

SYDENHAM TO BANKSTOWN

ENVIRONMENTAL IMPACT STATEMENT

> Technical Paper 1 – Traffic, transport
and access assessment

Sydney Metro City & Southwest Sydenham to Bankstown upgrade

Technical Paper 1 - Traffic, Transport and Access

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Technical Paper 1 - Traffic, Transport and Access

Client: Transport for NSW

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Abbreviations

Full description	Abbreviation
Australian Rail Track Corporation	ARTC
Central Business District	CBD
Construction Traffic Management Plan	CTMP
Degree of Saturation	DoS
Disability Discrimination Act 1992	DDA
Disability Standards for Accessible Public Transport 2002	DSAPT
Environmental Impact Statement	EIS
Level of Service	LoS
Metropolitan Freight Network	MFN
New South Wales	NSW
NSW Environmental Planning and Assessment Act 1979	EP&A Act
Passenger Car Unit	PCU
Public Transport Project Model	PTPM
Roads and Maritime Services	RMS
Secretary's Environmental Assessment Requirements	SEARs
Southern Sydney Freight Line	SSFL
Strategic Traffic Model	STM
Sydney Coordinated Adaptive Traffic System	SCATS
Technical Advisor	TA
Temporary Transport Plan	TTP
Temporary Transport Strategy	TTS
Transport for New South Wales	TfNSW

Glossary

Glossary of terms and acronyms Term	Meaning
Active Transport	Walking and cycling modes connecting to other transport modes.
Average Delay	Duration, in seconds, of the average vehicle waiting time at an intersection
Compound	The construction compound is an area within the project area that would include site offices, amenities, workshops, material and plant storage areas, laydown area, storage of rail track and ballast, concrete batching plant etc.
Construction Haulage Traffic	Traffic resulting from the construction of the new Sydney Metro network from Marrickville to Bankstown.
Interchange	A place where passengers move between vehicles or between transport modes including train stations, rapid transit stations, bus stops etc.
LinSig	Multi-intersection modelling software for corridor or small network analysis.

Glossary of terms and acronyms Term	Meaning
Local Road	Local roads provide for local access and circulation and are the responsibility of Councils with only limited funding assistance from the State Government.
Possession Periods	Periods of time during which the T3 Bankstown Line would be closed.
Project Area	The area where the project would be undertaken, including the existing rail corridor (from about one kilometre south-east of Marrickville Station to about one kilometre north-west of Bankstown Station), at the 10 existing stations within the corridor, and the area surrounding the rail corridor.
Rail corridor (or corridor)	This area includes all elements within the Sydney Rail land where it forms a linear corridor. The rail corridor includes the permanent way, cuttings and embankments, overhead lines, signalling equipment, vegetation etc.
Regional Roads	Roads which supplement the State Road network for significant intra-urban flows and provide access for significant flows to other commercial and industrial centres. Also known as sub-arterial roads.
Single Unit Truck	Construction haulage vehicle – 10 cubic metre capacity, maximum length 12.5 metres or 8.8 metres.
State Road	State Roads are the major arterial links throughout NSW and within major urban areas. They are the principle traffic carrying and linking routes for the movement of people and goods within the Sydney urban areas and which connect between urban centres, the major regional towns, the major regions of the State and the major connections interstate.
Station precinct	Includes the station and any development directly associated with the station such as adjacent retail and transport links and interchanges/roads.
Study Area	The area surrounding where the project would be undertaken, and potentially impacted from the works which is about one kilometre north-east of Sydenham Station to Sefton Station in the west, to Lidcombe Station in the north, and bounded to the south by a line approximately 3km south of the project area.
Sydney Metro	Sydney Metro is a new standalone automated rapid transit rail network under construction in Sydney. The Sydney Metro network consists of Sydney Metro Northwest (under construction) and Sydney Metro City & Southwest, which together would provide 66 kilometres of metro rail line and 31 metro railway stations.
Sydney Trains	The agency responsible for the provision of suburban passenger train services in/around Sydney.
T1 North Shore & Northern Line	Sydney Trains line - City to Berowra via Gordon, City to Hornsby via Macquarie University City to Epping via Strathfield.
T2 Airport line	Sydney Trains line - Macarthur to City via Airport or Sydenham
T2 Inner West & South Line	Sydney Trains line - Campbelltown or Leppington to City via Granville
T3 Bankstown Line	Sydney Trains line - Liverpool or Lidcombe to City via Bankstown
T3 Lane	Transit lane to provide improved travel for buses, taxis and other vehicles carrying multiple occupants. They can also be used by emergency vehicles, motorcycles and bikes.
Worksite	This area is the footprint of the construction works (also referred to as the project area). A range of construction activities would take place within this area including the construction of station buildings, public realm areas and ancillary works.

Executive Summary

Project Overview

Sydney Metro is part of the NSW Government's infrastructure investment program to respond to the growth in transport demand in Sydney. It will transform Sydney, delivering more trains and faster services for customers across the network.

Sydney Metro is a key component of Sydney's Rail Future (Transport for NSW, 2012a), a plan to transform and modernise Sydney's rail network so that it can grow with the city's population and meet the needs of customers in the future.

The Sydney Metro network consists of Sydney Metro Northwest (between Rouse Hill and Chatswood) and Sydney Metro City & Southwest (between Chatswood and Bankstown). Sydney Metro City & Southwest comprises two core components:

- the Chatswood to Sydenham project, which involves about 15.5 kilometres of new underground rail line and new stations between Chatswood and Sydenham
- the Sydenham to Bankstown upgrade component ('the project' and the subject of this document), which involves the upgrade for accessibility and conversion to metro standards of 10 stations along the existing Sydney Trains rail line between Marrickville and Bankstown.

The Sydney Metro Delivery Office, part of Transport for NSW, is managing the planning, procurement, and delivery of the Sydney Metro network.

The project would provide the following key benefits to traffic, transport and access in Sydney:

Increased capacity –the project would release train paths and facilitate extra services to operate on the T2 Airport Line and T2 Inner West and South Line, therefore improving capacity to meet demand and alleviate crowding on trains.

Supports growth -The Department of Planning and Environment has initiated urban renewal investigations along the Sydenham to Bankstown corridor. The project would support growth within this corridor by providing much needed additional capacity. Strong population growth from Sydney's south west is expected to see forecast demand exceed capacity on the Bankstown Line by around 2021. The project would provide critical congestion relief by 2025, and support long-term growth beyond.

Reduces station crowding - Potentially reduce the number of different service types/patterns operating through City Circle stations, improving service legibility and reducing the risk of platform congestion due to passengers having to dwell at these stations to wait for their desired service in the afternoon peak.

Enhances reliability- Eliminating several merges that currently occur with the T2 Airport Line and T2 Inner West and South Line services, thus reducing operational complexity and the risk of service unreliability.

Customer Benefits – The project would upgrade all stations to full access compliance and provide progressive improvements to individual stations and surrounding precincts along with travel time savings.

The project involves upgrading 10 stations along a 13 km long section of the Sydney Trains T3 Bankstown Line from west of Sydenham (Marrickville to Bankstown inclusive). This allows the existing catchment of train customers to be maintained along this alignment which would encourage mode shift from road based transport onto trains, delivering customers a more comfortable, reliable and efficient train service, and urban renewal around existing stations.

The existing T3 Bankstown Line and ARTC freight line need to remain operational whilst much of the project is being constructed. Many components can only be safely constructed during rail possession periods. Existing rail possession periods typically occur four times a year over a weekend to enable rail maintenance work to occur safely with no services operating. In order to deliver the project safely and efficiently, additional possession periods which extend into weekdays which are required to carry out the substantial construction works. This would include a final extended period of between three to

six months before the Sydney Metro conversion of the line is complete. During this time customers using the Sydney Trains service on the T3 Bankstown Line would be directed to replacement transport options. A suite of plans would be developed and implemented in these periods to minimise impacts to customers.

This technical paper, Technical Paper 1 - Traffic, transport and access, is one of a number of technical documents that forms part of the Environmental Impact Statement (EIS). The purpose of this technical paper is to identify and assess the traffic, transport and access impacts of the project during both construction and operation. In doing so, it responds directly to the Secretary's environmental assessment requirements.

Approach to traffic and transport assessment

This technical paper considers the construction and operational traffic, transport and access impacts of the project on pedestrians, cyclists, public transport and other motorised vehicles.

The construction haulage traffic, transport and access impact assessment has included:

- assessment of the impacts of works on pedestrians, cyclists and scheduled bus service networks
- consideration of parking provision during the works for both construction related activities and existing businesses, residents and commuters
- swept path assessment of the largest construction haulage vehicle anticipated for each compound to ensure that construction activities can be conducted as programmed
- collection of current traffic volume data as a baseline for key intersections in the vicinity of the construction works, including replacement bus routes, during the peak periods
- utilising forecast annual growth trends in traffic on Sydney roads as a result of development and economic growth to consider the future construction impacts
- forecasting of construction period traffic flows and assessment of effects through intersection modelling
- modelling of key intersections with and without construction (both phases) haulage to and from the project worksite and construction compounds to ascertain the impact on the local area of the proposed construction tasks and program
- assessment of the impact of the replacement buses required during the possession periods of the construction program including the impact to parking spaces at stations from bus stops and layovers
- testing potential mitigation measures for selected critical intersections
- consideration of diversions resulting from the closure or restrictions on existing bridges which cross the rail line and are to be upgraded as part of the works
- consideration of how pedestrian and cycle routes in close proximity to construction activities may be impacted
- consideration of pedestrian, cycle and bus movements on routes proposed for construction haulage, or impacted by bridge closures
- potential impacts of construction works on pedestrian, cyclist and motorist safety, major special events, emergency vehicles and power supply routes
- a cumulative assessment that considers approved construction projects adjacent to the project.

As such the assessment has considered the effects of construction on all modes of transport within the vicinity of the project.

Construction of the project would commence once all necessary approvals are obtained (anticipated to be in 2018), and would take about five years to complete.

The Operational (end-state) Traffic Impact Assessment has included consideration of:

- a description of how many customers would access the station and how
- pedestrian routes to stations including the accessibility for mobility impaired
- cycle routes to the stations and the provision of bike parking
- consideration of interchange amenity for bus passengers
- improvements to intersections surrounding the stations
- assessment of availability of taxi stand, kiss and ride and parking adjacent to stations.

Overview of potential impacts

During Construction

In assessing the current traffic volumes and conditions surrounding the project alignment, it was noted that several intersections are operating at, or close to capacity in the morning and evening peaks, as could be expected in built up urban areas of Sydney. When the anticipated population and traffic growth has been added to reflect the conditions which are likely to be present for the latter years of the construction (i.e. background traffic growth), the assessment found that even without any disruption or additional construction related traffic resulting from the project, some of these intersections would have demands exceeding capacity resulting in long delays unless otherwise mitigated.

