible without development consent.

On 5 December 2014, the project was declared by the Minister for Planning to be State significant infrastructure and critical State significant infrastructure, under sections 115U(4) and 115V of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) and clause 16 of the *State Environmental Planning Policy (State and Regional Development) 2011*. Approval from the Minister for Planning is required for State significant infrastructure, and an EIS is required to be submitted and publicly displayed.

## What alternatives were considered?

A number of different alternatives to the project were considered. These included:

- A 'base case' (or 'do minimum') alternative. This alternative involves retaining the M4 (with the M4 Widening completed) and Parramatta Road as the main east-west route between Western Sydney and Haberfield. This alternative would not involve any other WestConnex projects
- Improving the existing arterial road network, such as upgrading Parramatta Road, Victoria Road and/or alternative road corridors such as Patterson Street, Gipps Street, Queens Road and Ramsay Road
- Investing in public transport and freight rail improvements in isolation, without any improvement to the road network
- Demand management policies which are intended to reduce individual trips and make alternative mode options more viable
- Extension of the M4 as part of WestConnex (the project).

In the context of the substantial identified congestion and transport challenges facing Sydney, the 'base case' option is not considered viable if Sydney is to maintain global competiveness and remain an attractive and liveable city. In particular, congestion is already a significant issue on the M4 and along Parramatta Road and will continue to worsen as both population and the freight task increases. Therefore the 'do minimum' scenario was not considered a viable option.

The other alternatives are desirable and complementary to the project, but none were considered to provide an adequate stand-alone response to the identified strategic need and project objectives. In particular, the public transport and rail freight improvements and demand management alternatives alone would not address the diverse and dispersed point-to-point transport connections that can only be provided by the road network and the project.

Extension of the M4 (the project as described in this EIS) as part of WestConnex is the preferred strategic alternative, and was considered to best meet the Government's objectives. Specifically it would facilitate long-term economic growth throughout the project corridor and through to Sydney's international gateways which create Sydney's commercial and freight demands. While accomplishing this, the project would improve the speed, reliability and safety for vehicles travelling along Parramatta Road and parallel arterial roads and cater for the wide range of road travel demands in the area. The project would also integrate with other WestConnex stages without creating significant cumulative impacts. Lastly, by reducing traffic volumes on Parramatta Road, the project would cater for improved public transport services, cycleways, pedestrian access and general liveability for residents and workers.

In addition to the strategic alternatives considered, a number of tunnel corridor, interchange location, and ventilation system design and location options were also considered in development of the preferred design. The options selected in the preferred design would:

- Improve access to key centres such as Sydney Olympic Park, Strathfield and Rhodes
- Minimise impact on properties, including the number of properties to be acquired
- Minimise impacts on future development potential as a result of the presence of tunnels, particularly along Parramatta Road
- Connect and integrate with the M4–M5 Link, while minimising cumulative impacts on the local community.

## How did the community participate in development of the preferred design?

Consultation activities for WestConnex commenced as part of early planning work in late 2011. Community consultation activities on the preliminary concept design, and the commencement of EIS preparation began in November 2013.

A program of communication and consultation activities has been undertaken to seek feedback from the community and stakeholders during preparation of the EIS. Communication and consultation activities have included:

- Community updates:
  - Preliminary concept design: Distribution of 105,000 updates in December 2013
  - Midway tunnelling point announcement: Distribution of 1,800 updates in April 2015
  - Preferred design display: Distribution of 105,000 updates in June 2015
- Staffed community information sessions:
  - Preliminary concept design: Three sessions in December 2013 and four sessions in February 2014
  - Midway tunnelling point announcement: Two sessions in May 2015
  - Preferred design display: Four sessions in July 2015
- Establishment of WestConnex information kiosks at Westfield shopping centres at Burwood, Parramatta, Hurstville and at Centro Roselands since February 2015, with over 26,000 visitations
- Community feedback report, which was published on the project website in April 2014 following the display of the preliminary concept design
- Individual meetings with property owners and nearby residents to discuss impacts on properties and to explain the property acquisition process
- Door knocking activities to notify residents of technical and environmental investigations during the preparation of the EIS, to notify property owners about acquisition requirements, and to inform residents and businesses in close proximity to the project of the preferred design and upcoming EIS exhibition

- Briefings with councils, schools, local places of worship, bicycle and pedestrian user groups, chambers of commerce, industry groups, clubs and organisations.

A community information phone line, email address and postal address were established and have been ongoing channels for receiving and responding to community feedback.

The consultation activities outlined above were an opportunity for information about the project to be provided and for the community and other stakeholders to comment. A range of other consultation activities were also adopted including regular email broadcasts, website updates and notification letters.

Extensive community and stakeholder feedback was received which has informed the preparation of this EIS. WDA will continue to provide opportunities for the community and stakeholders to participate in the ongoing refinement of the preferred design and construction process to further minimise project impacts.

## What benefits would the project provide?

The project would:

- Provide a motorway standard link between Concord and Haberfield which would improve safety and provide reliability and savings in travel time for through traffic
- Provide improved access and travel along and across Parramatta Road for local vehicle trips and for active transport
- Enable improvements to public transport on Parramatta Road, including provision of kerbside bus lanes between Burwood Road at Burwood/Concord and Chandos Street at Ashfield/Haberfield at project opening, and the possible future provision of rapid public transport services along Parramatta Road
- Facilitate urban renewal in precincts adjoining the Parramatta Road corridor by improving local amenity with less traffic noise and vehicle emissions from congested traffic.

Together with the M4 Widening, the project would:

- Support the economic development of Sydney by providing a high quality and efficient road connection for motorists and freight vehicles between Parramatta and Global Sydney (as defined in *A Plan for Growing Sydney* (NSW Government 2014)
- Enable possible opportunities to transform Parramatta Road as well as local centres that exist alongside Parramatta Road
- Provide better connectivity between local centres adjacent to Parramatta Road
- Provide additional capacity to address existing traffic congestion on the M4 and Parramatta Road by separating longer-distance through traffic from local traffic. Current traffic congestion is causing poor amenity along Parramatta Road and constraining the operation of existing businesses and efficient movement of people and freight
- Accommodate rising travel demand created by increasing population and employment in high growth localities in the Parramatta to Strathfield corridor, including Sydney Olympic Park and Burwood.

## What are the key issues associated with the project?

### Traffic

Traffic models were developed to assess the performance of the road network during the morning (AM) and afternoon (PM) peak periods. Future year networks and traffic demands were developed for five key modelling scenarios that were assessed: 2017 construction peak; 2021 and 2031 'do minimum' (ie without the project but assuming the M4 Widening project is complete); 2021 ‘do something (ie with the project and M4 Widening complete); and 2031 ‘do something’ (ie with the project and other WestConnex projects (M4 Widening, King Georges Road Interchange Upgrade, New M5 and M4–M5 Link) complete).

Construction of the project would generate additional heavy and light vehicle traffic on the surrounding road network, which is predicted to be around two per cent of current total daily traffic on Parramatta Road. Construction ancillary facilities are located to provide convenient access from the M4 and Parramatta Road, which would minimise the impact to the local road network. While there would be some delays resulting from additional construction traffic, intersection performance would be broadly similar to traffic conditions without the project. The majority of road works, including temporary road closures, are therefore anticipated to result in limited impacts to road users and bus service travel times. For safety reasons, some bus stops would be relocated during construction. Pedestrian and cyclist diversions would also be required during construction which would result in increased walking and cycling distances and potentially extended wait times at some signalised intersections.

In the 2021 'do something' scenario, once the project is operating, daily two-way traffic volumes on Parramatta Road are predicted to decrease by about 53 per cent compared to the 2021 'do minimum' scenario, while on Queens Road they are predicted to decrease by about 28 per cent. In 2031, although total traffic volumes in the M4 and Parramatta Road corridor (including the project and the existing surface road network) are predicted to increase, the project would still reduce traffic volumes on Parramatta Road by about 47 per cent on Queens Road by about 25 per cent.

Analysis indicates that mid-block operational performance levels along Parramatta Road would significantly improve between the end of the M4 at Concord and Dalhousie Street at Haberfield, with small deteriorations elsewhere. Modelling outputs suggest that the project would create average travel time savings of between six and eight minutes in 2021 on strategic routes between Western Sydney and the CBD, with more substantial time savings of between 10 and 18 minutes by 2031, which is mainly due to the operation of the connecting M4–M5 Link.

The intersection analysis highlighted significant reductions in delay and congestion in the study area during all future years and peak periods as a result of the project, in comparison to the 'do minimum' scenario. However, a number of intersections that are already congested would continue to experience delays. A number of mitigation measures would be implemented to minimise these impacts.

The project's operation would create additional route options along the corridor, increasing network resilience. Additionally, the reduction of traffic volumes on Parramatta Road would provide an opportunity to improve the quality of public transport services along the corridor through the introduction of bus lanes between Burwood Road at Burwood and Chandos Street at Haberfield/Ashfield, to coincide with opening of the project. Indicative results demonstrate travel time savings for buses of up to 14 minutes in the westbound direction in 2021.

## Air quality

The NSW Advisory Committee on Tunnel Air Quality – chaired by the NSW Chief Scientist and Engineer and including representatives from the NSW Environment Protection Authority, NSW Health, Roads and Maritime and NSW Department of Planning and Environment (DP&E) – was consulted during development of the air quality assessment methodology. The assessment was based on the 2021 and 2031 'do minimum' and 'do something' scenarios described above for the traffic assessment.

Potential impacts on local air quality from dust produced during construction was assessed using a risk-based approach, which determined that standard management measures would be sufficient to mitigate the effects of construction work on local air quality and the community.

During operation, the assessment of ambient air quality impacts concluded that there would be a general improvement in air quality along Parramatta Road as a result of the project. This is due to the reduction in traffic volumes on Parramatta Road and the improved dispersion of emissions from diverted traffic through tunnel ventilation outlets.

Air quality modelling indicated that the concentrations of all criteria pollutants at receptors would usually be dominated by the existing background contribution. This applies to short-term criteria as well as annual means. The background concentrations would be especially dominant for airborne particulate matter.

Under expected traffic conditions, the contribution of tunnel ventilation outlets to pollutant concentrations would be negligible for all receptors. For some pollutants and metrics (such as annual mean nitrogen dioxide) there would also be a significant contribution from the future predicted surface road traffic.

Exceedances of some air quality criteria (one-hour nitrogen dioxide, 24-hour particulate matter of up to 10 micrometres in size, and annual and 24-hour particulate matter of up to 2.5 micrometres in size) are predicted to occur at a small proportion of receptors along the project corridor, both with and without the project. These exceedances would largely be as a result of increased surface road traffic associated with future population growth. However, overall there would be a decrease in the number of receptors that would experience air quality criteria exceedances as a result of the project.

### 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, within the context that the existing noise environment is generally dominated by relatively high levels of existing road traffic noise.

During construction, the project would result in noise and vibration impacts due to the operation of construction ancillary facilities. The assessment predicted that noise levels for the worst-case construction scenarios (ie all equipment operating at once) would result in exceedances for the majority of nearby receivers, particularly during site establishment works and surface roadworks. Where noise exceedances are expected during both standard work hours and out of hours, a range of noise mitigation measures including temporary noise hoardings would be implemented. Construction traffic is not predicted to significantly increase traffic noise.

There would be potential for short-term ground-borne noise from tunnelling activities to be an issue at a number of locations along the project. These impacts are expected to be short term (a period of a few days) for any impacted location.

Up to 203 residential and light commercial buildings would be within the safe working distances for risk of cosmetic damage from vibration for these building types, and 11 heritage-listed buildings would be within the safe working distance for ‘structurally unsound’ buildings. Ten of the heritage-listed buildings are of masonry construction, and are not likely to be structurally unsound. In terms of human comfort, a low risk of annoyance is predicted as a result of tunnelling works, while a significant number of receivers would be within the nominated safe working distance for human comfort vibration. Vibration impacts would be mitigated through the implementation of appropriate mitigation measures.

During operation of the project, a reduction in the overall number of sensitive receivers that currently experience an exceedance of the relevant noise goals is predicted, due to the reduction in traffic on Parramatta Road. Notwithstanding this, increases in noise levels would be experienced at the Concord Road, Parramatta Road and Wattle Street interchanges as a result of new noise sources, increased traffic volumes and/or reduced shielding due to demolition of buildings. Mitigation measures, such as low noise pavement and noise barriers, would be provided as part of the project, which would minimise noise impacts. In addition, at-property acoustic treatment would be considered where noise exceedances are still predicted.

### Human health

The human health risk assessment followed national guidelines and addresses requirements from key government agencies and councils, such as NSW Health, in relation to air quality, noise and vibration and social aspects.

A human health risk assessment is a way of deciding now, what the consequences (to health) of some future action (such as the project) may be. We try to learn from previous experience about impacts from road tunnels and their potential effects on people who live or work around them. We then use this information to predict the impacts of the project on community health. The human health risk assessment included a detailed review of what impacts may occur, who may be exposed to these impacts, and whether there is potential for these impacts to result in adverse health effects within the local community.

In relation to air quality, the project is expected to result in a decrease in total pollutant levels in the community. The project is expected to result in a redistribution of impacts associated with vehicle emissions. For much of the community, this will result in an improvement (or decreased concentrations and health impacts); however, for a number of areas, a small increase in pollutant concentration may occur. Potential health impacts associated with changes in air quality (specifically nitrogen dioxide and particulates) are low and essentially negligible within the community when measured against existing background air quality.

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.

Changes in the urban environment associated with the project have the potential to result in both positive and negative impacts. Negative impacts may occur as a result of traffic changes during construction, property acquisitions, visual changes, noise impacts and changes in access/cohesion of local areas. These may result in increased levels of stress and anxiety. In many cases, the impacts identified are either short-term, or mitigation measures have been identified to minimise the impacts on the community. Positive impacts on the community include traffic improvements, better connectivity and accessibility, and improved local amenity at many locations.

### Property and land use

The project has been designed to minimise land acquisition and limit the impact on private properties. Based on the preferred design, full and partial acquisition of 182 properties and 10 road reserves would be required. In addition, 98 properties owned by Roads and Maritime, of which 21 were acquired through voluntary acquisition based on the preliminary concept design, would be needed to construct the project. One additional property, Bill Boyce Reserve at Homebush, would be leased during construction. In addition to the temporary lease of Bill Boyce Reserve, three other public reserves would be impacted as follows:

- Arnotts Reserve at Homebush (south of the existing M4 and currently fenced off and inaccessible by the public): temporary lease during construction of about 19 per cent of the total area of the reserve, and permanent partial acquisition of about an additional seven per cent to accommodate the Powells Creek M4 westbound on-ramp
- Cintra Park at Concord: permanent acquisition of land which contains the Cintra Park hockey field (which is currently being replaced with a new facility at St Lukes Park on the northern side of Gipps Street, including additional car parking) and an overflow car park on the northern side of Concord Oval (which would be upgraded). This site would be used during construction, and would also accommodate the fresh air supply facility, the operational water treatment facility and a distribution substation during operation. A significant proportion of Cintra Park would be rehabilitated and returned for use as open space following construction. The nature of this future open space would be determined in consultation with Canada Bay Council
- Reg Coady Reserve at Haberfield: temporary lease during construction of about six per cent of the total area of the reserve south of Dobroyd Canal (Iron Cove Creek), and permanent partial acquisition of about an additional 12 per cent to accommodate widening of Wattle Street.

All public reserves leased during construction would be rehabilitated and returned to their owners for use as open space following construction.

Construction of the project would result in temporary changes in land use due to the establishment of construction work areas and facilities. Following construction, the majority of land impacted during construction would be used for operational aspects of the proposal. There would, however, be areas of residual land (other than public reserves) which would potentially be available for redevelopment. This would be subject to separate assessment and planning approval.

The project would result in some short-term property access impacts during construction; however, these are not expected to be significant. During operation, there would be changes to the way some properties are accessed, but these would not significantly differ from the existing situation.

The project, as part of WestConnex, would act as a catalyst for urban revitalisation in the Parramatta Road corridor, which has the potential to significantly alter land use. However, urban renewal does not form part of the project and would be subject to separate assessment and approval.

### Urban design and visual amenity

A total of 15 landscape character zones were identified as having the potential to be impacted by surface components of the project. These zones reflect the differences in character that are inherent in such a densely urbanised setting. Potential impacts were considered across the 15 landscape character zones and the assessment found that high visual impacts would only occur at three of the zones: Cintra Park precinct, Haberfield precinct, and Yasmar Estate (State significant heritage item and NSW Department of Juvenile Justice training facility), with opportunities to reduce these impacts through the implementation of mitigation measures.

Potential impacts on visual amenity were also considered across four different user groups: residents, pedestrians, recreational users and motorists. High potential visual amenity impacts were considered likely for the residential user group. To minimise the potential impacts identified, site compounds and work areas would be screened. Vegetation clearance would be minimised where possible. Notwithstanding the application of mitigation, construction activities would still be visible from some locations. However, construction impacts would be temporary and therefore the residual impacts are considered to be low.

The project would introduce new operational elements and ancillary infrastructure into an existing built environment and would be located next to or within major transport corridors. The key landscape character and visual amenity impact would be a change from a visually enclosed four-lane motorway with vegetated embankments, to a substantially wider corridor incorporating multiple lanes and the opening up of new view lines to the transport corridor. Operational facilities and buildings would be designed in accordance with the draft *WestConnex Motorway Urban Design Framework* (Roads and Maritime 2013) and landscaped to complement and blend with their surroundings. The urban design and landscape approach for the project would be developed during detailed design with the aim of integrating the project into the surrounding landscape and visual setting.

### Social and economic

The socio-economic assessment determined that the construction expenditure of the project would be of significant benefit to the local, regional and state economies over the three-year construction period.

The construction of the project is predicted to directly contribute around $470 million to gross State product for each average year of construction, with indirect effects of around $220 million, giving an estimated total contribution of $690 million for each average year of construction.

Around 4,120 full time jobs per average year of construction would be generated by the project, including:

- About 1,280 full time jobs directly employed on the project
- About 1,260 full time jobs employed by businesses supplying directly to the project
- About 1,580 indirect full time jobs.

The project would involve the full acquisition and removal of 168 residential dwellings and removal of 35 residential dwellings owned by Roads and Maritime. The project also involves the acquisition and removal of 20 commercial buildings used by a number of private businesses.

For many of the directly affected property owners, relocating would be a significant but short-term impact. For some, if they wish to relocate locally but are unable to, the social impact may involve extended recovery time, as relocation may cause dislocation of social networks, and disruption and change to daily routines (work, study, recreation etc).

In addition to the owner's entitlement to compensation under the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW), Roads and Maritime would provide affected property owners with access to a counselling support service and an additional independent service to vulnerable households (such as the elderly and/or those suffering an illness) to assist with their relocation.

Impacts on amenity would be most likely to occur during the construction phase and relate to noise and vibration, and changes to the visual environment. Measures to avoid, mitigate and manage amenity impacts would be implemented.

The process of refinement involved in selecting the preferred design has resulted in fewer and less severe impacts on social infrastructure compared to the preliminary concept design. During operation, the project has the potential to have both adverse and beneficial impacts on amenity. Adverse impacts would be experienced primarily along the M4 corridor at Homebush, at the ventilation facilities, and the Concord Road, Wattle Street and Parramatta Road interchanges. However, with much of the project located underground, a reduction in traffic on the surface M4 and Parramatta Road is expected to deliver amenity benefits.

As a significant volume of traffic currently using Parramatta Road would transfer to the tunnels, businesses that are reliant on passing trade would be affected by the project. Reductions in passing trade would potentially be offset to some degree by improved amenity and accessibility for the businesses affected. The project would also improve network efficiency, delivering travel time savings and provide for more efficient movement of freight and commercial vehicles, thereby reducing operational costs associated with fuel and wages.

### Soil and water quality

The project crosses four main waterways (Saleyards Creek, Powells Creek, St Lukes Park Canal, and Dobroyd Canal (Iron Cove Creek)) and their associated sub-catchments, with a fifth waterway (Barnwell Park Canal) close to the project footprint. All of these waterways are concrete-lined channels where they are crossed by the project, and the sub-catchments are well established urban catchments with predominantly residential and commercial land use.

During construction, the highest risk of impacts on soils and water quality would be associated with exposure of soils resulting in off-site movement of eroded sediments by wind and/or stormwater to receiving waterways. In addition, potential accidental leaks or spills of chemicals, fuels, oils and/or greases from construction plant and machinery, may pollute receiving waterways. These impacts would be managed through the implementation of standard construction site mitigation measures.

During operation, the main potential impacts on water quality would be associated with discharge of treated groundwater, stormwater runoff during rainfall events and direct deposition of airborne particles, causing contamination of water quality in downstream waterways. The minor increase in the area of impervious surfaces associated with the surface works of the project would have the potential for a small additional adverse impact on the hydrological regime due to increased runoff volumes and peak flows and associated potential increases in erosion and sedimentation of downstream watercourses.

However, the project would incorporate appropriate surface water management and drainage design measures to manage potential impacts to surrounding watercourses. These would include the capture, treatment and discharge of groundwater inflow into the tunnels, provision for spill containment within the tunnels, and the augmentation of existing drainage infrastructure along the project footprint, including grass swales, treatment basins and spill containment basins.

### Contamination

Published maps indicate the potential for acid sulphate soil at some locations in the project corridor. Soil testing at some of these locations was undertaken which has indicated latent acidity within the residual clay and weathered bedrock strata. No samples exceeded the action criterion for equivalent sulfur or equivalent acidity based on the chromium reducible sulfur results. Based on these results, the likelihood of widespread acid sulphate soil is considered to be low.

The project covers an area of diverse characteristics and is surrounded by a number of potentially contaminating land uses including industrial complexes, petrol service stations, a bus depot, carwashes and mechanical workshops.

Fill soils have been recorded along the project corridor at varying depths. The available site investigation information has recorded concentrations of hydrocarbons, lead and asbestos in soils predominantly below the applicable screening criteria. All exceedances were within the fill soils, except for one location at two metres below ground level located within the underlying residual material. The groundwater samples collected and analysed as part of these investigations recorded concentrations above the applicable screening criteria for metals including arsenic, cadmium, copper, nickel and zinc. The observed concentrations are considered likely to be indicative of natural background metal concentrations in groundwater within the Sydney basin. Based on these results, the need for any broad scale remediation as part of the construction or operation of the project has not been identified.

While contamination is not considered to present an imminent risk of harm to human health or the environment, it would require appropriate management during construction. The risks can be managed through an environmental management plan that would include an unexpected finds protocol to handle any latent contamination, groundwater, waste and acid sulfate soils.

## Flooding

During construction, there is the potential for local catchment runoff to enter project excavations at the interchange locations and impact the construction ancillary facilities. This would be addressed through local stormwater controls at these sites and with management measures including staging of works, temporary relocation of flows and using barriers to prevent overland flow from entering works areas. Construction activities also have the potential to exacerbate flooding conditions in adjacent developments, however physical barriers would be designed to protect the works areas and tunnel entries so as not to increase flooding conditions in adjacent areas.

During operation, floodwater inundation has 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. As such, the preferred design includes measures that would achieve the hydrologic standard requirements and manage the impact the project would have on the flooding characteristics of adjacent development under post-construction conditions. The tunnel portals and ancillary facilities such as substations, ventilation buildings and emergency response facilities would be located above the flood risk level.

The investigation found that changes in the characteristics of flooding associated with future climate change would not lead to a significant increase in the flood risk to the project.

## Groundwater

A transient groundwater model calculated tunnel inflows during construction to reach a maximum rate of about 1.6 megalitres per day, or 584 megalitres per year, from a total 43,323 megalitres available per year within the groundwater source.

The risk to individual structures from ground movement resulting from tunnelling works is anticipated to be negligible (cosmetic damage only) for the majority of properties affected. For a limited number of properties (about 100), ground movement may result in cracking of up to 15 millimetres. Mitigation and management measures would be implemented to minimise potential ground movement impacts, including pre-construction surveys, ongoing monitoring, and make good provisions where required.

To the north of the project, wetland systems rely heavily on the Parramatta River for their water supply and as such there is a low risk of these features being impacted by drawdown associated with the project. Monitoring and mitigation measures are proposed to reduce this risk further. There are a number of groundwater bores registered for domestic use where modelled drawdown impacts would exceed two metres. These are considered to be potentially adversely impacted and appropriate mitigation and monitoring measures would be implemented.

Modelling suggests saline water may migrate from Parramatta River to the project corridor, changing the salinity of the groundwater in this area. Such saline inflow may not develop immediately and may take several years to have an impact on inflow water quality; however, it is likely to develop over the design life of the tunnel. In any case, the aquifer system is expected to remain in the same beneficial use category.

Management measures would include construction water treatment plants to treat tunnel groundwater during construction, and an operational tunnel drainage system including a water treatment facility. Tunnel lining would be installed progressively following tunnel excavation to minimise groundwater inflows.

### Non-Aboriginal heritage

The project would result in a number of buildings being demolished, of which 16 are locally-listed heritage items and a further nine are potential heritage items (a place that is not listed on a heritage register but has been assessed to have heritage significance). A number of street trees that form part of two separate heritage listings would also be removed. In addition, listed and contributory items in the Powells Estate and Haberfield heritage conservation areas would be demolished. Across the project footprint and in adjacent areas, heritage items may be affected by changes to setting and visual amenity from temporary construction works or the operational project.

The detailed design, documentation and construction of the project would be managed to ensure that, as far as possible, the identified potential for heritage and archaeological impacts is avoided or minimised.

Heritage items, potential heritage items and heritage conservation areas above the proposed tunnels and in the vicinity of construction works may be subject to vibration impacts. Vibration could affect the condition of heritage fabric through cracking and settlement and, in the worst case scenario, compromise a heritage item's structural integrity. Appropriate vibration criteria would be established to minimise impacts and condition surveys of potentially impacted buildings would be undertaken.

In relation to historic archaeology, excavations and other intrusive ground works associated with the project could affect soil horizons that potentially contain archaeological relics. The archaeological potential has been assessed to be of local significance, with a low potential for State significant relics associated with the Longbottom Stockade at Cintra Park. Management guidelines and recommendations have been established in this report in accordance with the heritage significance of the archaeological resources.

### Biodiversity

The project is located in a highly urbanised environment and much of the project would be tunnelled under existing roads and residential areas. No intact, remnant native vegetation communities are present in the project footprint or immediately adjacent to the study area. Construction of the project would result in the removal of about 15.7 hectares of vegetation, comprising about 12.9 hectares of planted trees and screening vegetation (mainly from alongside the existing M4) and about 2.8 hectares of grassland with scattered trees (such as from Cintra Park and Reg Coady Reserve). Vegetation to be removed comprises foraging habitat for two threatened fauna species (Grey-headed Flying-Fox and Eastern Bentwing-bat). However, no threatened flora or fauna (including bats) is likely to be significantly impacted by the project.

Given the above considerations, there are likely to be only minor residual impacts on the natural environment and a formal biodiversity offset is not necessary. The planting of food trees for Grey-headed Flying-Fox following construction would compensate for the removal of existing planted vegetation within the project footprint and assist in maintaining foraging habitat for this species in the study area.

On the basis of the assessments undertaken, the project is not likely to result in a significant impact on any matter of national environmental significance, including threatened and migratory species.

### Greenhouse gas

The design of the project has been optimised so that measures to reduce energy and resource requirements, and therefore greenhouse gas emissions, are inherent in the design. The results of the assessment demonstrate the benefits of road tunnel usage in urban areas, where travel along a more direct route at a higher average speed results in fewer greenhouse gas emissions being generated by road users, as reduced congestion and stop-start driving reduces the fuel used by vehicles.

The assessment results indicate the project would reduce annual greenhouse emissions by around 56,800 tonnes of carbon dioxide equivalent in 2021 and around 45,400 tonnes of carbon dioxide equivalent in 2031. The predicted reduction in greenhouse gas emissions as a result of the project is due to an improvement in vehicle fuel efficiency for most sections of Parramatta Road, as well as the operational efficiency of the project tunnels.

### Aboriginal heritage

The Aboriginal Heritage Information System database has no sites registered within the project footprint and no surface expressions of Aboriginal objects or places were identified. The terrain within the project footprint and surrounding study area is highly disturbed and unlikely to contain unidentified Aboriginal archaeological objects, and as such the project is not anticipated to have any impact on objects or places of Aboriginal cultural heritage. Mitigation and management measures would be implemented to avoid, minimise or mitigate impacts on unidentified Aboriginal cultural heritage objects or places.

### Resource use and waste minimisation

Construction resource requirements may have an impact on resource availability within the local area; however, the impact would be minor and limited to the construction period. It is anticipated that the local water supply network would have sufficient capacity to accommodate project construction water requirements. Initial discussions with power supply authorities have confirmed that local substations have the required capacity to supply the construction ancillary facilities without affecting the local supply network.

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

### Climate change

The initial climate change risk assessment identified the potential impacts of climate change on the project during the operation phase and did not identify any risks rated as high or extreme. Of the 23 risks that were analysed for the project, a total of 10 risks were identified as being medium. A number of adaptation options for these medium risks have been recommended for consideration during detailed design.

During detailed design, a detailed climate change risk assessment would be undertaken in accordance with the standard AS 5334-2013 *Climate change adaptation for settlements and infrastructure – A risk based approach*. The assessment would identify and, where required, implement adaptation measures to comprehensively address any high and extreme risks.

### Hazard and risk

The design of the project has been developed to inherently minimise the likelihood of incidents and accidents. The project would include a work health and safety plan which would support and augment the measures and procedures included in the construction environmental management plan and would be supplemented by site and activity specific Safe Work Method Statements. 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) and relevant Australian Standards and legislation.

### Cumulative impacts

Cumulative positive impacts of the project are expected to be largely delivered when all stages of WestConnex are completed and operational. The project in isolation and in the context of the entire WestConnex is expected to reduce noise impacts as vehicles move off surface roads to tunnels.

WestConnex has the potential to result in both positive and adverse impacts on businesses and the community. A key benefit of WestConnex would be the improved movement of freight around Sydney as journey reliability and productivity improvements deliver positive flow on effects to the economy. Improved air quality along the majority of the Parramatta Road corridor would also benefit the local community.

Construction of the multiple projects forming WestConnex would be staggered and would therefore result in extended construction periods for some residents in the vicinity of the project. The two locations where overlap or consecutive construction periods would occur would be at the western and eastern ends of the project. At the western end, the M4 Widening and M4 East projects would be under construction at the same time, while at the eastern end, tunnelling for the M4–M5 Link project may occur shortly after completion of the M4 East project. However, infrastructure to facilitate the easy connection to the M4-M5 Link would be completed as part of the project, in order to reduce potential cumulative impacts on the local community at Haberfield.

In relation to other developments occurring in the vicinity of and at the same time as the project, these are generally located away from the project and therefore significant cumulative traffic and amenity impacts are unlikely.

### Sustainability

One of the key objectives of the project is to assist in reducing traffic congestion on Parramatta Road and provide shorter travel times for road users. As part of WestConnex, the project would provide the missing link in the motorway network that supports Sydney's global economic corridor. Improvements to the transport network, including this project, support the global economic corridor by enabling domestic and international trade, and therefore underpin a sustainable NSW economy and Sydney's role as a global city.

The WestConnex Sustainability Strategy sets targets to be met by the project, including sourcing at least six per cent of the total energy requirements from renewable sources. The strategy describes how sustainability initiatives would be integrated into the design, construction and operation of projects across WestConnex.

The Infrastructure Sustainability Council of Australia administers an Infrastructure Sustainability rating scheme. A target infrastructure sustainability rating under this scheme of at least 'Excellent' for the design and construction of the project has also been set and is a requirement of the construction contract.

The WestConnex sustainability objectives and targets would be met through the implementation of a project-specific sustainability management plan.

## How will the likely impacts be managed?

The EIS identifies comprehensive mitigation and management measures that would be implemented to avoid, manage, mitigate, offset and/or monitor impacts during construction and operation of the project. These include best practice construction environmental planning and management techniques, urban design and landscaping treatments and noise mitigation measures. Further mitigation opportunities are likely to be identified during detailed design and construction planning.

The design, construction and operation of the project would be undertaken in accordance with extensive environmental management commitments identified in this EIS, as well as any additional measures identified in conditions of approval for the project.

