sydney METRO | city & southwest

Sydenham to Bankstown Upgrade

STATE SIGNIFICANT INFRASTRUCTURE APPLICATION REPORT

NSW GOVERNMENT | Transport for NSW

NSW MAKING IT HAPPEN

Executive summary

Sydney Metro

Sydney Metro is Australia's largest public transport project. It will transform Sydney, delivering more trains and faster services for customers across the network.

A new fully-automated railway with key interchanges with other public transport modes, this 21st century network will deliver 31 metro stations and 66 kilometres of metro rail for Australia's biggest city – revolutionising the way Sydney travels.

The Sydney Metro network consists of Sydney Metro Northwest (previously known as the North West Rail Link) and Sydney Metro City & Southwest. When Sydney Metro is extended into the CBD and beyond in 2024, there will be ultimate capacity for a metro train every two minutes in each direction under the city – a level of service never before seen in Sydney.

In addition, planning is underway for Sydney Metro West, to provide a new underground metro railway linking the Parramatta and Sydney CBDs, and communities along the way, doubling rail capacity in this corridor and addressing Sydney's rapid growth.

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.

Sydney Metro is needed to boost the capacity and reliability of Sydney's rail network. This is currently constrained by a number of factors, in particular the large number of tracks that enter Sydney's CBD and the complexity of points where two train tracks converge. As a result, the existing rail network in Sydney is heavily congested, with customers on most rail lines often experiencing significant crowding on trains and station platforms during the morning and evening peaks.

As Sydney's population and employment continue to grow, rail is forecast to experience the highest growth in travel demand, with about an additional 100,000 trips expected on Sydney's rail network during the morning peak by 2036. This will place additional pressure on the rail network. The closer the rail network gets to capacity, the less reliable it will become and the more likely it will fail to meet the needs and expectations of rail customers.

Sydney Metro City & Southwest

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 ('the project' and the subject of this document), which involves the upgrade and conversion to metro standards of the existing 13.5 kilometre Sydney Trains rail line from Sydenham to Bankstown.

Transport for NSW is investigating opening Sydney Metro City & Southwest in two phases. Initially, Sydney Metro Northwest services would be extended from Chatswood through to Sydenham Station (phase 1). Some months later, metro operations would be extended from Sydenham through to Bankstown Station (phase 2), with both stages planned to be completed by the end of 2024.

Opening of Sydney Metro in phases will provide customers with the benefit of a progressive rollout of Sydney Metro services, starting in 2019 with the opening of Sydney Metro Northwest (Cudgegong Road to Chatswood).

The phased opening will also ensure that the final shutdown of the Sydenham to Bankstown component would only occur after the opening of the Chatswood to Sydenham component.

This would make a metro service available from Sydenham Station to the city and further north whilst the Bankstown Line is being prepared for metro operations. This would mitigate the impact to existing customers who would temporarily need to travel to and from Sydenham via rail replacement bus services, since there would be a frequent turn-up-and-go metro service available at Sydenham Station for travel to/from the CBD and Sydney's northwest.

To enable earlier opening of City & Southwest, Transport for NSW will consider how the delivery of components of the project as described in this application could be accelerated. This would involve a separate delivery contract for the work at Sydenham Station and junction. Delivery of elements earlier may involve a separate planning approval process to the main conversion of the Bankstown Line as described in this application, in order to best align with the construction contracts and how the work is sequenced. Further details on how City & Southwest would be delivered would be provided within the Environmental Impact Statement released later this year.

Once complete, Sydney Metro City & Southwest would deliver a major increase in the capacity of Sydney's rail network, with the capacity to run up to 30 trains per hour through the Sydney CBD in each direction. This provides the foundation for delivering a 60 per cent increase in the number of trains operating through Sydney's CBD during peak periods, which would cater for an extra 100,000 customers per hour.

The project

Conversion of the Bankstown Line between Sydenham and Bankstown to metro (the project) would free up paths on other heavy rail lines and simplify the existing network. This would increase both the capacity and reliability of large parts of the Sydney Trains network, for instance enabling up to 20 trains per hour on the City Circle.

The project would provide a number of community and customer benefits during delivery and subsequent operation of metro services between Sydenham and Bankstown, including improved station facilities, improved public domain at the station entries, and improved ability to interchange with other transport modes at stations.

For customers on the Bankstown Line, once metro services commence in 2024, travelling either locally or to other parts of Sydney via the metro would be more attractive due to more frequent services and faster travel times.

The significant increase in transit amenity along the Bankstown Line and beyond would facilitate increased economic productivity and land use efficiency in areas across the corridor.

The project would connect to Sydney Metro tracks at the tunnel dive structure, which would be constructed north-east of Sydenham Station as part of the proposed Chatswood to Sydenham component.

Planning and assessment process

The project has been declared to be State significant infrastructure and critical State significant infrastructure under sections 115U(4) and 115V of the *Environmental Planning and Assessment Act 1979* (EP&A Act), respectively. Therefore, the project would be subject to assessment and approval by the NSW Minister for Planning under Part 5.1 of the EP&A Act.

Purpose of this document

This State Significant Infrastructure Assessment Report supports an application to the Minister for Planning seeking the Secretary's environmental assessment requirements for the environmental impact statement. It has been prepared based on the indicative locations and

design developed to date. It is noted that the project components, location and design may be subject to further changes as part of the ongoing design development and community consultation, and clarifications may be made during the environmental impact assessment process.

Key environmental issues for the project

A preliminary environmental risk analysis for the project has identified the following 'key' environmental issues:

- traffic, transport and access
- noise and vibration
- non-Aboriginal heritage
- hydrology and flooding
- property and land use
- business impacts
- landscape character and visual amenity
- ecology
- social impacts and community infrastructure
- cumulative impacts.

A preliminary environmental assessment of the project's potential impacts has confirmed that the above issues have the potential to result in a significant impact. Detailed assessment of these issues, and the other environmental issues identified, would be undertaken as part of the environmental impact statement. As part of this assessment process, environmental mitigation measures would be developed to minimise the potential impacts of the project during construction and operation.

Next steps

Following the receipt of the Secretary's environmental assessment requirements, Transport for NSW will prepare and publicly exhibit an environmental impact statement, in accordance with the requirements of Part 5.1 of the EP&A Act. The environmental impact statement will include:

- a description of the project, including its components and construction activities
- a description of the existing environment
- an assessment of the potential direct and indirect impacts on the environment for the key and other potential environmental issues, during construction and operation of the project
- identification of measures to be implemented to avoid, minimise, manage, mitigate, offset, and/or monitor potential impacts of the project
- identification and consideration of issues raised by stakeholders and the community.

Table of contents

Table index

Figure index

1. Introduction

This chapter provides an overview of the project, its strategic context and key features. The structure of the report is also provided.

1.1 Overview

1.1.1 Sydney Metro

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 customers in the future.

Sydney Metro is a new standalone rail network identified in *Sydney's Rail Future.* The Sydney Metro network consists of Sydney Metro Northwest (previously known as the North West Rail Link) and Sydney Metro City & Southwest, which together would provide 66 kilometres of metro rail line and 31 metro railway stations (refer to Figure 1-1).

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 ('the project' and the subject of this document).

In addition, planning is underway for Sydney Metro West, to provide a new underground metro railway linking the Parramatta and Sydney central business districts (CBDs), and communities along the way, doubling rail capacity in this corridor and addressing Sydney's rapid growth.

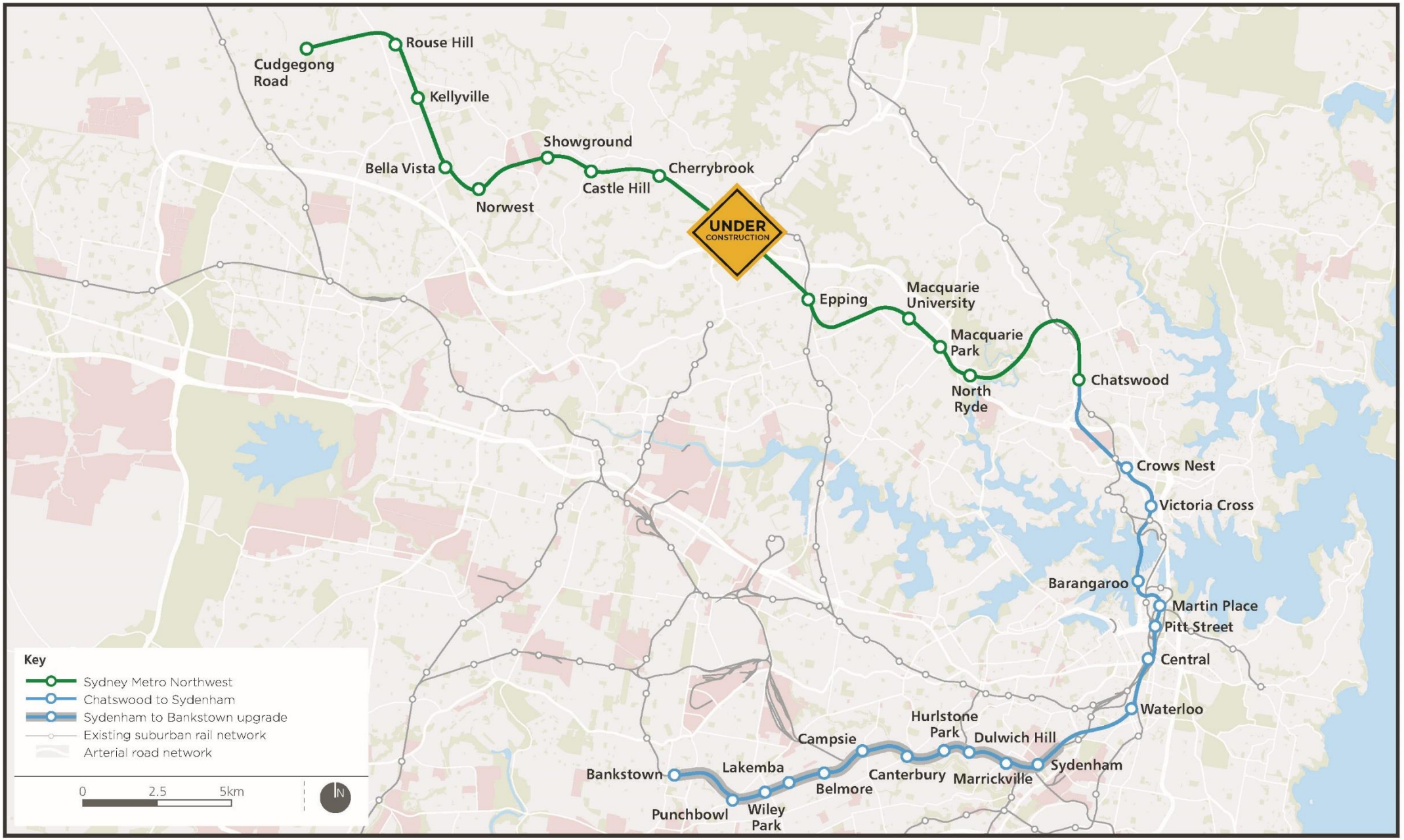
The Sydney Metro Delivery Office has been established as part of Transport for NSW to manage the planning, procurement and delivery of the Sydney Metro network.