In the context of the volumes of vehicles that the road network is carrying in the peak periods, the construction haulage vehicles are forecast to add a negligible volume to the flows, and therefore from a capacity and delay perspective have very minor impacts. However, careful consideration of construction haulage traffic routes to maintain safety and avoid a loss of amenity for residents especially, has led to the development of specific routes between the primary road network and the project area. These routes have been developed with the principle of having direct access to major arterial roads with easy access to the wider road network.

A Temporary Transport Strategy has been developed, that describes the process for planning and delivering the integrated, multi-modal transport network that would operate during possession periods on the Bankstown Line. The Temporary Transport Strategy outlines that for each possession period, a number of Temporary Transport Plans¹ would be developed in line with the Temporary Transport Strategy as the guiding document and utilising the assessment outlined in this Technical Paper. The plans would define initiatives to be implemented to assist customers affected by closures of the line and its stations. These Temporary Transport Plans would be developed post-approval and would be informed through community feedback, and refined based on further understanding of construction planning, timetabling options on the rail network and customer needs and ongoing development of alternatives to deliver improved customer outcomes.

A Baseline Temporary Transport Plan is described in this document. This includes replacement buses during possession periods that provide a full rail capacity replacement by buses only, as currently occurs during typical weekend possession. This Baseline Temporary Transport Plan has been assessed in this Technical Paper. In this case there would be extensive impacts with both intersection capacities and the ability to provide safe and efficient boarding and alighting facilities at stations being affected. This scenario would have the potential to adversely affect not just the amenity for passengers using the rail replacement service, but those on existing bus routes in the area, private car users and cyclists.

A Refined Baseline TTP has been tested to assess an alternative rail replacement strategy to convey passengers west of Campsie to parallel rail lines and reduce the impact on intersections between Dulwich Hill and Marrickville.

The assessment of bridge works includes 27 bridges (17 overbridges, three footbridges and 7 underpass structures). Bridge works would require both partial closures and full closures, requiring general traffic to divert or use restricted lanes on the bridge. At no time would bridge works occur on

¹ Temporary Transport Plans, as referenced in this document, are now referred as Temporary Transport Management Plans in the EIS main report and other technical papers.

adjacent bridges simultaneously and scheduling of closures would consider the broader network in conjunction with other activities. The assessment of potential impacts demonstrates that the majority of the bridges can be upgraded with minimal delays to traffic. However, there are several key bridges where the proposed upgrade works would create significant restrictions on capacity, have the potential to cause long delays, and the effects could be expected to extend a significant distance across the network. Having highlighted these issues, detailed construction traffic management plans developed when specific scheduling of works is defined, would seek to minimise these impacts.

The addition of construction haulage vehicles on haulage routes and of vehicles accessing the worksites has been assessed to determine the potential impact on the existing transport network facilities. This concluded:

- a number of bus routes would need to be diverted as a result of temporary lane or road closures during the construction of the project, which includes bridge works. Potential diversion routes have been allocated in a manner which minimises the effect on bus passengers by designating direct routes where possible
- some bus stops in proximity to works would be relocated to ensure effective operations and safety of customers. The temporary relocation of bus stops would be selected taking into account the most practical location for bus passengers, while maintaining safe and efficient pedestrian, cycle and traffic movements
- pedestrians and cyclists movements at a number of bridge locations would be periodically effected during half lane bridge closures. During these partial closures temporary traffic management would divert pedestrians to the opposite side of the road. Cyclists would in most cases follow the diversion routes established for vehicles. During full bridge closures, pedestrians and cyclists would need to be diverted to an adjacent bridge. The diversion routes would aim to minimise the additional travel distance required and consider the suitability of those routes for the safety of cyclists
- bicycle parking would be affected during construction works at a number of stations. Replacement bicycle parking would be provided at alternative locations during these works where practicable.

The construction traffic assessment is based on forecast construction traffic generation along specified construction haulage routes, and their associated affects upon intersection operation. Specific activities requiring closures, work zones and other traffic management activities would be detailed in Construction Traffic Management Plans.

During Operation

The project would deliver a component of the Sydney Metro network within the existing T3 Bankstown Line rail corridor. However, the project may impact on the road network as a result of the project changing mode share for existing customers and attracting new customers. .

The upgraded Metro network would provide twice as many trains per hour in peak periods. This would reduce waiting time at stations for passengers and transfer from a timetabled service to a “turn up and go” service, removing the need for pre-planning to co-ordinate with a specific train.

The project would provide travel time savings from the new metro stations to the CBD and to stations along the Sydney Metro Northwest component. On board travel times would be up to 10 minutes faster for customers from Bankstown to Central compared to the current journey on Sydney Trains. These customer benefits would be further realised through an increased reliability which arises from the segregation of the Metro from the Sydney Trains network.

The project design has prioritised pedestrian and cyclist access to stations within the modal hierarchy. These modes are sustainable, cost-effective, equitable, accessible and require the least amount of space. The project would upgrade the pedestrian environment and facilities within the station precinct to improve cycle connections and bike parking at stations to support these modes.

The project design would safeguard for an active transport corridor between Sydenham and Bankstown. Components of the active transport corridor would be delivered as part of station precinct work. The active transport corridor would facilitate strategic walking and cycling connections to a number of important destinations, including linking public transport interchanges between Sydenham and Bankstown, residential areas, schools, retail and commercial precincts.

Appropriate footpath widths and gradients would be provided outside of station exits and throughout the public domain. Vision and mobility impaired customers would be considered in the pavement designs, for example by keeping one side of the travel path clear of fittings and fixtures and providing tactile ground surface indicators on travel paths to warn of hazards and assist wayfinding where required.

Benefits to bus patrons would also be achieved as a result of the project. Connections between bus and rail services would be provided to optimise routes from origin to destination. The project would provide bus stops within 100m from the platform gate line where practicable. This would increase the accessibility for passengers choosing to transfer from bus to rail.

Summary of Mitigation

Construction

To manage the construction impacts of the project, a range of mitigation measures have been incorporated during project planning and are discussed in the Paper. The key recommended mitigation measures are as follows:

- ongoing consultation with relevant councils, Sydney Co-ordination Office, Roads and Maritime Services, Sydney Trains, NSW TrainLink, RailCorp, emergency services and bus operators would be consulted throughout the construction period in relation to the programme of works and nature of planned activities
- the Temporary Transport Strategy would be developed into a suite of Temporary Transport Plans which would be implemented to maintain public transport mode choice during rail shutdown periods
- possession periods would be scheduled to occur at times of lower demand on road and rail demand, with a focus on the programming minimising the effect of the six most critical bridges
- directional signage and line marking around construction sites and the surrounding network would include Variable Message Signs to direct and guide drivers and pedestrians past construction sites and advise of potential delays, diversion routes for traffic, buses, cyclists and pedestrians, during partial or full road closures and speed restrictions
- ongoing monitoring and reporting of the road network would be carried out by the Traffic Management Centre and Sydney Co-ordination Office, including of other ongoing project construction such as WestConnex, to identify traffic congestion and make operational changes as required
- minor intersection upgrades would be assessed during the detailed planning of the construction phase and where appropriate and in consultation with local councils and Roads and Maritime Services alterations to lane markings, parking, kerblines and permitted turns would be implemented for the duration of local construction activities
- a Construction Traffic Management Plan would contain measures for managing hours of work and deliveries, staff transport and staff parking to limit impact to the public during peak hours, school hours and minimise construction staff traffic by the use of shuttles and public transport
- scheduled bus service timetables, routes and stops would be assessed and monitored during the works and changes made as required to minimise the effects on bus patrons during the construction works
- early engagement activities would be carried out to alert the community in advance of proposed road and pedestrian network changes via media channels and other appropriate forms of community liaison
- the construction program would be designed to where feasible, restrict works from being carried out simultaneously on adjacent bridges
- specific traffic management plans for special events would be developed in conjunction with the relevant stakeholders.

Operation

To manage the operational impacts of the project a suite of management measures have been outlined in this Technical Paper, primarily to further encourage integration of the project with other transport modes. The recommended mitigation measures include:

- the ongoing review and monitoring of pedestrian and cycle facility usage following the commencement of operations and implementation of safety and amenity upgrades as required
- review and update of the bus services to provide adequate capacity for integration of bus and metro services
- provision of wayfinding signage to support customer experience and accessibility with specific focus for directions to cycle facilities, bus stops, kiss and ride, taxi bays and dedicated commuter parking
- regular reviews of the cycle and bike parking and kiss and ride facilities with provision of additional facilities and management as required.

1.0 Introduction

1.1 Project background

The New South Wales (NSW) Government is implementing Sydney's Rail Future (Transport for NSW, 2012a), a plan to transform and modernise Sydney's rail network so that it can grow with the city's population and meet the needs of rail customers into the future.

Sydney Metro is a new standalone rail network identified in Sydney's Rail Future, providing 66 kilometres of metro rail line and 31 metro stations. The NSW Government is currently delivering the first two stages of Sydney Metro, shown in **Figure 1.1**, which consist of Sydney Metro Northwest (between Rouse Hill and Chatswood) and Sydney Metro City & Southwest (between Chatswood and Bankstown).

Sydney Metro Northwest is currently under construction. Sydney Metro Northwest services will start in the first half of 2019, with a metro train running every four minutes in the peak period. Services will operate between a new station at Cudgong Road (beyond Rouse Hill) and Chatswood Station.

Sydney Metro City & Southwest will extend the Sydney Metro system beyond Chatswood to Bankstown, delivering about 30 kilometres of additional metro rail, a new crossing beneath Sydney Harbour, new railway stations in the lower North Shore and Sydney central business district (CBD), and the upgrade of existing stations from Marrickville to Bankstown. City & Southwest trains would run between Sydenham and Bankstown stations in each direction, at least every four minutes in peak periods, averaging around 15 trains per hour.

Sydney Metro City & Southwest comprises two core components (shown in **Figure 1.1**):

- the Chatswood to Sydenham project
- the Sydenham to Bankstown upgrade ('the project' and the subject of this document).