To assist in further mitigating traffic impacts on the wider road network, Roads and Maritime will continue to prioritise improvements to the overall network including works to address intersection congestion where required. In addition, the Transport Master Plan commits to the development of an integrated package of transport improvements to renew the Parramatta Road corridor in conjunction with the delivery of WestConnex. These improvements include the installation of dedicated public transport lanes which would only be possible once the M4 East is operational.

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

The NSW Department of Planning and Environment (DP&E) will make the EIS publicly available for a minimum of 30 days. During this period, it will be available for inspection at:

- The DP&E website: http://majorprojects.planning.nsw.gov.au/
- At selected local council offices and libraries in the Auburn, Strathfield, Canada Bay, Burwood and Ashfield local government areas
- At selected Roads and Maritime offices
- At various staffed displays in the region, as advertised in local media
- Via the WestConnex website: www.westconnex.com.au.

WDA will continue conducting community information sessions. A project information line (1300 660 248) will also be available throughout the exhibition period to answer enquiries 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 6307). All submissions received will be placed on the DP&E website.

Written submissions may be made online at http://majorprojects.planning.nsw.gov.au or directed to:

SSI 6307
NSW Department of Planning and Environment
GPO Box 39
Sydney NSW 2001

# Contents

## Volume 2E

Appendix M – Social impact assessment

Appendix N – Economic impact assessment

Appendix O – Soil and water assessment

## Volume 2F

Appendix P – Soil and land contamination assessment

## Volume 2G

Appendix Q – Surface water: flooding and drainage

Appendix R – Groundwater impact assessment

## Volume 2H

Appendix S – Non aboriginal heritage impact assessment

Appendix T – Biodiversity impact assessment

Appendix U – Detailed greenhouse gas calculations

Appendix V – Aboriginal heritage assessment

Appendix W – Climate change risk assessment framework

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# Certification

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

**Environmental impact statement prepared by:**

**Name:** Monique Roser

**Qualifications:** Bachelor of Town Planning (Hons I)

**Address:** GHD, Level 15
33 Castlereagh Street
Sydney NSW 2000

**Responsible person:** Mark Andrew
Principal Manager Motorway Project Procurement
Roads and Maritime Services
Level 9, 101 Miller Street
North Sydney NSW 2060

**Address of the land to which the statement relates:**
Land within Auburn, Strathfield, Canada Bay, Burwood and Ashfield local government areas as described within this environmental impact statement.

**Description of the infrastructure to which this statement relates:**
Construction and operation of a tolled motorway (known as WestConnex) linking the M4 Motorway between Homebush Bay Drive at Homebush to Parramatta Road and City West Link (Wattle Street) at Haberfield/Ashfield, including operational ancillary facilities for the control and management of the road.

**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 dated 16 June 2015. 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:** Monique Roser

**Date:** 6 September 2015

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# Glossary of terms and abbreviations

| Term | Meaning |
|---|---|
| **A** | |
| 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*. |
| ABS | Australian Bureau of Statistics |
| ACM | Asbestos containing material(s) |
| ADT | Average daily traffic |
| ADWG | *Australian Drinking Water Guidelines* (National Health and Medical Research Council 2013) |
| AHD | Australian height datum<br>A common national surface level datum approximately corresponding to mean sea level |
| AHIMS | Aboriginal Heritage Information Management System.<br>A register of NSW Aboriginal heritage information maintained by the NSW Office of Environment and Heritage. |
| Alignment | The geometric layout (eg of a road) in plan (horizontal) and elevation (vertical). |
| AMO | Allied Meteorological Office |
| AM peak period | 6.00 am to 10.00 am weekdays |
| Ancillary | A subordinate part of an element. |
| ANZECC | Australian and New Zealand Environment Conservation Council |
| Aquifer | A groundwater bearing formation sufficiently permeable to transmit and yield groundwater |
| AR5 | Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (IPCC 2013) |
| ARI | Average recurrence interval<br>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 1 per cent chance (i.e. a one-in-100 chance) of occurrence in any one year<br>The frequency of floods is generally referred to in terms of their AEP or ARI.In this report the frequency of floods generated by runoff from the study catchments is referred to in terms of their ARI, for example the 100 year ARI flood. |
| ARMCANZ | Agriculture and Resources Management Council of Australia and New Zealand |
| Arterial roads | The main or trunk roads of the State road network. |
| AS | Australian Standard |
| ASC NEPM | *National Environment Protection (Assessment of Site Contamination) Measure 1999* (Commonwealth) |

| Term | Meaning |
|---|---|
| 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. |
| ASS | Acid sulfate soils<br>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. |
| ASTER | Advanced Spaceborne Thermal Emission and Reflection Radiometer |
| At-grade | A road at ground level, not on an embankment or in a cutting. |
| AWS | Automatic weather station |
| AWT | Average weekday traffic |
| **B** | |
| Background concentration | 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. |
| 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. |
| bgl | Below ground level |
| BH | Borehole |
| BITRE | Bureau of Infrastructure, Transport and Regional Economics |
| BoM | 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. |
| BTS | Bureau of Transport Statistics |
| Bus lane | A traffic lane dedicated to buses, but which can also be used by taxis, bicycles and motorcycles. |
| **C** | |
| Carriageway | The portion of a roadway used by vehicles including shoulders and ancillary lanes. |
| 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 |
| CEMP | Construction Environmental Management Plan<br>A site specific 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. |

| Term | Meaning |
|---|---|
| CETU | Cente d'Etudes des Tunnels |
| CLM Act | *Contaminated Land Management Act 1997* (NSW) |
| CO | Carbon monoxide |
| $CO_2$ | Carbon dioxide |
| 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. |
| Construction ancillary facility | Facilities used to support the operation of a construction site including (but not limited to) site offices, workshops, delivery areas, storage areas, crib sheds, staff vehicle parking, material and plant equipment. |
| Construction footprint | Area required for the construction of the project. This includes the operational footprint and temporary construction ancillary facilities. |
| Contributory item | Place within a Heritage Conservation Area that contributes to its heritage significance. |
| CPTED | Crime Prevention Through Environmental Design |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| Cul-de-sac | A street or road that is open for vehicular traffic at one end only. |
| Cumulative impacts | Impacts that, when considered together, have different and/or more substantial impacts than a single impact considered alone. |
| 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** | |
| dBA | A-weighted decibels<br>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. |
| DCP | Development Control Plan |
| DECC | Former Department of Environment and Climate Change (now OEH). |
| DECCW | Department of Environment, Climate Change and Water (formerly DECC, but now OEH). |
| Design speed | A nominal speed which determines the geometric design features of a road. |
| Detailed design | The stage of design where project elements are designed in detail, suitable for construction. |
| Deviation | An alteration to the alignment of a portion of a road. |
| DFO | Direct Factory Outlet |
| 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. |

| Term | Meaning |
|---|---|
| DGRs | Director-General's requirements.<br>Now Secretary's Environmental Assessment Requirements (SEARs). |
| DP&E | NSW Department of Planning and Environment |
| DPI | NSW Department of Primary Industries |
| DPI – Water | NSW Department of Primary Industries – Water (formerly NSW Office of Water) |
| 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. |
| **E** | |
| Enabling works | Works which are required to enable the commencement of the main construction works. |
| Earthworks | All operations involved in loosening, excavating, placing, shaping and compacting soil or rock. |
| EC | Electrical conductivity<br>The measure of a material's ability to accommodate the transport of an electric charge. |
| EEC | Endangered ecological community |
| Egress | Exit |
| EIS | Environmental impact statement |
| 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. |
| ENMM | *Environmental Noise Management Manual* (Roads and Traffic Authority 2001) |
| ENSO | El Nino-Southern Oscillation |
| EPA | NSW Environment Protection Authority |
| EP&A Act | *Environmental Planning and Assessment Act 1979* (NSW) |
| EPBC Act | *Environment Protection and Biodiversity Act 1999* (Commonwealth) |
| EPL | Environment protection licence |
| Erosion | A natural process where wind or water detaches a soil particle and provides energy to move the particle. |
| ESD | Ecologically sustainable development. |
| ESP | Electrostatic precipitator |
| EU | European Union |
| **F** | |
| FBA | *Framework for Biodiversity Assessment* (Office of Environment and Heritage 2014a) |
| Feasible and reasonable | Consideration of best 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. |

| Term | Meaning |
|---|---|
| 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. |
| Footprint | The extent of impact that a development makes on the land. |
| FFDI | Forest Fire Danger Index |
| 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. |
| FTE | Full-time equivalent |
| **G** | |
| GCCSA | Greater Capital City Statistical Area |
| GHG | Greenhouse gas |
| GIS | Geographic information systems |
| 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. |
| Grade | The rate of longitudinal rise (or fall) with respect to the horizontal expressed as a percentage or ratio. |

| Term | Meaning |
|---|---|
| Grade separation | The separation of road, rail or other traffic so that crossing movements at intersections are at different levels. |
| Groundwater | Water that is held in rocks and soil beneath the earth's surface. |
| GRAL | Graz Lagangrian dispersion model<br>Air quality modelling package. |
| GRAMM | Graz Mesoscale Model |
| GRP | Gross Regional Product |
| GSP | Gross State Product |
| **H** | |
| HAMU | Historical archaeological management unit |
| Hazard | A source of potential harm or a situation with a potential to cause loss. In relation to the *NSW Floodplain development manual* (DIPNR 2005) the hazard is flooding which has the potential to cause damage to the community. |
| Heavy vehicles | A heavy vehicle is classified as a Class 3 vehicle (a two axle truck) or larger, in accordance with the Ausroads Vehicle Classification System. |
| Heritage Act | *Heritage Act 1977* (NSW) |
| Heritage item | Place listed on a statutory heritage register |
| Hydraulic conductivity | A characteristic of soil that describes how easily water moves through it. |
| Hydrogeology | The area of geology that deals with the distribution and movement of groundwater in soils and rocks. |
| Hydrology | The term given to the study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods. |
| **I** | |
| IAQM | Institute of Air Quality Management |
| ICNG | *Interim Construction Noise Guideline* (Department of Environment and Climate Change 2009a) |
| ICOMOS | International Council on Monuments and Sites |
| Impact | Influence or effect exerted by a project or other activity on the natural, built and community environment. |
| 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 |
| INP | *Industrial Noise Policy* (Environment Protection Authority 2000) |
| Intrusive item | Place within a heritage conservation area that detracts from its heritage significance. |
| 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. |
| IPCC | Intergovernmental Panel on Climate Change |
| ISCA | Infrastructure Sustainability Council of Australia |

| Term | Meaning |
|---|---|
| ITS | Intelligent Transport Systems<br>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. |
| **K** | |
| KGRIU | King Georges Road Interchange Upgrade |
| kL | Kilolitres |
| kL/day | Kilolitres per day |
| km/h | Kilometres per hour |
| **L** | |
| $L_{A90}$ | The noise level exceeded for 90 per cent of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level. |
| LAC | Local area command (when referring to police stations) |
| $L_{Aeq}$ | The 'energy average noise level'. It is often expressed with a time period eg 1 hour, 9 hour (to represent the night-time period from 10.00 pm to 7.00 am) or 15 hour (to represent the daytime and evening periods from 7.00 am to 10.00 pm). The $L_{Aeq}$ can be likened to a noise dose representing the cumulative effects of all the noise events occurring in the relevant time period. |
| LALC | Local Aboriginal Land Council |
| Lane | A portion of the carriageway allotted for the use of a single line of vehicles. |
| LEP | Local environmental plan |
| LGA | Local government area |
| 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). |
| LoS | Level of service |
| LSJH JV | Leighton, Samsung C&T and John Holland Joint Venture |
| L/s/km | Litres per second per kilometre |
| **M** | |
| M4 and Parramatta Road corridor | The M4 and Parramatta Road Corridor is 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. |
| $m^2$ | Square metres |
| $m^3$ | Cubic metres |
| M | Metres |
| m/day | Metres per day |
| Mainline tunnels | The main two tunnels to be constructed as part of the project. This does not include tunnels for on- and off-ramps. |
| 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. |

| Term | Meaning |
|---|---|
| Mathematical/computer models | The mathematical representation of the physical processes involved in runoff generation and stream flow. These models are often run on computers due to the complexity of the mathematical relationships between runoff, stream flow and the distribution of flows across the floodplain. |
| Median | The central reservation which separates carriageways from traffic travelling in the opposite direction. |
| Methodology | The method for analysis and evaluation of the relevant subject matter. |
| mg/L | Milligrams per litre |
| microSiemens per centimetre | A measure of electrical conductivity. Commonly used to measure the salinity of water. |
| ML | Megalitres |
| ML/day | Megalitres per day |
| Motorway | Fast, high volume controlled access roads. May be tolled or untolled. |
| **N** | |
| NATA | National Association of Testing Authorities |
| NCG | *Noise Criteria Guideline* (Roads and Maritime Services 2014a) |
| NEPM | National Environmental Protection Measure |
| Neutral item | Place within a heritage conservation area that does not contribute to or detract from its heritage significance |
| NGA | National Greenhouse Accounts |
| NGER | National Greenhouse and Energy Reporting |
| NGER Act | *National Greenhouse and Energy Reporting Act 2007* (Commonwealth) |
| NMG | *Noise Mitigation Guideline* (Roads and Maritime Services 2014b) |
| NML | Noise management level |
| $NO_2$ | Nitrogen dioxide |
| $NO_x$ | Nitrogen oxides |
| NOW | (former) NSW Office of Water (now the Department of Primary Industries – Water) |
| NSW | New South Wales |
| NWQMS | National Water Quality Management Strategy |
| **O** | |
| OEH | NSW Office of Environment and Heritage (formerly DECCW) |
| Off-ramp | A ramp by which one exits a limited-access highway/tunnel. |
| On-ramp | A ramp by which one enters a limited-access highway/tunnel. |
| Operational footprint | Areas to be directly impacted by the operational components of the project such as roadways and associated facilities (eg motorway operations complex and ventilation facilities. The operational footprint also includes sections of the M4 East that are located below ground in tunnel. |
| 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 which 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. |

| Term | Meaning |
|---|---|
| **P** | |
| PACHCI | *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime 2011b) |
| PAD | Potential archaeological deposits |
| PAH | Polycyclic aromatic hydrocarbons |
| Parramatta Road corridor | The Parramatta Road Corridor is 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. |
| Pavement | The portion of a carriageway placed above the subgrade for the support of, and to form a running surface for, vehicular traffic. |
| PEA Act | *Protection of the Environment Administration Act 1999* (NSW) |
| Peak discharge | The maximum discharge occurring during a flood event. |
| Peak flood level | The maximum water level occurring during a flood event. |
| 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 Congress |
| Photo-ionisation detector measurements | A measurement of the concentration of volatile organic compounds and other gases within the soil. |
| PM | Particulate matter |
| $PM_{10}$ | Particulate matter of up to 10 micrometres |
| $PM_{2.5}$ | Particulate matter of up to 2.5 micrometres |
| PMF | Probable maximum flood<br>The flood that occurs as a result of the probable maximum precipitation on a study catchment. The PMF 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 PMF defines the extent of flood prone land (i.e. the floodplain). |
| POEO Act | *Protection of the Environment Operations Act 1997* (NSW) |
| POEO Regulation 2005 | *Protection of the Environment Operations (Waste) Regulation 2005* (NSW) |
| Pollutant | Any measured concentration of solid or liquid matter that is not naturally present in the environment. |
| Potential heritage item | Place identified in this report as potentially having heritage significance, which is not recognised on a heritage register. |
| PPFL | Preliminary peak flood level |
| Preferred design | The design that is the subject of this environmental impact statement. |
| Probability | A statistical measure of the expected chance of flooding (see annual exceedance probability). |
| Proponent | The person or organisation that proposes to carry out the project or activity. For the purpose of the project, the proponent is the NSW Roads and Maritime Service. |
| Project | M4 East project |
| **R** | |
| RBL | Rating background noise level |

| Term | Meaning |
|---|---|
| RCP | Representative concentration pathway |
| REP | Regional Environmental Plan |
| Residual land | Land acquired for construction that is not required during operation of the project. |
| Risk | Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of the manual it is the likelihood of consequences arising from the interaction of floods, communities and the environment. |
| RNP | *Road Noise Policy,* Department of Environment, Climate Change and Water (DECCW) 2011. |
| Roadheader | A commonly used machine for excavation in sandstone using pics mounted on a rotary cutter head attached to a hydraulically operated boom. |
| Road reserve | A legally defined area of land within which facilities such as roads, footpaths and associated features may be constructed for public travel. |
| 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. |
| RTA | (Former) NSW Roads and Traffic Authority (now Roads and Maritime Services) |
| Runoff | The amount of rainfall that ends up as streamflow, also known as rainfall excess. |
| RWC | Regulatory worst case |
| RWR receptors | Residential, workplace and recreational receptors. |
| **S** | |
| SA1 | Statistical area level 1 district |
| SA2 | Statistical area level 2 district |
| SCATS | Sydney Co-ordinated Adaptive Traffic System |
| SEARs | Secretary's Environmental Assessment Requirements Requirements and specifications for an environmental assessment prepared by the Secretary of the Department of Planning and Environment under section 115Y of the *Environmental Planning and Assessment Act 1979* (NSW). |
| Section 170 register | State Government agency section 170 Heritage and Conservation Register |
| SEPP | State Environmental Planning Policy |
| SES | State Emergency Services |
| Shotcrete | Concrete and mortar that is sprayed 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. |
| $SO_2$ | Sulfur dioxide |
| Socio-economic | Involving combination of social and economic matters. |
| Span | The distance between the centres of adjacent supports of a bridge. |
| Spoil | Surplus excavated material |
| SSROC | Southern Sydney Region of Councils |
| Stockpile | Temporarily stored materials such as soil, sand, gravel, spoil/waste. |
| Strata | Geological layers below the ground surface. |

| Term | Meaning |
|---|---|
| Streamflow | |
| 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 the possible future M4–M5 Link. |
| Surface road concentration | 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. |
| Sydney Catchment REP | Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 |
| **T** | |
| TAGG | Transport Authorities Greenhouse Group |
| TBM | Tunnel boring machine.<br>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). |
| TDS | Total dissolved solids |
| TEC | Threatened ecological community |
| TfNSW | Transport for NSW |
| The Blue Book | *Managing Urban Stormwater – Soils and Construction* Volumes 1 and 2, NSW Government 2004 and 2006 |
| TMSP | Traffic Management and Safety Plan |
| Total concentration | The sum of the background, surface road and ventilation outlet concentrations. It may relate to conditions with or without the project under assessment. |
| TSC Act | *Threatened Species Conservation Act 1995* (NSW) |
| TSP | Total suspended particulate matter |
| Transport Master Plan | *NSW Long Term Transport Master Plan* (Transport for NSW 2012a) |
| TRH | Total recoverable hydrocarbons |
| Typical cross section | A cross section of a carriageway showing typical dimensional details, furniture locations and features of the pavement construction. |
| **U** | |
| µg | microgram |
| UFP | Ultrafine Particle |
| UNFCCC | United Nation Framework Convention on Climate Change |
| Urban design | The process and product of designing human settlements, and their supporting infrastructure, in urban and rural environments. |
| **V** | |
| VDV | Vibration dose value |
| VENM | Virgin excavated natural material |
| Ventilation facility | Facility for the mechanical removal of air from the mainline tunnels, or mechanical introduction of air into the tunnels. |
| Ventilation outlet concentration | Describes the contribution of pollutants from tunnel ventilation outlets. |

| Term | Meaning |
|---|---|
| VKT | Vehicle kilometres travelled |
| VMS | Variable message signs |
| VOC | Volatile organic compounds |
| **W** | |
| WARR Act | *Waste Avoidance and Resource Recovery Act 2001* (NSW) |
| Waterway | Any flowing stream of water, whether natural or artificially regulated (not necessarily permanent). |
| WCL | Workers compensation liability |
| WDA | WestConnex Delivery Authority |
| WHO | World Health Organisation |
| WHS | Work Health and Safety Plan |
| WM Act | *Water Management Act 2000* (NSW) |
| WRTM | WestConnex Road Traffic Model |

# 1 Introduction

This chapter provides a brief overview of the proposed M4 East project (the project), including its location and key features, and also outlines the benefits that would arise from the project.

This chapter also describes the purpose and structure of this environmental impact statement (EIS).

## 1.1 Project overview

The WestConnex Delivery Authority (WDA), on behalf of the NSW Roads and Maritime Services (Roads and Maritime), is seeking approval to upgrade and extend the M4 Motorway from Homebush Bay Drive at Homebush to Parramatta Road and City West Link (Wattle Street) at Haberfield. This includes twin tunnels about 5.5 kilometres long and associated surface works to connect to the existing road network. These proposed works are described as the M4 East project (the project). The regional context of the project is shown in **Figure 1.1**.

Approval is being sought under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act). On 5 December 2014, the project was declared by the Minister for Planning to be State significant infrastructure and critical State significant infrastructure, under sections 115U(4) and 115V of the EP&A Act and clause 16 of the *State Environmental Planning Policy (State and Regional Development) 2011*. An EIS is therefore required under section 115Z of the EP&A Act.

The project is a component of WestConnex, which is a proposal to provide a 33 kilometre motorway linking Sydney's west and south-west with Sydney Airport and the Port Botany precinct. The location of WestConnex is shown in **Figure 1.2**. The individual components of WestConnex are:

- M4 Widening – Pitt Street at Parramatta to Homebush Bay Drive at Homebush (planning approval granted and under construction)
- M4 East (the subject of this report)
- New M5 – King Georges Road at Beverly Hills to St Peters (planning application lodged and subject to planning approval)
- King Georges Road Interchange Upgrade (planning approval granted and work has commenced)
- M4–M5 Link – Haberfield to St Peters, including the Southern Gateway and Southern Extension (undergoing concept development and subject to planning approval).

Separate planning applications will be lodged for each individual component project. Each project will be assessed separately, but the impacts of each project will also be considered in the context of the wider WestConnex.

Planning approval for the M4 Widening project (M4 Widening) was granted on 21 December 2014 and work commenced in March 2015. Subject to approval, parts of the project construction works may be undertaken concurrently with the M4 Widening works. Planning approval for the King Georges Road Interchange Upgrade project was granted on 3 March 2015 and work commenced in July 2015.

A planning application was made for the New M5 project in November 2014. A separate planning application will be made for the possible future M4–M5 Link project (M4–M5 Link) following further concept development.

The NSW Government has established WDA to deliver WestConnex. WDA has been established as an independent public subsidiary corporation of Roads and Maritime. Its role and functions are set out in Part 4A of the *Transport Administration (General) Regulation 2013* (NSW). WDA is project managing the planning approval process for the project on behalf of Roads and Maritime. However, for the purpose of this planning application for the project, Roads and Maritime is the proponent.

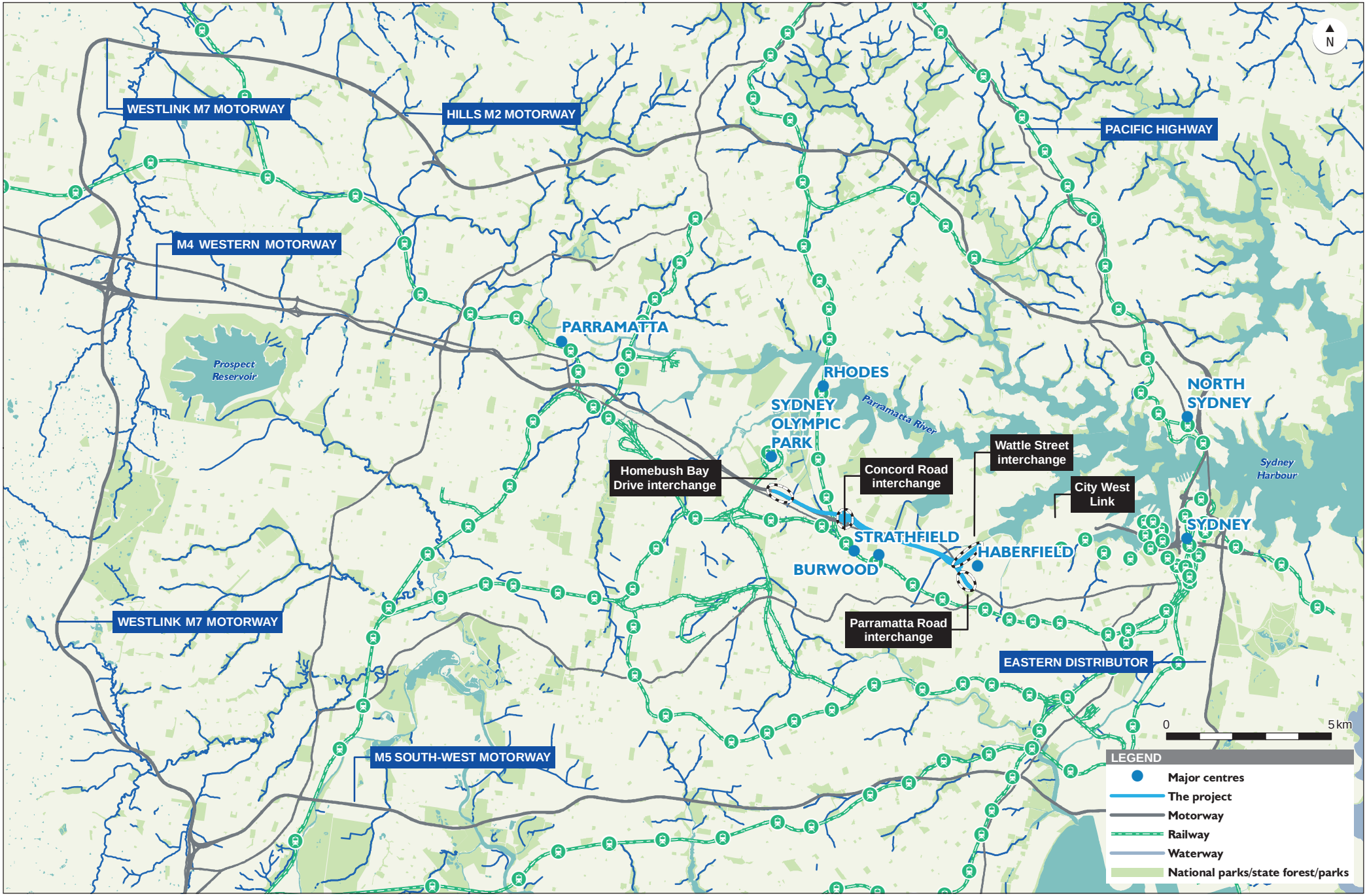


**Figure 1.1 Regional context of the project**

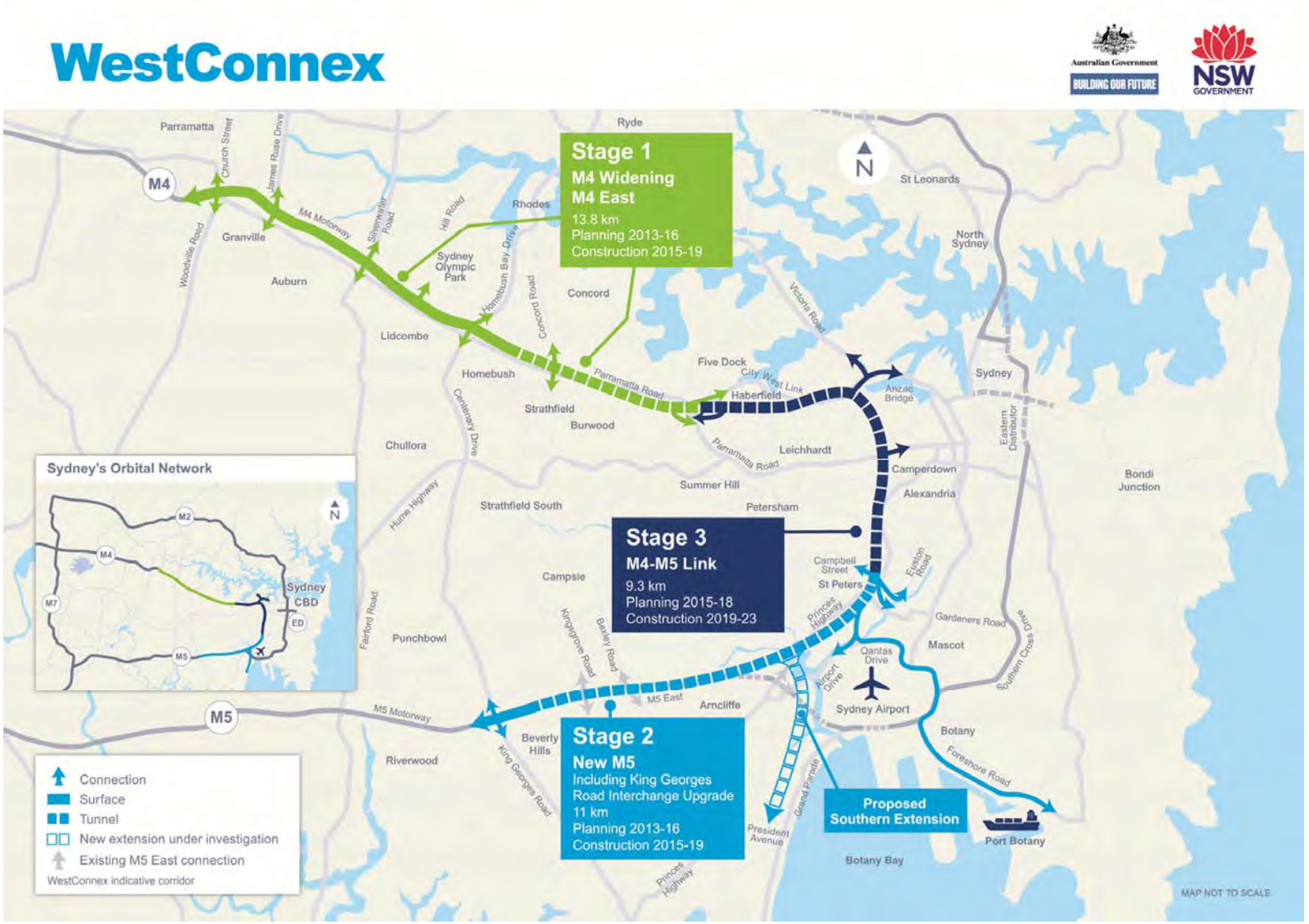


**Figure 1.2 WestConnex**

## 1.2 Project location

The project is generally located in the inner west region of Sydney within the Auburn, Strathfield, Canada Bay, Burwood and Ashfield local government areas (LGAs). The project travels through 10 suburbs: Sydney Olympic Park, Homebush West, Homebush, North Strathfield, Strathfield, Concord, Burwood, Croydon, Ashfield and Haberfield. The local context of the project is shown in **Figure 1.3**.

The project is generally located within the M4 and Parramatta Road corridor, which links Broadway at the southern end of the Sydney central business district (CBD) and Parramatta in Sydney's west, about 20 kilometres to the west of the Sydney CBD. This corridor also provides the key link between the Sydney CBD and areas further west of Parramatta (such as Penrith and western NSW).

The western end of the project is located at the interchange between Homebush Bay Drive and the M4, about 13 kilometres west of the Sydney CBD. The project at this location would tie in with the M4 Widening project in the vicinity of Homebush Bay Drive. The tunnel dive structures would start at the centre of the M4, west of the existing pedestrian footbridge over the M4 at Pomeroy Street, and would continue underground to the north of the existing M4 and Parramatta Road, before crossing beneath Parramatta Road at Broughton Street at Burwood. The tunnels would continue underground to the south of Parramatta Road until the intersection of Parramatta Road and Wattle Street at Haberfield. Ramps would connect the tunnels to Parramatta Road and Wattle Street (City West Link) at the eastern end of the project. The tunnels would end in a stub connection to the M4–M5 Link, near Alt Street at Haberfield.

The project would include interchanges between the tunnels and the above ground road network, along with other surface road works, at the following locations:

- M4 and Homebush Bay Drive interchange at Sydney Olympic Park and Homebush (Homebush Bay Drive interchange)
- Powells Creek, near George Street at North Strathfield (Powells Creek M4 on-ramp)
- Queen Street at North Strathfield, near Parramatta Road (Queen Street westbound cycleway on-ramp)
- M4 and Sydney Street, Concord Road and Parramatta Road interchange at North Strathfield (Concord Road interchange)
- Wattle Street (City West Link), between Parramatta Road and Waratah Street at Haberfield (Wattle Street (City West Link) interchange)
- Parramatta Road, between Bland Street and Orpington Street at Ashfield and Haberfield (Parramatta Road interchange).