1.1.2 The project for which approval is sought

Transport for NSW ('the proponent') is seeking approval to construct and operate the Sydenham to Bankstown component of the Sydney Metro City & Southwest project. The Sydenham to Bankstown upgrade ('the project') involves upgrading the existing 13.5 kilometre rail line and 11 existing stations from Sydenham to Bankstown to metro standards, and providing a stabling facility to support the operations of Sydney Metro City & Southwest. The project would connect to Sydney Metro tracks at the tunnel dive structure, which would be constructed north-east of Sydenham Station as part of the proposed Chatswood to Sydenham component. The project is described in Chapter 6 (Project description).

The Chatswood to Sydenham component of the Sydney Metro City & Southwest project ('the Chatswood to Sydenham project') is subject to a separate application which was granted planning approval by the Minister for Planning on 9 January 2017.

The project is subject to assessment and approval by the Minister for Planning under Part 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). This document supports an application to the NSW Department of Planning and Environment seeking the Secretary's environmental assessment requirements for the environmental impact statement, as part of the first step in the environmental assessment and planning approvals process for the project.



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The Sydney Metro network

FIGURE 1.1

1.2 Overview of the project

1.2.1 Location

The project is located within the existing rail corridor from about one kilometre north-east of Sydenham Station to about one kilometre west of Bankstown Station. The location of the project and the 11 existing stations is shown in Figure 1-2.

A new stabling facility for Sydney Metro trains (the Sydney Metro Trains Facility South) would be built on industrial land adjacent to the tunnel dive structure on the northern side of the rail corridor. The location of the Sydney Metro Trains Facility South is shown in Figure 1-2.

The term 'project area' is used throughout this document to refer to the existing rail corridor (from about one kilometre north-east of Sydenham Station to about one kilometre west of Bankstown Station), the 11 existing stations within the corridor, the train stabling facility and the area surrounding the rail corridor.

1.2.2 Key features

The project involves converting the existing 13.5 kilometre section of the Sydney Trains Bankstown Line between Sydenham and Bankstown to a metro line. The conversion of the line would also include upgrading 11 existing stations to the standards required for metro services, including full accessibility.

The key features of the project are expected to include:

- upgrades to the existing stations
- a new stabling facility for Sydney Metro trains
- utility and rail system protection and relocation works
- adjustment of existing track alignments and overhead wiring
- installation of Sydney Metro rail systems
- adjustment of existing Sydney Trains rail systems
- turn back facilities and track crossovers
- corridor works to access tracks/paths, rail corridor fencing, and noise walls
- installation of high security fencing along the entire corridor
- precinct works to suit the new station layouts
- upgrade of existing bridges/underpasses that cross the rail corridor
- stormwater drainage works
- provision of new traction substations
- works to facilitate altered train operations on the existing Sydney Trains network
- provision for rail corridor development
- provision for an active transport corridor between Sydenham and Bankstown
- temporary transport measures implemented during rail possession periods.

The project would interchange with Sydney Trains services at Sydenham Station and Bankstown Station. Once the project is operational, Sydney Trains would no longer operate on the Bankstown Line between Sydenham and Bankstown stations. Further details on the project, including construction and operational elements are provided in Chapter 6 of this document.

Figure 1-2 Overview of the project

1.2.3 Timing of operations

Construction of the project would commence in 2018. Sydney Metro City & Southwest would be fully operational by 2024. Transport for NSW will investigate the potential to commence operations in two phases. Initially, Sydney Metro Northwest services would be extended from Chatswood through to Sydenham Station (phase 1). Some months later, Metro operations would be extended from Sydenham through to Bankstown Station (phase 2), with both stages planned to be completed by the end of 2024. This is discussed further in Section 6.9.5.

Initially, six-car trains would run at least every four minutes in the peak period (between 15 and 20 trains per hour) in each direction between Sydenham and Bankstown stations.

1.3 Background to the project

1.3.1 Strategic planning context

Sydney's Rail Future (Transport for NSW, 2012a) is an integral part of the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012b). The Master Plan sets the direction for transport planning in NSW for the next 20 years, providing a framework for transport policy and investment decisions.

To cater for the differing and changing needs of customers, *Sydney's Rail Future* provides a plan for a three-tiered rail network:

- Tier 1: Metro – based on 'turn-up-and-go' services and single−deck metro trains (see Section 1.3.2)
- Tier 2: Suburban – timetabled services with double-deck trains
- Tier 3: Intercity – timetabled services with on-board amenities for long distance trips.

Further information on the strategic context and need for the project, including a summary of the *NSW Long Term Transport Master Plan* and *Sydney's Rail Future*, is provided in Chapter 2.

1.3.2 Sydney Metro

Customer experience

The customer experience underpins how Sydney Metro is being planned and designed. The customer experience incorporates all aspects of travel associated with the transport network, service and project including:

- the decision on how to travel
- the travel information available
- the speed and comfort of the journey
- the range and quantity of services available at stations, interchanges and within the vicinity of stations.

Sydney Metro aims to serve a diverse set of customers who will undertake a number of journeys throughout the day and week. The design and delivery of service is centred around the customer – their needs, behaviours, and their jobs to be done.

At a very basic level customers expect us to provide a service that is on time, clean, safe, comfortable, efficient, convenient, has the right information and has adequate customer service. These basics are key drivers of customer satisfaction.

Our goal is to deliver a level of service that goes beyond satisfaction and makes it easy for customers' to use the metro and encourages repeat use across the multiple types of journeys they may make. This will endeavour to support the Transport for NSW goal of increasing the number of journeys taken on public transport by the public both in the peak and off peak.

Designing for an easy customer experience is an important part of engaging customers to use Sydney Metro as part of their journey. Customers will expect more from our service over time and ease of use is the foundation for design and development of all our products, services, systems and spaces going forward.

Sydney Metro features

Sydney Metro is being delivered with an easy approach for customers, integrating walking, cycling, bus, ferries, light rail, taxi, parking, on demand vehicle, share ride and kiss-and-ride infrastructure to make the journey to and from the metro station as seamless as possible.

Key features of Sydney Metro include:

- no timetable – customers can just turn up and go with services every four minutes in the peak
- opal ticketing – fares are the same as the rest of Sydney
- customer service assistants at every station and moving through the network during the day and night
- Australian-first platform screen doors improving customer safety and allowing trains to get in and out of stations much faster. These doors run the full length of all metro platforms and open at the same time as the train doors
- continuous mobile phone coverage throughout the metro network
- operational performance requirements that include 98 per cent on time running and clean platforms and trains
- multi-purpose areas for prams, luggage and bicycles
- wheelchair spaces, separate priority seating and emergency intercoms inside trains
- safety benefits including security cameras on trains and the ability for customers to see inside the train from one end to the other
- video help points at platforms, connecting directly with train controllers – an Australian first
- level access between the platform and train and three double doors per side per carriage for faster loading and unloading
- heating and air-conditioning in all metro trains
- on-board real time travel information and live electronic route maps.

As Australia's first fully-automated railway, customer safety is a priority of Sydney Metro. At all times, a team of expert train controllers will monitor the system, making sure everything runs smoothly.

Sydney's current suburban system can reliably carry 24,000 people an hour per line. Sydney's new metro railway has a target capacity of more than 40,000 customers per hour in each direction, similar to other metro systems worldwide.

1.4 Structure of this report

The structure and content of this report are outlined in Table 1-1.