1.1.1 The project for which approval is sought

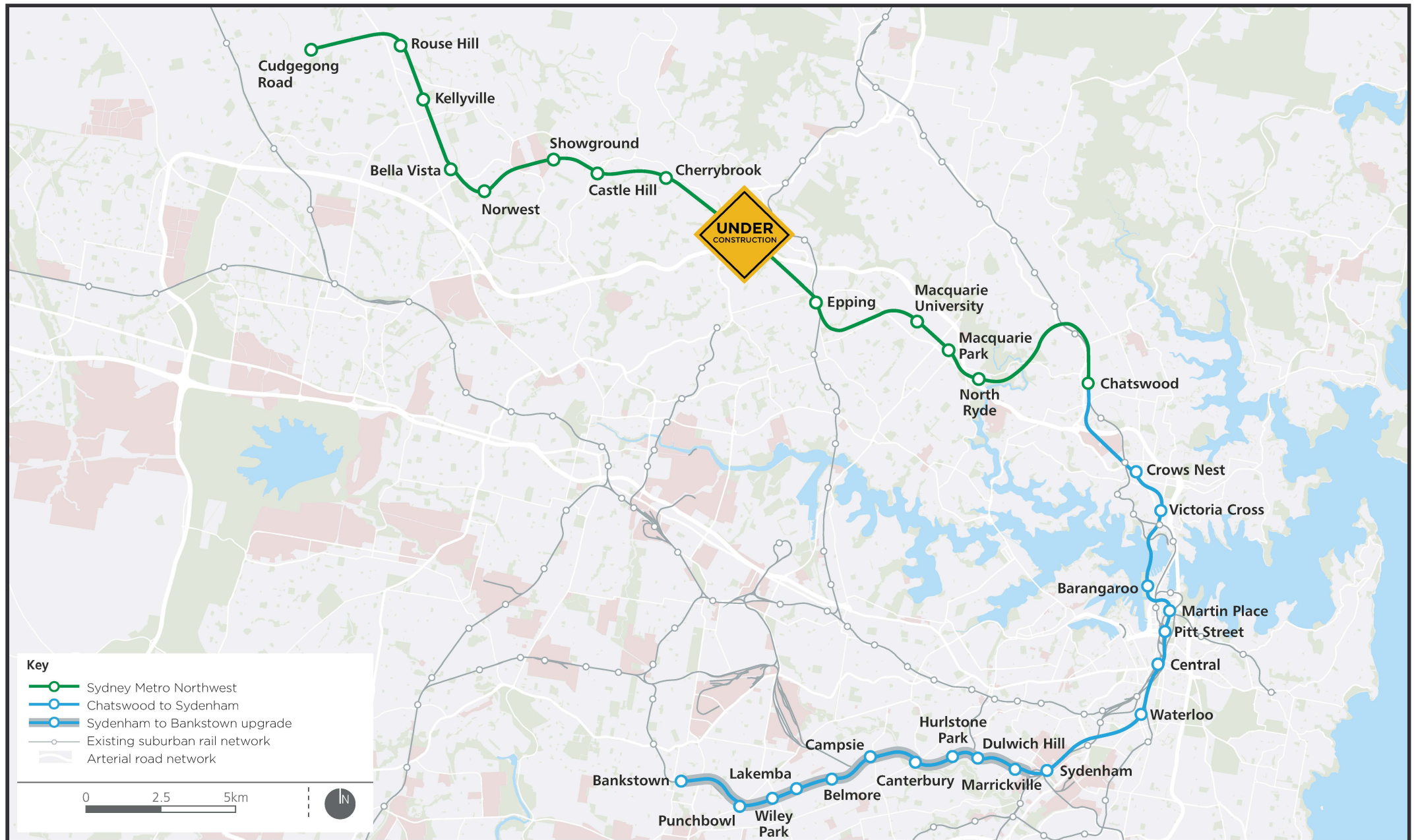
Transport for NSW is seeking approval to construct and operate the Sydenham to Bankstown upgrade component of Sydney Metro City & Southwest (the project).

The project involves upgrading 10 existing stations west of Sydenham (Marrickville to Bankstown inclusive), and a 13 kilometre long section of the Sydney Trains T3 Bankstown Line, from west of Sydenham Station to just west of Bankstown Station, to improve accessibility for customers and meet the standards required for metro operations. The project would enable Sydney Metro to operate beyond Sydenham, to Bankstown.

A key element of the project is upgrading stations along the corridor from Marrickville to Bankstown, to allow better access for more people by providing new concourses, level platforms, and lifts at stations. These upgrades aim to provide a better, more convenient and safer experience for public transport customers, by delivering:

- stations that are accessible to people with a disability or limited mobility, the elderly, people with prams, and people travelling with luggage
- upgraded station buildings and facilities for all transport modes that meet the needs of a growing population
- interchanges that support an integrated transport network and allow seamless transfers between different modes for all customers.

The project is subject to assessment and approval by the NSW Minister for Planning under Part 5.1 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act).



1.2 The project

1.2.1 Location

The location of the project is shown in **Figure 1.2**.

The key elements of the project are located mainly within the existing rail corridor, from about 800 metres west of Sydenham Station in Marrickville, to about one kilometre west of Bankstown Station in Bankstown. The project is located in the Inner West and Canterbury-Bankstown local government areas.

The term 'project area' is used throughout this document to refer to the area where the physical works for the project would be undertaken. This area encompasses the existing rail corridor (as described above), the 10 existing stations within the corridor, and areas surrounding the rail corridor as shown in **Figure 1.2**.

1.2.2 Key features

The key features of the project are summarised below and are shown in Figure 1.2.

Works to upgrade access at stations

The project includes upgrading the 10 stations from Marrickville to Bankstown as required, to meet legislative requirements for accessible public transport, including the requirements of the *Disability Discrimination Act 1992* and the *Disability Standard for Accessible Public Transport 2002*. The proposed works include:

- works to platforms to address accessibility issues, including levelling and straightening platforms
- new station concourse and station entrance locations, including:
 - new stairs and ramps
 - new or relocated lifts
- provision of additional station facilities as required, including signage and canopies.

Works would also be undertaken in the areas around the stations to better integrate with other modes of transport, improve travel paths, and meet statutory accessibility requirements. This would include provision of pedestrian, cyclist, and other transport interchange facilities; as well as works to the public domain, including landscaping.

Works to convert stations and the rail line to Sydney Metro standards

Station works

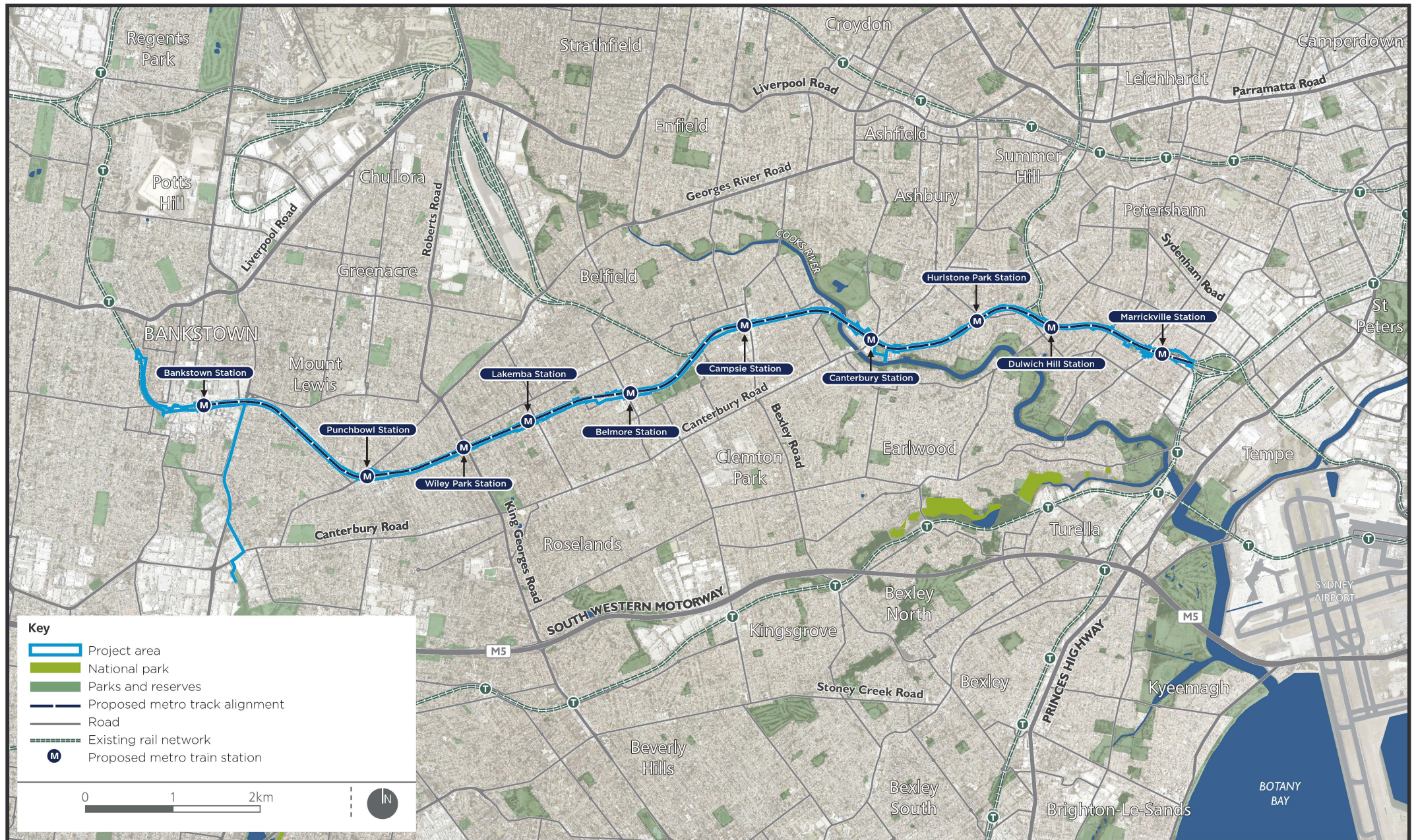
In addition to the station upgrades to improve accessibility, works to meet the standards required for metro services would be carried out, including:

- installation of platform screen doors
- provision of operational facilities, such as station services buildings.

Track and rail system facility works

Upgrading the track and rail systems to enable operation of metro services would include:

- track works where required along the rail corridor, including upgrading tracks and adjusting alignments, between Sydenham Station and west of Bankstown Station
- new turn back facilities and track crossovers
- installing Sydney Metro rail systems and adjusting existing Sydney Trains rail systems
- overhead wiring adjustments.



Other works

Other works proposed to support Sydney Metro operations include:

- upgrading existing bridges and underpasses across the rail corridor
- installation of security measures, including fencing
- installation of noise barriers where required
- modifications to corridor access gates and tracks
- augmenting the existing power supply, including new traction substations and provision of new feeder cables
- utility and rail system protection and relocation works
- drainage works to reduce flooding and manage stormwater.