## 1.3 Project features

The project would comprise the construction and operation of the following key features:

- Widening, realignment and resurfacing of the M4 between Homebush Bay Drive and Underwood Road at Homebush
- Upgrade of the existing Homebush Bay Drive interchange to connect the western end of the new tunnels to the existing M4 and Homebush Bay Drive, while maintaining all current surface connections
- Two new three-lane tunnels (the mainline tunnels), one eastbound and one westbound, extending from west of Pomeroy Street at Homebush to near Alt Street at Haberfield, where they would terminate until the completion of the M4–M5 Link. Each tunnel would be about 5.5 kilometres long and would have a minimum internal clearance (height) to in-tunnel services of 5.3 metres
- A new westbound on-ramp from Parramatta Road to the M4 at Powells Creek, west of George Street at North Strathfield

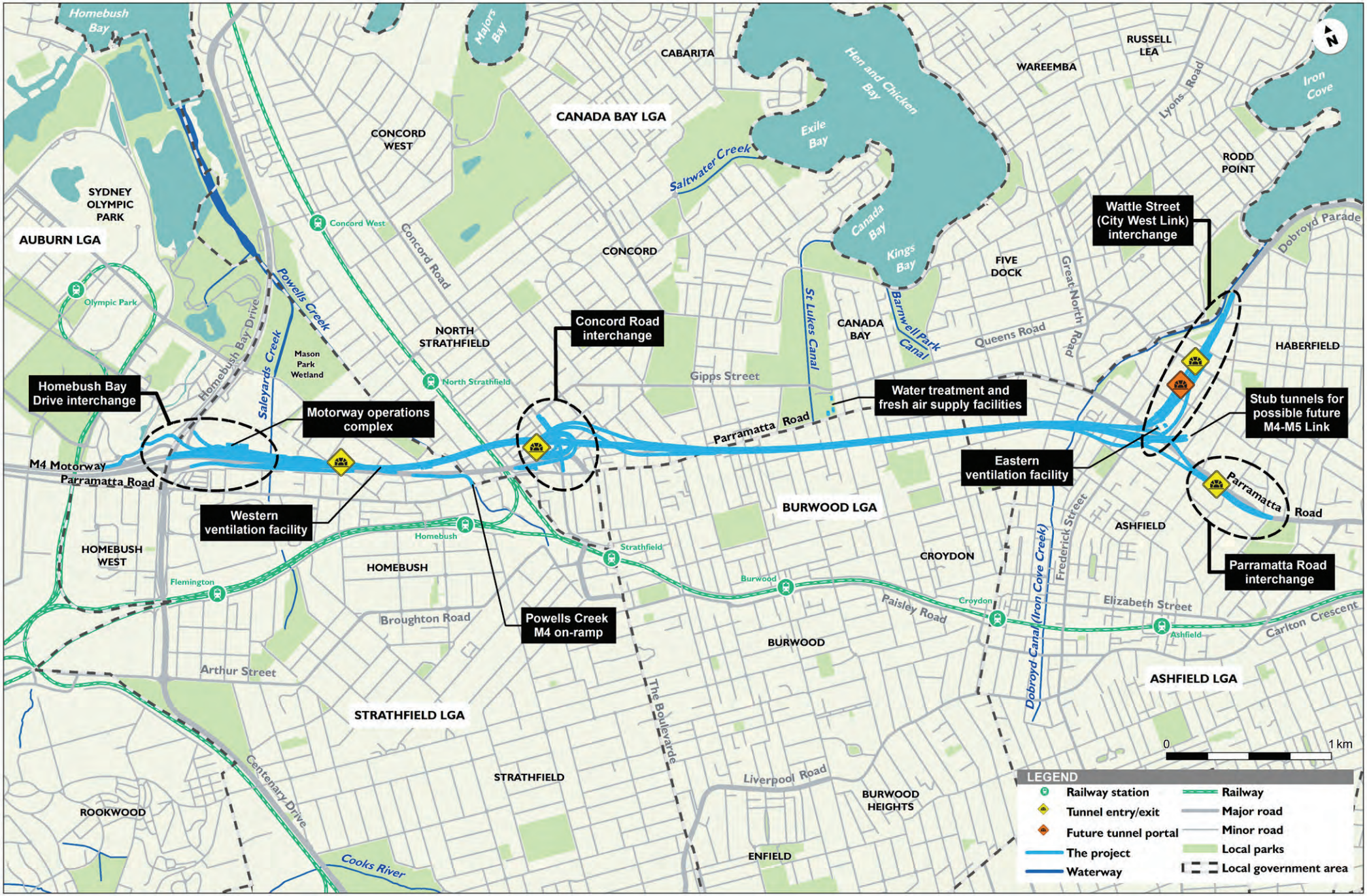


**Figure 1.3 Local context of the project**

- An interchange at Concord Road, North Strathfield/Concord with on-ramps to the eastbound tunnel and off-ramps from the westbound tunnel. Access from the existing M4 to Concord Road would be maintained via Sydney Street. A new on-ramp would be provided from Concord Road southbound to the existing M4 westbound, and the existing on-ramp from Concord Road northbound to the existing M4 westbound would be removed
- Modification of the intersection of the existing M4 and Parramatta Road, to remove the left turn movement from Parramatta Road eastbound to the existing M4 westbound
- An interchange at Wattle Street (City West Link) at Haberfield, with an on-ramp to the westbound tunnel and an off-ramp from the eastbound tunnel. The project also includes on- and off-ramps at this interchange that would provide access to the M4–M5 Link. In addition, the westbound lanes of Wattle Street would be realigned
- An interchange at Parramatta Road at Ashfield/Haberfield, with an on-ramp to the westbound tunnel and an off-ramp from the eastbound tunnel. In addition, the westbound lanes of Parramatta Road would be realigned
- Installation of tunnel ventilation systems, including ventilation facilities within the existing M4 road reserve near Underwood Road at Homebush (western ventilation facility) and at the corner of Parramatta Road and Wattle Street at Haberfield (eastern ventilation facility). The eastern ventilation facility would serve both the project and the M4–M5 Link. Provision has also been made for a fresh air supply facility at Cintra Park at Concord
- Associated surface road work on the arterial and local road network, including reconfiguration of lanes, changes to traffic signalling and phasing, and permanent road closures at a small number of local roads
- Pedestrian and cycle facilities, including the permanent re-routing of part of the existing eastbound cycleway on the northern side of the M4 from west of Homebush Bay Drive (near Hill Road) to near Pomeroy Street, and a new westbound cycleway on-ramp connection from Queen Street at North Strathfield to the existing M4
- Tunnel support systems and services such as electricity substations, fire pump rooms and tanks, water treatment facilities, and fire and life safety systems including emergency evacuation infrastructure
- Motorway operations complex on the northern side of the existing M4, east of the Homebush Bay Drive interchange
- Provision of road infrastructure and services to support the future implementation of smart motorway operations (subject to separate planning approval)
- Installation of tolling gantries and traffic control systems along the length of the project
- Provision of new and modified noise walls
- Provision of low noise pavement for new and modified sections of the existing M4
- Temporary construction ancillary facilities and temporary works to facilitate the construction of the project.

The project does not include work required for reconfiguring Parramatta Road as part of the urban transformation program. The project does not include ongoing motorway maintenance activities during operation. These would be subject to separate assessment and approval as appropriate.

Construction activities associated with the project would generally include:

- Enabling and temporary works, including construction power, water supply, ancillary site establishment, demolition works, property adjustments and public transport modifications (if required)
- Construction of the road tunnels, interchanges, intersections and roadside infrastructure
- Haulage of spoil generated during tunnelling and excavation activities
- Fitout of the road tunnels and support infrastructure, including ventilation and emergency response systems

- Construction and fitout of the motorway operations complex and other ancillary operations buildings
- Realignment, modification or replacement of surface roads, bridges and underpasses
- Implementation of environmental management and pollution control facilities for the project.

The project assessed in this EIS does not include surveys, sampling or investigation to inform the design or assessment, such as test drilling, test excavations, geotechnical investigations, or other tests. It also does not include adjustments to, or relocation of, existing utilities infrastructure undertaken prior to commencement of construction. These would be subject to separate assessment and approval as appropriate.

Further details on the project can be found in **Chapter 5** (Project description) and **Chapter 6** (Construction work).

## 1.4 Benefits of the project

Parramatta Road is Sydney's main east−west route, and the only continuous route between Parramatta and the Sydney CBD. The section of Parramatta Road between Burwood and the Sydney CBD is identified in the *NSW Long Term Transport Master Plan* (Transport for NSW 2012a) (Transport Master Plan) as the most important Sydney transport corridor, due largely to it having the highest public transport movements of any corridor in Sydney. As described in **Chapter 3** (Strategic context and project need), Parramatta Road currently experiences heavy traffic congestion, particularly during peak travel times. This results in slow speeds and unreliable travel times for motorists, buses, commercial and freight vehicles, as well as poor amenity for residents and businesses located along Parramatta Road.

Due to the existing traffic numbers along Parramatta Road, east−west movements are given priority, limiting other movements such as north−south movements across the corridor and movements from Parramatta Road (via right turn bays) to streets north or south of the corridor. Traffic light signalling also limits the amount of time available for north−south movements, including pedestrian movements. Parramatta Road has thus become a barrier for north−south movements, with only limited locations enabling movements across or from the corridor.

The project would:

- Provide a motorway standard link between Concord and Haberfield which would provide reliability and savings in travel time for through traffic
- Provide improved access and travel along and across Parramatta Road for local vehicle trips and for active transport
- Enable improvements to public transport on Parramatta Road, including provision of kerbside bus lanes between Burwood Road at Burwood/Concord and Chandos Street at Ashfield/Haberfield at project opening, and the possible future provision of rapid public transport services along Parramatta Road (bus rapid transit or light rail transit)
- Facilitate urban renewal in precincts along Parramatta Road by improving local amenity with less traffic noise and vehicle emissions from congested traffic.

Together with the M4 Widening, the project would:

- Support the economic development of Sydney by providing a high quality and efficient road connection for motorists and freight vehicles between Parramatta and Global Sydney (as defined in *A Plan for Growing Sydney* (NSW Government 2014a) (see discussion in **Chapter 3**)
- Enable possible opportunities to transform Parramatta Road as well as local centres that exist alongside Parramatta Road
- Provide better connectivity between local centres adjacent to Parramatta Road
- Provide additional capacity to address existing traffic congestion on the M4 and Parramatta Road by separating longer distance through traffic from local traffic. Current traffic congestion is causing poor amenity along Parramatta Road and constraining the operation of existing businesses and efficient movement of freight

- Accommodate rising travel demand created by increasing population and employment in high growth localities in the Parramatta to Strathfield corridor, including Sydney Olympic Park and Burwood.

## 1.5 Purpose of this environmental impact statement

This EIS has been prepared in accordance with the relevant provisions of the EP&A Act.

It has been prepared to address the environmental assessment requirements issued by the Secretary of the NSW Department of Planning and Environment on 16 June 2015 and the relevant provisions of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (NSW).

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.

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 would consider this feedback in the further development of the project.

## 1.6 Structure of this environmental impact statement

This EIS is divided into two volumes.

Volume 1 has the following structure:

- Introduction — provides a broad overview of the project, its location and scope (**Chapter 1**)
- Assessment process – outlines the statutory requirements and explains the steps in the assessment and approval process (**Chapter 2**)
- Strategic context and project need — provides the strategic context, explains the need for the project and identifies the project objectives (**Chapter 3**)
- Project development and alternatives — reviews the alternatives and options considered in developing the project, including the consequences of not proceeding (**Chapter 4**)
- Project description — provides a detailed description of the project including the route alignment, design standards and key design features (**Chapter 5**)
- Construction work – describes the construction methodologies and staging (**Chapter 6**)
- Consultation – outlines the consultation activities undertaken, issues raised and how these have been addressed (**Chapter 7**)
- Assessment of environmental issues— identifies the environmental issues, assesses the impacts and proposes environmental management measures (**Chapters 8 to 25**)
- Cumulative impacts – assesses the impacts which the project coupled with other projects in the region would have on the community (**Chapter 26**)
- Sustainability – outlines how the project will be delivered in a manner that meets sustainability requirements throughout its planning, construction and operation (**Chapter 27**)
- Environmental risk analysis – details the risk analysis process by which the potential environmental issues for assessment were identified (**Chapter 28**)
- Summary of environmental management measures – collates all of the environmental management measures for the project identified through the impact assessment (**Chapter 29**)
- Project justification and conclusion — presents the justification for the project, including consideration of the principles of ecologically sustainable development (ESD) and the objectives of the EP&A Act (**Chapter 30**).

Volume 2 contains the following supporting appendices:

- Appendix A — Secretary's Environmental Assessment Requirements checklist
- Appendix B — *Environmental Planning and Assessment Regulation 2000* (NSW) checklist
- Appendix C — Preferred design drawings
- Appendix D — Properties affected by acquisition
- Appendix E — Government agency submissions
- Appendix F — Draft Community Consultation Framework
- Appendix G — Technical Working Paper: Traffic and Transport Assessment
- Appendix H — Technical Working Paper: Air Quality Impact Assessment
- Appendix I — Technical Working Paper: Noise and Vibration Impact Assessment
- Appendix J — Technical Working Paper: Human: Health Risk Assessment
- Appendix K — Shadow diagrams
- Appendix L — Technical Working Paper: Urban Design, Landscape character and Visual Impact Assessment
- Appendix M — Technical Working Paper: Social Impact Assessment
- Appendix N — Technical Working Paper: Economic Impact Assessment
- Appendix O — Technical Working Paper: Soil and Water Quality Assessment
- Appendix P — Technical Working Paper: Soil and Land Contamination Assessment
- Appendix Q — Technical Working Paper: Surface Water – Flooding and Draining
- Appendix R — Technical Working Paper: Groundwater Impact Assessment
- Appendix S — Technical Working Paper: Non-Aboriginal Heritage Impact Assessment
- Appendix T — Technical Working Paper: Biodiversity Impact Assessment
- Appendix U — Detailed greenhouse gas calculations
- Appendix V — Technical Working paper: Aboriginal Heritage Assessment
- Appendix W — Climate change risk assessment framework

## 1.7 Directions used in this environmental impact statement

In this EIS, the existing M4 and Parramatta Road are considered to travel in an east–west direction at all times, even where parts of Parramatta Road follow a more north–south alignment. In this regard, all locations relative to Parramatta Road are referenced as being either to the north or to the south.

Because of this, Wattle Street is considered to travel in a north–south direction, and all locations relative to it are referenced as being either to the east or to the west.

In all cases, direction of travel is described as eastbound (towards the CBD) and westbound (towards Parramatta and Penrith).

This is shown in **Figure 1.4**.

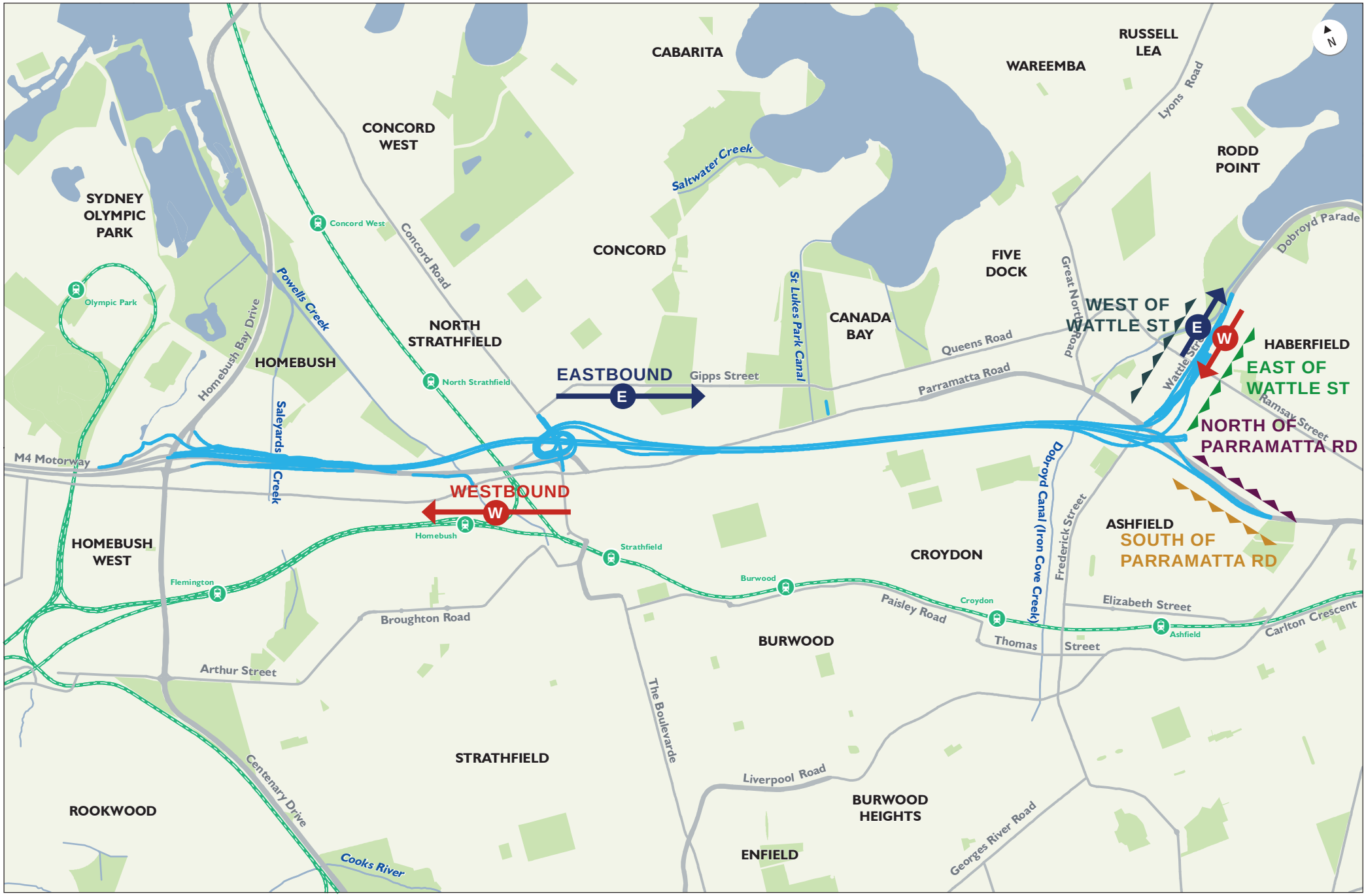


**Figure 1.4 Orientation and directional descriptions in this EIS**

# 2 Assessment process

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

## 2.1 Approval framework

### 2.1.1 Environmental Planning and Assessment Act 1979

The WestConnex Delivery Authority (WDA), on behalf of NSW Roads and Maritime Services (Roads and Maritime) is seeking approval for the project under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).

On 5 December 2014, the project was declared, by Ministerial Order, to be State significant infrastructure and critical State significant infrastructure under sections 115U(4) and 115V of the EP&A Act. The order also amended Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011* to include the M4 East as critical State significant infrastructure. In accordance with section 115Z of the EP&A Act, an environmental impact statement (EIS) is required.

An application under section 115X of the EP&A Act to carry out the project was lodged with the then Director General of NSW Planning and Infrastructure (the Director General) in November 2013. An application report describing the project aimed to assist the formulation of environmental assessment requirements by the then Director General under section 115Y of the EP&A Act.

On 7 January 2014, the then Director General notified Roads and Maritime of the environmental assessment requirements for the proposed infrastructure project. In accordance with section 115Y(2) of the EP&A Act, the environmental assessment requirements required an environmental impact statement to be prepared. In April 2014, NSW Planning and Infrastructure and the position of Director General were replaced with the NSW Department of Planning and Environment (DP&E) and the position of Secretary respectively.

On 16 June 2015, modified environmental assessment requirements (now referred to as Secretary's Environmental Assessment Requirements, or SEARs) were provided to Roads and Maritime. The modified requirements reflect changes to the project since the application was lodged, in particular the inclusion of work in the Auburn local government area (LGA), and are also consistent with the SEARs for the New M5. These requirements are included in **Appendix A**.

The approval 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 DP&E's website (planning.nsw.gov.au).

### 2.1.2 Environmental Planning and Assessment Regulation 2000

Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (NSW) set out requirements for the form and content of EISs. These requirements are included in Appendix B.

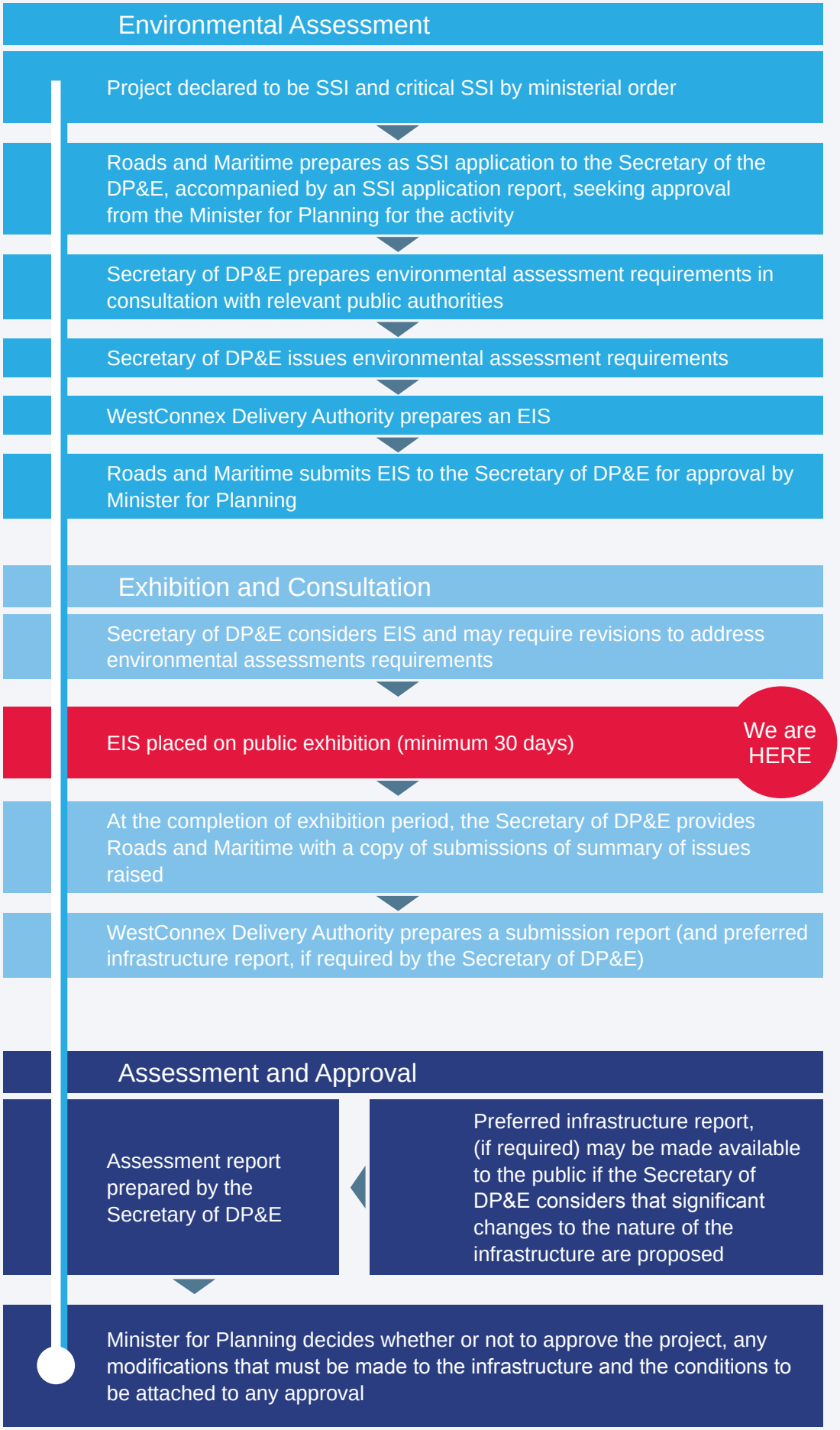


**Figure 2.1 State significant infrastructure assessment and approval process**

## 2.2 Environmental planning instruments

### 2.2.1 State environmental planning policies

Section 115ZF of the EP&A Act in general excludes the application of environmental planning instruments to State significant infrastructure projects (except as they may apply to the declaration of State significant infrastructure or critical State significant infrastructure – see **section 2.1.1**). Regardless of the above, consistent with good environmental assessment practice, the provisions of the following relevant state environmental planning policies (SEPPs) have been considered.

#### State Environmental Planning Policy (Infrastructure) 2007

*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 and 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.

#### 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 local government areas of Auburn, Strathfield, Canada Bay and Ashfield. Clause 7 of SEPP 19 states that works undertaken by public authorities (such as Roads and Maritime Services) shall not disturb bushland zoned or reserved for public open space for specific purposes which include the purpose of construction or maintaining roads without first considering the aims of SEPP 19.

As outlined in **Chapter 20** (Biodiversity), the project footprint and immediately adjacent areas do not contain any native vegetation. Existing vegetation has been planted and comprises private gardens, landscaped parks, reserves and strips of vegetation predominantly used as screening from major infrastructure. As there is no native vegetation in the project footprint, no vegetation is considered to be bushland in accordance with SEPP 19.

#### 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) aims to provide a statewide planning approach to the remediation of land. SEPP 55 is further considered in **Chapter 16** (Contamination).

#### Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

*Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005* (Sydney Catchment REP) provides planning principles and development controls for the Sydney Harbour Catchment. Although the project is located within the Sydney Harbour Catchment area, it would not be located within any foreshore area, waterway or strategic foreshore site and would not affect any mapped heritage or wetland areas under the Sydney Catchment REP. As discussed in **Chapters 15** (Soil and water quality) and **18** (Groundwater), the project is not considered to result in an adverse impact on the water quality of Sydney Harbour.

### 2.2.2 Local environmental plans

Local environmental plans (LEPs) do not apply in respect to State significant infrastructure projects; however, the Minister for Planning may take into account the provisions of relevant LEPs when deciding whether to approve a project. The project is located within five LGAs: Auburn, Strathfield, Canada Bay, Burwood and Ashfield. Above ground works are proposed to be located within each of these LGAs, except for the Burwood LGA.

Land use zones under each of the following LEPs, corresponding to LGAs where above ground works are proposed to be located, are discussed further in **Chapter 12** (Property and land use):

- *Auburn Local Environmental Plan 2010*
- *Strathfield Local Environmental Plan 2012*
- *Canada Bay Local Environmental Plan 2013*
- *Ashfield Local Environmental Plan 2013.*

## 2.3 Other legislation

### 2.3.1 NSW legislation

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

- Permits under sections 201, 205 and 219 of the *Fisheries Management Act 1994* (NSW) (see **Chapter 20** (Biodiversity))
- Approvals under Part 4 and excavation permits under section 139 of the *Heritage Act 1977* (NSW) (see **Chapter 19** (Non-Aboriginal heritage))
- Aboriginal heritage impact permits under section 90 of the *National Parks and Wildlife Act 1974* (NSW) (see **Chapter 22** (Aboriginal heritage))
- Authorisations under the *Native Vegetation Act 2003* (NSW) to clear native vegetation or State protected land (see **Chapter 20** (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 (see **Chapter 15** (Soils and water quality)).

Approvals under other NSW legislation that may be required include the following:

- An environment protection licence under chapter 3 of the *Protection of the Environment Operations Act 1997* (NSW). 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 the Part 5.1 approval. This is further discussed in **Chapter 6** (Construction work)
- An aquifer interference approval under the *Water Management Act 2000* (NSW). This is further discussed in **Chapter 18** (Groundwater)
- An approval under the *Crown Lands Act 1989* (NSW) to grant a relevant interest (ie licence, permit, easement or right of way) over a Crown Reserve. This is further discussed in **Chapter 12** (Property and land use).

Other NSW legislation that may apply to the project includes:

- *Land Acquisition (Just Terms Compensation) Act 1991* (NSW), which applies to the acquisition of any land required for the project. Acquisition is further discussed in **Chapter 5** (Project description) and **Chapter 12** (Property and land use)
- *Crown Lands Act 1989* (NSW), which applies to the acquisition or use of land reserved or dedicated under this Act. Crown land affected by the project is further discussed in **Chapter 12** (Property and land use).

Because the project has been declared critical State significant infrastructure, sections 115ZG(2) and 115ZG(3) of the EP&A Act preclude 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 the State Heritage Register under Division 8 of Part 6 of the *Heritage Act 1977* (NSW)

- An interim protection order (within the meaning of the *National Parks and Wildlife Act 1974* (NSW) or the *Threatened Species Conservation Act 1995* (NSW))
- An order under Division 1 (Stop work orders) of Part 6A of the *National Parks and Wildlife Act 1974* (NSW), Division 1 (Stop work orders) of Part 7 of the *Threatened Species Conservation Act 1995* (NSW) or Division 7 (Stop work orders) of Part 7A of the *Fisheries Management Act 1994* (NSW)
- A remediation direction under Division 3 of Part 6A of the *National Parks and Wildlife Act 1974* (NSW)
- An environment protection notice under Chapter 4 of the *Protection of the Environment Operations Act 1997* (NSW)
- An order under section 124 of the *Local Government Act 1993* (NSW).

Certain third party appeal provisions are also precluded (refer to section 115ZK of the EP&A Act).

### 2.3.2 Commonwealth legislation

Under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act), proposed 'actions' that have the potential to have a significant impact on matters of national environmental significance or on the environment of Commonwealth land, or 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 would be required for the project, in addition to the approval of the NSW Minister for Planning.

As discussed in **Chapter 20** (Biodiversity), the project is not likely to result in a significant impact on any matter of national environmental significance under the EPBC Act, including threatened and migratory species, or Commonwealth land. Accordingly, the project has not been referred to the Australian Government Department of the Environment for further assessment or approval under the EPBC Act.

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# 3 Strategic context and project need

This chapter describes the strategic context of the M4 East project (the project) within the State and national planning and policy framework, and explains the need for the project, from both regional and local perspectives.

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued a set of environmental assessment requirements for the project; these are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 3.1** sets out these requirements, and identifies where they have been addressed in this environmental impact statement (EIS).

**Table 3.1 Secretary's Environmental Assessment Requirements – strategic context and project need**

| Secretary's Environmental Assessment Requirement | Where addressed in the EIS |
|---|---|
| [A] statement of the objectives of the project, | **Chapter 3**, **section 3.3** |
| including a description of the strategic need, justification, objectives and outcomes for the project, taking into account existing and proposed transport infrastructure and services within the adjoining subregions, | **Chapter 3**, **section 3.2** |
| and as relevant the outcomes and objectives of relevant strategic planning and transport policies, including, but not limited to, *NSW 2021*, *NSW Government State Infrastructure Strategy*, *NSW Long Term Transport Master Plan* (December 2012), *A Plan for Growing Sydney* (December 2014) and any other relevant plans | **Chapter 3**, **section 3.1** |

## 3.1 Strategic planning and policy framework

The following sections describe the compatibility of the project with various State and national strategic planning and policy documents.

### 3.1.1 NSW 2021: A Plan to Make NSW Number One

*NSW 2021: A Plan to Make NSW Number One* (NSW Department of Premier and Cabinet 2011) (NSW 2021) is the NSW Government's 10 year strategic business plan. It sets priorities for action and guides resource allocation to deliver economic growth and critical infrastructure throughout NSW. The *NSW 2021 Performance Report* (NSW Department of Premier and Cabinet 2014) provides information on how the NSW Government intends to measure and deliver on the goals, targets and measures outlined in NSW 2021.

NSW 2021 emphasises investment in and delivery of an efficient and effective transport system including road infrastructure that will relieve congestion, reduce travel times, improve road safety and enhance and expand capacity on key road corridors. These outcomes will contribute to both the national and state economies as well as reducing the costs of doing business for many large and small businesses and services.

Within the context of the goals identified in NSW 2021, the project (as part of WestConnex) will help to achieve several priority actions by expanding the capacity of the M4 and extending it further east along the Parramatta Road corridor.

Specifically, the project would help achieve several NSW 2021 goals as shown in **Table 3.2**.