Table 1-1 Structure and content of this report

Chapter	Description
Chapter 1 Introduction	Provides an overview of the project and its role in terms of the Sydney Metro rail network.
Chapter 2 Strategic justification and need	Provides an overview of the strategic context, need for the project, and the project objectives.
Chapter 3 Project development and alternatives	Describes how the project was developed and reviews the strategic alternatives and options considered to date.
Chapter 4 Planning and assessment process	Provides information on the statutory framework and approval pathway for the project.
Chapter 5 Site description	Provides a description of the project area and the regional context and existing rail infrastructure facilities relevant to the project.
Chapter 6 Project description	Identifies the key physical infrastructure anticipated for the project and provides an overview of how the project may be constructed.
Chapter 7 Preliminary environmental risk analysis	Provides a preliminary environmental risk analysis taking into account the current project scope.
Chapter 8 Preliminary assessment of environmental impacts	Provides a preliminary assessment of the potential environmental issues that may result during construction and operation of the project.
Chapter 9 Consultation	Outlines the consultation undertaken to date and the consultation that will occur during the environmental impact statement process.
Chapter 10 Summary of proposed environmental impact statement scope	Outlines the proposed scope for the environmental impact statement.
Chapter 11 Conclusion	Provides closing comments for consideration.

2. Strategic justification and need

This chapter outlines the strategic need and justification for the project taking into account the transport challenges that Sydney faces now and in the future.

2.1 The key benefits of this project

The benefit, need and justification for the Sydenham to Bankstown component of Sydney Metro City & Southwest covers two key aspects:

- the broader rail network
- the Bankstown Line itself.

2.1.1 The broader rail network

Conversion of the existing heavy rail infrastructure to metro operations would free up paths on other heavy rail lines and simplify the existing network, increasing both the capacity and reliability of large parts of the Sydney Trains network.

The T3 Bankstown Line impacts on the operating efficiency of the wider suburban train network because of track configuration and consequent merges with other railway lines in the approach to the Sydney CBD.

The T3 Bankstown Line and the T2 Airport, Inner West & South Line use the City Circle to traverse the Sydney CBD. To do this, in the morning peak, the T3 Bankstown Line operates with some services on the City Inner track (counter-clockwise) and some on the City Outer track (clockwise). As well as being complicated for passengers, T3 Bankstown Line services must merge at:

- Sydenham with T2 services from Campbelltown
- the approach to Central with T2 services from Granville and Homebush
- Central with T2 Airport services.

These merging movements limit the capacity of the network and the ability to operate reliably on each of these lines.

Figure 2-3 shows how the project would unlock capacity on the City Circle. Converting the Bankstown Line to Sydney Metro would remove this line from this complex arrangement, and effectively eliminate the first two of the three merges listed above. This in turn would allow the City Circle to be dedicated to the T2 Airport, Inner West and South Line, providing the ability to accommodate more reliably up to 20 trains per hour in each direction. There would also be an increase in the number of trains that currently operate on the Bankstown Line. These benefits to the overall network would be achievable on the assumption that the Chatswood to Sydenham project is also delivered.

Furthermore, the Bankstown Line is currently a shared corridor and conversion to metro operations would segregate freight and passenger infrastructure, creating separate ‘corridors’ between Marrickville and Belmore, which would increase the reliability and maintainability of both.

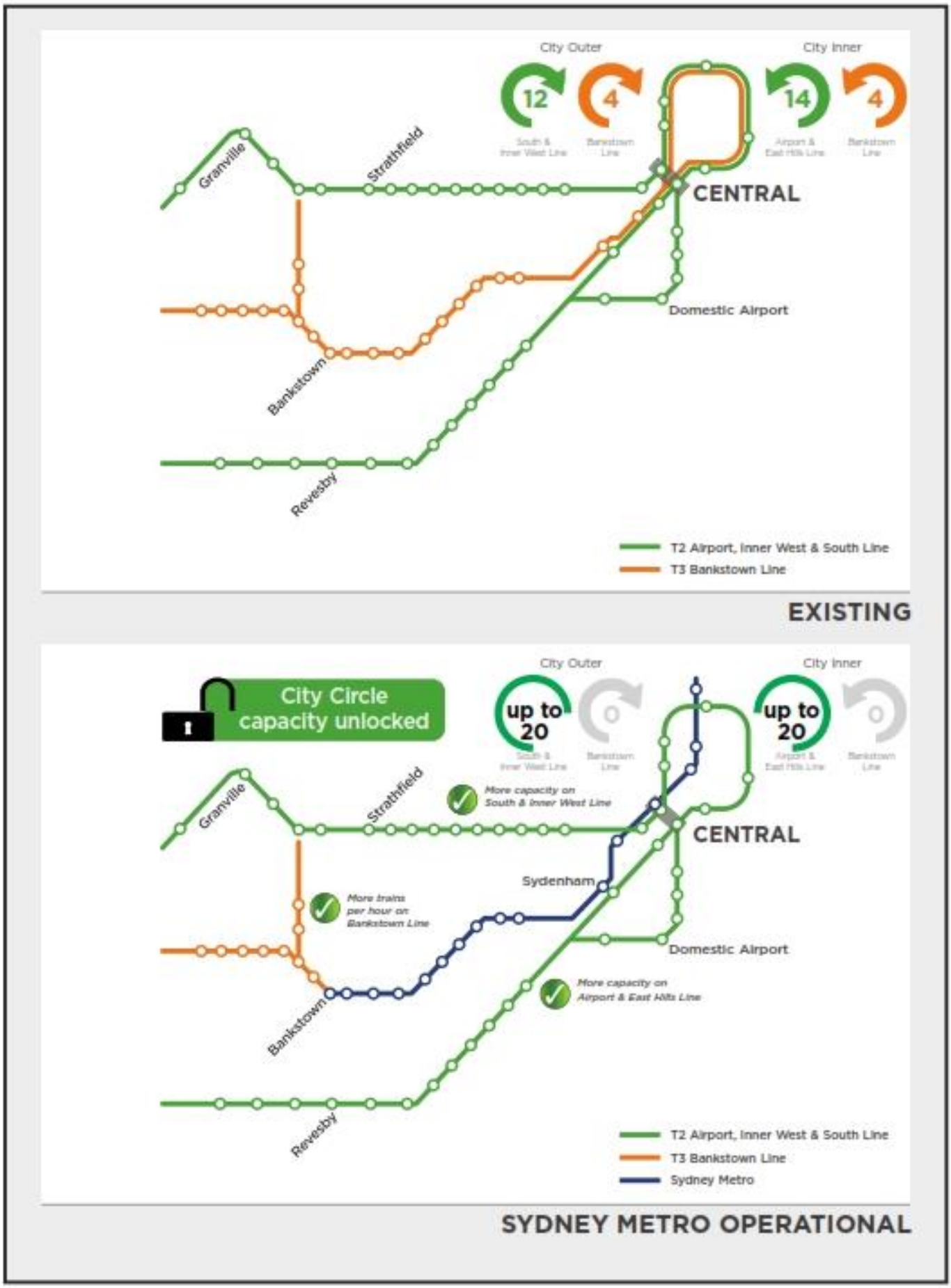

Figure 2-1 Overview of the project's effect on the City Circle

2.1.2 The Bankstown Line

The project would provide a number of community and customer benefits during delivery and subsequent operation of metro services between Sydenham and Bankstown.

At a local community level, progressive improvements to individual stations and surrounding precincts would begin from 2020, including:

- full disability access, including lifts (currently six of the 11 stations have lift access)
- safer platform environments with improved CCTV surveillance, screen doors, platforms level with train floors, and minimal gaps between platforms and trains
- new concourses, greater circulation space, and new station entries better located to connect with local town centres
- improved public domain that celebrates the high-quality heritage assets in the local communities
- improved station interchange facilities.

Opportunities to control access to station car parks using the Opal card (or other technologies) would also be explored, which may enable a direct linkage to be established between customer parking and use of the metro service.

For customers on the Bankstown Line, once metro services commence in 2024, travelling either locally or to other parts of Sydney via the metro would be more attractive due to:

- the improved station access noted above
- all trains stopping at all local stations – no waiting for the right train
- less waiting, as a result of higher frequency services (four versus six to nine minutes in the peak, and 10 versus 15 minutes in the off-peak)
- safe and efficient connections during the peak and non-peak periods between key centres along the T3 Bankstown Line
- reduced travel times to key destinations such as Central and Town Hall
- new direct and fast services to Martin Place, Barangaroo, North Sydney, Chatswood and Macquarie Park
- interchanges to other rail services at Sydenham, Central and Martin Place.

2.2 Sydney's challenges

2.2.1 Population and economic growth

Sydney is Australia's financial and economic capital with half of Australia's globally competitive service sector jobs. Its economy accounts for about 70 per cent of total NSW economic output and 23 per cent of Australia's gross domestic product (SGS Economics, 2016).

The city is home to over four million people, and is considered to be a 'global city' (NSW Government, 2014a) – a status that reflects its importance in terms of its economic and cultural influences, engagement with international trade and finance, and attractiveness to globally mobile workers and visitors. Businesses and workers are attracted to Sydney for the city's way of life and amenity, which help it score highly in international quality of life surveys.

A sign of Sydney's attractiveness for business is that its economic output and population are growing. Close to 200,000 jobs have been added to the NSW economy over the past five years (NSW Government, 2014a). By 2031, Sydney's economic output will almost double to

$565 billion a year, and there will be 689,000 new jobs. In the next 20 years Sydney's population will grow by 1.6 million people (Department of Planning and Environment, 2015).