Active transport corridor and surrounding development

The project would also provide for:

- parts of an active transport corridor where located within the station areas or surplus rail corridor land, to facilitate walking and cycling connections to each station and between Marrickville and Bankstown
- Enabling works to support future development at Campsie Station (future development would be subject to a separate approvals process).

Temporary works during construction

During construction, the project would involve:

- provision of temporary facilities to support construction, including construction compounds and work sites
- implementation of alternative transport arrangements for rail customers during possession period and/or station closures, guided by the Temporary Transport Strategy (included in **Appendix E**).

1.2.3 Timing

Construction

Construction of the project would commence once all necessary approvals are obtained (anticipated to be in 2018), and would take about five years to complete.

The T3 Bankstown Line would remain operational for the majority of the construction period. However, to ensure the station and infrastructure upgrade works are completed as efficiently and safely as possible and to accommodate works that cannot be undertaken when trains are operating, would be necessary to undertake some work during rail possession periods, when trains are not operating. It is anticipated that these rail possession periods would comprise the routine weekend maintenance possession periods during periods of reduced patronage such as school holidays.

A final, longer possession of about three to six months would also be required. This would involve full closure of the line to enable conversion to metro operations. This would include works such as the installation of new signalling, communication systems, and platform screen doors.

During each possession period, alternative transport arrangements would be implemented to ensure that customers can continue to reach their destinations.

Operation

Sydney Metro City & Southwest would be fully operational by 2024, with the opportunity of operation commencing in two phases. Initially, Sydney Metro Northwest services would be extended by the City & Southwest project, and would operate from Chatswood Station to Sydenham Station. Some months later, metro operations would extend from Sydenham Station to Bankstown Station, with both phases planned to be completed before the end of 2024. The opportunity for phased opening of the project

would enable metro trains to operate from Cudgegong Road Station to Sydenham Station prior to the final conversion of the T3 Bankstown Line to metro operations.

Once the project is operational, Sydney Trains services would no longer operate along the T3 Bankstown line between Sydenham and Bankstown Stations. Customers would be able to interchange with Sydney Trains services at Sydenham and Bankstown stations. Sydney Trains services to and from Bankstown to Liverpool and Lidcombe stations would not be affected.

1.3 Purpose and scope of this report

This technical paper, Technical Paper 1 – Traffic, transport and access, is one of a number of technical documents that forms part of the EIS. The purpose of this technical paper is to identify and assess the traffic, transport and access impacts of the project during both construction and operation. In doing so it responds directly to the Secretary's environmental assessment requirements (Section 1.4).

This technical paper considers the construction haulage and operational traffic, transport and access impacts to customers, and to the walking, cycling, public transport and road networks surrounding the project. It also addresses the impacts to the existing parking at stations along the corridor during construction and permanent changes to dedicated commuter parking during operation.

The construction haulage traffic, transport and access assessment has included:

- assessment of the impacts of works on pedestrians, cyclists and scheduled bus service networks
- consideration of parking provision during the works for both construction related activities and existing businesses, residents and commuters
- swept path assessment of the largest construction haulage vehicle anticipated for each compound to ensure that construction activities can be conducted as programmed
- modelling of key intersections with and without construction (both phases) haulage to and from the project worksite and construction compounds to ascertain the impact on the local area of the proposed construction tasks and program
- assessment of the impact of the replacement buses required during the possession periods of the construction program
- testing potential mitigation measures for selected critical intersections
- consideration of diversions resulting from the closure or restrictions on existing bridges which cross the rail line and are to be upgraded as part of the works
- potential impacts of construction works on pedestrian, cyclist and motorist safety, major special events, emergency vehicles and power supply routes
- a cumulative assessment that considers approved construction projects adjacent to the project.

The methodology for the assessment of the potential construction impacts of the project included:

- consideration of how pedestrian and cycle routes in close proximity to construction activities may be impacted
- consideration of pedestrian, cycle and bus movements on routes proposed for construction haulage, or impacted by bridge closures
- collection of current traffic volume data as a baseline for key intersections in the vicinity of the construction works, including replacement bus routes, during the peak periods
- utilising forecast annual growth trends in traffic on Sydney roads as a result of development and economic growth to consider the future construction impacts
- forecasting of construction period traffic flows and assessment of effects through intersection modelling.

As such the assessment has considered the effects of construction on all modes of transport within the vicinity of the project.

The most significant consideration for this technical paper is the potential construction impacts resulting from the project. The existing Sydney Trains Sydenham to Bankstown Line and ARTC freight line need to remain operational whilst much of the project is being constructed. Given this, much of the project is required to be constructed during rail possession periods. Existing rail possession periods typically occur four times a year over a weekend period to enable rail maintenance work to occur safely with no services operating. In order to deliver the project by 2024, additional possession periods of a longer duration are required to carry out the substantial construction works safely. In addition, a longer period of testing and commissioning is required. For these periods the Sydney Trains services on the Sydenham to Bankstown Line would need to be replaced by alternative transport. This assessment has considered the addition of the buses required during these periods to the road network, as well as construction haulage required within and outside of these periods.

In parallel to this traffic and transport assessment, a Temporary Transport Strategy (TTS) has been developed to address the likely temporary modal shift during these periods and its implications on bus transport, other rail lines, parking availability, walking, cycling and the road network (refer to Section 4.5).

The Temporary Transport Strategy outlines that for each possession period, a number of Temporary Transport Plans² (TTPs) would be developed in line with the Temporary Transport Strategy as the guiding document and utilising the assessment outlined in this Technical Paper. The plans would define initiatives to be implemented to assist customers affected by closures of the line and its stations. These TTPs would be developed post-approval and would be informed through community feedback, and refined based on further understanding of construction planning, timetabling options on the rail network and customer needs and ongoing development of alternatives to deliver improved customer outcomes.

There are also a number of bridges that cross the current alignment that would require enhancements and upgrade to facilitate the operation of the metro. During these works, access may be restricted and road users may need to be diverted to other bridges.

As detailed in subsequent chapters, whilst the overall construction duration would span from 2018 - 2024, the track closures, individual station works and bridge activities occur for shorter periods within that overall program, and whilst some overlap, not all would occur at the same time. The construction assessment approach outlined in Chapter 4 and then presented in Chapter 5 and Chapter 6 provides the detail of the assumptions and constraints related to the timing of these activities.

Conversely the operational assessment is somewhat more straightforward. Whilst the project would deliver enhancements to the public transport system between Marrickville and Bankstown, there are already stations present. As such the facilities for modal interchanges with private car (parking and passenger drop off), bus, cycling and walking whilst modified, are present and would, where possible, be improved. Qualitative descriptions of these improvements and interactions are outlined in Chapter 8.

The Operational (end-state) Traffic Impact Assessment has included consideration of:

- pedestrian routes to stations including the accessibility for mobility impaired
- cycle routes to the stations and the provision of bike parking
- consideration of interchange amenity for bus passengers
- improvements to intersections surrounding the stations
- assessment of availability of taxi stand, kiss and ride and parking adjacent to stations
- consideration of changes to total station entry and egress
- consideration of changes to mode of access.

Mitigation measures during construction and operation have been identified.

² Temporary Transport Plans, as referenced in this document, are now referred as Temporary Transport Management Plans in the EIS main report and other technical papers.

The key mitigation requirements are during construction. Mitigation strategies have been developed for selected critical intersections to demonstrate that the construction haulage traffic, TTPs and bridge diversions can occur simultaneously whilst minimising disruption and maintaining an acceptable level of service for Sydney Road network users.

This assessment focusses on:

- the ten station precincts of Marrickville, Dulwich Hill, Hurlstone Park, Canterbury, Campsie, Belmore, Lakemba, Wiley Park, Punchbowl and Bankstown where construction works would be undertaken as part of this project, and the rail corridor between west of Sydenham and west of Bankstown (the project area)
- the intersections identified as being impacted by the construction and operation of the project. This is discussed in more detail in Chapter 4 and Chapter 8.

1.4 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to traffic and transport, and where these requirements are addressed in this technical paper, are outlined in **Table 1.1**.

Table 1.1 Secretary's environmental assessment requirements – traffic, transport and access

Secretary's environmental assessment requirements	Where addressed/drafting comment for discussion
13. Transport and traffic	
1. The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to:	Chapter 4, Chapter 5, Chapter 6, and Chapter 7.
(a) a considered approach to route identification and scheduling of transport movements;	
(b) the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements);	Chapter 4, Section 4.3, Chapter 5, Chapter 6 and Appendix C
(d) the need to upgrade roads proposed as construction vehicle routes including impacts of road closures, construction worker parking and impacts on availability of public parking;	Chapter 4, Chapter 5, Chapter 6, Chapter 7 and Chapter 9.
(e) the nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements);	Chapter 3, Chapter 4, Chapter 5, Chapter 6 and Appendix A
(f) information on how construction and scheduling of works will be coordinated in regard to cumulative traffic impacts resulting from concurrent work on WestConnex and other approved key construction projects.	Chapter 10
(g) access constraints and impacts on public transport, pedestrians and cyclists including:	Chapter 5 and Chapter 6
<ul style="list-style-type: none"> impacts on customers and reliability of suburban and intercity rail services (including increased demand for rail services on other lines, particularly the T2 Inner West, T1 North Shore, Northern and Western Lines) during possession periods and testing and commissioning of metro trains; 	Section 4.5, Chapter 5 and Sections 3.1 to Section 3.3 of Appendix E

Secretary's environmental assessment requirements	Where addressed/drafting comment for discussion
<ul style="list-style-type: none"> alternative transport arrangements for customers during rail possessions and closure of the rail line (including how the Temporary Transport Plan will be developed in consultation with relevant Councils and community); and 	Section 4.5, Chapter 5, and Appendix E
<ul style="list-style-type: none"> identification of key traffic performance issues in the surrounding areas during rail shutdowns and implementation of alternative transport arrangements. 	Section 4.5, Chapters 5 and Chapter 6 and Appendix E
(h) the need to close, divert or otherwise reconfigure elements of the road and cycle network associated with construction of the project.	Chapters 5, Chapter 6 and Chapter 7
(i) assess the likely risks of the project to public safety, paying particular attention to pedestrian safety	Chapter 5, Chapter 6 and Chapter 7 for assessment, and Chapter 9 for mitigation
2. The Proponent must assess the operational transport impacts of the project, including the wider transport interactions (local and regional roads, change to commuter parking and loading zones, provision of kiss and ride facilities, cycling, public and freight transport). The EIS must define a transport hierarchy and a framework for an active transport strategy.	Section 2.3 and Chapter 8
14. Place Making and Urban Design	
1. The Proponent must describe the accessibility elements of the project including relevant accessibility legislation and guidelines and:	Chapter 5, Chapter 6, Chapter 7 and Chapter 8
(a) impacts on pedestrian access in and around stations and connecting streets (including consideration of land use change);	Chapter 5, Chapter 6 for construction and Chapter 8 for operation
(b) enhancing the accessibility of each station and the general vicinity of walking and cycling catchments;	Chapter 8
(c) the provision of infrastructure to support accessible paths of travel and interchange;	Chapter 8
(d) impacts on cyclists (including provision of and integration with active transport routes) and pedestrian access and safety; and	Chapter 8
(e) minimising barriers across the rail corridor and opportunities to integrate cycling and pedestrian elements with surrounding networks and in the project.	Chapters 5 and Chapter 6 for Construction Chapter 8 for operation Chapter 9 for mitigation

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2.0 Strategic Transport Context

2.1 Overview

This chapter provides an overview of the overall strategic transport context in which the project sits.