**Table 3.2 NSW 2021 goals that are relevant to the project**

| NSW 2021 goals | Relevance to project |
|---|---|
| Goal 4 – Increase the competitiveness of doing business in NSW | The project would result in a reduction in travel times along the M4 and Parramatta Road corridor, particularly through journeys with destinations outside the corridor. The M4 and Parramatta Road corridor is the area from Parramatta central business district (CBD) to Sydney CBD, generally between the Main Western Rail Line in the south and the Parramatta River to the north.<br>A reduction in travel times would reduce the cost of doing business, and help to increase the competitiveness of doing business, in NSW. Further discussion on travel times is provided in **Chapter 8** (Traffic and transport). |
| Goal 7 – Reduce travel times | The project would be a key link in the transport network to support Sydney's growth. The project is designed to reduce travel times along the M4 and Parramatta Road corridor by removing through traffic from the surface network into tunnels. |
| Goal 8 – Grow public transport patronage | The project (as part of WestConnex) is considered to be a key driver for the introduction of a rapid transport solution (ie buses or light rail). The introduction of a rapid transit solution would result in more frequent and reliable public transport which would encourage higher patronage of public transport along the M4 and Parramatta Road corridor. |
| Goal 10 – Improve road safety | The reduction in congestion along Parramatta Road would result in improved road safety because lower vehicle numbers would result in fewer potential conflicts between vehicles. **Section 3.2.2** outlines how a reduction in congestion would improve road safety.<br>A reduction in the number of vehicles would also potentially result in increased safety for pedestrians and cyclists, making these modes more desirable along the M4 and Parramatta Road corridor. |
| Goal 19 – Invest in critical infrastructure | The project was declared to be critical State significant infrastructure in December 2014 (as described in **section 2.1.1** in **Chapter 2** (Assessment process)). |
| Goal 20 – Build liveable centres | The planned reduction in trucks and cars travelling longer distances on Parramatta Road (refer to **Chapter 8** (Traffic and transport)) would facilitate urban renewal along the corridor through improved urban amenity and liveability characteristics, supported by improved public transport, active transport such as walking and cycling, and local vehicle travel. The project would enhance the connections between key housing and employment areas (as described in **section 3.1.5**). |

Further details of how the project would help to achieve these goals are outlined in **Chapter 14** (Social and economic) and **Chapter 8** (Traffic and transport).

### 3.1.2 State Infrastructure Strategy

The *State Infrastructure Strategy 2012–2032* (Infrastructure NSW 2012a) (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 has 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 reduced functionality along the M4 corridor. This corridor is important for freight and business transport, and provides connections to Global Sydney (as defined in *A Plan for Growing Sydney*, which is discussed in **section 3.1.5**), its cultural precincts and its 'global economic corridor'. WestConnex (including the project) is identified in the State Infrastructure Strategy as a critical program of work with a range of benefits including reduced congestion, improved access to the major international gateways of Sydney Airport and Port Botany (and future Western Sydney Airport), and improved industrial and business efficiency including along the M4 corridor. The project would also provide opportunities for urban renewal along Parramatta Road.

### State Infrastructure Strategy Update

In November 2014 Infrastructure NSW released a revised State Infrastructure Strategy – 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 Rebuilding NSW initiative.

The State Infrastructure Strategy Update has identified the possible expansion of WestConnex to include connections to Victoria Road and the Anzac Bridge to the north (the Northern Extension) and a connection to President Avenue at Rockdale to the south (the Southern Extension). These extensions, together with a completed WestConnex, would provide a western bypass of the Sydney CBD, alleviating pressure on existing north−south corridors (eg Eastern Distributor) on the Sydney orbital network and reducing journey times to Sydney's southern suburbs. The State Infrastructure Strategy Update recommends completing final business cases for these two extensions by 2015.

The State Infrastructure Strategy also highlights investigations into a third road crossing of Sydney Harbour (the Western Harbour Tunnel), which would connect to the WestConnex Northern Extension and provide access to North Sydney between the Gore Hill and Warringah Freeways. This possible new tunnel, together with the M4−M5 Link, would avoid the need to travel through the CBD.

The possible future WestConnex extensions and the Western Harbour Tunnel are expected to be funded through tolls on other roads, such as the project and M4 Widening.

## 3.1.3 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. **Figure 3.1** identifies the project and WestConnex more broadly as key connections for the Sydney motorway network to 2031.

The Transport Master Plan recognises that WestConnex will 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 commits the NSW Government to develop integrated land use and transport solutions to renew the Parramatta Road corridor in conjunction with the delivery of WestConnex. Strategies to deliver an integrated package of transport improvements in parallel with the construction of WestConnex are recognised in the Transport Master Plan. As part of the Transport Master Plan, six modal strategies were developed to expand on the actions and recommendations outlined in the Transport Master Plan. The connection of each of these modal strategies to the project and WestConnex are discussed in the following sections.

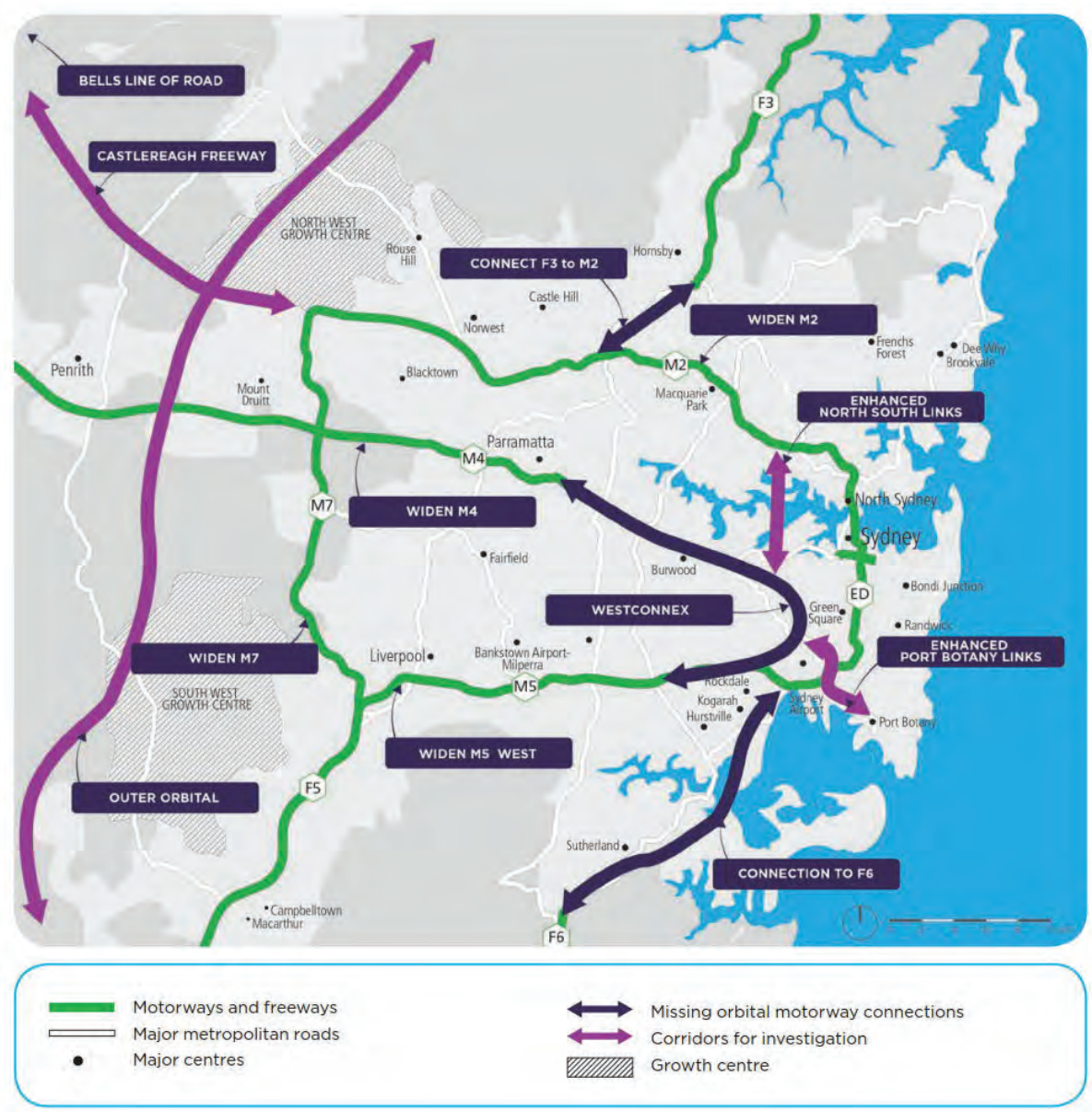


**Figure 3.1 Potential connections to complete the Sydney Motorway network by 2031**

### 3.1.4 Mode specific transport strategies

#### Sydney's Rail Future

*Sydney's Rail Future: Modernising Sydney's Trains* (Transport for NSW 2012b) was developed to complement the Transport Master Plan with a particular focus on improving Sydney's rail system. In particular, *Sydney's Rail Future* highlights the need to improve the Western Rail Line, which runs parallel to the project, and also highlights the introduction of a Sydney Rapid Transit (now known as Sydney Metro) as an extension of the North West Rail Link (once completed). Sydney Metro would primarily serve north-western Sydney and the Lower North Shore through the CBD to Bankstown or Hurstville, and would help to remove some key bottlenecks (for example along the Western Rail Line).

### Sydney's Bus Future

*Sydney's Bus Future: Simpler, faster, better bus services* (Transport for NSW 2013a) was developed to complement the Transport Master Plan by planning on 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 trips (the project) along the M4 and Parramatta Road corridor. The project would be used generally by people who currently use Parramatta Road for through trips or longer distance trips.

WestConnex (including the project) would result in a reduction of traffic along Parramatta Road which would provide the opportunity to change the road layout to accommodate a dedicated bus rapid transit route between the CBD and Burwood along Parramatta Road (refer to **section 3.1.7** for further details). The project would include provision for a future bus rapid transit route in the design of the Parramatta Road interchange, however any bus rapid transit route would be subject to separate assessment and approval as appropriate. Once in place, this bus rapid transit route could be upgraded to light rail, to respond to the increased transport demand associated with population growth along Parramatta Road (Transport for NSW 2013a).

### Sydney's Light Rail Future

*Sydney's Light Rail Future: Expanding public transport, revitalising our city* (Transport for NSW 2012c) was developed to guide 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 to be reallocated on City Road or Parramatta Road to allocate space to public transport in the University of Sydney corridor, the area that services the Universities to the west of Sydney CBD.

At present, four light rail routes linking to Parramatta CBD are under investigation. One of these would connect the CBD to Sydney Olympic Park, running parallel to the existing M4 and the project to Burwood/Strathfield.

### Sydney's Cycling Future

The Transport Master Plan sets the strategic policy direction for transport and transport infrastructure for NSW. It is supported by *Sydney's Cycling Future* (Transport for NSW 2013b), which 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 will '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, investigating opportunities for enhanced cycling facilities
- Where existing cycling facilities, or access to them, are directly affected during or post-construction, relocating the cycling to provide long-term enhancement.

**Chapter 5** (Project description) describes the proposed changes and enhancements to cycling infrastructure and facilities.

### Sydney's Walking Future

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

The project would support the *Sydney's Walking Future* strategies by reducing the numbers of longer distance vehicles (including heavy freight) on Parramatta Road. These longer distance vehicles add to the noise and congestion on Parramatta Road. Removing longer distance vehicles would improve urban amenity and road safety, contributing to an improved pedestrian environment.

### 3.1.5 A Plan for Growing Sydney

*A Plan for Growing Sydney* (NSW Government 2014a) 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 will 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 will 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 WestConnex. The project, along with the M4 Widening (due to be opened in 2017), 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.

Direction 1.5.2 seeks to minimise the impacts of the movement of freight on the communities through which it travels. The project would assist in reducing these impacts by removing heavy freight trucks and other through traffic from Parramatta Road between Homebush Bay Drive and Haberfield, with expected associated improvements in local air quality and lower traffic noise.

In order for Sydney 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 includes areas such as the Sydney CBD, Parramatta CBD, Sydney Airport, Port Botany and Sydney Olympic Park. WestConnex (including the project) would assist in increasing productivity between centres in the global economic corridor by improving road connections for the transport of goods and services and business travel.

Improved access through Sydney would also improve connections for regional NSW (Direction 1.8) to key destinations in Sydney such as Flemington Markets, supporting the supply of fresh produce 'from paddock to plate' through improved travel times. In future, the M4 corridor would connect the Blue Mountains and Central West regions of NSW via the Castlereagh Connection and Bells Line of Road corridor.

Direction 1.11 of *A Plan for Growing Sydney* identifies the WestConnex corridors as corridors that should be preserved to allow Sydney's transport networks to expand as Sydney grows.

#### 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 Widening, would be the removal of the majority of longer distance trips from Parramatta Road. Removing these longer distance trips would drive of the renewal of precincts in the Parramatta Road corridor. Direction 2.2 of *A Plan for Growing Sydney* outlines the need to promote urban renewal within inner city Sydney, with Parramatta Road identified as one of the key corridors for renewal. Further discussion on the *Draft Parramatta Road Urban Renewal Strategy* can be found in **section 3.1.7**.

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

The project and the urban renewal of areas along Parramatta Road 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 have become degraded and unattractive to pedestrians and customers due to reduced amenity and limited parking, while areas away from the road are much more attractive. The project would enable the revitalisation of precincts along the Parramatta Road corridor consistent with the *Draft Parramatta Road Urban Renewal Strategy*.

### 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 design of the project has incorporated a number of measures to reduce energy use, pollution and impacts on the natural environment during the construction and operation of the project. Resilience to climate change has also been incorporated into the design. **Chapter 27** (Sustainability) provides further detail of sustainability considerations.

## Subregional planning

*A Plan for Growing Sydney* also guides subregional planning by identifying the metropolitan priorities for each of the subregions across Sydney. Subregional planning demonstrates how the growth of the city will 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 Strathfield, Canada Bay, Burwood and Ashfield local government areas (LGAs), which are in the Central Subregion under *A Plan for Growing Sydney*. Part of the project is also located in the Auburn LGA, which is in the West 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, CBD and South East Light Rail, and WestConnex
- Work with 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 Sydney CBD via Parramatta Road.

The project would facilitate these priorities by reducing traffic on Parramatta Road, which would in turn enable urban revitalisation and free up road space in the short term for possible use as a bus rapid transit route between Sydney CBD and Burwood on Parramatta Road, with the opportunity to extend this route and introduce a light rail corridor on part of Parramatta Road in the future. The Central Subregional strategy also mentions the need to connect Port Botany and Sydney Airport to WestConnex, and identifies the importance of WestConnex for the movement of people and freight within the Sydney basin.

The priorities for the West Subregion that are relevant to the project are to:

- Create a competitive economy, particularly off the back of the growth of Parramatta and the extension of the global economic corridor
- Provide connections to employment areas within the region such as Bankstown and Marsden Park
- Plan for continued growth in the North West Growth Centre
- Investigate the development of priority precincts within the Parramatta to Sydney Olympic Park corridor.

The project would facilitate these priorities by providing a suitable road network which would connect areas within the western region to the CBD. WestConnex is identified as a key project for facilitating movement of people and goods from the western region to the CBD, Sydney Airport and Port Botany.

### 3.1.6 NSW Freight and Ports Strategy

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

The Freight Strategy 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. The role of heavy vehicles in moving freight across NSW will continue to be substantial for the foreseeable future. The Freight Strategy identifies the challenge of increasing the capacity of NSW roads to support the growth in the freight task.

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, delivering travel time savings. This would provide more efficient movement of freight, thereby reducing operational freight costs
- Network capacity – the project would provide increased road capacity along the M4/Parramatta Road corridor, which is a key corridor for the movement of freight between Sydney Airport/Port Botany and the western suburbs, particularly the area located along the M4 Motorway. This program specifically identifies the project
- Network sustainability – the project (and other WestConnex projects) would remove a large number of heavy freight vehicles from Parramatta Road, which would result in a range in amenity related benefits for local communities located along Parramatta Road. The construction of an alternative route would present savings in travel time.

The Freight Strategy identifies improvements to network capacity as strategic action program 2. Task 2A-1 under this program is to establish corridors to meet the long-term freight needs of NSW. The project (as part of WestConnex) is specifically identified as a key link to be investigated. Additionally, task 2B-1 (to connect and complete Sydney's motorway network) identifies key motorway connections with benefits for freight. This includes the construction of WestConnex to provide a connection between the M4 and M5 that would provide the opportunity to streamline interstate movements around and through Sydney.

### 3.1.7 Parramatta Road Urban Transformation Program

The *New Parramatta Rd: Draft Parramatta Road Urban Renewal Strategy* (UrbanGrowth NSW 2015) (Parramatta Road Strategy) identifies areas along the corridor where there will be a focus on encouraging growth and changes in the long term (about 20 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 40,000 new dwellings and 50,000 new jobs would be generated in the urban renewal precincts (UrbanGrowth NSW 2015).

A Parramatta Road Urban Transformation Program is being undertaken in parallel with the project to implement the strategy. A concept plan is currently being developed with stakeholders to guide the long-term renewal of the corridor. The concept plan integrates land use and transport planning, optimising locations and scale of growth close to transport and open space networks.

A key element of this program is improved public transport services along Parramatta Road. The project and WestConnex would enable traffic reductions on Parramatta Road from Burwood to the CBD, which would in turn free up road space and create greater public transport options for existing and new residents along the Parramatta Road corridor. This road program is also planning for the construction and delivery of walking and cycling infrastructure in key locations along the corridor.

Over recent years the following issues have contributed to the deterioration of the streetscape along Parramatta Road:

- More than 90,000 vehicles, including up to 6,000 trucks (refer to **Chapter 8** (Traffic and transport)), travel each weekday on some sections of the road

- Noise, visual clutter from cables, poles and signage and a lack of street trees to relieve the urban landscape
- Poor north−south connection across the corridor for pedestrians, cyclists and motorists
- Planning of the corridor has not been uniform or coordinated across the 10 councils located along the corridor.

To improve the corridor, the Parramatta Road Strategy has identified eight urban renewal precincts at Granville, Auburn, Homebush, Burwood, Kings Bay (Five Dock), Taverners Hill, Leichhardt and Camperdown. These precincts were selected because of their:

- Proximity to places of employment
- Accessibility, especially to public transport
- Capacity to support new housing types
- Proximity to existing infrastructure
- Opportunity for future development
- Unique character and diversity
- Potential for new or refreshed linkages.

The project (as part of WestConnex) is identified within the Parramatta Road Strategy as a catalyst for the restoration of the Parramatta Road corridor, because it would remove through traffic from the Parramatta Road 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.

The project area contains three of these urban renewal precincts: Homebush, Burwood and Kings Bay (Five Dock). The project would result in a reduction in the number of vehicles along Parramatta Road in these locations, which would help support future growth. While the project alone would not facilitate the growth of all areas along Parramatta Road, in concert with other WestConnex projects it would assist in improving amenity along the corridor and make the corridor more attractive for future growth.

### 3.1.8 WestConnex Business Case

The *WestConnex Business Case Executive Summary* (the Business Case) was endorsed by the NSW Government in September 2013 (Sydney Motorways Project Office 2013a). The Business Case outlines the need for WestConnex and identifies the process for delivering this major infrastructure initiative.

The Business Case articulates the overall objectives of WestConnex:

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

- Optimise user pays contributions to support funding in a way that is affordable and equitable.

Congestion on many parts of the corridor will inevitably increase with population growth if there are no road capacity improvements along Parramatta Road. WestConnex is expected to significantly reduce this growth in congestion.

Funding of WestConnex as proposed in the Business Case assumes a distance based toll would be implemented on operation of the M4 Widening and M4 East. It is likely the maximum toll for cars and light commercial vehicles travelling on the M4 East section of WestConnex would be about $3.60 (2013 dollars). Cars and light commercial vehicles would pay one third of the toll for heavy commercial vehicles. The proceeds of this toll would be applied to fund the construction of the project and, in the longer term, remaining WestConnex projects. The NSW Government is contributing over $2 billion to fund WestConnex, while the Australian Government is providing contributions to the NSW Government of $1.5 billion.

In 2014, Infrastructure Australia prepared an Assessment Brief for WestConnex (Infrastructure Australia 2014). The Assessment Brief was based on the WestConnex Business Case as well as an update to the cost benefit analysis reflecting that the New M5 project has been brought forward following the Australian Government's decision to provide a concessional loan to the NSW Government. The benefit cost ratio was quoted as 1.8:1, excluding wider economic benefits which were assessed to add 0.3 to the project's benefits.

The WestConnex Business Case is currently being updated to reflect enhancements to the scope of WestConnex, including the northern and southern extensions and the Southern Gateway (refer to **Chapter 4** (Project development and alternatives)).

### 3.1.9 Our Cities Our Future – A National Urban Policy

In 2011 the Australian Government released *Our Cities Our Future – A National Urban Policy for a productive, sustainable and liveable future* (Australian Government 2011). An update was released in June 2012. The Policy outlines the Australian Government's vision to deliver prosperity and wellbeing for city communities, and identifies four goals to achieve this based around productivity, sustainability, liveability and governance.

#### Productivity

The project would support the Policy goal of economic growth and productivity by improving freight, commercial and business efficiency through reduced congestion and better access to international gateways at Sydney Airport and Port Botany and to Sydney's Global Economic Corridor.

#### Sustainability

The project would facilitate urban renewal and improve the ability of communities to use space more efficiently. Reducing congestion and through traffic in a number of communities would enable road space to be reallocated to public transport, and has the potential to improve air quality and reduce traffic noise in these areas.

Sustainability considerations would be integrated into planning, construction and operation of the project (refer to **Chapter 27** (Sustainability)).

#### Liveability

The project would reduce through traffic on surface arterial roads, which would facilitate urban renewal in precincts along the Parramatta Road corridor and contribute to improved liveability in these areas. The reduction in through traffic will free up space to facilitate local movement by more space efficient and sustainable modes – walking, cycling and public transport. The project also has the potential to play a key role in facilitating social inclusion, by providing better access to employment locations and connecting people to social and cultural hubs.

#### Governance

As part of WestConnex, the project is consistent with the Policy's governance objective of improving the planning and management of our cities, by facilitating an integrated approach to planning systems, infrastructure delivery and management.

### 3.1.10 Alignment with other national strategic planning documents

#### National Infrastructure Plan

A national infrastructure priority list was last recommended to the Infrastructure Australia Council by the National Infrastructure Coordinator in 2013.

Action 6 of the *National Infrastructure Plan June 2013* (Infrastructure Australia 2013) (National Infrastructure Plan) is to 'create a complete national freight network'. The National Infrastructure Plan recommends a number of long-term directions for incorporation into the national freight network, including progress towards connecting the designated National Land Transport Network by road to all nationally significant container and bulk freight ports. The National Infrastructure Plan identifies WestConnex under the national freight network theme.

#### National Land Freight Strategy

The National Land Freight Strategy Discussion Paper (Infrastructure Australia 2011) identifies an 'improvement in the efficiency of freight movements across infrastructure networks' as a key objective of the strategy, with priority actions to effect this objective including 'freight infrastructure improvement and access'. For roads, this includes improvements to relevant highway level of service standards, access for high productivity weight-dimension vehicle configurations, and compatibility of freight transfer with rail freight and international shipping. Identified goals include the completion of urban motorway networks. The project and WestConnex are therefore consistent with this strategy.

#### National Road Safety Strategy 2011−2020

Working towards safer roads is a major component of the *National Road Safety Strategy 2011−2020* (Australian Transport Council 2011) (National Road Safety Strategy). The National Road Safety Strategy indicates that infrastructure improvements can have a major influence in preventing crashes or minimising the consequences of a crash. Given that road infrastructure has a life of 25 years or more, investment in infrastructure improvement will continue to save lives and avoid serious injuries well into the future. By relieving road congestion (and thereby improving the speed, reliability and safety of travel on the M4 and Parramatta Road), the delivery of the project is consistent with the overarching road safety directions identified in the National Road Safety Strategy.

## 3.2 Why the project is needed

### 3.2.1 Regional context

The population of the Sydney metropolitan area is expected to grow by around 1.6 million people by 2031. The majority of this growth is expected to be in Western Sydney, which will experience a population increase of around 900,000 people (NSW Government 2014a). While growth in jobs in Western Sydney is expected to be strong, it is not expected to match the numbers of new jobs forecast in the eastern half of Sydney (NSW Government 2014a). Workforce and employment forecasts between 2011 and 2031 indicate that employment will remain higher in eastern Sydney than in the west. This increase in population in Sydney's west (without a similar rate of jobs growth) will significantly increase travel demand towards the east (where the majority of jobs will exist) on an already constrained transport network, particularly along the M4 and Parramatta Road corridor. This corridor is the main east−west corridor providing access between Sydney's west, and particularly the major economic precinct of Parramatta, and the Sydney CBD. Growth in population and employment is also projected for areas surrounding the Parramatta Road corridor in the Homebush/Olympic Park precinct, Lidcombe and Burwood. Growth in these centres will also increase their need for goods and services.

In addition, heavy freight activity precincts are concentrated in Western Sydney. Land use changes, including development of the North and South West Growth Centres, the planned construction of the Western Sydney Airport, and proposed intermodal terminals at Moorebank and in greater western Sydney near the Western Sydney Employment Area, are reinforcing this concentration. The importance of a well-connected motorway network that facilitates the major east−west movements will increase as the freight task increases. Rail freight improvements have also been implemented through construction of the Southern Sydney Freight Line and components of the Northern Sydney Freight Corridor within Sydney in order to improve the movement of freight by train within the Sydney metropolitan area. Investment in both road and rail freight infrastructure is required as the two modes

are complementary; for example, rail freight is traditionally used for long distance haulage (ie bringing goods into Sydney), while road freight is used to distribute the freight once it arrives in Sydney.

The existing passenger rail network surrounding the M4–Parramatta Road corridor performs an important function in connecting people to jobs. The Western Line rail corridor has been identified in *Sydney's Rail Future* (Transport for NSW 2012b) as a corridor requiring improvement to accommodate current and future rail demand. The bus network is currently being redesigned so that it covers more areas and improves service reliability on inner Sydney's congested corridors, including Parramatta Road (Transport for NSW 2012a). The Australian Infrastructure Audit (Infrastructure Australia 2015) identified the public transport corridor between the Strathfield-Burwood-Ashfield area and Sydney Inner City as the fourth busiest public transport corridor in Sydney. Even with the planned improvements to the rail and bus networks, public transport does not provide a convenient alternative to car travel for a large proportion of travellers due to the diffuse nature of employment and variety of purposes of travel.

### 3.2.2 Existing road network conditions

#### Congestion

Parramatta Road is Sydney's main east−west route, and the only continuous route between Parramatta and the Sydney CBD. The section of Parramatta Road between Burwood and the Sydney CBD is identified in the *NSW Long Term Transport Master Plan* as the most important Sydney transport corridor, due largely to it having the highest public transport movements of any corridor in Sydney.

Sections of Parramatta Road carry more than 90,000 vehicles each day, with up to around 6,000 of these being heavy vehicles (**section 8.2.2** in **Chapter 8** (Traffic and transport)). On an average weekday, 2.8 million trips start or finish within the Parramatta Road corridor. This represents 14 per cent of all trips made within Sydney daily (derived from Transport for NSW Household Travel Survey 2012/13). The locations with highest traffic volumes are between the end of the M4 at Concord and Wattle Street. In comparison, the 2012 weekday traffic volumes on the M4 Motorway at Homebush were 96,100 vehicles and the M5 South West Motorway carried 99,800 vehicles. This means that Parramatta Road, an urban arterial road, is carrying a similar traffic volume to two of Sydney's busiest motorways.

The performance of Parramatta Road as a major transport link has declined over time, largely because it was not designed to manage the volumes and variety of road users generated by Sydney's changing population profile. Parramatta Road is one of the six most congested transport corridors in Sydney. This means there is high travel demand and the road is considered highly constrained in its ability to meet this demand with average travel speeds of private vehicles during the morning peak of about 30 kilometres an hour (Transport for NSW 2012a).

Currently, road congestion costs NSW $5.1 billion each year, due largely to time delays. This figure is expected to increase to $8.8 billion by 2020 (Transport for NSW 2012). If no improvements are made to this corridor, traffic model forecasts show that travel times between Strathfield and the Sydney CBD will continue to increase, even assuming the implementation of the various public transport improvements currently planned or under construction. These public transport enhancements include the North West Rail Link, Sydney Rapid Transit and the CBD and South East Light Rail, as well as other road enhancements such as NorthConnex and M4 Widening. Congestion on Parramatta Road between Concord Road and Wattle Street may cause drivers to use local roads − such as Patterson Street, Gipps Street, Queens Road and Ramsay Street − as an alternative route. The project may also reduce through traffic on Queen Street between Croydon and Burwood Roads in peak hours, which would improve the amenity and safety of this street.

Congestion reduces the safety of road networks. This is expressed through 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 July 2009 to 30 June 2014, 919 crashes occurred on Parramatta Road, of which 91.4 per cent were car crashes of which the highest proportion were rear-end crashes. Around 70 per cent of crashes were on weekdays, with 76 per cent in fine weather and 63 per cent in daylight (Centre for Road Safety (Transport for NSW) 2015). These figures indicate that congestion was a likely factor in these crashes given that poor light and poor weather were not factors.

Due to the existing traffic numbers along Parramatta Road, east−west movements are given priority, limiting north−south movements across the corridor and movements from Parramatta Road (via right turn bays) to streets north or south of the corridor. Parramatta Road has thus become a barrier for north−south movements, with only limited locations enabling movements, including pedestrian movements, across or from the corridor.

### Impact of congestion on public transport

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

During Urban Growth's consultation *on Draft Parramatta Road Urban Renewal Strategy* (UrbanGrowth NSW 2015), improved public transport services were identified by survey participants as the highest priority issue for the Parramatta Road corridor.

### Impact of congestion on pedestrians and cyclists

Parramatta Road currently offers no on- or off-road cyclist facilities. Traffic congestion, noise and air quality impacts also associated with the large numbers of vehicles reduces the attractiveness of Parramatta Road for cyclists, even though it is in many cases the quickest and most direct route in the east−west direction. Such amenity impacts are also considered to contribute to Parramatta Road's lack of appeal for pedestrians.

A Sydney Cycleways designated bicycle route runs from the Cooks River to Homebush. This route crosses Parramatta Road at Bridge Road and continues along Hillcrest Street and onto Park Road before passing under the M4 (on a dedicated cycleway) and continuing on Pomeroy Street on the northern side of the M4 (http://sydneycycleways.net/map). There are also dedicated cycle lanes running parallel to the Parramatta Road/M4 corridor on Gipps and Patterson streets and along the greater part of Queens Road. The shoulders of the M4 are also used by cyclists in both directions within the project footprint.

## 3.2.3 Job creation in Western Sydney

As detailed in *A Plan for Growing Sydney* (NSW Government 2014a), Sydney is expected to have 689,000 additional jobs by 2031. Many of these jobs are expected to be created in Western Sydney, to respond to an expected increase in population of 900,000 in the area. A large percentage of these jobs would be located in zoned employment areas or in areas still to be investigated, such as around the future Western Sydney Airport, which is expected to produce up to 19,900 jobs for Western Sydney (Western Sydney Airport Alliance 2013).

*A Plan for Growing Sydney* (NSW Government 2014a) and the *NSW Long Term Transport Master Plan* (Transport for NSW 2012a) both identify the need to prioritise development of centres such as Parramatta, Penrith and Liverpool to bring jobs closer to homes and areas of increasing population. However, as discussed in **section 3.2.1** there will continue to be stronger growth in jobs in eastern Sydney in the same time period, despite the higher rate of growth in population in Western Sydney during the next few decades, and the development of the employment hubs and the Western Sydney Airport. The Australian Government has indicated that the Western Sydney Airport at Badgerys Creek may be opened in the mid-2020s, but that Sydney Airport will continue to be the primary airport for both passengers and freight.

The Transport Master Plan identified 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). Although jobs growth in Western Sydney is forecast to be strong, surpassing that of the eastern half of the city in the coming decades, it is not forecast to match the job numbers of the city's eastern half (Bureau of Transport Statistics 2014). This disparity is due to a complex mix of factors including greater housing affordability in Sydney's west, and the existing employment zones and infrastructure that support stronger business investment and location decisions in the global economic corridor and in Sydney's eastern half more generally. As outlined in *A Plan for Growing Sydney* (NSW Government 2014a), 28 per cent of workers who live in Western Sydney work in other areas of Sydney and therefore are required to travel to work by car or on public transport.