Sydney's key employment and economic areas are clustered along a corridor that runs from Port Botany and Sydney Airport to Macquarie Park, known as the Global Economic Corridor (see Figure 2-2). In the last decade, demand for office space has seen overflow activity in Sydney's CBD and the Global Economic Corridor extend the corridor towards Parramatta and Norwest Business Park, Sydney Olympic Park and Rhodes. The Global Economic Corridor now accounts for over 41 per cent of the NSW gross State product and provides jobs in a range of knowledge-based sectors including education, financial and other business services, communications, high-tech manufacturing and biotechnology (NSW Government, 2014a).

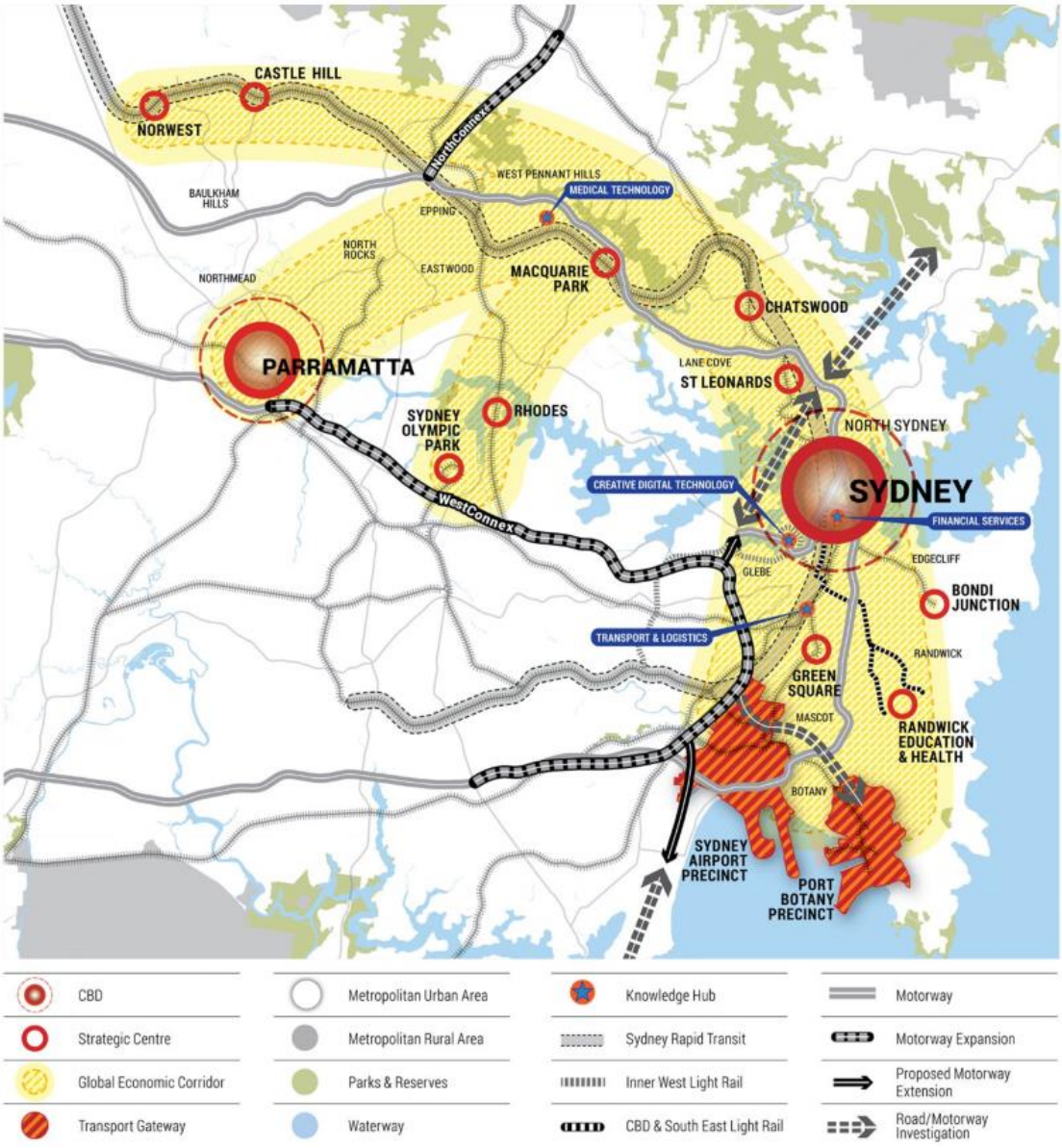

Figure 2-2 Sydney's Global Economic Corridor

Note: Taken from A Plan for Growing Sydney (NSW Government, 2014a). References to Sydney Rapid Transit in the above figure are references to Sydney Metro.

Sydney will continue to be NSW's primary employment centre, with employment in the city expected to increase from its current level of 2.1 million workers to three million workers by 2031, with about two thirds working within the Global Economic Corridor (NSW Government, 2014a).

To continue to grow and develop, the Global Economic Corridor will require high quality transit services to remain an attractive place to do business and to work.

Attracted by this economic prosperity, the city's population is growing much faster than during the previous 20 years. To support this growth, the rate of development of new dwellings will also need to increase with up to 664,000 new homes needed by 2036 to house this population. To maintain liveability and support continued growth in productivity, these homes will need to be serviced by transport infrastructure connected to employment areas, thereby enabling residents to actively participate in Sydney's growing economy.

2.2.2 Transport capacity and reliability

Importance of the rail network

Sydney's suburban rail network is the backbone of the city's public transport system, connecting the city's skilled workforce with high value employment land located throughout the Global Economic Corridor. On a typical workday, commuters make about one million journeys on the rail network, with one third occurring in the morning peak (between 6 am and 9.30 am) (Transport for NSW, 2012a).

Sydney will require increased transportation capability to support employment and population growth. Of the three primary transport modes, it is projected that travel by rail will experience the highest growth in demand, more than double that of buses, and over a third more than that of car trips.

Constraints on the rail network

The rail network is heavily congested, with customers on most rail lines often experiencing significant crowding on trains and station platforms during the morning and evening peaks. The reliability and capacity of Sydney's rail network is currently constrained by a number of factors, which include:

- large numbers of 'junctions' on the rail network (ie points where two train tracks converge, requiring trains to cross paths)
- a large number of tracks that enter Sydney's CBD
- capacity constraints including limitation in the number of services able to be provided, generally limited to 20 trains per hour per line, with each train having a reliable capacity of 1,200 passengers
- complex train timetables that demand trains with different service patterns share the same track, which can result in slower trains delaying fast and express trains
- crowded trains with internal stairs and 3 + 2 seating arrangements, which are slow to load and unload, resulting in long 'dwell times' (the time a train needs to stop in a station for passengers to board and alight)
- crowded station and narrow platforms in busy Sydney CBD stations, which hinder passenger flow between trains and stairs, and make it difficult for customers on the platform to make way for passengers alighting from trains
- traditional signalling technology, which impedes optimised train running and maximum utilisation of line capacity.

As population and employment continue to grow, rail is forecast to experience the highest growth in travel demand, with about an additional 100,000 trips expected on Sydney's rail network during the morning peak by 2036. This will place additional pressure on the rail network.

It is forecast that without further investment, Sydney's rail network will reach capacity in the Sydney CBD and on critical suburban rail lines by the mid to late 2020s (Transport for NSW, 2012a). This means most rail lines on the network will be overcrowded in the morning peak. The closer the rail network gets to capacity, it is likely to become less reliable and more likely to fail to meet the needs and expectations of rail customers.

Constraints on alternative transport modes

Alternative transport modes have limited capacity to absorb Sydney's forecast long-term travel demand growth.

Sydney's roads are already some of the most congested in Australia. Planned investment by the NSW Government in road infrastructure projects such as WestConnex and NorthConnex will enable substantial improvements in travel times for road users, strengthening both the State and National economies. However, there is limited ability to augment the existing road network within Sydney's CBD. Accessing the Sydney CBD by car is further constrained by a lack of available on-street car parking.

Sydney's bus network is complex, consisting of over 600 bus routes with many different types of bus services that provide more than 220 million bus trips each year (Transport for NSW, 2012a). With buses competing for road space with cars, the bus network is affected by the growing congestion on Sydney's roads, especially along arterial connections and routes to the Sydney CBD. In the morning peak, around 1,000 buses converge on the Sydney CBD.

Demand for bus travel across Sydney is forecast to grow by 30 per cent by 2031.

Previous attempts to meet extra demand have involved adding new services to Sydney's already complex bus network. While extra buses can carry more people, these services are not necessarily faster or more reliable. Without measures to improve journey times, adding more buses simply adds to congestion and each bus becomes less effective in meeting customer needs. Services continue to experience significant delays in peak times, even with bus lanes and traffic light prioritisation.

2.3 Why Sydney Metro

Given the current and predicted travel demand for rail services within Sydney, and the limited capacity of other modes of transport to absorb forecast population and employment growth, improvements in rail capacity, through initiatives like the Sydney Metro network, are critical.

The proposed Sydney Metro network, comprising Sydney Metro Northwest and Sydney Metro City & Southwest, would deliver a seamless metro network for 66 kilometres between Rouse Hill and Bankstown. The proposed Sydney Metro network is shown in Figure 1-1 and described in Section 1.3.2.