Sydney's rail network is the backbone of the city's public transport system. On a typical workday, customers take approximately 1.2 million journeys on the rail network, one-third of which occur between 6.00am and 9.30am.

The estimated rate of growth across Sydney over the next 10 or 20 years is expected to exceed the operating capacity of the existing rail network and as a result significant changes to support are required. This change is required in the near future to allow forecast increases in rail network demand of over 40 per cent by 2026, and over 60 per cent by 2036 (NSW Government, 2016).

The existing T3 Bankstown Line, along which the project sits, effectively slows down the Sydney Trains network because of the way it merges with other railway lines close to the city and impacts the ability to operate the surrounding network reliably. Further, by 2026, without an increase in network capacity, demand will exceed capacity on the T1 North Shore, T1 Northern, T2 Inner West and South, and T3 Bankstown lines, and demand will be approaching capacity on the T2 Airport and South Line.

The upgrade of the existing T3 Bankstown Line forms part of the rail network solution for accommodating growth in public transport patronage now and into the future. Further, over half of the stations along the project alignment have not had major upgrades and remain largely as built early last century. These stations do not comply with NSW and Australian Government accessibility standards for public transport. The project would help to contribute to urban renewal and improved operating conditions, including reliability, capacity enhancements and accessibility within the CBD and across the south and south-west region of the rail network.

This phase of the project consists of the T3 Bankstown Line section of the existing Sydney Train rail network and includes the rail corridor and 10 station precincts between Marrickville and Bankstown which are affected by construction works as part of this project. In addition, the impact of TTS buses on Sydenham Station and the stations west of Bankstown on the T3 Bankstown Line are considered. Station precincts are generally the area within 800m for walking and up to 2.5 km for cycling from the relevant station, which are typically a focus for station access, changes in urban form and for effectively managing growth within a region.

Rail trips (Metro and Sydney Trains) are almost always just one part of a multi modal journey that includes walking, and often other modes such as bus, car or travel by bicycle. All of these modes are currently used to access stations and in order to manage demand, access would be prioritised. The prioritisation of modes typically follows Sydney Metro's transport integration and traditional travel demand management principles with travel and access by private vehicle being the lowest priority. This is very relevant for planning in Sydney's south west where there is a high level of reliance on private car for trips starting or ending in areas surrounding the project. This is coupled with significant road network capacity constraints, a restricted urban environment and limited program for enhancing the road network in this area of Sydney beyond current commitments.

2.2 Regional public transport network

Sydney has an extensive and developing public transport network which consists of a wide variety of modes and options. Each of these modes is described below in the context of the project area.

2.2.1 Suburban Rail

The Sydney Trains rail network is experiencing significant patronage growth, with the reliability and capacity constrained by a number of factors. Most of the rail network was built more than 100 years ago, and involves complex operations. Part of the complexity is a result of up to 13 lines having to converge into eight inbound tracks (including freight) through the CBD. The funnelling of these lines into the limited CBD track capacity constrains the number of services that can be operated 'upstream'. Merging and crossing movements required as part of the funnelling also introduce risks to service reliability during times of service disruption. Other key constraints, such as narrow platforms and vertical egress at key CBD Stations such as Town Hall, the limitations of the existing double deck

rolling stock in terms of passenger flow rate, as well as the numerous stopping patterns that each CBD station platform has to serve, results in long station dwell times, further limiting the capacity of the network.

In addition, future demand for rail services is expected to either exceed or be approaching capacity on much of the existing rail network by 2026 under projected population growth and subsequent increase in employment. This would result in overcrowding and reduced network reliability.

As shown in **Figure 2.1** there are three suburban train routes operating in the Sydney's south and south-west regions.



Figure 2.1 Sydney Trains Network (Transport for NSW website, accessed on 7 September 2016)³

The T3 Bankstown Line traverses the study area and connects suburbs as far west as Liverpool and Lidcombe to the Sydney CBD. These services currently utilise Platform 1 and 2 at Sydenham Station. T2 Airport Line between Campbelltown / Macarthur and the CBD also operate via Sydenham Station during peak periods, and these services operate via Platforms 3 and 4. T3 Bankstown Line and T2 Airport Line services share the Illawarra Local tracks north of Sydenham Station. Lastly, T4 Illawarra Line services between Waterfall / Cronulla and the CBD operate via Sydenham Station Platform 5 and 6, on the Illawarra Main tracks.

Key existing issues in Sydney's south and south-west regions include:

- the Sydney Trains rail network is experiencing significant growth, with the reliability and capacity constrained by a number of factors. The T3 Bankstown Line services have to merge with other railway lines approaching the city, including the T2 Airport Line at Sydenham (during the AM Peak) and the Inner West & South Line approaching Central (again during the AM Peak). The T3 Bankstown Line effectively slows down the Sydney Trains network because of the way it merges with other railway lines close to the city, including the T2 Airport, Inner West & South Line

³ Note: The NSW government are implementing a More Trains, More Services program in 2018, which involves delivering extra services and upgraded rail infrastructure to the Sydney Trains rail network. This will replace the current Sydney Trains Network Map shown in Figure 2.1.

- merging and crossing movements also introduce risks to service reliability during times of service disruption. The existing timetable provides for windows to accommodate merging/crossing movements without affecting reliability. However, problems arise during times of disruption, when those windows for merging and crossing are affected, increasing the susceptibility of delays on one Line impacting another. The merging of services approaching the city (because of limited track capacity) also limits the operable service frequency on each individual line, given the upper limit of 20 trains per hour per track on the Sydney Trains network governed by the signalling system in use
- by 2026, without an increase in network capacity, demand will exceed capacity on the T1 North Shore, T1 Northern, T2 Inner West and South, and T3 Bankstown lines, and demand will be approaching capacity on the T2 Airport and South Line
- by 2036, demand for rail services will be at 108 per cent of capacity, leading to widespread crowding and decreases in reliability. For the T3 Bankstown Line, based on the annual growth rate of six per cent between 2014 and 2016, there will be around twice as many customers attempting to use the service
- of the 10 stations between Marrickville and Bankstown, five have not had major upgrades and remain largely as built early last century. Access is generally provided by stairs or ramps, with lifts available at five of the stations. These stations do not comply with Commonwealth accessibility standards for public transport.

The project would result in the following benefits for the existing local and regional rail network:

- **supporting growth on the rail network** - with the projected additional 100,000 customers per hour catered for through the delivery of the full City & Southwest metro rail system (including the Project)
- **increasing accessibility and trip diversity** – improving the frequency of services, interchange with other transport modes, and connections to key destinations would increase accessibility (for example, to major employment, commercial, industrial, and residential areas) and trip diversity (for example, journey to work, education, local service trips and work related trips)
- **reducing network complexity, improving reliability** – the project would remove the T3 Bankstown Line from its existing requirement to merge/diverge with the T2 Airport, Inner West and South Line at flat junctions, converging into the constrained City Circle. This in turn would allow the City Circle to be dedicated to the T2 Airport, Inner West and South Line, reducing operational complexity and the risk of service unreliability
- **increasing rail network capacity** - removing T3 Bankstown Line services from the City Circle would enable the T2 Airport, Inner West and South Line to use the released capacity. This would improve service frequencies on the Sydney Trains network, reducing likelihood of trains and stations from being overcrowded and station dwell times from being impacted. Note - this is subject to the design of future suburban rail timetables by TfNSW
- **improved service legibility** – Sydney Metro would provide passengers with the ability to ‘turn up and go’ as opposed to pre-planning and co-ordinating with a specific train. This service model has led to greater rail patronage in other cities around the world. Removal of T3 Bankstown Line services from the City Circle would also reduce the number of different service types/patterns operating through City Circle stations, improving service legibility and reducing the risk of platform congestion due to passengers having to dwell at these stations to wait for their desired service in the afternoon peak. Note - this is subject to the design of future suburban rail timetables by TfNSW
- **travel time savings** - T3 Bankstown Line customers would have access to more direct Sydney Metro services to key activity areas in the Global Economic Corridor. Travel time savings would be experienced by existing rail service passengers (who would directly benefit from shorter travel times), new metro passengers (who could transfer from road-based transport such as buses and cars to rail), and road users, who would potentially experience less congestion.

2.2.2 Bus network

Buses in Sydney either provide local connections to key transport interchanges and other services, or provide regional public transport.

The key bus routes operating south of Sydney CBD include Princes Highway and King Street. Cross-regional services also operate between Marrickville and Bondi Junction (Jacobs and Arcadis, 2016).

Public transport use in Sydney is rapidly increasing, putting more pressure on already crowded buses. Previous attempts to meet growing demand have resulted in additional services added to the network, however this may not necessarily result in faster or more reliable services, and also adds further congestion to the road network. Bus services can experience delays in peak periods despite the addition of bus priority lanes and traffic light prioritisation.

The majority of bus routes traverse the project area in a north-south direction, providing perpendicular linkage to the T3 Bankstown Line. Cross-regional and local services are concentrated at the key transport interchanges of Bankstown, Campsie and Sydenham stations.

Restwell Street at Bankstown is a key bus corridor, carrying numerous bus routes such as the M90, M91 and M92. The corridor connects suburbs such as Parramatta, Lidcombe and Burwood, to Liverpool, Hurstville, and Sutherland. Beamish Street at Campsie is the other key bus corridor in the project area, with routes such as the M41, 492 and 400 providing connections from Hurstville, Rockdale, and Burwood, to Macquarie Park, Drummoyne, and the Sydney International Airport. These routes have frequent services during peak hours, and experience low speeds and unreliability due to the congested traffic environment within the town centres.

Parallel to the rail corridor, a number of bus services connect suburbs within the project area to their local station. Additionally, some services operating along Canterbury Road and Marrickville Road connect the project area to inner city suburbs, the Sydney CBD, and Mosman.

A number of school bus services also operate in the project area; however, these represent only a small proportion of the total number of bus services in the project area. However it is recognised that school buses play an important capacity relief function to the road network.