There is a need to provide a link between Western Sydney and other centres in Sydney such as the Sydney CBD, Sydney Airport and Port Botany. These connections are required to allow not only for the flow of workers, but also for the flow of goods and freight which can only occur by road transport, as rail transport does not provide access to individual warehouse and commercial premises. This two-way flow between the international gateways and Western Sydney is necessary for centres such as Parramatta to develop further.

The project, together with the other projects forming part of WestConnex, would improve accessibility to jobs in Sydney's east, but more significantly, would encourage business and industry investment (and therefore employment opportunities) in centres such as Parramatta and Penrith through improved connections to other centres, allowing for the flow of people and goods.

While rail and public transport provide for efficient travel between major centres, there will continue to be a need for travel by road to jobs that are dispersed across the metropolitan area and not easily accessed by public transport. In addition, commercial vehicle movements and business travel, for example to provide trade services or to attend clients, will continue to rely on the road network. The transport network will therefore need to serve a larger number of long distance trips between Sydney's west and east to accommodate population growth.

Residents from Sydney's west spend longer, on average, commuting than their counterparts in Sydney's east. Residents in Sydney's west are far more car dependent for work. Nearly 85 per cent of the workforce residing in Sydney's west travels to work by car, compared with about 55 per cent of the workforce residing in Sydney's east. A Campbelltown resident drives on average two and a half times the vehicle kilometres of an inner Sydney resident (Transport for NSW 2012a), which indicates longer travel times, including for commuting.

### 3.2.4 Freight, commercial and business services

Sydney's freight, service and business task is large and significant. *Trade and Logistics Report 2011-12* (Sydney Ports Corporation 2012) indicates that 98 per cent of containers imported through Port Botany, and more than 60 per cent of exported containers, have their destination or origin within Greater Sydney.

There are opportunities to shift more freight onto rail, and this remains a priority for the NSW Government. However, assuming the target of doubling the share of container freight moved by rail is achieved by 2020 (Transport for NSW 2013b), 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 and airport precincts.

In managing the freight task, heavy commercial vehicles require a primary network with high quality connections between major freight hubs, whereas light commercial vehicles, such as goods delivery vans, depend on a multi-layered network with many connections to service more diverse and dispersed markets across Sydney. There are around four times as many light commercial vehicle trips on Sydney's road network as heavy commercial vehicle trips (Transport for NSW 2013b) (refer to **section 4.2.3** and **Figure 4.1** in **Chapter 4**), and this trend is forecast to continue. A key reason for this trend is that heavy freight activity precincts are concentrated in a few key locations in the vicinity of the port and across Western Sydney, and this land use pattern is also set to continue into the future. Sydney Airport and Port Botany generate about $10.5 billion of economic activity for Sydney each year (Xu and Milthorpe 2010) and both locations are heavily dependent on road vehicles for the movement of people and freight. Investment in additional road infrastructure such as the M4 East and other WestConnex projects would increase connections to Sydney's west, where the majority of airport and port freight traffic originates or ends.

The *Sydney Airport Master Plan 2033* (Sydney Airport Corporation Limited 2014) notes that Sydney Airport handles about half of Australia's international air freight. The total amount of freight handled at Sydney Airport is 76 per cent more than any other Australian airport. The volume of freight handled by Sydney Airport is projected to increase from 615,378 tonnes in 2012 to 1,011,312 tonnes in 2033 (Sydney Airport Corporation Limited 2014). Air freight exports from Australia are dominated by fresh, chilled or frozen perishables such as meat, seafood, fruit, vegetables, flowers, livestock and manufactured goods.

A key location for supply and re-distribution of fresh, chilled or frozen perishables in Sydney is the Sydney Markets at Flemington, adjacent to the M4 at Homebush. These time-critical exports rely on productive, efficient and effective landside and airside logistics that are best met by road rather than rail. Rail freight transport remains reliant on road transport to move freight to a train from the source, and from the train to the final destination. In Sydney, road transport provides a direct link between the source of the produce (eg regional areas) and the Sydney Markets, and from the markets to retail outlets as well as Sydney Airport.

The development of the proposed Western Sydney Airport has the potential to change the way some freight is moved around Sydney, by providing an alternative entry or exit point for freight. Overall, however, the movement of freight around Sydney is not considered to be significantly altered by the introduction of the new airport, for the following reasons:

- The operation of the proposed Western Sydney Airport would be staged, ramping up over time, with initial operations only commencing in the mid-2020s (a minimum of five years after the completion of the project)
- Freight arriving at the new airport would still have destinations across wider Sydney
- Port Botany and Sydney Airport would still be key freight entry and exit points, with the new airport to complement the existing airport.

### 3.2.5 Parramatta Road urban renewal

The NSW Government has prioritised urban renewal as a means of improving the availability of mixed income housing, housing affordability, employment access and public transport choice. *A Plan for Growing Sydney* seeks to support sustainable growth by planning major renewal and growth areas around existing and planned transport and road infrastructure (NSW Government 2014a). This 'infill development' brings people closer to jobs, and improves access to transport.

*A Plan for Growing Sydney* identifies the Parramatta Road/M4 Motorway as a key focus for an increase in housing, economic activity and social infrastructure, especially around centres with existing good public transport access and amenity. An integrated land use and multimodal response will be required to service renewal of the corridor, and to improve amenity in local movements along and across the corridor. As such, the urban renewal of the Parramatta Road corridor relies initially on a major improvement to existing traffic conditions.

The transformation of Parramatta Road is being guided by the *New Parramatta Road: Draft Parramatta Road Urban Renewal Strategy* (UrbanGrowth NSW 2015). This strategy is further discussed in **section 3.1.7**.

The project and other WestConnex projects would facilitate the urban renewal of Parramatta Road, by allowing for the reduction in through traffic from Parramatta Road which currently makes the corridor unattractive to new development due to noise, air quality and traffic issues.

### 3.2.6 Transport improvements in the Parramatta Road corridor

Over the coming years, significant population and employment growth is expected in the Parramatta Road corridor, which will increase the demand for travel. Long term transport improvements are required to manage this growth and to promote urban renewal. Regardless of this growth, people already living in the corridor need to be provided with improved transport infrastructure and services.

Planning has commenced for a series of projects that will support public transport, active transport and local vehicle travel improvements in the corridor.

The opening of the project would allow kerbside bus lanes to be extended from Leichhardt to Burwood (bus lanes currently run from Railway Square, CBD to Leichhardt), the operating times of kerbside bus lanes to be extended, and new priority bus services to be introduced in line with demand. A fully completed WestConnex and urban growth would facilitate a new rapid transit transport solution (ie bus rapid transit or light rail transit) and improved facilities for pedestrians and cycling, while also improving local traffic movements (in particular north-south movements across the Parramatta Road corridor). The delivery of transport improvements is crucial to the realisation of urban renewal in the corridor. Transport improvements will support:

- An integrated transport network – construction of interchanges for easy transfers between the rapid public transport and other transport services
- Connected communities – improved balance between north−south and east−west movements without compromising traffic flow
- A safer environment – improved intersections and traffic flow will reduce traffic incidents, while changes to layout will make it safer for pedestrians and cyclists
- A sustainable transport route – a new layout will encourage more people to use public and active transport (walking and cycling), reduce the number of vehicles on Parramatta Road and allow for future growth and urban changes in the corridor.

This project and other WestConnex projects would remove around 45 per cent of the existing traffic from Parramatta Road in 2031 (as described in **Chapter 8** (Traffic and transport)), which would in turn enable the use of some road space for other purposes such as bus lanes. This provision of space for public transport will enable the growth in local trips from urban renewal and general development in the corridor to be met. The project would therefore serve as a catalyst for urban renewal and transport improvement in the Parramatta Road corridor.

## 3.3 Project objectives

The core objectives of the project, which are consistent with the core objectives of WestConnex, are to:

- Support Sydney's long-term economic growth through improved motorway access and connections linking Sydney's international gateways (Sydney Airport and Port Botany), Western Sydney and places of business across the city
- Relieve road congestion so as to improve the speed, reliability and safety of travel in the M4 corridor, including parallel arterial roads
- Cater for the diverse travel demands along these corridors that are best met by road infrastructure
- Create opportunities for urban revitalisation, improved liveability, and public and active transport improvements along and around Parramatta Road
- Enhance the productivity of commercial and freight generating land uses strategically located near transport infrastructure
- Enhance movements across the Parramatta Road corridor which are currently restricted
- Fit within the financial capacity of the State and Federal Governments, in partnership with the private sector
- Optimise user pays contributions to support funding in a way that is affordable and equitable
- Integrate with the preceding and proposed future stages of WestConnex, without creating significant impacts on the surrounding environment or duplicating any potential issues across the construction periods
- Protect natural and cultural resources and enhance the environment through the following key approaches:
  - Manage tunnel ventilation emissions to ensure local air quality meets EPA standards
  - Maintain regional air quality
  - Minimise adverse impacts at a local level on air and noise quality
  - Manage in-tunnel air quality to meet community visibility and health expectations
  - Minimise energy use during construction and operation
  - Manage noise impacts in accordance with the NSW Road Noise Policy and realise opportunities to reduce or mitigate noise
  - Provide for improvement of social and visual amenity

- Minimise impacts on natural systems including biodiversity
- Minimise impact on Aboriginal and non-Aboriginal cultural heritage
- Minimal impact on surface and groundwater sources and water quality including management of contaminated areas
- Reduce susceptibility to, and minimise impacts of, flooding
- Integrate sustainability considerations throughout the design, construction and operation of the project, including consideration of the Infrastructure Sustainability Council of Australia (ISCA) Sustainability Rating tool scorecard.

## 3.4 Summary

Once completed, the project would provide immediate operational benefits in relieving congestion along the M4 and Parramatta Road, between Homebush Bay Drive at Homebush and Wattle Street (City West Link) and Parramatta Road at Haberfield/Ashfield, including reduction in travel times and improvements in the level of road safety.

The project is being developed as part of the first stage of WestConnex which also includes the M4 Widening project. On completion of both projects, WestConnex would provide a full motorway connection between the Blue Mountains in the west and Haberfield in the east. Future stages of WestConnex would link the project with Sydney's south-west, Sydney Airport and the Port Botany precinct.

Once approved and constructed, the project would play a key role in supporting the financial delivery of proposed future stages of WestConnex by using toll revenue to raise private sector debt. Investment in the project and subsequent stages of WestConnex would facilitate a step change in network performance, enabling delivery of major city shaping improvements and delivering economic growth.

As part of WestConnex, the project would support NSW's key economic generators and provide a strategic response to the currently inadequate, and highly congested, transport routes. Critically, this includes providing the missing link in the motorway network which supports Sydney's global economic corridor. Improvements to the transport network, including this project, support the global economic corridor by enabling domestic and international trade and therefore underpin a sustainable NSW economy and Sydney's role as a global city.

Integrated land use and transport planning initiatives are key factors in developing a future where Sydney's growing population can reliably access jobs and services. The project complements a number of other transport and freight based infrastructure initiatives identified in the Transport Master Plan. Ultimately, it is the combination of these initiatives that will best address global Sydney's needs.

Sydney's freight, service and business task requires distribution of goods and services across the Sydney region, which relies on more diverse and dispersed point-to-point transport connections. The project supports this task by improving access to, and reliability of, the motorway network. The project would also provide a high quality road connection between the key centres in the global economic corridor, such as the Parramatta and Sydney CBDs.

WestConnex is intended to be delivered as an integrated package of transport improvements across Sydney, with complementary enhancements to the existing road network (including associated surface street changes, bus priority measures, heavy vehicle access improvements), redesign of bus services and facilities, improved access to rail stations and upgrades to cyclist and pedestrian facilities.

*A Plan For Growing Sydney* (NSW Government 2014a) identifies the project as essential to support major planning renewal and growth areas, including precincts in the Parramatta Road corridor, where it would allow for significant improvements to local amenity by reducing through traffic on surface roads, and allowing for enhanced north−south local connectivity.

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# 4 Project development and alternatives

This chapter describes the alternatives that were considered as part of the development process for the M4 East project (the project), and explains how and why the project was selected as the preferred option. Design options and refinements for particular elements of the project are also addressed.

The Secretary of the Department of Planning and Environment has issued a set of environmental assessment requirements for the project; these are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 4.1** sets out the Secretary's Environmental Assessment Requirements that relate to project development and alternatives, and identifies where these have been addressed in this environmental impact statement (EIS).

**Table 4.1 Secretary's Environmental Assessment Requirements – project development and alternatives**

| Secretary's Environmental Assessment Requirement | Where addressed in the EIS |
|---|---|
| [A]n analysis of feasible alternatives to the carrying out of the project and project justification, including: | |
| • an analysis of alternatives/options considered having regard to the project objectives (including an assessment of the environmental costs and benefits of the project relative to alternatives and the consequences of not carrying out the project), and the provision of a clear discussion of the route development and selection process, the suitability of the chosen alignment taking into account environmental impacts, consideration of tunnel construction methods and whether or not the project is in the public interest | **Chapter 4** (this chapter)<br><br>Public interest is addressed in **Chapter 30** (Project justification and conclusion). |

## 4.1 History of the M4 East and WestConnex

It has been acknowledged that no single project provides a complete solution to Sydney's transport requirements. Variations on the component projects of WestConnex have been under consideration since the early 2000s and would augment and complete missing links in Sydney's motorway network.

**Figure 4.1** shows the project development process undertaken for theM4 East and WestConnex.

### 4.1.1 M4 Motorway

The construction of the M4 Motorway (originally the F4 Western Freeway) occurred in several stages between the late 1960s and the mid-1980s. It was first opened to traffic in 1971 and now comprises a 40 kilometre urban motorway connecting Concord with the Blue Mountains. The section between Parramatta and Concord was opened in 1992. Since then, various schemes and multiple options have been explored, developed and built to complement the M4.

Between 2003 and 2004 a preferred option for an eastern extension of the M4 to the Sydney central business district (CBD) was developed and publicly exhibited. This option, referred to as the M4 East, proposed extending the M4 to the City West Link and Parramatta Road at Ashfield as well as widening the existing motorway between Homebush Bay Drive and Concord Road. This scheme was put on hold indefinitely by the then NSW Government. The 2003 preferred option formed the basis of the concept design for the M4 East project, which forms part of WestConnex. The M4 Widening, which forms part of WestConnex, will upgrade the M4 to generally four lanes in each direction between Pitt Street at Parramatta and Homebush Bay Drive at Homebush. As discussed in **section 4.1.4**, planning approval for the M4 Widening was granted in December 2014 and work began in March 2015.

# Project development process

## Early schemes

**1971-1992**

F4 Western Motorway (now M4 Motorway) between Concord and Blue Mountains opened in stages

**2001**

M5 East opened

**2003-2004**

Preferred option for extension of the M4 to City West Link at Ashfield (referred to as M4 East) developed and placed on public display

**2004**

Marrickville Tunnel scheme considered but never placed on public display

**2009**

M5 East duplication project placed on public display

## WestConnex

**2012**

WestConnex identified in the State Infrastructure Strategy 2012-2032

M4 East comprised an extension to Taverners Hill at Petersham

**2013**

September: WestConnex Business Case developed in late 2013, M4 East comprised an extension to City West Link (Wattle Street) at Haberfield

November: Preliminary concept design for M4 East placed on public display

November: State Significant Infrastructure application for M4 East lodged with the then Department of Planning and Infrastructure

**2014**

February: Preliminary concept design for M4 East public display ends

May: Competitive tender process to design and construct the M4 East commenced

May: State Significant Infrastucture application lodged for King Georges Road Interchange upgrade project

June: Commencement of further development of WestConnex to include northern and southern extensions

August: Short list of three consortia for construction of the M4 East announced

November: State Significant Infrastructure application for New M5 lodged

December: Tenders received for construction of the M4 East

December: M4 Widening project planning approval granted

December: Western Harbour Tunnel identified in Rebuilding NSW: State Infrastructure Strategy 2014 as further extension of WestConnex

**2015**

March: M4 Widening project works commenced

March: King Georges Road Interchange upgrade project planning approval granted

June: Preferred tenderer for the design and construction of the M4 East, Leighton, Samsung C&T and John Holland Joint Venture, announced
Preferred design released

July: King Georges Road Interchange upgrade project works commenced

**Figure 4.1 Project development process**

### 4.1.2 M5 East Motorway

The M5 East Motorway is a 10 kilometre motorway connecting the M5 South West Motorway with General Holmes Drive and the Eastern Distributor. The M5 East opened in 2001 and from this time has operated at or near capacity. The M5 East Motorway has attracted ongoing community concern in relation to tunnel air quality.

A proposal for the M5 East duplication was publicly displayed in 2009. Since that time the scheme has undergone further development and now forms part of WestConnex – King Georges Road Interchange Upgrade and New M5 (King Georges Road at Beverly Hills to St Peters).

### 4.1.3 Connection between the M4 and M5 East

The Marrickville Tunnel was a scheme considered in around 2004 to create a direct connection between the then M4 East and Mascot, in order to provide a direct route for traffic between Port Botany, Sydney Airport and South 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 placed on public display. The Enfield Intermodal Terminal was then developed instead to increase the volume of freight carried by rail to and from Port Botany, with distribution by road from Enfield using existing arterial roads and the M4.

The concept of a connection between the M4 and M5 East has developed to become the possible future M4–M5 Link (M4–M5 Link) which, subject to planning approval, forms part of WestConnex. This would complete the orbital road network between western Sydney and the eastern gateways of Port Botany and Sydney Airport, and provide a north–south bypass of the Sydney CBD.

### 4.1.4 WestConnex and M4 East

WestConnex has evolved from the earlier schemes for the M4, M5 East and the connection between the two. It is aimed at enhancing the capacity and connectivity of the M4 and M5 East motorways. The WestConnex scheme was first set out in the *State Infrastructure Strategy 2012-2032* (Infrastructure NSW 2012a) as a strategic concept, developed as a response to a series of strategic challenges faced by Sydney and NSW.

The State Infrastructure Strategy identified the component projects of WestConnex to be delivered in two stages:

- Northern Sector, comprising widening of the existing M4 (now M4 Widening) and M4 Extension to Taverners Hill and St Peters (now M4 East and M4–M5 Link)
- Southern Sector, comprising the M5 East Expansion (now New M5 and King Georges Road Interchange Upgrade).

The ‘M4 Extension’ component of WestConnex comprised a connection between the existing M4 at Concord and Taverners Hill in Petersham (Infrastructure NSW 2012b). The M4 Extension was to be constructed in sections variously in tunnel, in cutting (or ‘slot’), at grade or on elevated road, to optimise urban renewal along Parramatta Road.

To reduce risks and costs, NSW Roads and Maritime Services (Roads and Maritime) engaged leading Australian and international construction industry partners to review and optimise the design (as developed to 2013) along with earlier works for the WestConnex scheme, and to develop innovative solutions for different forms of alignment options. The outcome of this work was incorporated into the project design development and assessment.

In September 2013, the *WestConnex Business Case Executive Summary* was released (Sydney Motorways Project Office 2013a). The Business Case Executive Summary identified the component projects of WestConnex to be delivered in three stages:

- Stage 1: Parramatta to Haberfield (now M4 Widening and M4 East)
- Stage 2: Beverly Hills to St Peters (now King Georges Road Interchange Upgrade and New M5)
- Stage 3: Haberfield to St Peters (now M4–M5 Link).

The M4 East component of WestConnex was proposed to continue the M4 from Homebush Bay Drive to Parramatta Road and City West Link at Haberfield, by providing a tunnel with three lanes in each direction, generally following the alignment of Parramatta Road. The preliminary concept design for the M4 East was publicly displayed between November 2013 and February 2014. Submissions received during the public display were considered and informed the development of the M4 East concept design.

A competitive tender process to design and construct the M4 East commenced in May 2014, when expressions of interest were called. A shortlist of three consortia to build the M4 East was announced by the NSW Government in August 2014. Tenders from shortlisted contractors to build the M4 East were received in December 2014, and tender evaluation and design refinement to cater for changes to WestConnex as described below took place over the first half of 2015. The preferred tenderer, a consortium comprising Leighton, Samsung C&T and John Holland, was announced on 4 June 2015.

Concurrent with the design and construct tender process, in June 2014, the NSW Government requested that the WestConnex Delivery Authority (WDA) assess the potential for enhancing the scope of WestConnex through northern and southern extensions to the scheme. The northern extension is proposed as a link to the former Rozelle Goods Yards, enabling connection to the Victoria Road corridor to the north and Anzac Bridge and Western Distributor to the east. The southern extension is proposed as a connection between the proposed New M5 tunnels (to be built as part of WestConnex) and President Avenue at Rockdale. WDA is currently developing a business case for the northern and southern extensions that sets out their strategic and economic rationale and indicates a path for their further development. The northern and southern extensions are shown in **Figure 1.2** in **Chapter 1** (Introduction).

In addition to the northern and southern extensions of WestConnex, *Rebuilding NSW: State Infrastructure Strategy 2014* (NSW Government 2014b) identifies the proposed Western Harbour Tunnel project as the next major motorway to be developed after or at the same time as the M4–M5 Link. It would see the construction of an additional Sydney Harbour road crossing of approximately seven kilometres, connecting the WestConnex northern extension around Rozelle with the Gore Hill or Warringah freeways. Feasibility work and business case development for the project is underway. Together, the WestConnex extensions and the Western Harbour Tunnel would facilitate a new north−south route through Sydney that avoids the Sydney Harbour Bridge and Tunnel, CBD, Eastern Distributor and Anzac Bridge.

The status of the other component projects of WestConnex is as follows:

- A planning application was made for the New M5 in November 2014 and an EIS is currently being prepared
- Planning approval for the M4 Widening was granted on 21 December 2014 and work began in March 2015
- Planning approval for the King Georges Road Interchange Upgrade was granted on 3 March 2015 and work began in July 2015
- A separate planning application will be made for the M4–M5 Link following further concept development.

## 4.2 Strategic alternatives

The merits of the project were considered by WDA and Roads and Maritime in the context of a range of other alternatives. The alternatives considered are consistent with those considered for other recent motorway upgrade and enhancement projects in the Sydney metropolitan area. Alternatives to the project were considered 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 to the project were considered:

- Alternative 1 – the base case or ‘do nothing/do minimum’ (‘do minimum’)
- Alternative 2 – improvements to the existing arterial road network

- Alternative 3 – investment in public transport and freight rail improvements
- Alternative 4 – demand management
- Alternative 5 – extension of the M4 as part of WestConnex.

These alternatives are described below.

### 4.2.1 Alternative 1 – Base case or 'do nothing/do minimum'

The base case 'do nothing/do minimum' option ('do minimum') would involve retaining the M4 (with the M4 Widening completed) and Parramatta Road, in essentially its current configuration, as the main east−west route between Western Sydney and Haberfield. The M4 between Church Street at Parramatta and Homebush Bay Drive at Homebush would be a tolled motorway as part of the 'do minimum' option. Only minimal new infrastructure such as routine road network and intersection upgrades would be provided over time to improve capacity.

Future transport demand in the Parramatta Road corridor represents a significant challenge for Sydney and NSW. Parramatta Road has one of the highest number of bus passengers, during the morning peak, of any major bus route in Metropolitan Sydney. Road congestion on Parramatta Road has led to bus services using the road being delayed and unreliable (ie not running to timetable).

Sections of Parramatta Road carry more than 90,000 vehicles each day, with up to 6,000 of these being heavy vehicles (refer to **section 8.2.2** in **Chapter 8** (Traffic and transport)). On an average weekday, 2.8 million trips start or finish within the Parramatta Road corridor. This represents 14 per cent of all trips made within Sydney daily. The locations with highest traffic volumes are between the end of the M4 at Concord and Wattle Street. Average travel speeds of private vehicles during the morning peak are about 30 kilometres an hour (Transport for NSW 2012a). Without the project, Parramatta Road would continue to operate at and beyond capacity in peak hours.

The current network does not support a growing population that needs to efficiently and reliably access dispersed employment areas and services. Currently, road congestion costs NSW $5.1 billion each year, due largely to time delays. This figure is expected to increase to $8.8 billion by 2020 (Transport for NSW 2012a). If no improvements are made to this corridor, traffic model forecasts show that travel times between Strathfield and the Sydney CBD will continue to increase, even assuming the implementation of the various public transport improvements currently planned or under construction. Without the project, congestion on Parramatta Road will continue to impact on the NSW economy through longer delivery and transport times in Sydney, and particularly for businesses in Western Sydney.

Traffic modelling under the 'do minimum' scenario indicates that, by 2031, morning peak travel times between Homebush Bay Drive at Sydney Olympic Park and Flood Street at Leichhardt would increase by about 17 minutes in the westbound direction and by less than two minutes in the eastbound direction. In the afternoon peak, travel times in both directions would increase by between five and eight minutes.

#### Summary

In the context of the transport challenges identified in **Chapter 3** (Strategic context and project need), a 'do minimum' option is considered unrealistic and would not address a number of Australian and NSW government commitments, including key goals in *NSW 2021: A Plan to Make NSW Number One* (NSW Department of Premier and Cabinet 2011) (see **section 3.1**). It would also not meet the project objectives as outlined in **section 3.3**.

### 4.2.2 Alternative 2 – Improvements to the existing arterial road network

Infrastructure NSW recognises that the wider road network, including major arterials, will also require improvement and that some of the highest value infrastructure investments come from 'pinch point' relief that addresses road congestion 'hotspots' (Infrastructure NSW 2012a). Improvements to the existing arterial road network are seen as complementary to the project objectives, reinforcing the function of the arterial road network as providing high order access routes to the broader road network, as distinct from the long distance through route function performed by Sydney's motorway network.

### Improvements to Parramatta Road

Consideration was given to upgrading Parramatta Road to improve traffic flow and reduce congestion. These works would likely include multiple improvements to roads and intersections along the Parramatta Road corridor and Parramatta Road itself, in an attempt to maintain an acceptable level of traffic operation.

Parramatta Road east of the intersection with the existing M4 generally experiences high levels of congestion during much of the day, including on weekends. As such, localised intersection improvements, refinements to traffic signal timing and/or phasing, road safety measures or similar small scale works may provide some improvement to travel times and would have an acceptable level of traffic impacts during their construction phase. More substantial improvements would likely require grade separation of intersections, which would have substantial traffic impacts during construction. These measures would still only manage current congestion issues, rather than catering for future demands related to increased traffic volumes and improved public transport, such as the planned bus rapid transit or light rail service. These demands could only be accommodated by providing additional lanes along the length of Parramatta Road. Construction of additional lanes would likely require considerable private property acquisition along the length of Parramatta Road.

### Improvements to Patterson Street, Gipps Street, Queens Road and Ramsay Road

Patterson Street, Gipps Street, Queens Road and Ramsay Road provide an alternative road corridor between the end of the M4 at Concord and Wattle Street (City West Link) at Haberfield. Existing congestion on Parramatta Road between Concord Road and Wattle Street causes drivers to use these local roads as an alternative route. These roads are generally one lane in each direction, with Queens Road carrying up to 27,325 vehicles during an average weekday (refer to **section 8.2.2** of **Chapter 8** (Traffic and transport)).

Substantial improvements to these roads would require considerable private property acquisition and removal of dedicated cycle lanes to accommodate additional traffic lanes. The amenity and safety of pedestrians and cyclists using these roads would likely be reduced as a result of traffic, noise and air quality impacts.

In addition, increasing the traffic capacity of these roads would further restrict north−south movements across the Parramatta Road corridor, as the dominant traffic flow would be east−west movements. This would not meet the project objective to enhance north−south movements across the Parramatta Road corridor.

### Improvements to Victoria Road

Victoria Road provides an alternative transport corridor from Parramatta to the Sydney CBD north of the Parramatta River. The character of this route differs from the M4 and Parramatta Road corridor because its topography is much more varied, with steeper slopes and tight bends. The Victoria Road corridor passes through a number of established centres and crosses major natural features and service/transport infrastructure, which presents significant challenges for increasing road capacity.

Improvements to the Victoria Road corridor would not meet the M4 East project objectives. They would not enhance movements across the Parramatta Road corridor, nor would they create opportunities for urban revitalisation, improved liveability, and public and active transport improvements along and around Parramatta Road.

Similar to the option to improve the Parramatta Road corridor, substantial improvements to Victoria Road would likely require grade separation of intersections, which would have substantial traffic impacts. These measures would still only manage current congestion issues rather than catering for the future traffic demands expected in these corridors. Construction would also likely require removal of bus lanes and/or considerable private property acquisition along the length of Victoria Road to accommodate additional general traffic lanes.

### Summary

The arterial road improvement alternatives described in the preceding sections are considered inadequate responses to the significant transport challenges on the Parramatta Road corridor. Localised road corridor improvements would only provide an incremental change to the network,

rather than supporting the additional capacity required for improved bus services and regional traffic growth.

For alternatives to be worthy of consideration, they must be broadly capable of accommodating the identified transport task and challenges being addressed by WestConnex. These can only be met by major arterial road improvements that will have significant construction impacts or require the construction of new infrastructure. Arterial road improvement options would therefore not meet the project objectives as outlined in **section 3.3** of **Chapter 3** (Strategic context and project need).

### 4.2.3 Alternative 3 – Investment in public transport and rail freight improvements

As discussed in **Chapter 3**, WestConnex is a key component of the *NSW Long Term Transport Master Plan* (Transport for NSW 2012a) (Transport Master Plan), the *State Infrastructure Strategy 2012–2032* (Infrastructure NSW 2012a) (State Infrastructure Strategy) and *A Plan for Growing Sydney* (NSW Government 2014a). As part of a broader integrated transport solution, the project supports a coordinated approach to the management of freight and passenger movements, as well as 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.

#### Public transport

The Parramatta Road corridor runs parallel to the Main Western Rail Line. Trains provide the trunk public transport service in this corridor, connecting Western Sydney and centres in the corridor to the Sydney CBD. *Sydney's Rail Future* (Transport for NSW 2012b) identified the need for service improvements on the Main Western Rail Line, which are being considered separately by the NSW Government. *Sydney's Rail Future* also outlines the establishment of Sydney Rapid Transit (now Sydney Metro) which, while not directly servicing the Parramatta Road corridor, would assist in removing some key bottlenecks on the Sydney Trains network. This would then improve train movements along the Main Western Rail Line.

Commercial and retail centres have developed around stations along the Main Western Rail Line, including at Strathfield, Burwood and Ashfield. Consequently, many bus services on and around the Parramatta Road corridor act as feeder services to train stations and centres, although there remains a strong demand for east−west services along Parramatta Road between Burwood and the Sydney CBD.

Public transport options such as rail, light rail or bus would be feasible potential alternatives if the project, as part of WestConnex, was primarily concerned with transporting people to and from centres. However, 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 greatly 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.

Public transport would only partially address these customer demands. There are no feasible strategic transport alternatives − such as heavy or light rail options or bus corridor enhancements − that would meet the diverse range of customer needs for travel in this corridor and address the project objectives as effectively as the project and WestConnex more broadly.

This does not preclude a number of these public transport alternatives being complementary to the project and the broader WestConnex scheme. In particular, the project is expected to reduce traffic volumes along Parramatta Road. As described in **Chapter 3** (Strategic context and project need), this would allow for the establishment of a mass transit corridor along Parramatta Road, and the project has been designed to allow for the provision of this mass transit corridor (refer to **section 5.5.5** (Project Description)). Such a corridor would provide suitable facilities for the transport of a high number of people along Parramatta Road by bus. In the long term and as outlined in *Sydney's Bus Future* (Transport for NSW 2013a), if demand permits, this corridor could be upgraded to light rail.

### Combined transport options

A ‘park and ride’ scenario, supplemented with a light rail line along Parramatta Road or express heavy rail services to Central Station, has been identified by a public transport advocacy group known as Eco-Transit. This transport alternative would introduce a ‘park and ride’ facility and bus−rail interchange in Olympic Park, an additional railway station on the Olympic Rail Line near its crossing of the existing M4, and an express service linking the new station with Central Station via the Main Western Rail Line. The park and ride facility would be supplemented by a light rail line from this new station, along Parramatta Road to Central Station.

Passenger trips for work, education, health, recreation and personal business are recognised as a key customer market on the M4 East. A majority of these trips are by private vehicle, as many destinations are located outside the major centres. Commuting and education trips typically occur in the morning and afternoon travel peaks, whereas other passenger trips are more discretionary and can occur in inter-peak times and on weekends. These trips are typically highly dispersed and travel patterns are complex.

Public transport is not the most effective way of servicing a majority of these passenger trips. It also fails to address demand for the movement of freight and trades and services. For these reasons, public transport options are seen as complementary services supporting, but not wholly able to address, the transport demands that would be addressed by the project and the broader WestConnex scheme.