At ultimate capacity, the Sydney Metro network would be able to run 30 trains per hour in each direction through Sydney's CBD, providing the foundation for a 60 per cent increase in the number of trains that could operate in the peak periods, and catering for an extra 100,000 customers per hour across the Sydney CBD rail lines.

Sydney Metro would improve reliability across the rail network by addressing current and emerging constraints such as train crowding, platform and station crowding, and network complexity. The metro rail network would be capable of carrying more people, more quickly, than any other form of public transport ever seen in Sydney.

Sydney Metro would therefore deliver a new rail tier for Sydney's integrated public transport network, supporting high demand with a high-capacity, turn-up-and-go service. It is also being

developed with an emphasis on supporting the needs of customers for easy 'door to door' journeys from origin to destination. Sydney Metro would also be Australia's first fully automated rail network. The benefits of the project are expanded on in Sections 2.1 and 2.4.

2.4 The key benefits of Sydney Metro City & Southwest

Sydney Metro City & Southwest would extend the currently approved metro network from Chatswood through the Sydney CBD to Bankstown.

Specific benefits of the Sydenham to Bankstown component have been outlined in Section 2.1. This section details the expected benefits of the full Sydney Metro City & Southwest including both Sydney Metro City & Southwest components. The full realisation of the benefits to the overall Sydney rail network in terms of catering for growth in demand and increasing rail network capacity would ultimately be dependent on delivering both these projects.

2.4.1 Key transport benefits

Catering for growth in demand

As detailed in Section 2.2.2, demand for rail services is projected to grow by about 100,000 trips in the AM peak hour by 2036. Without intervention this growth will be constrained by network capacity limitations. The development of Sydney Metro City & Southwest would support this increase by providing the capacity to accommodate an extra 100,000 customers per hour across the Sydney CBD rail lines.

Increased accessibility and trip diversity

Sydney Metro City & Southwest would increase the rail catchment through the provision of:

- new stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street, and Waterloo, as well as new underground platforms at Central Station
- more direct connections to high-capacity Sydney CBD stations at Martin Place and Pitt Street
- additional interchange capability at Central, Martin Place, Sydenham and Bankstown, enabling increased network connectivity and demand for rail services.

By increasing the reach of the rail network, frequency of services, interchange with other modes and connections to key destinations, Sydney Metro City & Southwest is expected to increase accessibility, trip diversity and utilisation of the network during both peak and non-peak periods. This would facilitate a greater mode shift to rail from car, particularly during non-peak periods where travel service consumers have greater choice. Customers won't need a timetable – they can just turn up and go.

Sydney Metro City & Southwest would facilitate a diverse range of trips, providing not only a fast journey to work but also encouraging trips for other purposes such as access within the Sydney CBD, local or business trips, access to universities and educational institutions, service and recreational uses.

Increased rail network capacity

The Sydney Metro network would considerably increase rail network capacity by introducing new high-capacity rail connections from the Sydney CBD to other key economic centres in the broader Sydney area. The project would from the outset enable an increase in services on the Sydney rail network.

The reliable capacity of an existing Sydney Trains double deck train is about 1,200 passengers. Upon opening, Sydney Metro would operate with six car trains, with an ultimate capacity to

operate eight car trains in the future. These new, high-capacity metro style trains would have a carrying capacity of about 1,500 passengers at the ultimate eight car configuration.

In addition, the Sydney Trains network is generally limited to 20 trains per hour per direction, per line. Sydney Metro would provide dedicated track, train control, rolling stock and platform configurations to support up to 30 trains per hour through the CBD. Figure 2-3 illustrates the line capacity between the Sydney Trains and Sydney Metro networks.

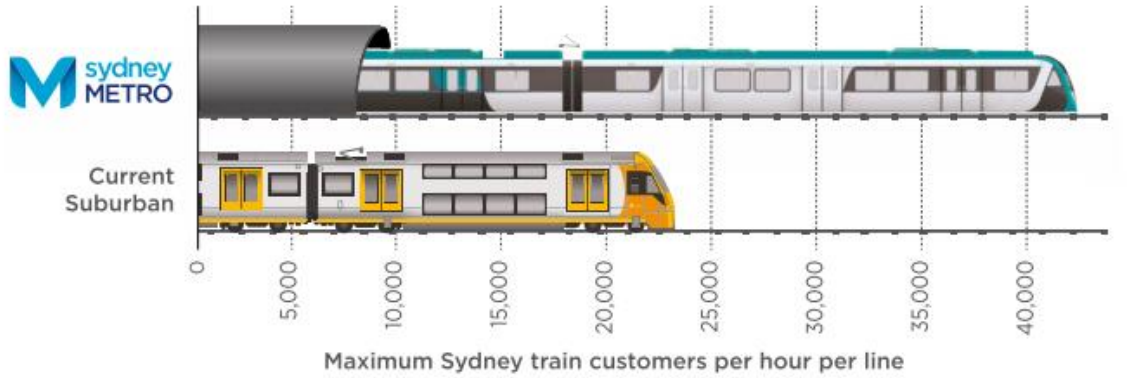

Figure 2-3 Line capacity comparison between Sydney Trains and Sydney Metro networks

Sydney Metro City & Southwest would provide a considerable increase in network capacity through the introduction of a new metro line through the Sydney CBD serviced by high-capacity trains.

Sydney Metro, together with signalling and infrastructure upgrades across the existing network, would increase the capacity of the rail network through the Sydney CBD from about 120 services per hour during peak periods today, to up to 200 services per hour beyond 2024, including capacity for up to 60 metro trains per hour during peak periods (or 30 trains per hour in each direction). This would equate to an increase of up to 60 per cent capacity across the network.

The two additional tracks from Chatswood to the city would more than double the number of train paths available from the north. The conversion of the T3 Bankstown Line to metro operations would remove the need for Bankstown services to use the City Circle, providing for additional train paths for other lines using the City Circle. Increasing rail line capacity through Sydney's CBD, and removing T3 Bankstown Line services from the City Circle, would enable a fundamental change in the suburban network service plan, diverting passengers from the T1 North Shore, Northern & Western Line; and allowing additional capacity on the T2 Airport, Inner West & South Line.

The extension of Sydney Metro from Chatswood to Bankstown would increase total train paths available to the Sydney CBD. Given that metro trains are of a higher reliable capacity than double deck trains, total passenger carrying capacity would increase by about 60 per cent.

The increase in network capacity and ability to make a significant change to how the network operates provides other benefits as discussed in the following sections.

The Sydney Metro City & Southwest project would improve travel times by:

- providing more direct routes to key destinations
- providing more direct routes for some suburban and intercity services, enabling additional capacity
- reducing crowding on trains and at stations, which would improve the reliability of services.

Travel time savings would be experienced by existing rail customers (who would directly benefit from shorter travel times), new rail customers (who would transfer from road-based transport to rail), and road users (who would experience less congestion).

With the completion of Sydney Metro City & Southwest, customers on the Sydney Metro Northwest, T1 North Shore Line and T3 Bankstown Line would have access to Sydney Metro services that would provide more direct connection with key destinations in the Global Economic Corridor.

Reduced train crowding

By enabling additional train services on the rest of the suburban rail network and diverting passengers from existing services, Sydney Metro would significantly reduce train crowding on the T1 North Shore, Northern & Western Line; and the T2 Airport, Inner West & South Line.

Decreased station crowding

Currently there is station crowding at the Sydney CBD stations of Wynyard and Town Hall during peak periods.

With passenger travel demand to the Sydney CBD forecast to increase, additional constraints will be placed on Sydney CBD and other key interchange stations, particularly crowding on platforms and vertical transport (lifts, stairs or escalators). This is likely to result in excessive delays to platform and station clearance times.

A key benefit of Sydney Metro City & Southwest is relief to platform crowding at existing Sydney CBD stations and a reduction in the amount of passenger time spent under heavily crowded platform conditions. Sydney Metro City & Southwest would achieve this by providing an alternative route through the Sydney CBD and increasing the number of high-capacity inner city stations.

With Sydney Metro City & Southwest, it is predicted that by 2036, overall passenger movements during the one-hour morning peak would reduce by around 30 per cent at Wynyard and Town Hall stations, and by around 40 per cent at North Sydney and St Leonards stations.

Improved network resilience

Suburban rail access through the Sydney CBD and across the harbour is limited to the T1 North Shore, Northern & Western Line.

Forced shutdowns during unplanned and planned events impacts on customer service provision. The Sydney Metro City & Southwest project would provide an additional, high-capacity public transport link through the Sydney CBD and across the harbour, enabling rail network redundancy for this critical link. During planned and unplanned events patrons would continue to have access to a direct high-capacity transport service.

Improved conditions for bus customers

Sydney Metro City & Southwest would be part of an integrated public transport network with high-quality bus connections to the stations and easy transfers for customers travelling to and from locations beyond walking distance. The existing and future planned bus networks would continue to be reviewed by Transport for NSW to enhance the bus network and its connectivity with Sydney Metro stations.

By connecting metro services to areas traditionally serviced by bus routes, Sydney Metro would potentially allow for a reduction in the number of bus services traveling into the Sydney CBD in the morning peak. This would contribute to:

- improving the reliability of journey times for the remaining bus passengers
- reducing the number of buses accessing the Sydney CBD via the Harbour Bridge
- reducing the number of buses in the Sydney CBD and at Wynyard Bus interchange
- reducing journey times for existing bus passengers who switch to using Sydney Metro for all or part of their journey.