The project and implementation of the wider Sydney Metro network may assist with minimising the need to add further bus services to meet future public transport demand, resulting in reduced congestion of the road network, and assisting to minimise overcrowding on existing bus services.

2.2.3 Light rail

Light rail is expected to play a central role in the future of transport in Sydney. With reliable and high capacity services, the light rail network will provide additional capacity to the public transport network that cannot be met by enhancements to current networks. The L1 Dulwich Hill Line was completed in March 2015 and together with the planned CBD and South East Light Rail will form the new Sydney Light Rail network. The light rail lines will be running north from Central to Circular Quay along George Street, west to Pyrmont and Dulwich Hill, and south east through Surry Hills to Moore Park, Randwick and Kingsford.

The light rail network present in the study area is located within the suburb of Dulwich Hill, defined by the L1 Dulwich Hill Line between Dulwich Hill and Central via Lilyfield and Pyrmont. It has frequent services over extended periods and plays an important role in connecting suburban areas with the Sydney CBD.

The interchange at Dulwich Hill between Sydney Trains and the Light Rail provides the opportunity to significantly increase the effective catchments of the individual rail systems. However, the current capacity constraints in the peaks on Sydney Trains and the differing service frequencies are creating a barrier to the attractiveness of this interchange.

2.2.4 Ferry

Ferry services within Sydney perform two core functions – serving commuters and serving tourists / leisure customers. Most services connect to the Sydney CBD at Circular Quay.

The Sydney's ferry network doesn't have any close access to the south-west rail line, but feeding into Sydney Metro and light rail in the CBD allows the facilitation of access to public transport over a wider area.

2.3 ARTC metropolitan freight network

The Sydney Freight Network, managed by the Australian Rail Track Corporation (ARTC), is a network of dedicated railway lines for freight in Sydney linking the state's rural and interstate rail network with the city's main yards at Enfield and Port Botany. Its primary components are the Southern Sydney Freight Line (SSFL) and a line from Sefton to Enfield and Port Botany.

The Southern Sydney Freight Line (SSFL) is a dedicated freight line for a distance of 36 kilometres between Sefton Park Junction and Macarthur in southern Sydney. The SSFL provides a track in the rail corridor specifically for freight services, allowing passenger and freight services to operate independently and provides an end-on-end connection to the Metropolitan Freight Network (MFN).

As shown in **Figure 2.2**, there are three freight rail lines linking or traversing the study area. These freight lines are:

- the MFN which is the core of the Sydney freight system and extends from Lidcombe / North Strathfield in the north to Sefton Park Junction in the west and Marrickville in the south / east. This network has two tracks dedicated to freight but shares a corridor with passenger trains on the Bankstown line. At Marrickville (Meeks Road Junction), there is an existing connection from the Down Bankstown Line track to this Goods Line
- the Botany line which links from the MFN at Marrickville (at Meeks Road Junction) to the container port at Botany
- the Illawarra Line which is a shared passenger and freight rail corridor that extends between South Coast and the interface with the MFN at Marrickville (at Meeks Road Junction).

The part of the MFN between Sefton Park Junction and Marrickville generally has ample capacity but the shared tracks with suburban passenger services on the Illawarra Line and the Western Line have already constrained flexibility for freight. Passenger growth will represent a major challenge for future capacity of these sections (2015 Sydney Metropolitan Freight Strategy).

The project would not utilise the freight tracks, and would allow for further segregation of the freight from the Metro. The investment which has been made on these freight tracks to allow greater efficiency in the rail freight network would therefore be further protected.

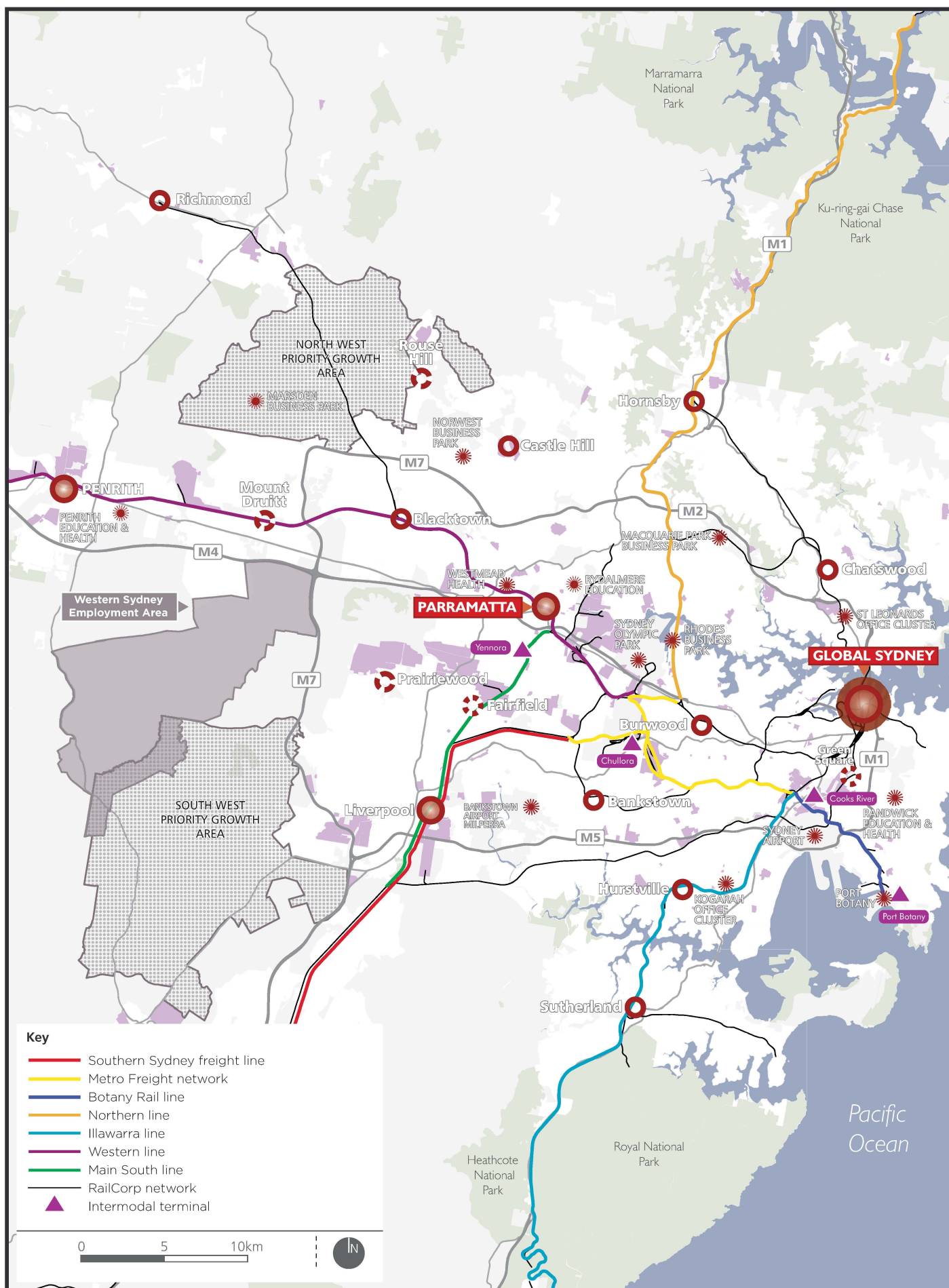
2.4 Road Network

North of Sydney Harbour, the road network is dominated by several motorways, including the Lane Cove Tunnel and the Hills M2 Motorway and Warringah Freeway / Gore Hill Freeway, connecting to the Sydney CBD. Traffic volumes generally increase on the approaches to the Sydney Harbour crossings.

Key roads south of the Sydney CBD include the Eastern Distributor (providing a connection to the M5 Motorway), King Street, the Princes Highway and Regent Street.

Sydney's road network is already heavily congested and cannot be effectively augmented into the CBD under the projected increase in transport demand (driven by population growth). While there is significant investment planned for the road network, cars and buses alone cannot provide for future travel demands.

The introduction of an efficient and reliable metro system (including the project) that delivers seamless travel between modes would encourage greater public transport use. This would likely result in a reduction of cars using the road network and contribute to lower levels of congestion. The project would also reduce the need for further bus services to be added to the road network to cater for future public transport demand.



Key State Roads in the vicinity of the project area which serve Sydney CBD, Port Botany and the wider Sydney metropolitan area include the M5 East Freeway and M5 South Western Motorway which run some 1.5-3km to the south of the project alignment, and the M1 Southern Cross Drive approximately 6km to the east of the project area. The M5 East Freeway is almost 10 kilometres in length and connects to the Sydney International Airport, Port Botany and the Cross City Tunnel. It includes twin four kilometre tunnels between Bexley Road, Earlwood and Marsh Street, Arncliffe. These routes and the key local road network are shown in **Figure 2.3** overleaf.

The WestConnex project which is currently partially under construction and partially in planning phase will result in the following changes to the road network (Sydney Motorway Corporation, 2017):-

- widen the M4 between Parramatta and Homebush and extend it in underground tunnels between Homebush and Haberfield
- double road capacity along the M5 East corridor with the New M5 underground tunnels running between St Peters and Kingsgrove
- join these underground routes together via the M4–M5 Link tunnel to form a seamless motorway without traffic lights
- provide a western bypass of the Sydney central business district (CBD)
- provide for future connections to the Western Harbour Tunnel and Beaches Link
- provide a connection to Sydney Airport and Port Botany via Sydney Gateway.

These scheme components will provide additional road capacity, to help support the continued population and economic growth of Sydney, and New South Wales.