### Rail freight

Apart from moving passengers, Sydney's rail network plays a significant role in moving freight between Sydney's ports and destinations around Sydney, regional NSW and other states. The *Trade and Logistics Report 2011-12* (Sydney Ports Corporation 2012) indicates that some 98 per cent of imported containers and over 60 per cent of exported containers through Port Botany have their origin and destination within Greater Sydney.

The Transport Master Plan identifies a number of current and future freight-related projects that complement the existing freight network. These include:

- Completion of the Southern Sydney Freight Line
- Development of an intermodal terminal at Enfield (commenced limited operation in March 2015 with some construction work ongoing)
- Stage one of the Northern Sydney Freight Corridor Program (under construction)
- Development of an intermodal terminal at Moorebank (in planning approval phase)
- A Western Sydney Freight Line (corridor for future preservation under investigation)
- Western Sydney Intermodal Terminal (sites being considered as part of investigation for the Western Sydney Freight Line).

There are opportunities to shift more freight onto rail, and this remains a priority for the NSW Government. However, assuming the target of doubling the share of container freight moved by rail is achieved by 2020 (Transport for NSW 2013d), more than 70 per cent of Port Botany’s projected trade would still be moved by road, requiring investment in an efficient road network to support the port and airport precincts.

Rail freight transport is more effective for long distance transport of goods to regional centres. However, Sydney’s freight, service and business task requiring distribution within the Sydney metropolitan area relies on dispersed point-to-point transport connections to customers. Predominantly, freight rail serves the first leg of the freight journey, with containerised freight broken down at distribution nodes and further distributed across Sydney. In managing the freight task, heavy commercial vehicles require a primary network with high quality connections between major freight hubs, whereas light commercial vehicles 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 trips on Sydney's road network as heavy commercial vehicle trips (Transport for NSW 2013b) (refer to **Figure 4.2**), and this trend is forecast to continue. A key reason for this trend is that heavy freight activity precincts are concentrated in a few key locations in the vicinity of the port and across Western Sydney, and this land use pattern is also set to continue into the future.

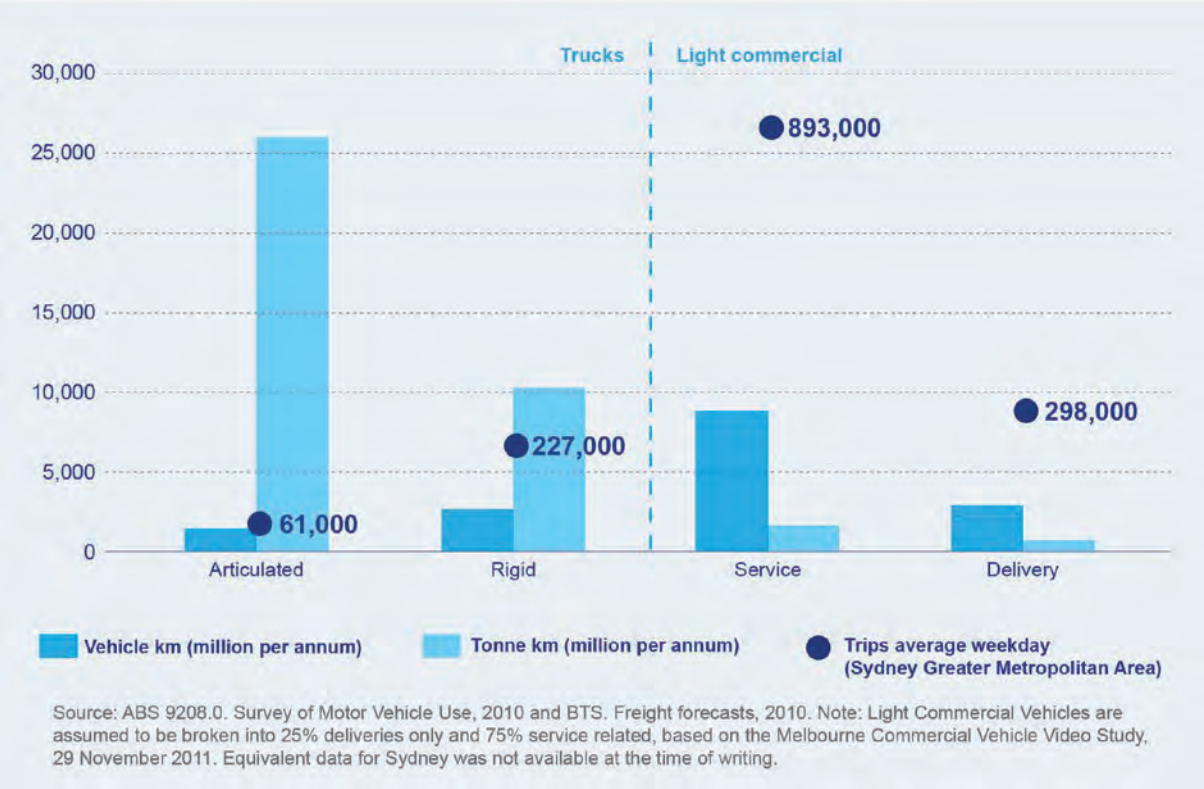



**Figure 4.2** **Comparison of truck and light commercial activity in NSW with trips on an average weekday (Transport for NSW 2013b)**

The *Sydney Airport Master Plan 2033* (Sydney Airport Corporation Limited 2014) notes that Sydney Airport handles about half of Australia's international air freight. The total amount of freight handled at Sydney Airport is 76 per cent more than any other Australian airport. The volume of freight handled by Sydney Airport is projected to increase from 615,378 tonnes in 2012 to 1,011,312 tonnes in 2033 (Sydney Airport Corporation Limited 2014). Air freight exports from Australia are dominated by fresh, chilled or frozen perishables such as meat, seafood, fruit, vegetables, flowers, livestock and manufactured goods.

A key location for supply and re-distribution of fresh, chilled or frozen perishables in Sydney is the Sydney Markets at Flemington, adjacent to the M4 at Homebush. These time-critical exports rely on productive, efficient and effective landside and airside logistics that are best met by road rather than rail. Rail freight transport remains reliant on road transport to move freight to a train from the source, and from the train to the final destination. In Sydney, road transport provides a direct link between the source of the produce (eg regional areas) and the Sydney Markets, and from the markets to retail outlets as well as Sydney Airport.

The development of the Western Sydney Airport has the potential to change the way some freight is moved around Sydney, by providing an alternative entry or exit point for freight. Overall, however, the movement of freight around Sydney is not considered to be significantly altered by the introduction of the new airport, for the following reasons:

- The operation of the Western Sydney Airport would be staged, ramping up over time, with initial operations only commencing in the mid-2020s (a minimum of five years after the completion of the project)
- Freight arriving at the new airport would still have destinations across wider Sydney

- Port Botany and Sydney Airport would still be key freight entry and exit points, with the new airport to complement the existing airport.

In combination with the freight-related projects identified above, the project and the broader WestConnex scheme would provide a robust freight solution and would best address the project objectives.

**Summary**

There are no feasible strategic public transport or rail freight alternatives that would fully meet the diverse range of needs for travel in the Parramatta Road corridor, and address the project objectives as outlined in **section 3.3**. Public transport and rail freight options are seen as complementary services supporting the project and the broader WestConnex scheme, and the NSW Government is currently implementing a number of public transport and rail freight projects.

### 4.2.4 Alternative 4 – Demand management

Demand management can be defined as a policy, planning and operational approach to the movement of goods or people. Demand management encompasses policies intended to reduce individual trips and make various mode options more viable. These policies include:

- Urban consolidation and 'centres' policies (land use planning) to reduce the need for travel
- Other planning control policies such as restricting parking provisions in new developments
- Road network management and network connectivity policies, including implementation of intelligent transport systems to improve public transport operation, management of clearways and transit lanes, and providing greater priority for public transport over general traffic
- Transport pricing to reduce travel demand; including demand based, tolling or transport pricing to discourage discretionary travel by private vehicle for trips that can be served by public transport.

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). This disparity is due to a number of factors that include greater housing affordability in Sydney's west, and the existing agglomerations and infrastructure that support stronger business investment (and therefore location decisions) in the global economic corridor and Sydney's east more generally.

Demand management measures can take many years to achieve changes in travel behaviour, as existing customer practices need to be modified and existing investment priorities changed. In the context of this project, travel demand management would require modifying travel decisions and reducing dependence on cars, especially during peak periods.

While demand management could help to spread the demand for peak travel to less congested time periods, its effectiveness would be limited by other constraints, such as availability of other travel modes at the user's origin and destination, and flexibility of working arrangements to take advantage of 'time of day' tolling or transport pricing benefits.

**Summary**

Demand management measures are seen as complementary initiatives rather than a viable stand-alone alternative to the project. To have a major impact on road traffic, demand management would also require major changes in social attitudes, travel behaviour and government policy.

### 4.2.5 Alternative 5 – Extension of the M4 as part of the WestConnex scheme

This alternative would involve extending the M4 to the east as part of the broader WestConnex scheme. As described in the *WestConnex Strategic Environmental Review* (Sydney Motorways Project Office 2013b), it would link the existing M4 at Homebush Bay Drive, Homebush to Parramatta Road and the City West Link at Haberfield. The extension would be a new motorway comprised of some surface road sections and two tunnels with three lanes in each direction. The extension would be a controlled access road with on and off ramps connecting to various locations on Parramatta Road subject to design.

As indicated in **Chapter 3** (Strategic context and project need), the WestConnex scheme has been developed as a key transport component of the Transport Master Plan integrated with the strategic land use outcomes as identified in *A Plan for Growing Sydney*. The Transport Master Plan identifies the WestConnex scheme as a critical link in Sydney's motorway network and an immediate priority for the NSW Government.

The extension of the M4 was identified, along with the M4 Widening project, as forming part of the first stage of the WestConnex scheme. It would complete a missing link in the motorway network between growing population, employment and industrial centres of Sydney's west and east.

### 4.2.6 Preferred strategic alternative

Extension of the M4 (Alternative 5) and the project as described in this EIS is the preferred strategic alternative. Investment in public transport and rail freight and demand management (Alternatives 3 and 4 respectively) are considered to be viable complementary strategic alternatives. A number of public transport and rail freight projects are being investigated and implemented in conjunction with the preferred strategic alternative. The NSW Government is also considering implementing 'smart motorway' operations on the M4.

The preferred option, as described in **sections 4.3** to **4.6**, has evolved from a series of ongoing concept developments and evaluations since 2003. **Chapter 3** demonstrates the need for the project and provides detail on its strategic context. The preferred option best achieves all of the project objectives as set out in **section 3.3**. It would:

- Support Sydney's long-term economic growth through improved motorway access and connections linking Sydney's international gateways (Sydney Airport and Port Botany), Western Sydney and places of business across the city
- Relieve road congestion to improve the speed, reliability and safety of travel in the Parramatta Road corridor, including parallel arterial roads
- Cater for the diverse travel demands along this corridor that are best met by road infrastructure
- Create opportunities for urban revitalisation, improved liveability, and public and active transport improvements along and around Parramatta Road
- Enhance the productivity of commercial and freight generating land uses strategically located near transport infrastructure
- Enhance the currently restricted movements across the Parramatta Road corridor.
- Fit within the financial capacity of the NSW and Australian Governments, in partnership with the private sector
- Optimise user pays contributions to support funding in a way that is affordable and equitable
- Integrate with the preceding and next stages of WestConnex, without creating significant impacts on the surrounding environment or duplicating any potential issues across the construction periods.

The preferred option is described in detail in **Chapter 5** (Project description). In summary, it comprises widening and realigning the M4 between Homebush Bay Drive and Underwood Road at Homebush; two new three-lane tunnels extending from west of Pomeroy Street at Homebush to near Alt Street at Haberfield; provision of interchanges at Concord Road at Concord, Wattle Street (City West Link) at Haberfield, and Parramatta Road at Ashfield; installation of tunnel ventilation systems and other operational ancillary facilities; and associated upgrades and modifications to surface roads.

## 4.3 Motorway options

### 4.3.1 Earlier options development

As outlined in **section 4.1**, there has been ongoing development of the project since 2003. This section discusses the early options considered for the M4 East.

#### 2003 options

Three options were considered during the M4 East options study (RTA 2003):

- Short tunnel option – construction of twin 3.6 kilometre tunnels running roughly below the alignment of Parramatta Road from the existing end of the M4 to City West Link (at Dobroyd Parade) and Parramatta Road at Haberfield
- Long tunnel option – construction of twin 6.5 kilometre tunnels running roughly below Parramatta Road until just west of Great North Road, then connecting with the City West Link at Lilyfield. A spur tunnel would be constructed where the main tunnels end north of Parramatta Road. This spur would include twin 1.3 kilometre tunnels for a connection to Parramatta Road at Haberfield
- Slot option – a number of surface options were considered; however, the 'slot' option was considered to be most viable. This option would involve lowering of the motorway into a 'slot', similar to the Eastern Distributor at Moore Park. The alignment would generally run parallel to Parramatta Road and be positioned to the south. This option would run between the end of the existing M4 and Parramatta Road at Haberfield.

These options are shown in **Figure 4.3**.

The short tunnel option was preferred for a number of reasons. When compared to the long tunnel option, the short tunnel was considered to have lower costs both during construction and operation (ie lower tolls) and would require fewer ventilation stacks. The long tunnel option was considered to have the potential to increase congestion on the approaches to the Anzac Bridge, including unacceptable queuing back into the eastbound tunnels.

The slot option could be constructed at a similar cost to the short tunnel; however, it was considered to not provide the same level of traffic benefits as the tunnel option. The construction period for this option would be longer, due to the need to acquire a substantial number of properties. The impacts on the community and traffic on Parramatta Road during construction were also considered to make the slot option less attractive.

#### 2012 original WestConnex slot scheme

The original WestConnex scheme set out in the State Infrastructure Strategy and *WestConnex – Sydney's next motorway priority* (Infrastructure NSW 2012b) comprised a connection between the existing M4 at North Strathfield and Taverners Hill at Petersham.

A key feature of the conceptual scheme was a slotted motorway running parallel to Parramatta Road, to optimise opportunities for urban renewal. **Figure 4.4** provides a conceptual illustration of the proposed slot arrangement as shown in the State Infrastructure Strategy.


**Figure 4.3 2003 M4 East options**

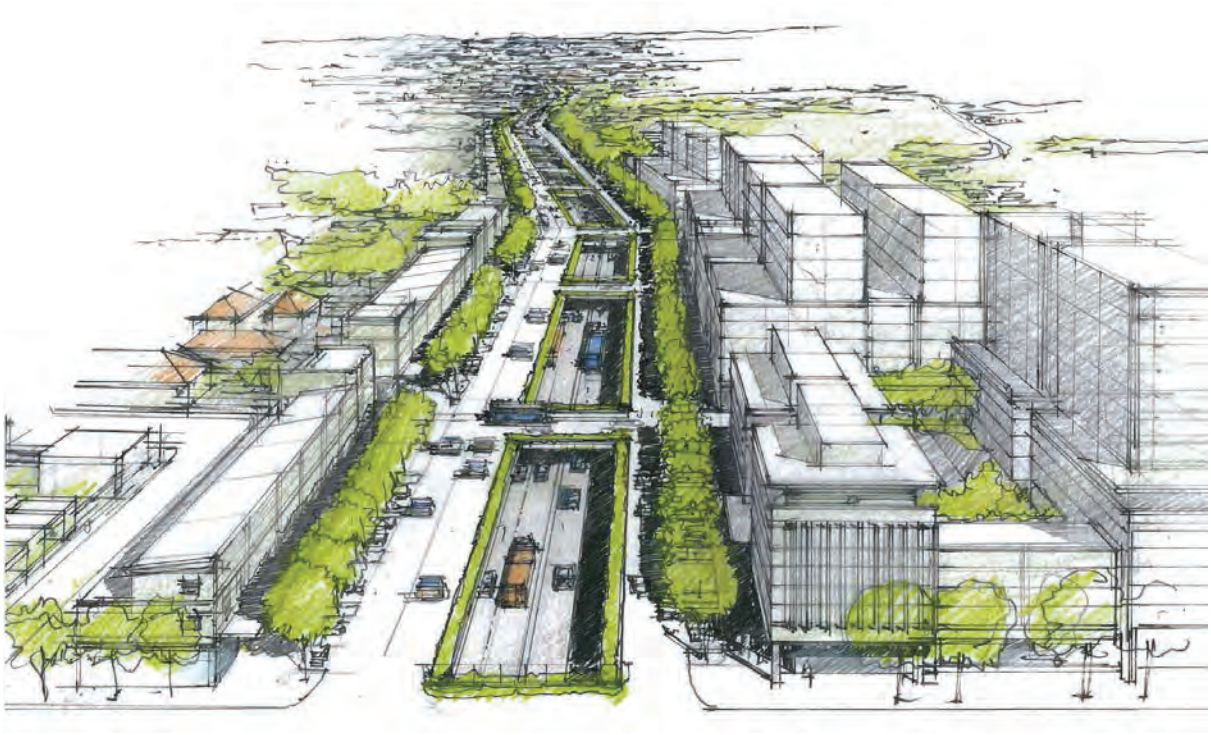


**Figure 4.4 Conceptual illustration of slot option**

Source: Infrastructure NSW 2012a

## 2013 industry partner development

Following the advice of Infrastructure NSW for *"greater private sector involvement at the design phase"* (Infrastructure NSW 2012a), four Australian and international construction industry consortia lead by Ferrovial Agroman, Leighton Contractors, Thiess and Baulderstone/Bouygues were selected as partners to assist with developing improved design and construction solutions for specific sections of WestConnex. Ferrovial Agroman and Leighton Contractors were assigned to the Northern Corridor, from the existing M4 and Parramatta Road at Homebush Bay Drive to Campbell Street at St Peters. Thiess and Baulderstone/Bouygues were assigned to the Southern Corridor, from the M5 to the Airport Link at St Peters.

The purpose of these engagements was to ensure that a wide variety of efficient and innovative options were identified and considered in the development of WestConnex. Preferred options were subject to multi-criteria analysis and further design refinement using traffic, financial and economic evaluation as part of the development of the 2013 business case.

Following the industry partner development process, the slot option was not preferred due to:

- The extent of property acquisition required
- Complex traffic management and substantial traffic impacts on Parramatta Road during construction
- Difficulties in managing surface water around and over the open slot.

## 2013 WestConnex Business Case

In September 2013, the Sydney Motorways Project Office (then part of Roads and Maritime and the precursor agency to the WestConnex Delivery Authority) released the WestConnex Business Case Executive Summary. The M4 East component of WestConnex was proposed to continue the M4 from Homebush Bay Drive to Parramatta Road and City West Link at Haberfield, by providing a tunnel with three lanes in each direction, generally following the alignment of Parramatta Road.

### 4.3.2 Tunnel corridor options

Three tunnel corridor options were considered and assessed against the project objectives:

- Generally following the alignment of Parramatta Road. This option was included in the concept design that was publicly displayed between 2013 and February 2014
- North of Parramatta Road for the full length of the project
- Generally south of Parramatta Road, except for a section at the western end.

The advantages and disadvantages of these options are outlined in **Table 4.2**.

**Table 4.2 Advantages and disadvantages of tunnel corridor options**

| Option | Advantages | Disadvantages |
|---|---|---|
| Following Parramatta Road | • Construction impacts of tunnelling would occur beneath commercial and industrial properties<br>• Ground conditions are expected to be suitable for tunnelling. | • Tunnels below Parramatta Road would restrict the depths to which buildings could be constructed, in particular basements or footings for taller buildings<br>• This would restrict opportunities for urban revitalisation and improved liveability along and around Parramatta Road. |
| North of Parramatta Road | • Tunnels would be shorter, which would reduce construction cost<br>• Tunnels would not cross beneath Parramatta Road, preserving the corridor for future urban renewal. | • Ground conditions are expected to be unsuitable for tunnelling, because of:<br>– Less stable rock<br>– Higher groundwater inflows<br>– Landfilling that has historically occurred in a number of areas including near Concord Oval. |
| Generally south of Parramatta Road | • Tunnels would be shorter, which would reduce construction cost<br>• Tunnels would only cross beneath Parramatta Road for a short distance, preserving the majority of the corridor for future urban renewal<br>• Ground conditions are expected to be favourable for tunnelling, which would allow for quicker construction and lower risks associated with tunnelling activities. | • Construction impacts of tunnelling would occur beneath residential properties. |

Positioning the tunnels generally to the south of Parramatta Road was preferred as ground conditions are generally considered to be better, which would allow for quicker construction and lower risks associated with tunnelling activities. This option would also result in a shorter tunnel length, which would in turn reduce construction cost.

The positioning of the tunnels south of Parramatta Road would also preserve the corridor for future development as part of the Parramatta Road urban renewal strategy. This would allow development along the majority of Parramatta Road to occur without the restriction of a tunnel below.

### 4.3.3 Number of lanes within tunnels

Three options were considered for the number of lanes within the tunnels, and assessed against the project objectives:

- Two lanes

- Three lanes. This option was included in the concept design that was publicly displayed between 2013 and February 2014
- Four lanes.

The advantages and disadvantages of these options are outlined in **Table 4.3**.

**Table 4.3 Advantages and disadvantages of tunnel lane number options**

| Option | Advantages | Disadvantages |
|---|---|---|
| Two lanes | • Reduced tunnel width would be cheaper to build. | • Not considered adequate to carry the expected traffic volumes<br>• Costly and disruptive upgrading to three lanes would likely be required not long after the project opened. |
| Three lanes | • Would match the number of lanes on the existing M4 at Concord and Parramatta Road at Haberfield/Ashfield<br>• Would cater for projected initial and future traffic volumes within the tunnel. | • Wider tunnel, which would be more expensive to build (but not as expensive as a four lane tunnel). |
| Four lanes | • Would allow for considerable capacity in the event of increases in traffic volume | • Wider tunnel, which would be more expensive to build<br>• Would result in bottlenecks at the eastern tunnel portals, as above ground infrastructure is unlikely to be greater than three lanes in each direction. |

The construction of three lanes in each direction within the tunnels was the preferred option, as it would match the number of lanes on the existing M4 at Concord and on Parramatta Road at Haberfield/Ashfield. It would cater for projected initial and future traffic volumes within the tunnel (refer to **Chapter 8** (Traffic and Transport)).

### 4.3.4 Preferred motorway option

Having considered the motorway options against the project objectives, the preferred motorway option is for a three-lane tunnel located generally on the southern side of Parramatta Road.

## 4.4 Interchange options

### 4.4.1 Western tunnel portals

#### Options considered

The following options were considered for the western tunnel portals:

- Option H1 – Concord Road interchange: This would have involved duplicating the existing M4 viaduct between Underwood Road at Homebush and Queen Street at North Strathfield. The western tunnel portals would form part of the Concord Road interchange
- Option H2 – west of Homebush Bay Drive: This option would involve locating the western tunnel portals on the western side of Homebush Bay Drive
- Option H3 – east of Homebush Bay Drive: This option would involve locating the western tunnel portals between Homebush Bay Drive and Powells Creek, but as a separate interchange to the Concord Road interchange. This option would allow all movements to and from both the existing M4 and Homebush Bay Drive into the mainline tunnels. This option was included in the concept design that was publicly displayed between 2013 and February 2014.

The general location of these portal options is shown on **Figure 4.5**.

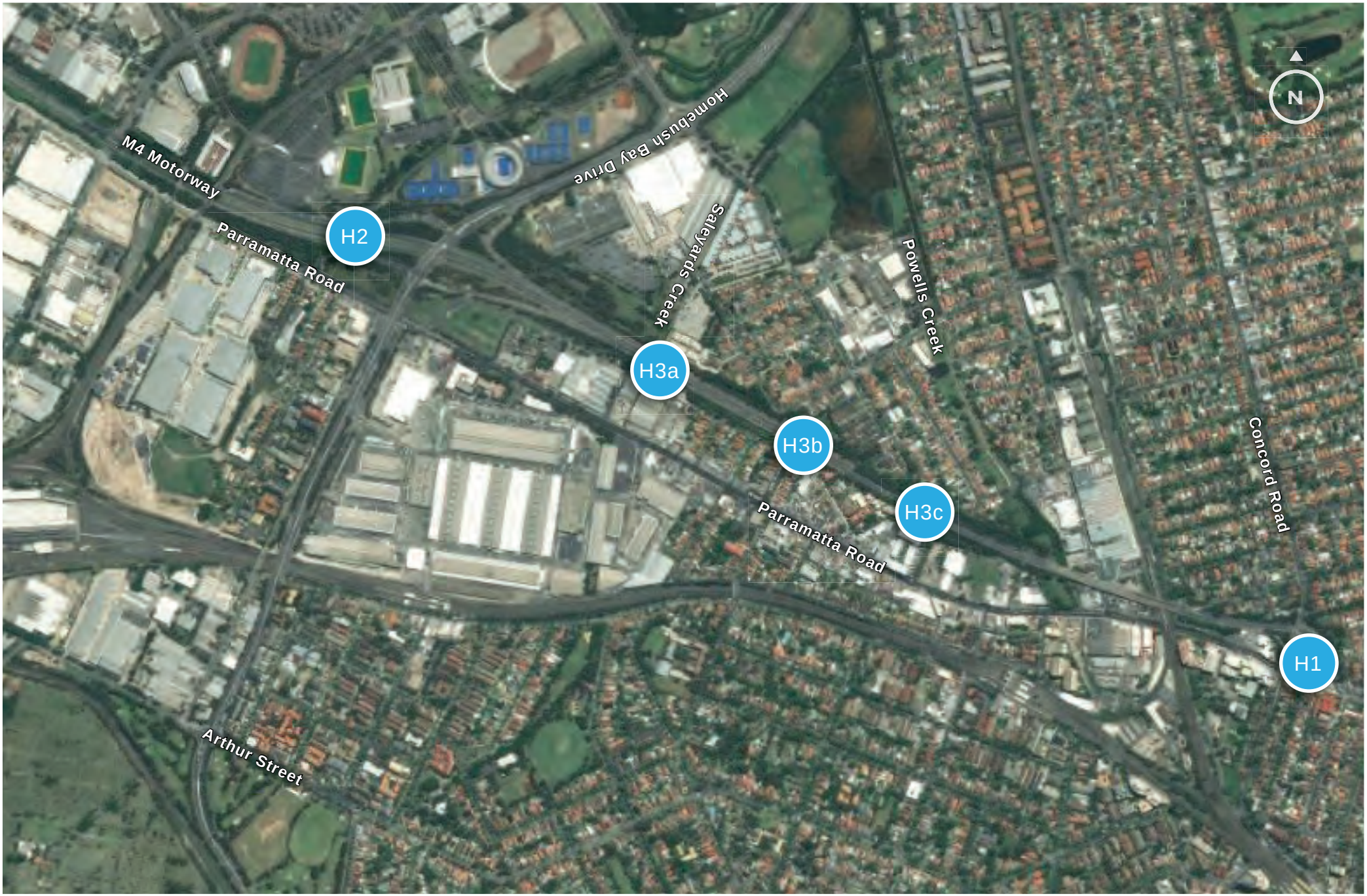



**Figure 4.5 Western tunnel portal options**

## Assessment of options

The advantages and disadvantages of these options are outlined in **Table 4.4**.

**Table 4.4 Advantages and disadvantages of western tunnel portal options**

| Option | Advantages | Disadvantages |
|---|---|---|
| H1 | • There would be cost savings as a result of integrating the western tunnel portals with the Concord interchange. | • Grades into the tunnel would have been greater than six per cent, which is considered too steep, and would have required substantial cut and cover tunnel sections, with associated significant impacts on residential properties on the eastern side of Concord Road<br>• Duplicating the existing M4 viaduct would limit future development potential of land at Railway Lane and George Street (Bakehouse Quarter)<br>• Construction staging in the vicinity of Concord Road while maintaining existing high traffic volumes would have been complex and would have had significant traffic impacts<br>• Concord Road would likely need to be widened, with associated impacts on residential properties. |
| H2 | • Surrounding development comprises Sydney Olympic Park and industrial development, and construction and operation impacts of the portals would avoid residential areas. | • This option would not allow traffic from the key centres of Sydney Olympic Park and Rhodes to access the M4 East tunnels<br>• It would have lengthened the tunnel, increasing cost. |
| H3 | • Grade and impacts on residential properties east of Concord Road would be minimised<br>• Future development potential of land at Railway Lane and George Street would not be restricted<br>• Traffic would be able to connect to the key centres of Sydney Olympic Park and Rhodes. | • Assuming a Concord interchange is also provided (see **section 4.4.2**), there would be two interchanges within less than two kilometres. |

## Preferred option

Option H3, locating the western portals east of Homebush Bay Drive, was selected as the preferred option, as it would:

- Minimise grade and impacts on residential properties east of Concord Road
- Not limit future development potential of land at Railway Lane and George Street
- Connect to the key centres of Sydney Olympic Park and Rhodes.

## Location refinement

Once Option H3, between Homebush Bay Drive and Powells Creek, was selected as the preferred western portal option, a number of design refinements were considered for the location of the portals, including:

- H3a – near Saleyards Creek

- H3b – near Bill Boyce Reserve at Wentworth Avenue and Pomeroy Street
- H3c – near Underwood Road.

The general location of these is shown on **Figure 4.5**. The selected design refinement was H3b, which is a location to the east of Saleyards Creek, about near the footbridge over the existing M4. This location was selected because it would:

- Avoid areas of flood inundation near Saleyards Creek
- Maintain the existing pedestrian bridge across the M4
- Not affect Wentworth Road South or Pomeroy Street on the northern side of the existing M4
- Allow the tunnel to be far enough below ground so as to not prevent high density development within the Bakehouse Quarter due to potential basements or building footings
- Utilise land within the existing M4 road reserve.

### 4.4.2 M4 westbound access options

#### Options considered

The following options were considered for access to the M4 westbound:

- Option OR1 – retain the existing arrangement: This option would involve retaining the westbound on-ramp to the M4 from Concord Road northbound, retaining the left turn from Parramatta Road eastbound to the M4 westbound, and not providing a new on-ramp
- Option OR2 – remove the westbound on-ramp to the M4 from Concord Road northbound and the left turn from Parramatta Road eastbound to the M4 westbound, and not provide a new on-ramp: Traffic would be required to access the M4 westbound by either approaching the Parramatta Road and M4 intersection from the east, or using the Homebush Bay Drive interchange
- Option OR3 – at the intersection of Parramatta Road and Station Street: This option would involve removing the westbound on-ramp to the M4 from Concord Road northbound and the left turn from Parramatta Road eastbound to the M4 westbound, and providing a new westbound on-ramp at the intersection of Parramatta Road and Station Street at Homebush
- Option OR4 – immediately to the west of Powells Creek: This option would involve removing the westbound on-ramp to the M4 from Concord Road northbound and the left turn from Parramatta Road eastbound to the M4 westbound, and providing a new westbound on-ramp to the west of Powells Creek.

#### Assessment of options

The advantages and disadvantages of these options are outlined in **Table 4.5**.

**Table 4.5 Advantages and disadvantages of M4 westbound on-ramp options**

| Option | Advantages | Disadvantages |
|---|---|---|
| OR1 | • This option requires no changes to the existing arrangement and is cost neutral. | • The performance of the intersection of Parramatta Road, Concord Road and Leicester Avenue at North Strathfield would decline further, resulting in increased significant delays. |

| Option | Advantages | Disadvantages |
|---|---|---|
| OR2 | • This option would provide relief to the intersection of Parramatta Road, Concord Road and Leicester Avenue at North Strathfield, by reducing through movements from Leicester Avenue to Concord Road and right turn movements from Parramatta Road to Concord Road<br>• It would be cheaper than options that involve building a new on-ramp. | • Vehicles coming from Leicester Avenue and other areas south of Parramatta Road at North Strathfield and wishing to access the M4 westbound would be required to either:<br>– Travel east via local roads to enter Parramatta Road and turn right at the Parramatta Road and M4 intersection<br>– Travel further west along Parramatta Road and use the Marlborough Road loop road to access the Homebush Bay drive interchange. |
| OR3 | • This option would provide relief to the intersection of Parramatta Road, Concord Road and Leicester Avenue at North Strathfield, by reducing through movements from Leicester Avenue to Concord Road and right turn movements from Parramatta Road to Concord Road | • This option would involve acquisition of privately-owned land, which has recently had development consent granted for a new residential flat building<br>• This option would be more expensive than options that involve not building a new on-ramp. |
| OR4 | • This option would provide relief to the intersection of Parramatta Road, Concord Road and Leicester Avenue at North Strathfield, by reducing through movements from Leicester Avenue to Concord Road and right turn movements from Parramatta Road to Concord Road<br>• This option would not involve acquisition of privately-owned land. | • This option would involve acquisition from Strathfield Council of a small part of the proposed future Arnotts Reserve<br>• It would involve constructing an on-ramp over Powells Creek, which is a concrete channel at this location<br>• This option would be more expensive than options that involve not building a new on-ramp. |

### Preferred option

Option OR4, involving an on-ramp adjacent to Powells Creek, was considered the preferred option as it would:

- Provide relief to the intersection of Parramatta Road, Concord Road and Leicester Avenue at North Strathfield
- Provide an alternate access to the M4 westbound within close proximity to the existing accesses, so as to not significantly increase travel time and affect network performance in other locations
- Not involve acquisition of privately-owned land.