Improved conditions for road users

By encouraging people to use the metro network, Sydney Metro City & Southwest would reduce the number of trips that would otherwise be made on the road network. This is particularly the case for sections of the road network that are constrained, such as the Harbour Bridge and the Sydney CBD, where the project would provide a high-quality transport alternative. Reduced congestion would mean that those road users who do not shift modes would gain from travel time and reliability benefits.

2.4.2 Key city building benefits

Sydney Metro City & Southwest would provide a significant increase in transit amenity throughout Sydney, which would facilitate increased economic productivity and land use efficiency. Sydney is the most urbanised area within Australia with the density of population and economic activity in its centres being major drivers of national productivity. Sydney Metro City & Southwest would facilitate:

- higher productivity by enabling businesses to become effectively closer together through reduced travel times between major economic centres, and between economic centres and potential employees
- opportunities for a higher intensity of land use around new and converted stations, including employment opportunities and potential for higher density residential areas which could offer more options for affordable housing with better access to services and employment, and support more liveable, vibrant communities.

Planning being carried out by the Department of Planning and Environment along the Sydney Metro corridor supports the following:

- Global Economic Corridor – about 650,000 jobs within 800 metre station catchments by 2036
- urban renewal corridor along the full length of the Sydney Metro line – about 514,000 people within 800 metre station catchments of the Sydney Metro line by 2036
- future priority precincts emerging from the current investigation between Bankstown and Sydenham
- 460,000 jobs and 67,000 residents at Barangaroo, Martin Place, Pitt Street and Central
- potential future priority precinct at St Leonards.

2.5 Consistency with NSW strategic planning and policy

2.5.1 State planning strategy

State priorities

In September 2015 the NSW Premier released 30 'State priorities', including 12 'Premier's priorities' to grow the economy, deliver infrastructure, and improve health, education and other services across NSW. Key priorities relevant to the Sydney Metro Sydenham to Bankstown component include 'building infrastructure' and 'creating jobs'.

Over the next 15 years, NSW will require infrastructure to support 40 per cent more train trips, 30 per cent more car trips and 31 per cent more households (NSW Government, 2015). Sydney Metro City & Southwest is identified as a key infrastructure project as part of the NSW government's infrastructure investment program.

The project would contribute to economic growth by:

- improving access to jobs
- reducing congestion by encouraging road users to change the modes they use to move around the city
- helping move people between key centres more reliably and efficiently
- enabling housing and employment growth west to Bankstown, and more broadly along the Global Economic Corridor.

By converting the T3 Bankstown Line to metro and delivering greater efficiency and reliability along the line, the project would encourage transit oriented urban development around stations between Sydenham and Bankstown.

Accessibility improvements and bicycle facilities at upgraded stations could encourage active transport use and deliver health benefits by encouraging customers to walk and cycle to and from train stations.

The NSW government is committed to the creation of 150,000 new jobs over the next four years. Through investment in infrastructure, such as the Sydenham to Bankstown upgrade, new jobs and apprenticeships are being created for the construction sector.

2.5.2 Sydney metropolitan planning strategy

A Plan for Growing Sydney (NSW Government, 2014a) sets out the NSW Government's strategy for accommodating Sydney's future population growth over the next 20 years. The plan consists of goals, directions and actions that provide a framework for strengthening the global competitiveness of Sydney and delivering strong investment and jobs growth in western Sydney. The project's expected contribution to achieving these goals, directions and actions is outlined in Table 2-1.

Table 2-1 Meeting the goals of *A Plan for Growing Sydney*

Directions of the plan	Corresponding actions of the plan	Project contribution to achieving the plan's directions and actions
Goal 1: A competitive economy with world-class services and transport		
Direction 1.6: Expand the Global Economic Corridor	Action 1.6.2: Invest to improve infrastructure and remove bottlenecks to grow economic activity	The project would support the Global Economic Corridor by providing faster and more reliable connections to jobs, education facilities, health services and sports and recreational facilities.
Direction 1.7: Grow strategic centres – providing more jobs closer to home	Action 1.7.1: Invest in strategic centres across Sydney to grow jobs and housing and create vibrant hubs of activity	The project would improve capacity and reliability of links along the Global Economic Corridor to the Sydney CBD. Together with Sydney Metro Northwest and the Chatswood to Sydenham component, the project would also improve links to the strategic centres of Chatswood, Macquarie Park, Castle Hill, Norwest and Rouse Hill.
Direction 1.11: Deliver infrastructure	Action 1.11.1: Preserve future transport and road corridors to support future growth	*A Plan for Growing Sydney* specifically identifies preserving a future corridor for Sydney Metro. The project is consistent with this action.
Goal 2: Sydney's housing choices		
Direction 2.2: Accelerate urban renewal across Sydney – providing homes closer to jobs	Action 2.2.2: Undertake urban renewal in transport corridors which are being transformed by investment, and around strategic centres	The project has significant potential to act as a catalyst for new housing development, giving new communities shorter and more reliable commutes to major job centres.
Goal 3: A great place to live with communities that are strong, healthy and well connected		
Direction 3.1: Revitalise existing suburbs	Action 3.1.1: Support urban renewal by directing local infrastructure to centres where there is growth	The project would improve rail accessibility to growing local centres in south-western Sydney, helping to support urban renewal around upgraded stations, and acting as a focal point for investment in local infrastructure.

The Greater Sydney Commission is responsible for Greater Sydney regional planning in a partnership between State and local government. Sydney district planning will guide the delivery of *A Plan for Growing Sydney* across six districts that form Greater Sydney. The project would be located within the South District.

The *Draft South District Plan* (Greater Sydney Commission, 2016) sets out the vision, priorities and actions for the development of the South District. The draft plan outlines the vision for the South District, with Sydney Metro City & Southwest reinforcing the district's strong connections to employment hubs at Sydney Airport and the Sydney CBD, and enhancing housing opportunities along the corridor from Sydenham to Bankstown.

2.5.3 Urban renewal corridor planning strategy

The Sydenham to Bankstown Urban Renewal Corridor strategy (Department of Planning and Environment, 2015) sets out the NSW Government's strategy for more homes, jobs, better public spaces, shops and cafes within walking distance of the 11 train stations between Sydenham and Bankstown. The strategy is being developed in close collaboration with the Inner West and Canterbury-Bankstown councils (covering the areas of the former Bankstown City Council, Canterbury Council and Marrickville Council) and the local community.

The strategy is being prepared in alignment with Transport for NSW's plans to extend the metro network between Sydenham and Bankstown. The project responds to current and future population and employment growth within this corridor. The project's expected contribution to achieving the aims of the strategy is outlined in Table 2-2.

Table 2-2 Meeting the aims of the Sydenham to Bankstown Urban Renewal Corridor

Aims of the strategy	Project contribution to achieving the strategy's aims
Opportunities for more homes and jobs within walking distance of railway stations	The project would provide shorter and more reliable commutes between new homes and jobs along the corridor, as well as further afield to key employment centres such as the Sydney CBD, North Sydney, Chatswood and Macquarie Park. Upgraded metro stations from Sydenham to Bankstown would be hubs of urban renewal activity, acting as catalysts for new housing development close to a fast and efficient metro network.
A planning vision for the next 20 years – creating great areas for communities	Conversion of the T3 Bankstown Line to a metro service would future-proof rail services for the growing numbers of people who would live, work and visit the burgeoning and diverse array of housing, services, shopping and eating precincts, and community spaces along the corridor.
The type of infrastructure and services that would be required in each area to meet future needs	The project would deliver fast and reliable 'turn-up-and-go' services to the 11 train stations from Sydenham to Bankstown. Upgraded platforms and concourse areas, including improvements to accessibility, would make moving around stations easier for all users. Improved interchange facilities would help users switch between buses, metro trains and suburban trains efficiently.

2.6 Consistency with NSW strategic transport infrastructure policy

2.6.1 Rebuilding NSW: State Infrastructure Strategy 2014

Rebuilding NSW: State Infrastructure Strategy 2014 (NSW Government, 2014b) outlines the NSW Government's plan to invest $20 billion in new productive infrastructure, to sustain productivity growth in NSW's major centres and regional communities, and support a forecast population of almost six million people in Sydney and more than nine million in NSW. Projects identified in Rebuilding NSW are based on investment recommendations made by Infrastructure NSW.

Rebuilding NSW identifies that $7 billion has been reserved to fund Sydney Metro City & Southwest. The project is therefore consistent with this strategy.

2.6.2 NSW Long Term Transport Master Plan

The *NSW Long Term Transport Master Plan* (Transport for NSW, 2012b) is the NSW Government's 20-year plan to improve the NSW transport system by delivering an integrated, modern transport system that puts the customer first. The plan identifies the transport challenges that will need to be addressed to support NSW's economic and social performance over the next 20 years, and establishes a number of short, medium and long-term actions to address those challenges. These actions provide the overall framework for how the NSW transport system develops, in terms of services and infrastructure.

A key element of the *NSW Long Term Transport Master Plan* is the need to increase the capacity of Sydney's rail network to meet existing customer needs, and accommodate the additional travel demand created by Sydney's forecast population and economic growth over the next few decades. The plan notes that over the next 20 years, the number of trips made by rail is expected to increase by 26 per cent. This growth cannot be accommodated on Sydney's existing rail network, which is already approaching its capacity and is subject to significant crowding on most lines at the height of the morning and evening peak periods (Transport for NSW, 2012b).