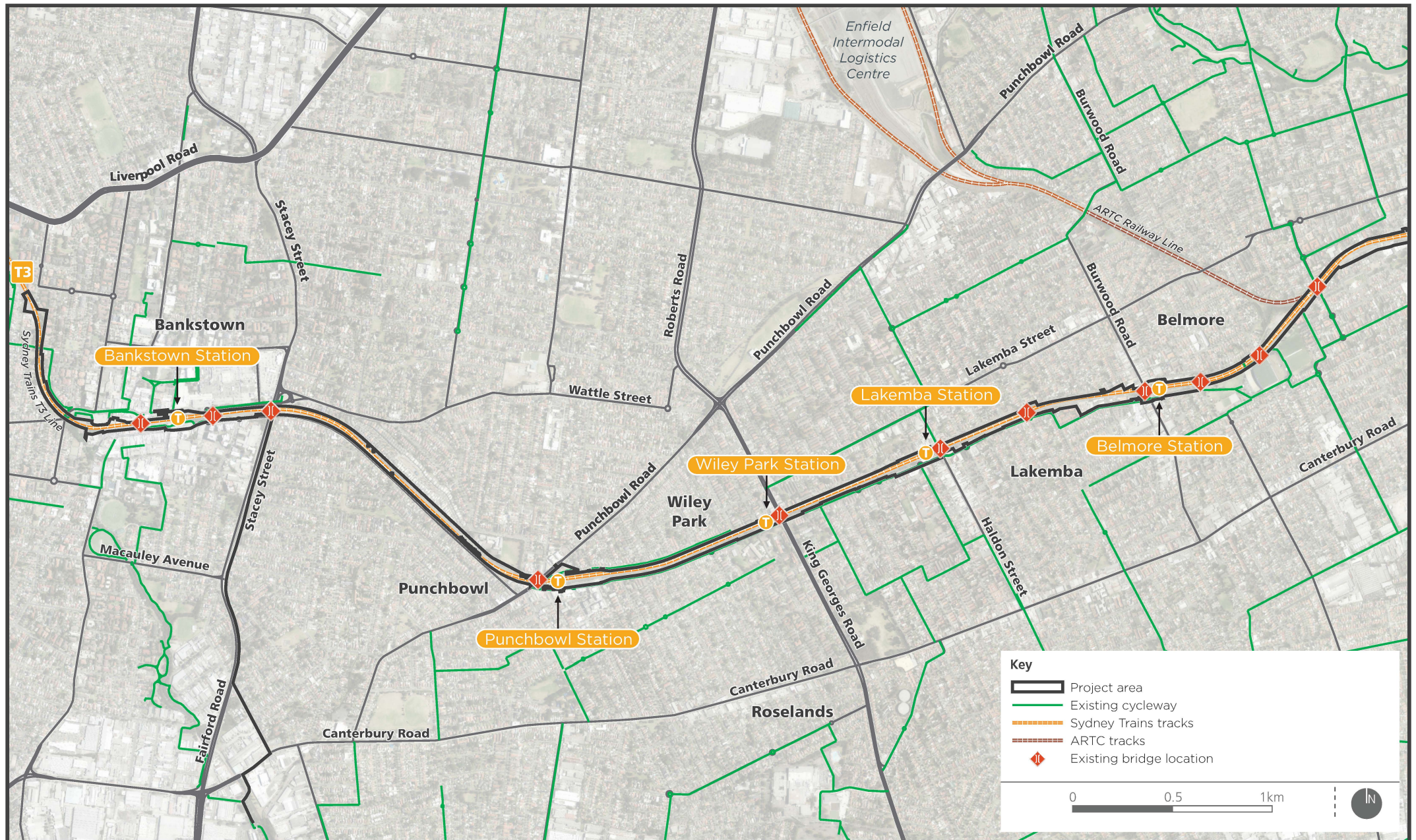
The project would work alongside these road network enhancements to provide an integrated transport network to deliver the capacity needed to cater for the projected population growth.

State Roads in the vicinity of the study area include:

- Canterbury Road / New Canterbury Road, which passes through the Dulwich Hill precinct, and Canterbury Road that continues through from the Hurlstone Park precinct to the Bankstown precinct. Traffic volumes on Canterbury Road are concentrated around the suburbs of Canterbury and Bankstown
- King Georges Road, which runs north-south through Wiley Park, connecting the M5 South Western Motorway with the M4 Western Motorway. The State Road corridor also connects to the suburbs of Ryde and Macquarie Park via Concord Road
- Stacey Street, which provides an important north-south connection through Bankstown, connecting the M5 South Western Motorway with the M4 Western Motorway. The corridor also connects to the Hills District via Silverwater Road
- Princes Highway, which passes through Sydenham in a north-south direction and provides connections via Local roads to the Inner West
- Hume Highway, which traverses Bankstown in an east-west direction and connects Sydney's western suburbs to Parramatta Road and the Inner West
- Punchbowl Road, which runs northeast-southwest through the Punchbowl precinct connecting to Canterbury Road at the southern junction. It runs parallel and further south to Hume Highway between Stacey Street and Roberts Road.



FIGURE 2.3



In addition to the above, east-west State Roads such as Unwins Bridge Road, Lakemba Street and Wattle Street are available as alternative routes for east-west movements. Numerous Regional roads provide connections from the surrounding areas to New Canterbury Road and Canterbury Road.

Regional roads that provide linkages through the town centres in the study area include:

- Railway Parade and Buckley Street, Sydenham
- Illawarra Road, Marrickville
- Wardell Road, Dulwich Hill
- Crinan Street, Hurlstone Park
- Broughton Street and Jeffery Street, Canterbury
- Beamish Street, Campsie
- Burwood Road, Belmore
- Haldon Street and The Boulevarde, Lakemba
- Lakemba Street, Wiley Park
- The Boulevarde, Punchbowl
- North Terrace and South Terrace, Bankstown.

The majority of the State and Regional road network experience significant traffic volumes and congestion, especially during the peak periods.

It should be noted that Canterbury Road/New Canterbury Road is congested throughout the project extent especially near to Canterbury, Campsie, Belmore, Wiley Park and Bankstown Stations. This can be attributed to the fact that Canterbury Road/New Canterbury Road is the only east-west State Road, in the locale, and runs broadly parallel to the project. For the north south movements; Illawarra Road at Marrickville Station, Beamish Street at Campsie Station, Burwood Road at Belmore Station, King Georges Road at Wiley Park Station and Stacey Street at Bankstown Station also exhibit congestion.

2.5 Walking Environment

Figure 2.4 shows that a majority of the south and south western Sydney sits within a greater than 17% walking mode share. The study area is located in the 17% to 19% walking mode share range. Travelling from west towards east, there is a gradual increase in the walking modal share as we approach areas of high density, employment areas and the CBD.

Pedestrians can generally move freely through the study area on local footpaths and dedicated road crossings, but experience reduced permeability within centres such as Bankstown due to large street blocks, major roads and the rail corridor. The areas surrounding these centres generally have a high volume of pedestrian access interchanges and commercial precincts.

With the exception of the medium density commercial/industrial land uses in Canterbury, Campsie and Bankstown, the rest of the area surrounding the project generally encompasses low density residential areas generating low pedestrian volumes adjacent to and between the stations.

Wide and inter-connected footpaths and a variety of pedestrian crossing facilities are provided all over the road network. Safer and more accessible pedestrian crossing facilities have also been provided close to the areas with higher pedestrian activity such as schools and pre-schools.

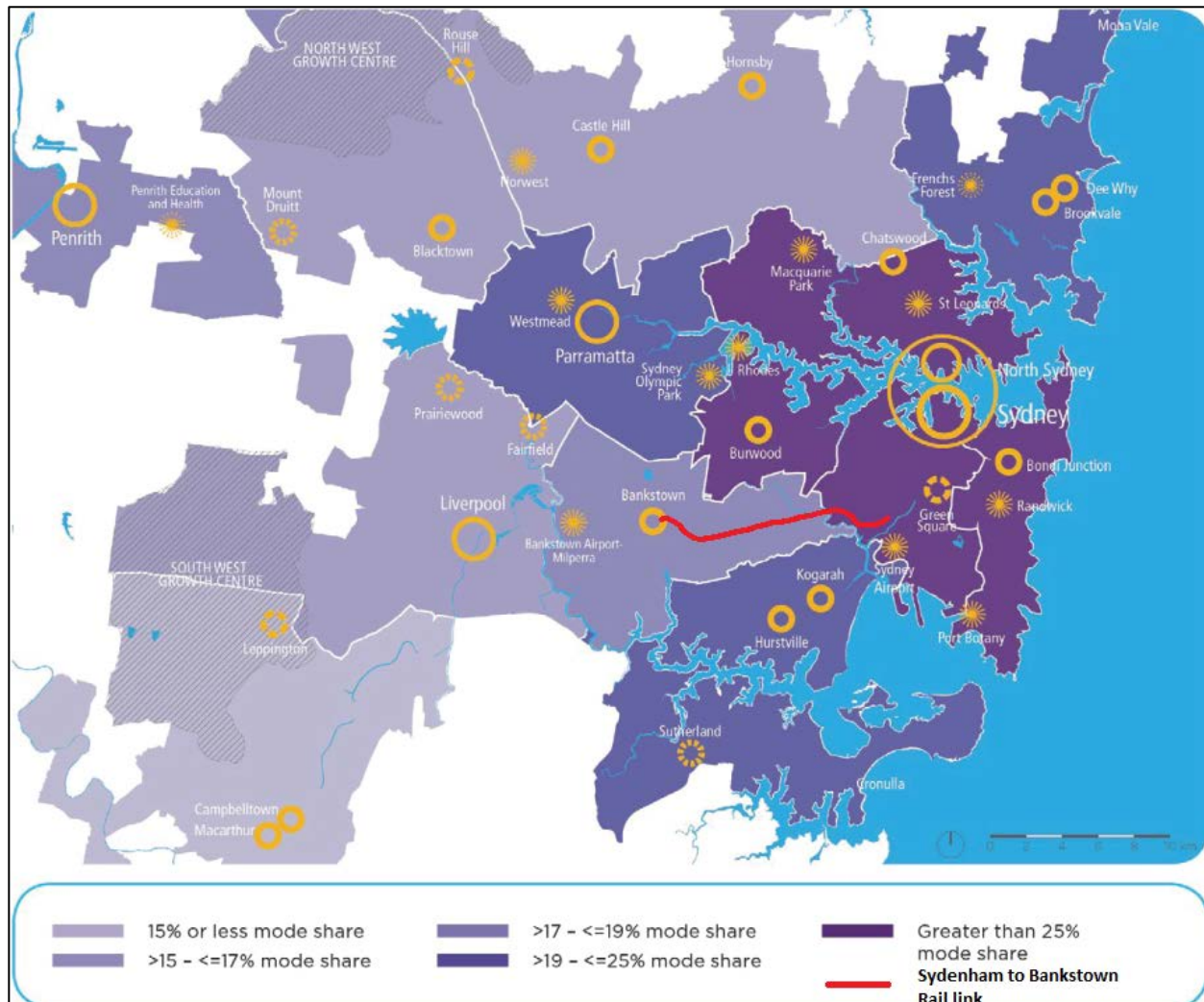


Figure 2.4 Walking Patterns across Sydney (Sydney's Walking Future, NSW Government, December, 2013)

2.6 Cycle Network

The cycle network in southern Sydney is developing from what has previously been a series of individual on and off road facilities towards a cohesive network which supports the varied needs of those cycling for leisure, personal business and commuting.

Figure 2.5 shows the activity centre catchments (Sydney's Cycling Future NSW Government, December, 2013). The overarching goal of Sydney's Cycling Future is to make cycling a safe, convenient and enjoyable transport option for short trips by improving access to towns and centres, reducing congestion and increasing capacity on the public transport system.