### Location refinement

As a number of options in different locations were considered for the M4 westbound on-ramp, there was no need to consider location refinements during preferred design development.

## 4.4.3 Concord interchange

### Options considered

The following options were considered for an interchange at or near Concord:

- Option C1 – no interchange: This option would involve having no interchange between the western portals and Wattle Street/Parramatta Road
- Option C2 – interchange on Parramatta Road near Wentworth Road: This option would involve providing an interchange on Parramatta Road near Wentworth Road at Strathfield and Shaftesbury Road at Burwood. This option would have provided an eastbound on-ramp and a westbound off-ramp

- Option C3 – interchange on Parramatta Road near Shaftesbury Road: This option would involve providing an interchange on Parramatta Road near Shaftesbury Road at Burwood. This option would have provided an eastbound on-ramp and a westbound off-ramp
- Option C4 – Concord Road: This option would involve providing an interchange at Concord Road, with an eastbound on-ramp and a westbound off-ramp. Movements to and from the existing M4 would be maintained. This option was included in the concept design that was publicly displayed between 2013 and February 2014.

The general location of these interchange options is shown on **Figure 4.6**.

### Assessment of options

The advantages and disadvantages of these options are outlined in **Table 4.6**.

**Table 4.6 Advantages and disadvantages of Concord interchange options**

| Option | Advantages | Disadvantages |
|---|---|---|
| C1 | • There would be cost savings as a result of not having an interchange at Concord as well as the western portals. | • This option would restrict access from the key centres of Strathfield and Rhodes to the M4 East tunnels, and would therefore not provide adequate transport connectivity to these centres. |
| C2 | • This option would involve only minimal impact on residential properties. | • This option would require very long on- and off-ramps due to topography<br>• This would have substantial impacts on commercial and industrial properties along Parramatta Road. |
| C3 | • This option could utilise a construction access tunnel excavated to access the mainline tunnels at Cintra Park for the on- and off-ramps, which would reduce property impacts and provide cost savings | • The proximity of the on-ramp connections to Wattle Street and Parramatta Road would have presented problems for the safe movement of vehicles entering or exiting at this location. The end of the on-ramp at this location would have been too close to the Wattle Street and Parramatta Road off-ramp, requiring vehicles to perform unsafe weave movements. |
| C4 | • This option would provide access from the key centres of Strathfield and Rhodes to the M4 East tunnels, and would therefore provide adequate transport connectivity to these centres | • There would be impact on residential properties. |

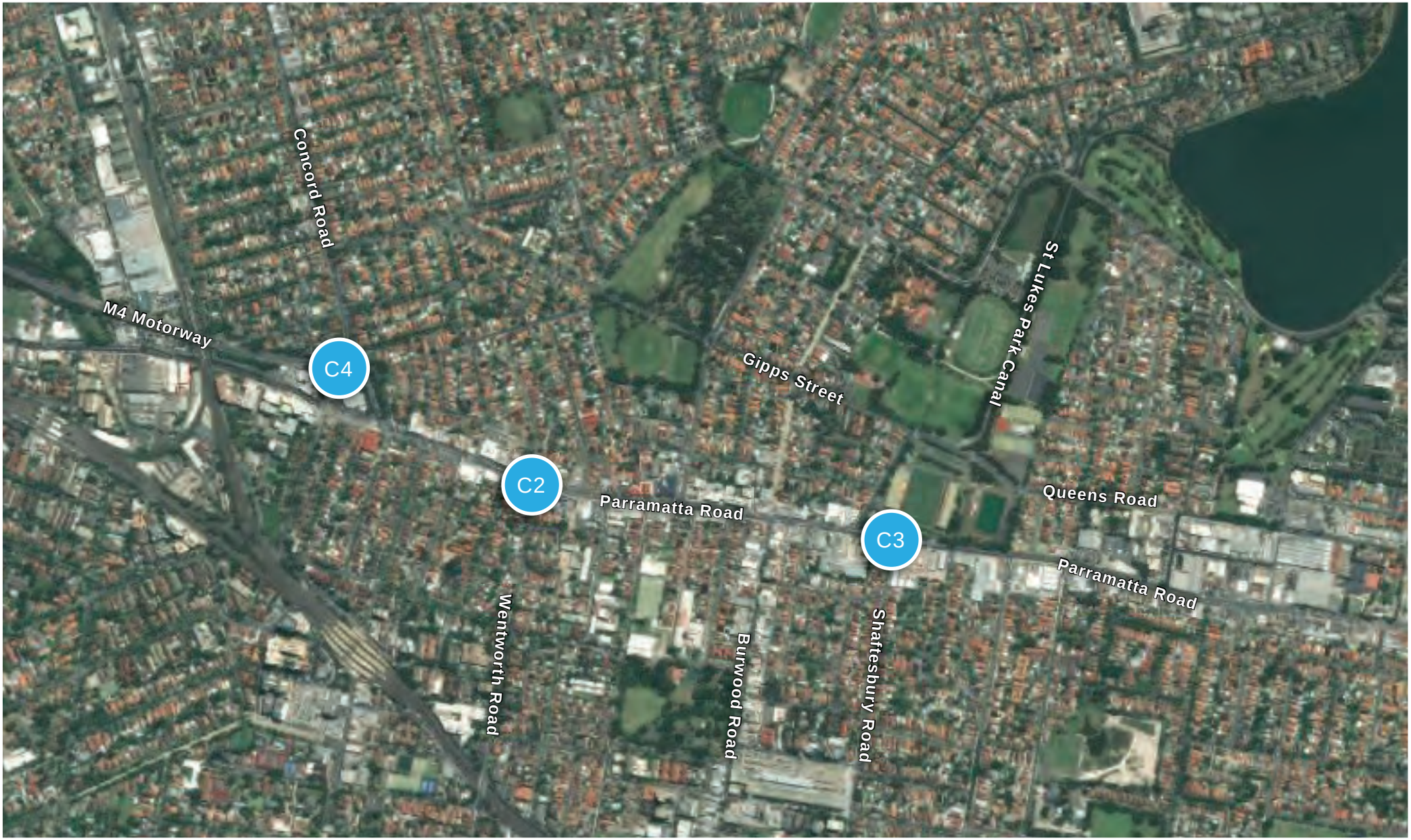
### Preferred option

Option C4, involving an interchange at Concord Road, was considered the preferred option as it would:

- Provide access to the key centres of Strathfield and Rhodes
- Not involve substantial impacts to commercial and industrial properties on Parramatta Road
- Not involve unsafe weave movements within the tunnel.

### Location refinement

Once Option C4 was selected as the preferred interchange option at Concord, a number of refinements were considered for the location and design of the interchange. The general location of these is shown on **Figure 4.6**.




C1 Option C1 involves no interchange between the western tunnel portals and Wattle Street

**Figure 4.6 Concord interchange options**

Two main designs for the interchange and locations of the on- and off-ramp portals were considered:

- C4a – mostly on the western side of Concord Road, including:
  - New northbound and southbound on-ramps connecting Concord Road to the eastbound tunnel
  - New northbound and southbound off-ramps connecting the westbound tunnel to Concord Road
  - Widening of Concord Road at the on- and off-ramps
  - Realignment of the existing M4 between Sydney Street and Parramatta Road
- C4b – mostly on the eastern side of Concord Road, including:
  - New eastbound on-ramp and westbound off-ramp connecting the new tunnels to Concord Road (via Sydney Street)
  - New westbound exit to Parramatta Road via the existing M4, including modification of the M4 between the Concord Road overbridge and Parramatta Road intersection, and lane changes on Parramatta Road
  - Widening of Concord Road to provide extra turning lanes into Sydney Street for the new eastbound on-ramp.

Location C4b would result in acquisition of a large number of properties to the east of the existing M4 associated with cut and cover works for connections to the driven tunnels. This location and design would have resulted in a number of residential properties in Ada Street and Franklyn Street being separated from the remainder of the residential area and facilities such as schools located to the north of Sydney Street. The physical barrier created by the cut-and-cover tunnels would have resulted in impacts on pedestrian connectivity. This concern was raised by a number of residents during early consultation activities for the project. Option C4b was the arrangement included in the concept design that was publicly displayed between 2013 and February 2014.

Location C4a was preferred as it would reduce the length of cut-and-cover tunnels and the number of properties to be acquired on the eastern side of Concord Road. It would, however, increase the number of properties to be acquired on the western side of Concord Road, including a number of heritage items and other dwellings located within a heritage conservation area. Location C4a would also provide connections between the tunnels and Concord Road as left-in and left-out only, which would result in improved traffic performance along Concord Road and at the intersection of Concord Road/Leicester Avenue and Parramatta Road.

As a further design refinement at Location C4a, the existing westbound on-ramp from Concord Road northbound to the M4 would be removed and replaced with a new westbound on-ramp about 500 metres to the west, near Powells Creek. In addition, a new westbound on-ramp would be provided from Concord Road southbound to the M4 westbound. These new ramps would reduce the volume of traffic using the Concord Road/Leicester Avenue and Parramatta Road intersection, and the existing M4 and Parramatta Road intersection.

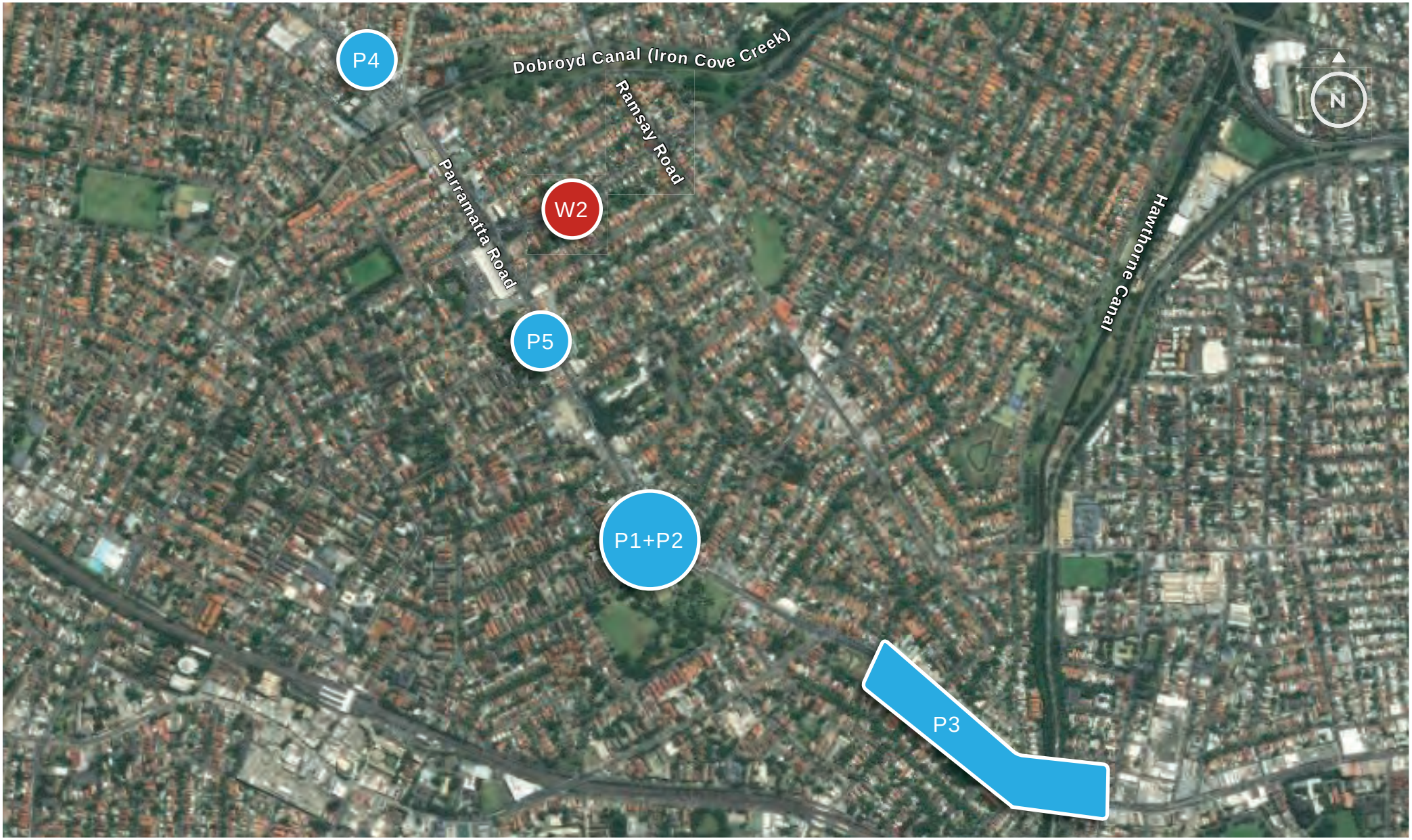
### 4.4.4 Wattle Street (City West Link) interchange

#### Options considered

The following options were considered for an interchange at or near Wattle Street (City West Link):

- Option W1 – no interchange: This would involve not providing an interchange to Wattle Street (City West Link), and would mean there would only be an interchange to Parramatta Road at the eastern end of the project
- Option W2 – interchange at Wattle Street (City West Link): This option would involve providing on- and off-ramps from the mainline tunnels to Wattle Street (City West Link). This option was included in the concept design that was publicly displayed between 2013 and February 2014.

The general location of these interchange options is shown on shown on **Figure 4.7**.




W1 Option W1 involves no interchange on Wattle Street (City West Link)

**Figure 4.7 Wattle Street and Parramatta Road interchange options**

### Assessment of options and preferred option

The State Infrastructure Strategy proposed a Western Harbour Tunnel that would connect Rozelle with the Warringah Freeway on the lower north shore. It would relieve pressure on the Harbour Bridge, the Anzac Bridge and the Eastern Distributor, and would complement and strengthen the benefits of the WestConnex scheme. As a result, rather than travel under Parramatta Road, the concept alignment of the M4–M5 Link was modified to travel north, connecting to the Western Harbour Tunnel, before turning south and connecting to the New M5 at St Peters.

This change in alignment of the M4–M5 Link meant that a connection to Wattle Street (City West Link) was required. Therefore Option W1 was not considered further, and Option W2 was the preferred option.

### Location refinement

Once Option W2 was selected as the preferred interchange option at Wattle Street, a number of refinements were considered for the design of the interchange. The location of the on- and off-ramp portals for all design refinements was near Ramsay Street.

The following design options for the interchange were considered:

- W2a – eastbound off-ramp and westbound on-ramp only, to be constructed as part of the project
- W2b – eastbound off-ramp and westbound on-ramp, as well as eastbound on-ramp to and westbound off-ramp from the M4–M5 Link, to be constructed as part of the project.

Design refinement W2b was preferred, as it would involve all infrastructure associated with the WestConnex scheme (both M4 East and the M4−M5 Link) near Wattle Street and Ramsay Street being constructed at the same time, reducing the impacts of construction in this area.

## 4.4.5 Parramatta Road interchange

### Options considered

The following options were considered for an interchange at Parramatta Road:

- Option P1 – interchange with M4 East near Ashfield Park: This option would provide an eastbound off-ramp and westbound on-ramp near Ashfield Park
- Option P2 – interchange with M4 East and M4–M5 Link near Ashfield Park (the same location as Option P1): This option would provide an eastbound off-ramp and westbound on-ramp, as well as an eastbound on-ramp to and westbound off-ramp from the M4–M5 Link near Ashfield Park, to be constructed as part of the project. This option was included in the concept design that was publicly displayed between 2013 and February 2014
- Option P3 – interchange with M4 East and M4–M5 Link at Taverners Hill: This option would provide an eastbound off-ramp from and westbound on-ramp to the M4 East near Sloane Street at Haberfield/Summer Hill, as well as an eastbound on-ramp to and westbound off-ramp from the M4–M5 Link near Flood Street at Leichhardt, to be constructed as part of the project. This option would include either a tunnel to Flood Street or a substantial viaduct from Haberfield Road to Flood Street, over Hawthorne Canal, connecting the project to the M4–M5 Link
- Option P4 – interchange with M4 East and M4–M5 Link west of Wattle Street: This option would provide an eastbound off-ramp and westbound on-ramp, as well as an eastbound on-ramp to and westbound off-ramp from the M4–M5 Link on the western side of Wattle Street, to be constructed as part of the project. This option was considered in conjunction with Option W1, which did not include an interchange at Wattle Street (City West Link)
- Option P5 – interchange with M4 East near Bland Street: This option would provide an eastbound off-ramp and westbound on-ramp near Bland Street. On- and off-ramps to and from the M4–M5 Link would not be provided under this option.

The general location of these interchange options is shown on **Figure 4.7**.

## Assessment of options

The advantages and disadvantages of these options are outlined in **Table 4.7**.

**Table 4.7 Advantages and disadvantages of Parramatta Road interchange options**

| Option | Advantages | Disadvantages |
|---|---|---|
| P1 and P2 | • The topography at this location is favourable and would mean that on- and off-ramps would require relatively low grades. | • This option would affect Ashfield Park (locally listed heritage item) and the Yasmar Estate (State listed heritage item)<br>• A number of local roads would be closed where they currently connect to Parramatta Road, reducing local connectivity<br>• A number of commercial and industrial properties on the northern side of Parramatta Road would be affected. |
| P3 | • Locating the interchange further east at Taverners Hill would remove the need for an interchange on Parramatta Road near Wattle Street, and provide cost savings. | • This option would have lengthened the tunnel by about one kilometre<br>• It would involve an indirect connection from Taverners Hill to the proposed Western Harbour Tunnel, which would have further lengthened the tunnel<br>• A viaduct would have significant visual impacts, |
| P4 | • The tunnels would be slightly shorter, representing represented a minor cost saving for the M4 East component of WestConnex. | • This option would have resulted in significant and unacceptable traffic impacts at the Wattle Street/Parramatta Road/Frederick Street intersection, particularly during the morning and afternoon peaks<br>• There would be issues with vehicles queuing back into the tunnel during the morning peak. |
| P5 | • This option would not affect Ashfield Park (locally listed heritage item) or the Yasmar Estate (State listed heritage item)<br>• No local roads would be permanently closed at Parramatta Road, maintaining local connectivity. | • A number of commercial and industrial properties on the southern side of Parramatta Road would be affected<br>• There would be issues with vehicles queuing back into the tunnel during the morning peak. |

## Preferred option

Option P5, involving an interchange near Bland Street, was considered the preferred option. It would not involve impacts on Ashfield Park and Yasmar, and would not create unacceptable traffic impacts on the Wattle Street/Parramatta Road/Frederick Street intersection. The change in alignment of the M4–M5 Link to connect with the proposed Western Harbour Tunnel removed the need to provide an eastbound on-ramp or westbound off-ramp at this location.

## Location refinement

As a number of options in different locations were considered for the Parramatta Road interchange, there was no need to consider location refinements for the preferred Parramatta Road interchange option during concept design development.

## 4.5 Design development of ancillary facilities

### 4.5.1 Ventilation system design

On an open roadway, vehicle emissions are diluted and dispersed by natural surface flows. A tunnel is defined in NSW as an enclosed roadway that is greater than 120 metres in length and all 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.

The basic function of tunnel ventilation is the dilution of vehicle emissions by providing fresh air to, and removing exhaust air from, the tunnel. 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 500 metres long, this volume of fresh air is usually adequate to manage in-tunnel air quality. In longer tunnels, under some circumstances, additional air may need to be forced through the tunnel by fans to dilute emissions and maintain appropriate air quality.

The requirements for tunnel ventilation are determined by the vehicle emissions in the tunnel and the limits of pollutant levels set by regulatory authorities. The levels of pollutants increase along the length of the tunnel as vehicles generate emissions as they travel through the tunnel. Air quality is managed by ensuring that the volume of fresh air coming into the tunnel adequately dilutes the pollutants. For longer tunnels the flow of fresh air can be supplemented where required by ventilation fans or by air exchanges which remove exhaust air and/or supplies additional fresh air depending on tunnel size and length and number and mix of vehicles. Elevated ventilation outlets are used for longer tunnels in urban areas to disperse tunnel air to protect local air quality.

A number of options for design of the ventilation system were considered. The advantages and disadvantages of the various systems are described below, and shown in **Figure 4.8**. Further discussion on the ventilation system can be found in **Chapter 9** (Air quality).

#### Longitudinal ventilation

The simplest form of ventilation 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 into the outside air. All road tunnels built in Australia in the last 20 years have been designed and operated with longitudinal ventilation systems.

#### Transverse ventilation

Another way to ensure adequate dilution of emissions is to provide fresh air inlets along the length of the tunnel along the side and to balance the amount of air coming in, outlets on the opposite of the side. This system requires two ducts to be constructed along the length of the tunnel: one for the fresh air supply and for the exhaust air. Transverse ventilation has been used in the past when vehicle emissions produced greater levels of pollutants than they do today in Australia. 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 at controlling smoke in the tunnel in case of a fire.

#### 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.

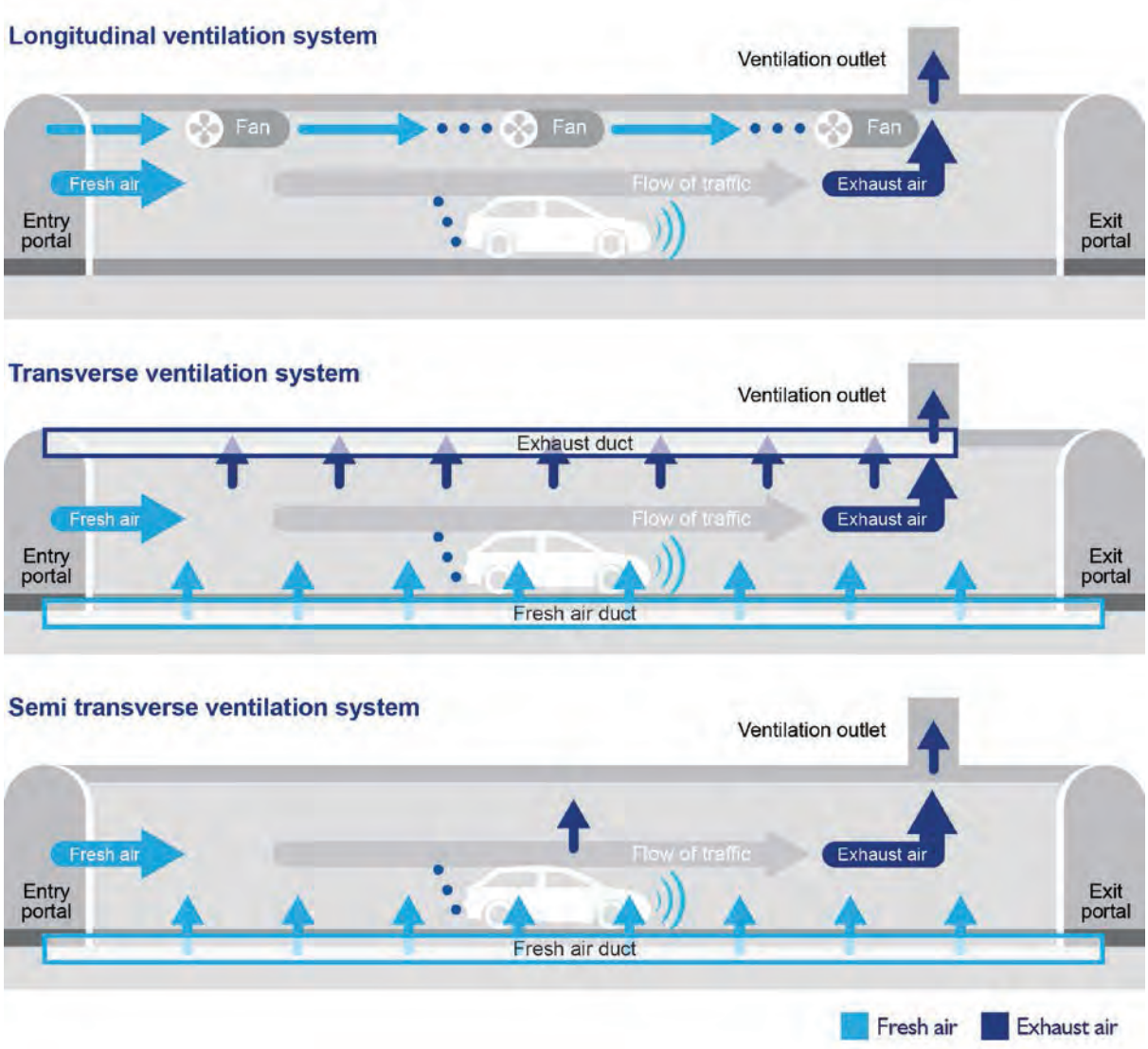



**Figure 4.8 Ventilation system design options**

## Ventilation outlets

Currently a key operating requirement for the longer tunnels opened in Sydney since 2000, is to minimise emissions through the portals, or tunnel entrances. Essentially this means that the ventilation systems are designed to have zero portal emissions with all air being expelled through an elevated ventilation outlet. Air is drawn in from all the portals, including the exit portals where it is drawn against the flow of traffic. The ventilation system is more complex than it would be if portal emissions were permitted with more fans required and 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 significantly increase the diameter of the outlet required. Zero portal emissions also means that the ventilation system needs to be operating all the time regardless of whether in-tunnel or ambient air quality warrants this operation.

## Summary

The development of cleaner vehicles in response to cleaner fuel and emissions standards means that a significant reduction in vehicle emissions has occurred over the past 20 years. 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 now easily maintain acceptable air quality in long tunnels and is considered the most efficient and effective tunnel ventilation system (Roads and Maritime 2014c).

Although all three ventilations systems could be designed to ensure that in-tunnel air quality criteria would be met, a longitudinal system has been selected for the project. Longitudinal ventilation is less costly to construct and to operate than transverse systems and, importantly for fire and life safety, is more effective for management of smoke in a tunnel.

Discharging tunnel air through an elevated ventilation outlet ensures that it is dispersed and diluted so that there is minimal or no effect on ambient air quality. 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.

The preferred ventilation system is longitudinal ventilation with elevated ventilation outlets.

### 4.5.2 Ventilation facility locations

The main considerations in relation to ventilation facilities are; 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 and is relatively insensitive to the location of the outlet for similar landform and surrounding development. The location of road tunnel ventilation outlets is very important for the efficiency of the tunnel ventilation system.

#### Background and design considerations that affect location

As described in **section 4.5.1**, vehicles travelling through tunnels create a piston effect, whereby the movement of vehicles draws air into the tunnel system through the entrance portals, with emission levels rising toward the tunnel exit in a tunnel with longitudinal ventilation as proposed for the project. A longitudinal system relies on single directional traffic flow, and therefore separate tunnels for eastbound and westbound traffic would be required. This also results in the need for a ventilation outlet at each end of the project, with at least one outlet for each tunnel.

No portal emissions are proposed for the project. This is unique to recent Australian road tunnels, with no international precedence for this approach to ventilation design. Zero portal emissions essentially requires that no air (polluted or otherwise) can be allowed to exhaust from the tunnel exit portals (or entry portals). This affects the design and location of the ventilation exhaust points and outlets.

The ventilation outlet needs to be located close to but not at the end of the tunnel exit portals. This is to allow some air to be drawn into the portals against the traffic flow. This forced reverse flow is achieved by jet fans positioned within the tunnel. Minimising the use of these fans increases the performance of the tunnels, reduces operational power consumption and thus reduces the cost associated with operation. This also has environmental benefits, by reducing greenhouse gas emissions associated with energy generation.

#### Western ventilation facility

The western ventilation facility would be located above the cut-and-cover section of the westbound mainline tunnel west of Underwood Road, avoiding the need for additional property acquisition. The requirement for zero portal emissions means that the ventilation outlet cannot be located right at the portal, because of the difficulty this would cause for managing air flow at this location. The location of the western ventilation facility is 200 metres from the western tunnel exit portal, optimising the distance over which air is drawn back from the portal while ensuring that there would be zero portal emissions. It would also not be possible to locate the facility closer to the tunnel portal given the presence of surface road infrastructure at this location.

The location of the western ventilation facility has also considered the potential future high rise residential redevelopment at Homebush north of the M4, which is contemplated in the *New Parramatta Road: Draft Parramatta Road Urban Renewal Strategy* (UrbanGrowth NSW 2015).

Potential alternative locations for the western ventilation facility were considered as follows:

- Above the westbound tunnel further to the west – while this would be closer to the tunnel exit portal, it would conflict with the realigned surface M4 in this location. As described above, it is not possible to locate the exhaust point at the end of the tunnel exit portal

- Above the westbound tunnel further to the east – this would increase the distance from the tunnel exit portal, and would require additional reverse flow jet fans to draw the air back to the ventilation outlet
- At one of the sites near Underwood Road proposed to be used as a construction ancillary facility (refer to **Chapter 6** (Construction work)) – these sites would be closer to a greater number of residential dwellings, and would increase the distance from the tunnel exit portal, requiring additional jet fans.

It was therefore considered that there are no other feasible and reasonable alternatives for the location of the western ventilation facility.

On this basis, the preferred option for the western ventilation facility was selected as above the cut-and-cover section of the westbound mainline tunnel west of Underwood Road. This location was considered to best meet the main considerations of minimising local air quality impacts on nearby receptors and maximising the operational efficiency of the tunnel ventilation system.

## Eastern ventilation facility

### *Number of ventilation outlets*

The design of the eastbound tunnel and ventilation facility has been determined by the requirement for:

- Eastbound exit portals to Wattle Street and Parramatta Road
- A possible future connection to the M4–M5 Link
- A possible future westbound exit onto Wattle Street from the M4–M5 Link.

This results in the need for five ventilation exhaust points, one for each off-ramp and two at the M4–M5 Link interface (one for each direction). The number of outlets is determined by the road geometry not the level of pollutants in the tunnel.

Based on the design considerations that affect the location of ventilation facilities discussed above, it may seem that the most efficient location of the outlets would lead to five separate ventilation outlets. This is not the case for the eastern ventilation facility because of the staging of WestConnex. At the completion of project, all of the air would be required to be exhausted from the Wattle Street and Parramatta Road off-ramps, because the M4–M5 Link would not yet be constructed and all of the traffic will use the off-ramps. Once the M4–M5 Link is complete (if approved), the required capacity of the Wattle Street and Parramatta Road off-ramps to exhaust air from the mainline tunnels would be reduced as the majority of air would continue through the mainline tunnels. Due to the project staging, a combined ventilation outlet for both the M4 East and M4–M5 Link projects would have a total exhaust capacity which is less than the total exhaust capacity if each ventilation outlet was separate. Other advantages include not having to acquire additional land, build separate structures, or provide separate power supply. The disadvantages of a combined outlet are additional underground tunnelling for ventilation ducts and a reduction in air flow efficiency because of these ducts.

Consideration was given to this ventilation facility only servicing the current project only (and not the M4-M5 Link as well). This would have meant that a second, separate ventilation facility would need to be constructed at another location near the M4–M5 Link tunnel portals (if approved), potentially involving additional property acquisition and two separate periods of construction would be required within a few years. This was considered to have an unacceptable impact on residents in this area, and two separate periods of construction would be needed within a few years.

### *Location*

The location of the eastern ventilation facility, on the north-eastern corner of the Wattle Street and Parramatta Road intersection, provides optimal ventilation performance for both the project (including the mainline tunnels and the Wattle Street and Parramatta Road off-ramps) and the M4–M5 Link (including the mainline tunnels and the Wattle Street off-ramp). The air quality assessment (see **Chapter 9**) shows that the ventilation outlet at the proposed location has minimal impact on nearby community receptors such as Haberfield Public School.