Without the creation of additional rail capacity, crowding levels on the network will continue to increase, with many parts of the rail network predicted to be near capacity in 2031, even with service improvements that are possible within the constraints of the current network configuration, as outlined in Section 2.1 (Transport for NSW, 2012b).

The *NSW Long Term Transport Master Plan* identifies a 'three-tiered network' approach to expand the capacity of Sydney's transport system. This approach involves the implementation of high-capacity metro into the current two-tier arrangement of suburban and intercity rail services, to untangle the current system and ensure fast, efficient and reliable services throughout the network. The plan identifies an increase to train capacity on the T3 Bankstown Line as critical to delivering improved reliability along the Bankstown and T1 North Shore, Northern & Western Lines.

Upgrading the T3 Bankstown Line between Sydenham and Bankstown, along with the connection to the earlier components of Sydney Metro (Chatswood to Sydenham and Sydney Metro Northwest) is a key long-term action of the *NSW Long Term Transport Master Plan*. Sydney Metro would improve access and connectivity for the North Shore Line and Sydney Metro Northwest, and improve travel times and capacity through the city from the north and south. Sydney Metro would provide the largest increase in capacity to the Sydney rail network for 80 years, while proposed new stations within the Sydney CBD would relieve pressure on Central, Wynyard and Town Hall stations.

The *NSW Long Term Transport Master Plan* is accompanied by *Sydney's Rail Future* (Transport for NSW, 2012a), which details how the NSW Government will deliver the core elements needed to give Sydney a world-class rail network that can support the city's growth. *Sydney's Rail Future* is discussed in Section 2.6.3.

The *NSW Long Term Transport Master Plan* is also accompanied by other future modal plans including *Sydney's Bus Future* (Transport for NSW, 2013c) which outline how the NSW Government will improve these transport modes, including improved interchange between modes.

Concurrent with the review of *A Plan for Growing Sydney* by the Greater Sydney Commission, Transport for NSW is developing the *Future Transport Strategy* for the next 40 years – a blueprint for transport services, infrastructure and technology in NSW.

The *Future Transport Strategy* has six priorities:

- safety and performance
- growing economy
- successful places
- accessible services
- customer focus
- financial sustainability.

The Future Transport Program, through the Future Transport Technology Roadmap, is investigating how Transport for NSW can use innovative technologies to transform transport services, better connect communities, and enhance the customer experience. The *Future Transport Strategy* will complement this work. It will prioritise the delivery of transport, guide policy decision making, and ultimately make NSW a better place to live, work and visit for generations to come.

In 2017, Transport for NSW will be talking to communities, its customers, industry and other stakeholders about how they can get involved and have their say on the *Future Transport Strategy*. The *Future Transport Strategy* will be aligned with the release of the Greater Sydney Commission's updated regional plan and six district plans.

2.6.3 Sydney's Rail Future

Sydney's Rail Future (Transport for NSW, 2012a) is the NSW Government's long-term plan to increase the capacity of Sydney's rail network by investing in new services and upgrading existing infrastructure. It aims to improve the customer's experience, improve reliability and increase services across the rail network. *Sydney's Rail Future* forms an integral part of the *NSW Long Term Transport Master Plan* (discussed in Section 2.6.2) and will eventually enable Sydney's rail network to carry another 90,000 to 100,000 people per hour in the peak period across the Sydney CBD rail lines.

Sydney's Rail Future recognises key challenges for Sydney's rail system, including increased demand for rail transport driven by employment and population growth, the limited capability of the current network, capacity constraints, Sydney CBD congestion, the need to support the on−going development of the Sydney CBD and suburban bottlenecks.

Sydney's Rail Future is based on the NSW Government's strategy to meet customer needs, which include:

- create a more reliable service
- get Sydneysiders to work on time
- maintain a safe, clean and comfortable commuting environment
- run more services
- reduce travel times.

Sydney's Rail Future describes the plan to transform and modernise Sydney's rail network based on a three-tiered system, comprising:

- Tier 1 – Metro: 'turn-up-and-go' services with single-deck metro trains
- Tier 2 – Suburban: timetabled services with double-deck trains
- Tier 3 – Intercity: timetabled services with double-deck trains and on-board amenities for long distance commutes.

2.6.4 Sydney City Centre Access Strategy

The *Sydney City Centre Access Strategy* (Transport for NSW, 2013a) outlines how people will enter, exit and move in and around the Sydney CBD over the next 20 years, and demonstrates how light rail, buses, trains, ferries, cars, taxis, pedestrians and cyclists will interact in the centre of Sydney. The strategy also provides a clear direction for how all the different transport modes will work together in the city centre to:

- reduce congestion
- provide for future growth
- improve the customer experience.

Under the *Sydney City Centre Access Strategy*, rail will remain the dominant transport mode for getting to the city centre.

The project is a key action of the *Sydney City Centre Access Strategy*, which identifies benefits to the Sydney CBD. The strategy would unlock the existing rail bottleneck for suburban trains accessing the Sydney CBD. Removing T3 Bankstown Line services from the City Circle, and increasing rail line capacity through Sydney's CBD, would divert passengers from the T1 North Shore, Northern & Western Line, enabling additional capacity on the Airport, Inner West & South lines. The project would also enable improved connections to employment opportunities within the Sydney CBD and across Sydney's Global Economic Corridor.

2.7 Associated Sydney Metro projects

The Sydenham to Bankstown component forms part of a suite of related Sydney Metro projects, the status of which are outlined in Table 2-3.

Table 2-3 Associated Sydney Metro projects

Project	Location	Status
Sydney Metro Northwest	Cudgegong Road to Chatswood	Under construction
Sydney Metro City & Southwest – Chatswood to Sydenham	Chatswood to Sydenham	Preparing for construction
Sydney Metro City & Southwest – Sydenham to Bankstown upgrade	Sydenham to Bankstown	Planning application submitted
Sydney Metro West	Parramatta to Sydney CBD	Corridor planning has commenced

2.8 Project objectives

The objectives of the project are to:

- improve the quality of the transport experience
- provide a system that is able to satisfy long-term demand
- grow public transport patronage and mode share
- support the productivity of the Global Economic Corridor
- serve and stimulate urban development
- improve the resilience of the transport network
- improve the efficiency and cost effectiveness of the public transport system
- implement a feasible solution recognising impacts, constraints and delivery risk.

3. Project development and alternatives

This chapter describes the alternatives and options evaluation process undertaken to determine the preferred option for the project.

3.1 Strategic alternatives

A number of strategic alternatives to a metro rail system were considered during the development of the *NSW Long Term Transport Master Plan* and *Sydney's Rail Future.* These options were:

- regulatory, governance and better-use reforms
- investment in road, bus and light-rail
- rail network options.

These options are discussed below, together with an assessment of their overall effectiveness in meeting Sydney's growing transport needs.

3.1.1 Regulatory, governance and better-use reforms

The NSW Government has considered a range of regulatory, governance and better-use reforms to improve transport outcomes, and meet Sydney's growing population needs. The reforms include review of transport legislation to allow for more flexible transport services, integrated transport and land use planning, and system improvements and modernisation.

While these reforms are vital to meeting the government's policy objectives and are already being implemented, additional investment in transport infrastructure will also be required to ensure Sydney's transport network meets future demand.

3.1.2 Investment in road, bus and light rail

The NSW Government is currently delivering or has delivered a number of road, bus and light rail projects across Sydney as part of the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012b) and the *Sydney City Centre Access Strategy* (Transport for NSW, 2013a). These projects include WestConnex, NorthConnex, the CBD and South East Light Rail, Inner West Light Rail and a number of bus priority projects, including the Northern Beaches Bus Rapid Transit project.

However, while investment in road, bus and light rail projects will form part of the solution to Sydney's transport need, these options are, by themselves, insufficient to address forecast growth in travel demand. The number of people travelling to the Sydney CBD each day is forecast to grow to 775,000 by 2031, which equates to 116,000 more cars or 2685 more buses each day (Transport for NSW, 2012a).

Where possible, new roads (such as a possible Western Harbour Tunnel and the M4 – M5 Link) will provide additional cross-regional links. However, investment in roads forms only part of the solution to providing the mass transit capacity required to support Sydney's growth.

Buses and light rail are complementary modes, bringing customers to and dispersing them from the major transport hubs served by suburban and metro rail services. However, buses and light rail cannot wholly support the large hourly commuter movements required in and out of the Sydney CBD and to other key destinations in the Global Economic Corridor. Buses can provide a flexible response to local demand pressures, and light rail offers medium capacity solutions for major transport corridors, replacing lower capacity bus services. However, both modes would not provide sufficient mass transit capacity to address Sydney's transport bottlenecks.

3.1.3 Rail network options

Based on projected population growth and transport demand, additional investment in rail is seen as a more efficient and effective solution than other strategic alternatives discussed above. In developing *Sydney's Rail Future*, 15 alternative capital investment options for an expansion of the transit network were identified. The 15 options were grouped into four broad network options as detailed in Table 3-1.