Sydney's Cycling Future notes that 70 percent of NSW residents would ride a bike more for everyday transport if it was safer and more convenient. Sydney's Cycling Future aims to fix the missing links in the cycle network so that people can bike to town centres, including railway stations, in a safer manner.

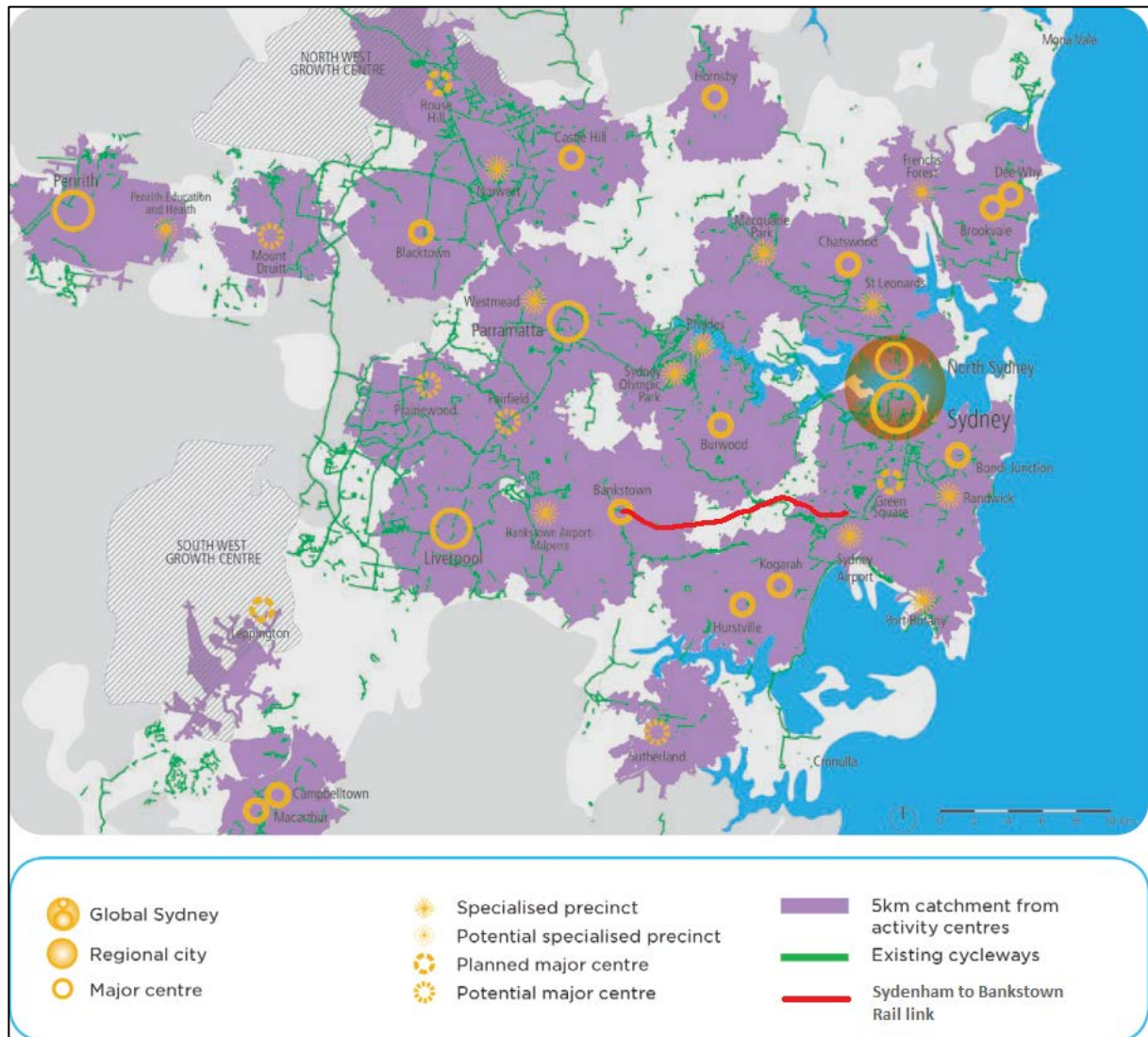


Figure 2.5 Existing Cycleways of Sydney and Activity Centre Catchments (Sydney's Cycling Future, NSW Government, December, 2013)

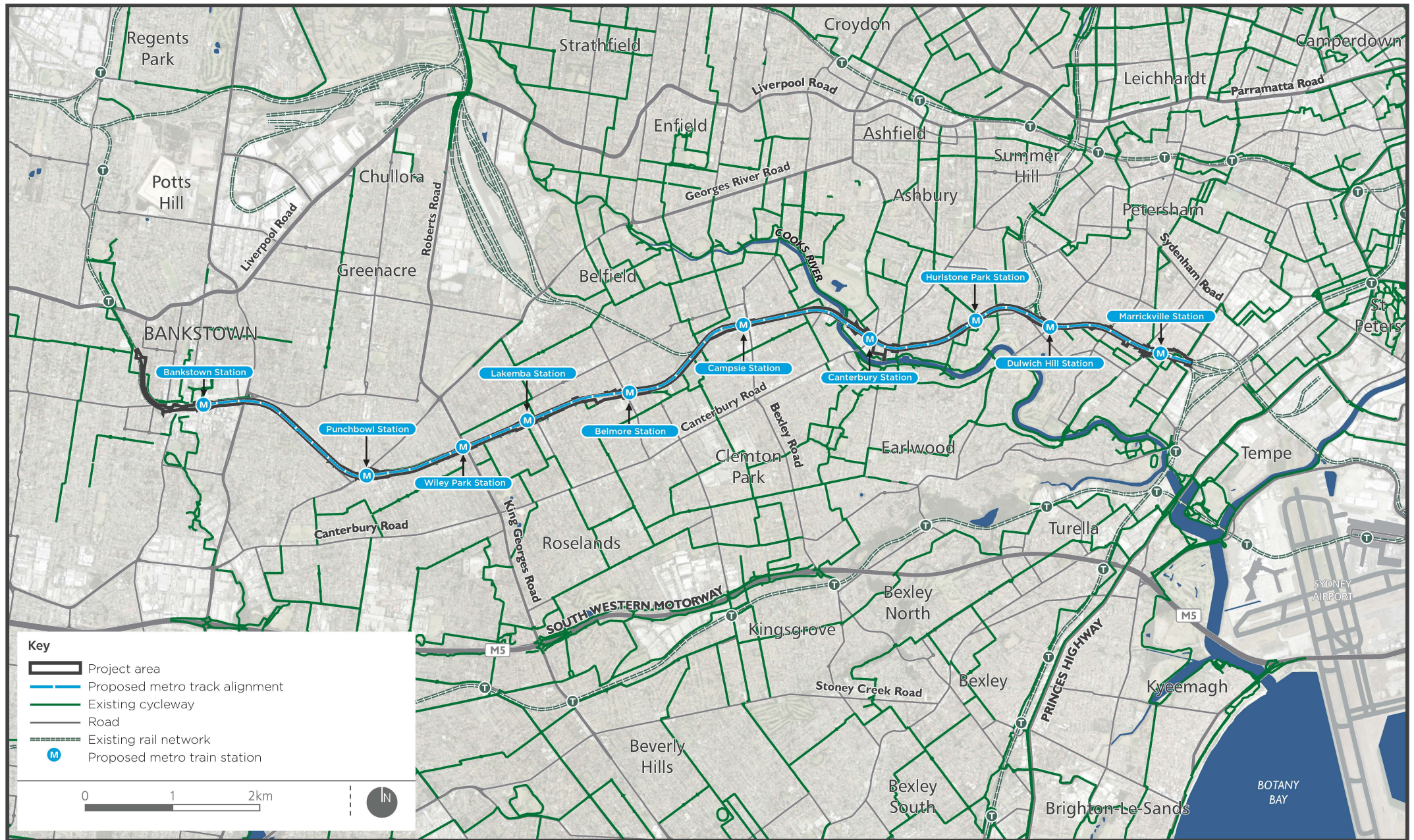
As shown in **Figure 2.5**, approximately half of the study area is providing the opportunity for residents who are more than 5km away from major activity centres to use the Metro as part of their journey. This demonstrates the need for both the project, and also for the linkages to the cycling network to provide multimodal journey opportunities for these longer journeys.

Figure 2.6 illustrates the project area and the existing cycleways in the vicinity of this alignment.

In the vicinity of the project area, the cycle network consists of:

- the Greenway Cycleway, which connects Dulwich Hill to Lewisham
- the Cooks River cycle route, which connects Campsie, Canterbury and Tempe
- Salt Pan Creek cycle route, which connects Bankstown to Georges Hall.

Whilst the existing facilities offer some amenity and connectivity to wider transport networks, there are several aspects of the system that are contributing to a relatively low uptake in cycling. These include restricted bike parking at some locations, poor facilities to enable mode transfer at stations, and the timetable constraints of the Sydney Trains services.



The project would address many of these aspects to support the wider use of cycling as a mode of transport and enable a greater number of Sydney residents to use cycling as a key mode of transport, with the addition of a Metro based leg on their journey.

To support this:

- each interchange is being configured to link directly to any existing or planned cycle routes, an active transport corridor and ample parking is to be provided for bikes through a mixture of bike sheds, bike shelters and bike hoops
- the facilities and plan are intended to encourage cyclists within a reasonable cycling distance – approximately 2.5km or 10 minutes ride of the interchange, to safely store their bike before transferring onto a metro or other public transport service
- design provision is provided to support the introduction of an active transport corridor to the south of the rail corridor linking each station between Marrickville and Bankstown.

2.7 Parking

The study area contains a variety of car parking opportunities for customers of Sydney Trains services. These include dedicated commuter parking spaces on RailCorp land, on and off-street unrestricted parking spaces within the surrounding residential streets of the train station. However, unrestricted spaces may also be used by employees within the employment centres, as well as visitors or shoppers. The existing parking situation at each station is discussed further in Chapter 3.

Whilst the use of car to access the Metro is not the preferred modal chain, there is the recognition that supporting the use of Metro for at least part of the journey offers many benefits to both the individual and the overall environment and economy of Sydney. As such the project would provide the following features to support this:

- kiss and ride facilities, as well as taxi ranks at some stations would be provided to enable customers to drop and pick up passengers at each station using safe and efficient routes
- where dedicated commuter parking has been provided on RailCorp land, the existing number of spaces would be retained on the day of opening
- in most cases, car parking spaces would be retained in the original position or moved to other locations within the precinct.