Other locations considered for the eastern ventilation facility, and the reasons they were discarded, were:

- On the south-eastern side of the Parramatta Road and Frederick Street intersection (the Bunnings site) – this would have involved impacts on a locally listed heritage item. Consideration was given to incorporating the ventilation outlet within the clock tower at this building; however, it is not sufficiently high or wide to meet operational needs and achieve air quality goals. Bunnings is a major local employer and construction of the ventilation facility at this location would have required acquisition of the property and relocation or closure of the Bunnings store
- On the south-western side of the Parramatta Road and Frederick Street intersection – this would increase the distance from the tunnel exit portals, and would require additional reverse flow jet fans to draw the air back to the ventilation outlet. It would also involve the acquisition of residential properties in Earle Avenue at Ashfield that are located within The Ranch heritage conservation area
- On land identified for use during construction of the project at Northcote Street, west of the Wattle Street intersection – this option would utilise land to be acquired for construction purposes. However this would mean that construction of the ventilation facility could not commence until tunnelling works are complete, extending the duration of construction and delaying project commissioning
- On land identified for use during construction of the project along Parramatta Road, further to the east – this would have been located a significant distance from the Wattle Street on- and off-ramps, resulting in the need to reverse air flow by jet fans through longer sections of tunnel, with increased energy use
- On land identified for use during construction of the project along Wattle Street, further to the north-east – this would have been located a significant distance from the Parramatta Road off-ramp, resulting in the need to reverse air flow by jet fans through longer sections of tunnel with increased energy use.

On this basis, a combined ventilation facility for the project and the possible future M4–M5 Link located on the north-eastern corner of Wattle Street and Parramatta Road was selected as the preferred option. It was considered to best meet the main considerations of minimising local air quality impacts on nearby receptors and maximising the operational efficiency of the tunnel ventilation system. It would also minimise cumulative impacts of construction on the local community.

### 4.5.3 Emergency smoke exhaust facility

A key aspect of safe tunnel operation is the efficient removal of smoke in the event of a fire in the tunnel. One option to achieve this in long tunnels is to provide an emergency smoke exhaust facility.

The need for an emergency smoke exhaust facility was considered during the development of the project. An emergency smoke exhaust facility was included in the preliminary concept design. Following design development and in consultation with relevant agencies (eg Fire & Rescue NSW), such a facility was considered to not be required.

### 4.5.4 Fresh air supply facility

The project includes the construction of a fresh air supply facility in the vicinity of Cintra Park at the mid-point of the tunnels which could potentially reduce the number of jet fans required in the tunnels. This facility would allow fresh air to be introduced into the tunnels. **Table 4.8** outlines the alternative locations that were considered for the location of the fresh air supply facility.

**Table 4.8 Fresh air supply facility location options**

| Location | Advantages | Disadvantages |
|---|---|---|
| Cintra Park | • Land would be acquired for the construction of the project<br>• Would not require acquisition of additional residential or commercial properties<br>• The existing hockey field would be relocated prior to the start of construction. | • Affects the Cintra Park hockey field, however, this would be relocated to St Lukes Park in any case to enable the site to be used as a construction ancillary facility (mid-point tunnel site). |
| Concord Oval | • Located close the mainline tunnels<br>• Would not require the acquisition of additional residential or commercial properties. | • This site would not be required for construction<br>• Concord Oval is a major sporting facility which is important to the region and is used by many sporting clubs. |
| St Lukes Park and Cintra Park north of Gipps Street | • Would not require the acquisition of additional residential or commercial properties. | • These sites would not be required for construction<br>• This option would affect additional open space and sporting facilities, potentially further reducing the amount of open space in the locality<br>• These sites are located a greater distance from the mainline tunnels, making it less efficient to operate. |
| Burwood Bus Depot | • Located close to the mainline tunnels, making the system more efficient to operate<br>• Land is owned by the NSW Government. | • This site would not be required for construction<br>• This is a major bus depot within inner western Sydney and is very important for buses which travel along Parramatta Road<br>• Relocating the depot would be difficult due to land use conflicts associated with such a land use and the additional property acquisition that would be required. |
| Residential and/or commercial properties | • Location can be selected to be directly above the mainline tunnels, making the system more efficient operate. | • Would require acquisition of additional residential and/or commercial properties. |

Cintra Park was considered to be the preferred location for the fresh air supply facility as it would use land that would be acquired for construction of the project. This would minimise the amount of open space, commercial and residential properties acquired by the proposal. The extent of permanent works would not prevent this land would be returned to Canada Bay Council and being used for open space in the future.

### 4.5.5 Motorway control centre

Each WestConnex project would require a control centre to monitor and manage the operation of the motorway and, where relevant, tunnels.

The respective merits of a stand-alone control centre for each stage, or a single control centre for all projects, have been considered. Should the separate components of WestConnex be operated by different operators, a stand-alone control centre for each stage would be preferred. Should WestConnex be operated by a single operator, a combined motorway control centre could be constructed. In this case, the motorway control centre constructed for the M4 East project would be used as a backup facility.

The proposed motorway control centre of the project would be located on the northern side of the existing M4 to the east of Homebush Bay Drive and south of the Ausgrid Mason Park substation. Access to the centre would be from the eastbound M4 on-ramp at Homebush Bay Drive.

This site was considered the best option for the location of the centre as it would make use of residual land that is required during construction but not during operation of the project. This would mean that additional residential, commercial or open space land would not need to be acquired. The location of this residual land adjacent to the M4 and near the eastbound mainline tunnel portal also means that access to the motorway would be readily available for emergency response and maintenance vehicles and equipment that would be stored at the site in the adjoining maintenance facility and bulky equipment store.

## 4.6 Construction methodology development

### 4.6.1 Tunnel construction methods

A number of options for tunnel construction methods were considered. The advantages and disadvantages of the various methods are described below.

#### Tunnel boring machine

A tunnel boring machine (TBM) is a specialist machine which excavates a circular bore of fixed diameter by rotary action. The machine comprises of 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. The TBMs are normally custom made to suit the particular requirement of the individual 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 the drilling of holes, charging the holes with explosive, blasting, mucking out and installing the roof and wall ground support. The method is an efficient and cost effective way of excavation of rock, providing an effective tunnel excavation method assisting in achieving an overall shorter project delivery. This method of excavation offers the shortest exposure to noise and vibration for residents and businesses above the tunnels compared to other methods of tunnel excavation.

#### Road header excavation

A road header is a commonly used machine for excavation in sandstone and has been successfully used in recent tunnel projects in Sydney. It is a specialist tunnelling plant, which 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 special dumpers designed to operate in an underground environment. The excavated material would then be stockpiled near the tunnel access where it would be removed from via truck to disposal or reuse locations. As the excavation advances, 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.

#### Preferred tunnel construction method

A combination of road header excavation and drill and blast was chosen. A heading about six metres high would be excavated with a road header and then a bench of about 1.8 metres deep would be excavated using drill and blast. Ramps would be excavated in two passes with a road header.

The combination of using both road header and drill and blast techniques was selected for the following reasons:

- The combination of methods speeds up excavation compared to work being undertaken solely with the use of road headers

- It is more economic due to reduced time taken for excavation
- It reduces the noise and vibration impacts on residential and commercial properties to shorter periods due to the short impacts associated with blasting
- Geological conditions along the alignment are suitable for both methods to be used.

### 4.6.2 Spoil disposal

Construction of the project would generate around 2.4 million bank cubic metres of spoil. As described in **Chapter 6** (Construction work), spoil reuse and disposal would be prioritised in accordance with the following hierarchy:

- Within the project for earthworks fill
- Environmental works/community works
- Development works/land restoration.

As the project comprises predominantly a road tunnel, there are limited opportunities for use of spoil within the project for earthworks fill. On this basis, **Chapter 6** identifies the currently proposed locations for spoil use and disposal, all of which are in western Sydney. Consideration has been given to the various modes available to transport this spoil to the reuse or disposal location, and included rail, barge and truck. **Table 4.9** outlines the advantages and disadvantages of each of these transport mode options.

**Table 4.9 Spoil disposal transport options**

| Disposal method | Advantages | Disadvantages |
|---|---|---|
| Rail | • Ability to move large volumes of spoil<br>• Reduces the number of heavy vehicles on the wider road network. | • Availability of train paths on the Sydney rail network is limited<br>• Trucks would still be required to transport material to a train loading facility and potentially to its final destination<br>• Infrastructure upgrades at rail yards would be required to allow the loading of material to trains. |
| Barge | • Ability to move large volumes of spoil<br>• Reduces the number of heavy vehicles on the wider road network. | • Trucks would still be required to transport material to a barge loading facility and potentially to its final destination<br>• Infrastructure upgrades would potentially be required to allow the loading of material to a barge<br>• Barges would not be able to travel all the way to the currently proposed spoil re-use and disposal locations. |
| Truck | • Avoids double handling of material, with trucks taking material directly from the project site to its destination. | • Limited to small volumes of spoil in each truck, and therefore there a large number of truck movements would be required. |

Spoil removal and disposal using trucks was considered to be the preferred option as it would involve transporting material from the construction site directly to the final disposal location. This option would streamline the handling of spoil (removes double and potentially triple handling spoil), but would result in a higher number of trucks on the road. This increase in truck numbers is not considered to be any more significant than the alternatives, since other transport options (rail and barging) would still require trucks to initially move material to the loading facility and, potentially, to the final destination.

# 5 Project description

This chapter describes the proposed scope of work, including the route alignment, corridor width, main project elements, ancillary facilities, design standards and construction activities for the M4 East project (the project), which forms part of WestConnex.

Construction details, including construction methodology, construction sites and spoil removal, are described in **Chapter 6** (Construction work).

The Secretary of the NSW Department of Planning and Environment has issued a set of environmental assessment requirements for the project; these are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 5.1** sets out these requirements, and identifies where they have been addressed in this environmental impact statement (EIS).

**Table 5.1 SEARs for the M4 East project – project description**

| Secretary's Environmental Assessment Requirements | Where addressed in EIS |
|---|---|
| A detailed description of the project including: | |
| Proposed route and road treatments | **Chapter 5**, **section 5.4**, **5.5** and **5.9** |
| Design of the:<br>• Tunnels.<br>• Interchanges (including tunnel portals and entry and exit ramps).<br>• Road user, pedestrian and cyclist facilities (including street furniture and lighting). | **Chapter 5**, **section 5.4**<br>**Chapter 5**, **section 5.5**<br>**Chapter 5**, **section 5.8.4** and **5.9** |
| Land use changes including resumption of residential and industrial lands and impacts to Crown Land. | **Chapter 5**, **section 5.11**<br>**Chapter 12** (Property and land use) |
| Location and operational requirements of construction ancillary facilities and access tracks. | **Chapter 6** (Construction work) |
| Relationship and/or interaction with existing public and freight transport services (including rail, bus, water-based traffic, and rail and bus stops). | **Chapter 8** (Traffic and transport) |

The description of the project provided in this chapter describes the key elements of the project based on the preferred design. The preferred design defines a constructible concept that provides:

- A definition of property acquisition requirements sufficient to allow acquisition 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 design of the project would continue to be refined during the detailed design phase and would be guided by the key principles developed during the preferred design and EIS phase. Sufficient flexibility has been provided in the preferred design to allow for refinement during detailed design and in response to any submissions received following the exhibition of this EIS or to minimise environmental impacts. The development of the detailed design would:

- Be consistent with key design parameters as described in this EIS and any subsequent response to submissions or preferred infrastructure report
- Address any unresolved issues associated with the development of the preferred design proposed in this EIS and any subsequent response to submissions or preferred infrastructure report
- Meet any conditions of approval arising from the approval process under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act)
- Avoid identified environmentally sensitive areas wherever possible
- Further develop and refine mitigation measures
- Appropriately develop and incorporate the urban design and landscape strategy for the project
- Establish detailed management plans for construction delivery methods, taking into account:
  - Buildability
  - Traffic capacity
  - Safety during construction
  - Ground conditions
  - Practicality and cost effectiveness
- Apply relevant Roads and Maritime Services (Roads and Maritime) specifications, design requirements, current guidelines and policies
- Address risk management during construction and operation
- Allow for safe and cost-effective maintenance of the project during operation, in accordance with occupational health and safety requirements and relevant Roads and Maritime specifications.

As a result of detailed design, the project that is built could vary from the description presented in this chapter.

## 5.1 The project

The project would comprise the construction and operation of the following key features:

- Widening, realignment and resurfacing of the M4 between Homebush Bay Drive at Homebush and Underwood Road at North Strathfield
- Upgrade of the existing Homebush Bay Drive interchange to connect the western end of the new tunnels to the existing M4 and Homebush Bay Drive, while maintaining all current surface connections
- Two new three-lane tunnels (the mainline tunnels), one eastbound and one westbound, extending from west of Pomeroy Street at Homebush to near Alt Street at Haberfield, where they would terminate until the completion of the possible future M4–M5 Link project (which is subject to planning approval) (M4–M5 Link). Each tunnel would be about 5.5 kilometres long and would have a minimum internal clearance (height) to in-tunnel services of 5.3 metres
- A new westbound on-ramp from Parramatta Road to the M4 at Powells Creek, west of George Street at North Strathfield
- An interchange at Concord Road, North Strathfield/Concord with on-ramps to the eastbound tunnel and off-ramps from the westbound tunnel. Access from the existing M4 to Concord Road would be maintained via Sydney Street. A new on-ramp would be provided from Concord Road southbound to the existing M4 westbound, and the existing on-ramp from Concord Road northbound to the existing M4 westbound would be removed
- Modification of the intersection of the existing M4 and Parramatta Road, to remove the left turn movement from Parramatta Road eastbound to the existing M4 westbound

- An interchange at Wattle Street (City West Link) at Haberfield, with an on-ramp to the westbound tunnel and an off-ramp from the eastbound tunnel. The project also includes on- and off-ramps at this interchange that would provide access to the M4–M5 Link. In addition, the westbound lanes of Wattle Street would be realigned
- An interchange at Parramatta Road at Ashfield/Haberfield, with an on-ramp to the westbound tunnel and an off-ramp from the eastbound tunnel. In addition, the westbound lanes of Parramatta Road would be realigned
- Installation of tunnel ventilation systems, including ventilation facilities within the existing M4 road reserve near Underwood Road at Homebush (western ventilation facility) and at the corner of Parramatta Road and Wattle Street at Haberfield (eastern ventilation facility). The eastern ventilation facility would serve both the project and the M4–M5 Link. Provision has also been made for a fresh air supply facility at Cintra Park at Concord
- Associated surface road work on the arterial and local road network, including reconfiguration of lanes, changes to traffic signalling and phasing, and permanent road closures at a small number of local roads
- Pedestrian and cycle facilities, including the permanent re-routing of part of the existing eastbound cycleway on the northern side of the M4 from west of Homebush Bay Drive to near Pomeroy Street, and a new westbound cycleway on-ramp connection from Queen Street at North Strathfield to the existing M4
- Tunnel support systems and services such as electricity substations, fire pump rooms and tanks, water treatment facilities, and fire and life safety systems including emergency evacuation infrastructure
- Motorway operations complex on the northern side of the existing M4, east of the Homebush Bay Drive interchange
- Provision of road infrastructure and services to support the future implementation of smart motorway operations (subject to separate planning approval)
- Installation of tolling gantries and traffic control systems along the length of the project
- Provision of new and modified noise walls
- Provision of low noise pavement for new and modified sections of the existing M4.

The project does not include work required for reconfiguring Parramatta Road as part of the urban transformation program. The project does not include ongoing motorway maintenance activities during operation. These would be subject to separate assessment and approval as appropriate.

The project assessed in this EIS does not include surveys, sampling or investigation to inform the design or assessment, such as test drilling, test excavations, geotechnical investigations, or other tests. It also does not include adjustments to, or relocation of, existing utilities infrastructure undertaken prior to commencement of construction. These would be subject to separate assessment and approval as appropriate.

An overview of the project at completion is shown in **Figure 5.1**. The following sections describe the features of the project in detail.

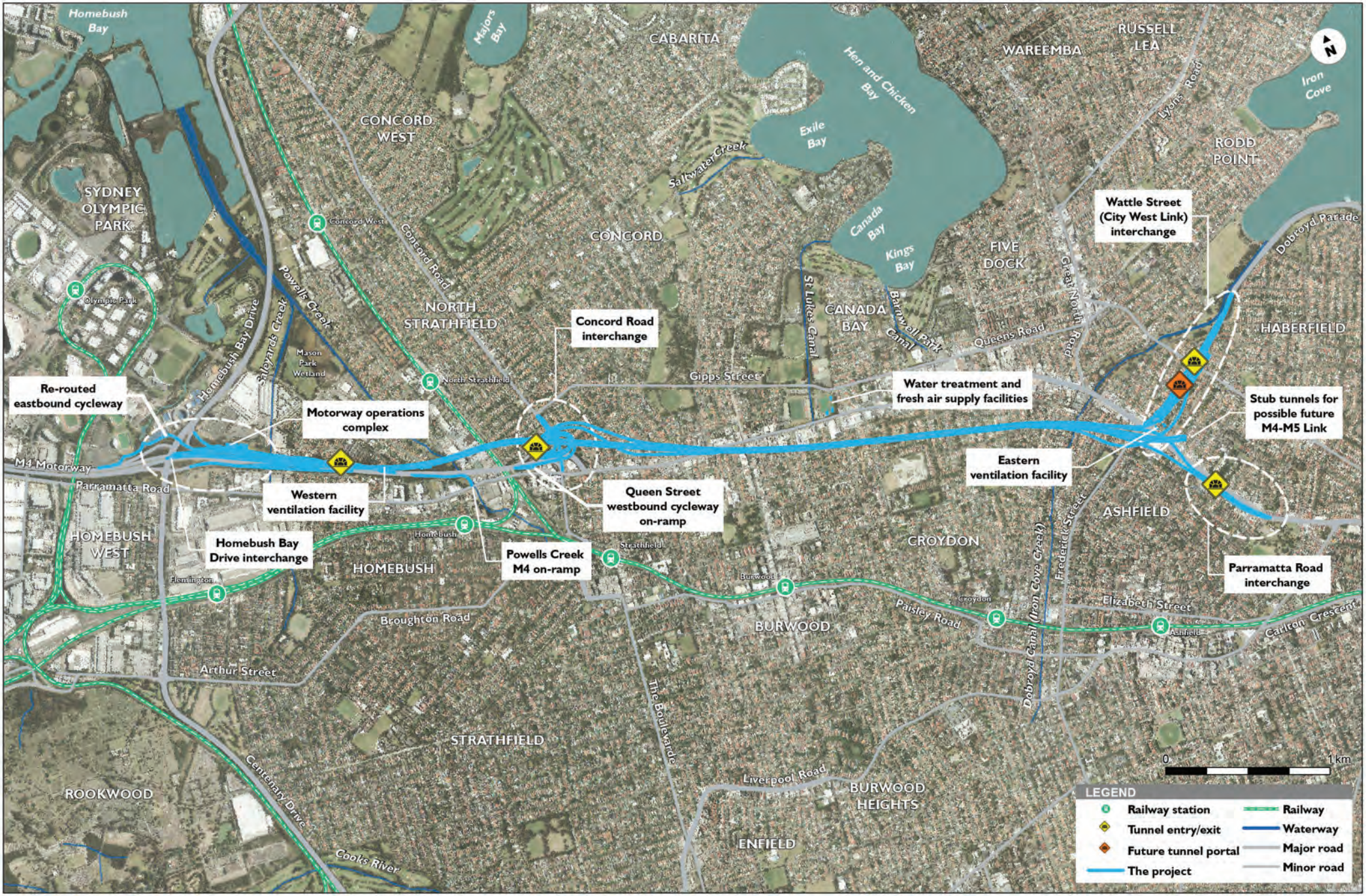



**Figure 5.1 Overview of the project**

## 5.2 Design criteria

### 5.2.1 Design standards

New works will be designed generally in accordance with Australian Standards, Austroads Design Standards, Guides and Codes, and the Roads and Maritime supplements to these documents. Existing roads and structures where no works are proposed as part of the project would not be modified to meet current standards.

Key design standards for the project are outlined in **Table 5.2**.

**Table 5.2 Key design standards**

| Criteria | Mainline tunnels | Surface mainline and M4 | On- and off-ramps | | Local road connections |
|---|---|---|---|---|---|
| | | | Single lane | Dual lane | |
| Minimum design speed | 90 km/h | 90 km/h | 70 km/h | 70 km/h | 10 km/h over posted limit |
| Minimum posted speed limit | 80 km/h | 80 km/h | 60 km/h | 60 km/h | Consistent with existing |
| Absolute maximum grade | 4% | 4% | 6% uphill<br>8% downhill | 6% uphill<br>8% downhill | Consistent with existing |
| Number of lanes | 3 | 3 | 1 | 2 | Consistent with existing |
| Lane width | 3.5 m | 3.5 m | 3.5 m | 3.5 m | 3.0 m (traffic lane)<br>3.2 m (bus lane) |
| Nearside shoulder width | 1.0 m | 2.5 m | 2.0 m | 1.0 m (tunnel)<br>2.0 m (surface) | N/A |
| Offside shoulder width | 1.0 m | 1.0 m | 0.5 m (tunnel)<br>1.0 m (surface) | 1.0 m | N/A |
| Vertical clear envelope | 5.3 m | 5.3 m | 5.3 m | 5.3 m | Consistent with existing |
| Carriageway width | 12.5 m | 14.0 m | 6.0 m (tunnel)<br>6.5 m (surface) | 9.0 m (tunnel)<br>10.0 m (surface) | N/A |

### 5.2.2 Urban design principles and objectives

The visual impacts of the project would depend on the design features of the interchanges and other surface infrastructure, landscape treatments and the exploration of opportunities to integrate the surface infrastructure elements with the surrounding features of the area. Design of the portals, interchanges and surface infrastructure would take into consideration their visibility and landscape to ensure an appropriate design response. Tie-ins with the existing M4 and the local road network would also take into account the visual design elements of these existing roads to ensure an appropriate visual transition to and from the project, in accordance with the Roads and Maritime guideline *Beyond the Pavement: Urban design policy, procedures and design principles* (Roads and Maritime 2014a).

The following urban design principles and objectives have been developed for the WestConnex scheme in the *Draft WestConnex Motorway Urban Design Framework* (Roads and Maritime 2013):

- Objective 1: Leading edge environmental responsiveness – Planning, design, construction and long term management shall be based upon a natural systems approach which is responsive to the environment and promotes the highest levels of sustainability

- Objective 2: Connectivity and legibility – Build connectivity across the city, beyond the boundaries of the motorway corridor and promote increased legibility of places, buildings, streets and landmarks
- Objective 3: Place-making – Create beautiful places, streets, structures and landscapes that draw their form, character and materiality from local context, the intrinsic natural and cultural qualities of each locale
- Objective 4: Urban renewal and liveability – Enable opportunities for urban renewal and provide high levels of urban amenity and liveability
- Objective 5: Memorable identity and a safe, enjoyable experience – Provide a memorable project identity and experiences for road users and adjacent stakeholders which are safe, convenient and enjoyable
- Objective 6: A new quality benchmark – Provide design and construction quality of world class standard. WestConnex shall establish a new benchmark for integrated sustainability, engineering, art, architecture and urban design.

In addition, the following Roads and Maritime design standards and guidelines have been considered, where applicable, during the design development process and the preparation of this EIS:

- *Bridge Aesthetics: Design guidelines to improve the appearance of bridges in NSW* (Roads and Maritime 2012a)
- *Noise wall design guideline: Design guidelines to improve the appearance of noise walls in NSW* (RTA 2006a)
- *Landscape guideline: Landscape design and maintenance guidelines to improve the quality, safety and cost effectiveness of road corridor planting and seed* (RTA 2008)
- *Shotcrete Design Guidelines: Design guidelines to avoid, minimise and improve the appearance of shotcrete* (RTA 2005).

### 5.2.3 Landscape framework

Landscape plans based on the preferred design have been developed for the project. These have taken into account the local context and aim to visually integrate the project into the surrounding environment. Details of landscape plans are provided in **Chapter 13** (Urban design, landscape character and visual amenity).

The landscape treatment details would be finalised during detailed design and subject to consultation with relevant stakeholders.

## 5.3 Project footprint

The project operational footprint would comprise the following tunnel and surface works:

- The twin (eastbound and westbound) mainline tunnels – a maximum of about 18 metres wide and about 5.5 kilometres long for each tunnel
- Surface and tunnel works associated with the Homebush Bay Drive interchange, widening and realignment of the existing M4, connection of the existing M4 to the mainline tunnels and eastbound cycleway – about five metres wide west of Homebush Bay Drive, about 275 metres wide at Homebush Bay Drive, and about 65 metres wide at Pomeroy Street
- Surface and bridge works associated with the Powells Creek Reserve westbound on-ramp – a maximum of about 14 metres wide
- Surface and tunnel works associated with the Concord Road interchange – a maximum of about 400 metres wide
- Surface and tunnel works associated with the Wattle Street (City West Link) interchange –about 170 metres wide at Parramatta Road and about 90 metres wide at Ramsay Street
- Surface and tunnel works associated with the Parramatta Road interchange – a maximum of about 100 metres wide.

The indicative footprint for the project at completion is shown in **Figure 5.2** to **Figure 5.8**. Properties affected by the project footprint are described in **section 5.11** and listed in **Appendix D**.

## 5.4 Tunnels

The alignment of the mainline tunnels is shown in **Figure 5.2** to **Figure 5.8**.

The mainline tunnels would extend from the existing M4, west of the Pomeroy Street footbridge over the motorway at Homebush, to just east of the Parramatta Road and Wattle Street intersection near Alt Street, Haberfield.

The mainline tunnel dives would start about 65 metres west of the Pomeroy Street footbridge, in the centre of the widened motorway. From about 85 metres (eastbound) and 90 metres (westbound) of the Pomeroy Street footbridge, the tunnel dives would be covered (known as cut-and-cover tunnels) and would extend through to Ismay Avenue where the driven tunnels would start.

The tunnels would continue underground to the north of the existing M4 and Parramatta Road, before crossing beneath Parramatta Road at Broughton Street, Burwood. The tunnels would continue underground to the south of Parramatta Road until reaching the intersection of Parramatta Road and Wattle Street at Haberfield. On- and off-ramps would connect the mainline tunnels to Wattle Street (City West Link) and Parramatta Road.

To enable connection to the M4–M5 Link, the mainline tunnels would extend beyond the on- and off-ramp connections to Wattle Street and Parramatta Road, to a point between Walker Street and Alt Street at Haberfield. The eastbound stub tunnel would about 550 metres long, while the westbound stub tunnel would be about 350 metres long. Ventilation shafts from the stub tunnels to the eastern ventilation facility would also be built as part of the project, so as to minimise cumulative construction impacts on the community, and the location of these shafts has determined the length of the stub tunnels.

Each mainline tunnel would generally be excavated to a height of between eight and 10 metres and a width of between 14 and 20 metres. After tunnel lining and fitout, each tunnel would have a minimum vertical clear envelope of 5.3 metres and a width of at least 12.5 metres. **Figure 5.9** shows an indicative cross-section of the tunnels.

The depth to the top of the mainline tunnels would generally vary between about 20 metres and about 50 metres below ground level. The minimum depth to the tunnel (below residential or commercial development not acquired for the project) is about 20 metres in the vicinity of the Bakehouse Quarter at George Street at North Strathfield. **Figure 5.10** to **Figure 5.13** shows an indicative long section of the mainline tunnels.

On- and off-ramps for the interchanges would include sections of tunnel to provide connections from the mainline tunnels to existing surface roads. On- and off-ramp tunnels would have a minimum vertical clear envelope of 5.3 metres and a minimum width of six metres for one lane ramps or nine metres for two lane ramps. Connections to existing and realigned surface roads are described in further detail in **section 5.5**.

To facilitate construction of the M4−M5 Link tunnels and minimise cumulative construction impacts on the community, the surface works, dives, and cut-and-cover on- and off-ramp sections of that project would be constructed as part of the M4 East project. The on- and off-ramps would connect with Wattle Street, near Allum Street, and extend to Martin Street.

A separate application will be made for the M4−M5 Link following further concept development.


**Figure 5.2 Indicative project footprint - Map 1**

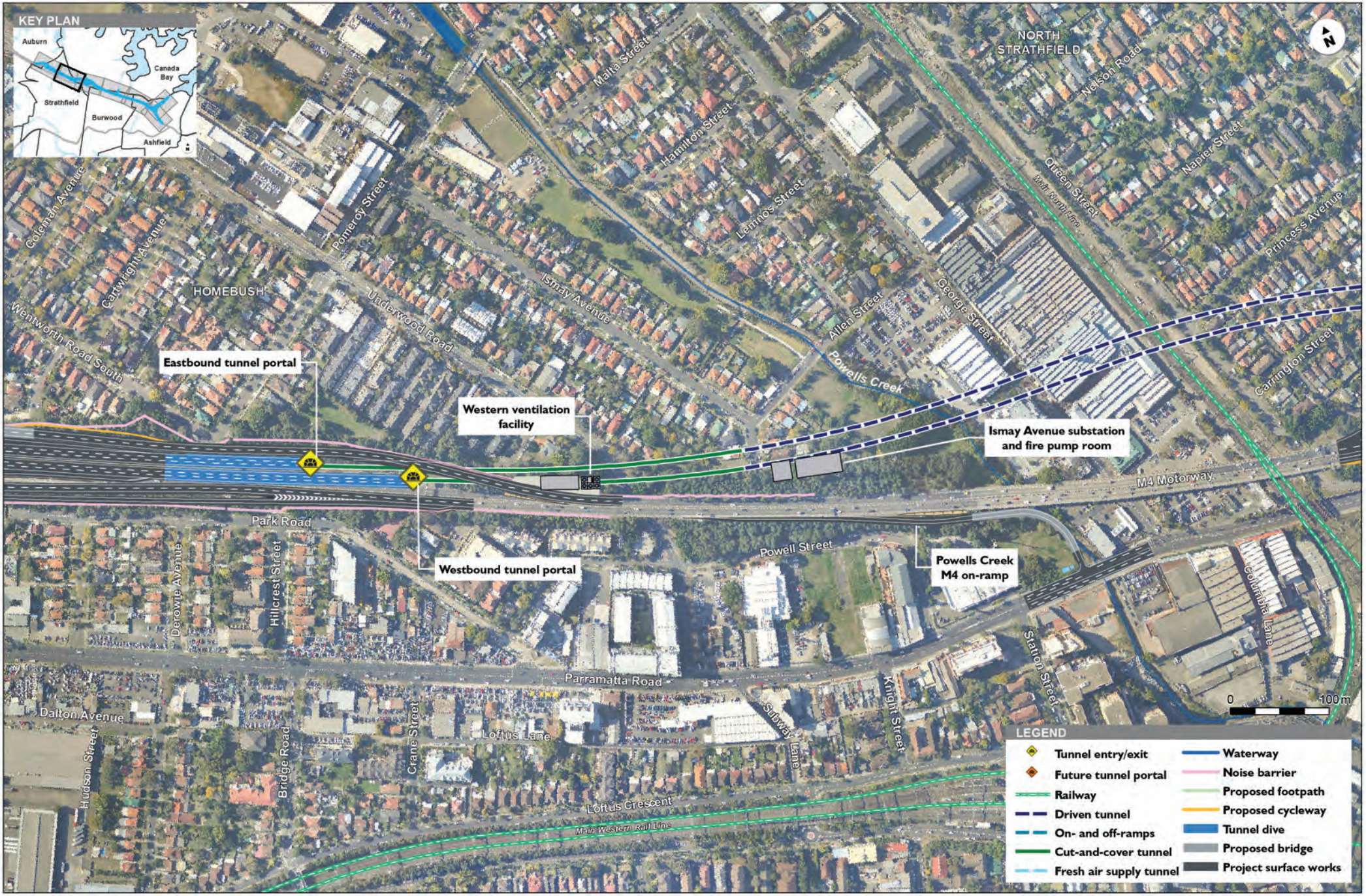



**Figure 5.3 Indicative project footprint - Map 2**


**Figure 5.4 Indicative project footprint - Map 3**


**Figure 5.5 Indicative project footprint - Map 4**


**Figure 5.6 Indicative project footprint - Map 5**


**Figure 5.7 Indicative project footprint - Map 6**