Table 3-1 The four rail network options considered in *Sydney's Rail Future*

Option	Key features
Rail Future A – suburban option	This option would involve the use of the existing double-deck rolling stock on the existing network, including for all future expansions (i.e. a second harbour crossing). This option would have a capacity of 20 trains per hour per direction (or 24,000 people per hour per direction). However, this option could not meet the long-term capacity and service improvements required by the *NSW Long Term Transport Master Plan,* and would not meet customer expectations for reliability, improved journey times, and convenience. The main beneficiaries of the suburban option would be the North Shore and East Hills lines. Benefits for the west and Illawarra (Sutherland) would be limited, and would require further investment to make a more than incremental difference to services on the Western and Illawarra lines.
Rail Future B – rebuild option	This option would involve rebuilding parts of the existing network to run single-deck metro trains. It would require conversion of the North Shore Line services across the Harbour Bridge, and major upgrading of the existing CBD infrastructure and stations. Although rebuilding the existing network would improve capacity in the medium term, it would not meet demand in the long term because capacity would be restricted to the current single train line across Sydney Harbour. Conversion of the existing line to accommodate a metro line would need to occur while maintaining existing services (to the extent possible), and would result in major disruptions and inconvenience for customers for a number of years. Further, the existing stations at Town Hall and Wynyard are already congested, and an increase in the number of services using these stations would impact on network reliability and resilience, and affect customer safety.
Rail Future C – Sydney's Rail Future (Sydney Metro network)	This option would involve construction of a metro rail network that would operate independently of the existing rail network, however it would provide integration and interchange points with the existing rail network. New infrastructure would mainly be used; however, a section of Sydney Metro Northwest (historically referred to as the Epping to Chatswood Rail Line) and the existing rail line from Sydenham to Bankstown would be converted to metro and form part of the metro network. This option includes a second crossing of Sydney Harbour and a new underground line within the Sydney CBD. Interchanges would be provided at key stations (e.g. Chatswood and Central). Rolling stock design would ensure that boarding and alighting would be faster, which would reduce dwell and journey times.
Rail Future D – an independent transit system	This option would operate independently and not integrate with the existing rail network. It would require construction of a harbour crossing and a CBD line. This option would only benefit customers along the new lines, and would not adequately address the future requirements of the rail network. It would result in marginal benefits in terms of service enhancement, capacity improvements, and improved operating efficiency on the existing rail network. This option would also be the most expensive of the four options, and would divert funding from service improvements on the existing rail network.

Each option was strategically assessed against a number of evaluation criteria. These criteria included: their ability to meet customer requirements; network capacity requirements; ability to improve network resilience; delivery risk; and cost effectiveness. A two-step process was used to select the preferred strategic option.

The first step involved assessing whether existing rail operations should be expanded and improved to provide continued operation of a double-deck fleet with a two-tiered system of suburban and intercity services (Rail Future A), or whether a separate, independent 'differentiated' system should be constructed to provide metro turn-up-and-go services (Rail Future B, C and D).

An assessment of these options found that a metro service is required to meet demand in both the short and long term. Rail Future B requires conversion of the North Shore Line services across the Harbour Bridge and rebuilding other parts of the existing network. This would result in major disruptions and inconvenience for customers, impacting network reliability and resilience. Accordingly, Rail Future A and Rail Future B were discarded and not further evaluated.

The second step involved analysing the differentiated service options against the assessment criteria. The assessment criteria applied included:

- delivery of capacity increases in key sections of Sydney's rail network
- high-quality levels of service
- provision of significant improvements in operational reliability required to service Sydney's growth.

The analysis found that Rail Future C would be superior to Rail Future D and consequently Rail Future D was discarded.

Rail Future C (referred to from this point as Sydney Metro, and incorporating the whole proposed Sydney Metro network) was selected as the preferred rail network option because it would:

- be more flexible and provide frequent services which benefit customers
- provide the required capacity and flexibility to respond to growing demand for rail in Sydney
- create a more modern, resilient and faster service
- deliver a seamless and less disruptive way of modernising Sydney's rail
- deliver transport benefits more cost effectively.

The full delivery of the Sydney Metro, including Sydney Metro Northwest from Cudgegong Road and Sydney Metro City & Southwest to Bankstown, was identified as a strategic option in *Sydney's Rail Future*.

3.2 Alignment options

Sydney's Rail Future provides the strategic direction to modernise Sydney's rail system by increasing the capacity of the rail network through investment in new services and upgrading of existing infrastructure. The development of *Sydney's Rail Future* was based on a whole-of-network approach to addressing current and future challenges and providing strategic direction for solutions. A critical benefit associated with the upgrade of existing infrastructure to metro operations is the removal of some suburban services from the existing network (sectorisation), which would provide substantial additional capacity for the remaining suburban services, and reduce train and platform crowding across many stations.

Sydney's Rail Future provides guidance on the strategy that will best meet future rail demand and provide the highest quality customer service, while maximising the value of existing rail infrastructure and assets in five stages. Stage 5, the 'Southern Sector Conversion', included extension of the new single deck service to Bankstown and Hurstville.

Notwithstanding this strategic direction, various options to maximise the value of existing rail infrastructure were reconsidered for the southern and western component of the Sydney Metro network from just south of Central Station. These options included full or partial upgrades to metro of the Bankstown Line and the Illawarra Line to Hurstville; alternative upgrades to metro of the Airport Line to Revesby, Inner West Line to Homebush and Bankstown Line to Lidcombe and Cabramatta; and some variations of these.

The options were assessed in terms of their ability to meet the key strategic objectives (from *Sydney's Rail Future*), of customer focus, network capacity, network resilience, delivery risk and cost effectiveness.

A wide range of potential upgrade to metro options (and sub-options) were considered within the following corridors:

- Sydney Metro on the Bankstown Line to Cabramatta and Lidcombe, and Illawarra Line to Hurstville (the Base Case as described in *Sydney's Rail Future*):
- or conversion of only the Bankstown Line
- or conversion of only the Illawarra Line to Hurstville
- Sydney Metro via the Airport to Hurstville and Revesby (Option 1):
- with the Bankstown Line remaining as suburban and continuing to operate around the City Circle
- with the Bankstown Line remaining as suburban but terminating at Central Station
- Sydney Metro via the Airport to Revesby and Inner West to Homebush only (Option 2)
- Sydney Metro via the Inner West to Parramatta and Liverpool (Option 3)
- Sydney Metro via the Airport to Revesby only (Option 4).

Table 3-2 Advantages and disadvantages of metro upgrade options

Metro upgrade options	Advantages	Disadvantages
Base case: Bankstown Line to Cabramatta and Lidcombe, and Illawarra Line to Hurstville	• Consistent with *Sydney's Rail Future* • Improved connectivity from the south and southwest to the CBD and North Shore • Strengthens travel and capacity within the Bankstown corridor • Allows wider suburban network to operate more effectively (especially additional capacity for the busy East Hills, South and Inner West lines) • Provides relief to the busy Illawarra Line.	• Very long metro network with multiple branches and complex operating patterns • Impacts on rail freight movements between Cabramatta and Lidcombe (beyond Bankstown) and the Illawarra Line requiring major infrastructure works to separate freight and passenger services • Operational conflicts with suburban and intercity rail operations from Cronulla and the South Coast • Significant infrastructure required and associated capital cost.
Base case (only Bankstown Line)	• Consistent with *Sydney's Rail Future* • Improved connectivity from the southwest to the CBD and North Shore • Strengthens travel and capacity within the Bankstown corridor • Allows wider suburban network to operate more effectively (especially additional capacity for the busy East Hills, and Inner West lines) • Less complex to convert and segregate from the existing rail network compared to other rail lines, such as the Illawarra, Airport, Inner West, and East Hills lines.	• Complex mixed passenger and freight train operations west of Bankstown • Difficult construction issues associated with surface rail alignment between Redfern and Sydenham; and the Cabramatta/Lidcombe link.
Base case (only Illawarra Line)	• Consistent with *Sydney's Rail Future* • Improved connectivity from the south to the CBD and North Shore • Relieves crowding on the busy Illawarra Line.	• Fails to remove complex rail operations associated with the City Circle and therefore cannot realise the wider suburban benefits associated with a more efficient suburban network • Impacts on rail freight movements on the Illawarra Line • Operational conflicts with suburban and intercity rail operations from Cronulla and the South Coast • Difficult construction issues associated with constrained Illawarra corridor (and associated capital cost) • Resolution of freight conflicts, including the need for ancillary freight projects across wider Sydney.
Option 1: Airport to Hurstville and Revesby (with Bankstown Line continuing on the City Circle)	• Improved connectivity from the south to the CBD and North Shore • Connectivity and a metro service to the International and Domestic Airport.	• Fails to remove complex rail operations associated with the City Circle and therefore cannot realise the wider suburban benefits associated with a more efficient suburban network • Difficult construction issues associated with surface rail alignment between Redfern and Sydenham.
Option 1: Airport to Hurstville and Revesby (with Bankstown Line terminating at Central)	• Improved connectivity from the south to the CBD and North Shore • Connectivity and a metro service to the International and Domestic Airport	• Requires customers on the Bankstown Line to transfer at Central Station from the intercity platforms • Difficult construction issues associated with surface rail alignment between Redfern and Sydenham at Wolli Creek (to allow metro to connect

Metro upgrade options	Advantages	Disadvantages
	• Allows wider suburban network to operate more effectively (especially additional capacity for the busy East Hills, South and Inner West lines).	to Hurstville) and new infrastructure to facilitate terminating the Bankstown Line at Central • Difficult and costly conversion of the Airport Line (tunnel) to facilitate metro operations, including significant shut down periods for construction • Inconsistent customer experience associated with commuter passengers from the south mixing with airport passengers (with luggage).
Option 2: Airport to Revesby and Inner West to Homebush only	• Connectivity and a metro service to the International and Domestic Airport • Improved connectivity from all local stations on the Inner West Line to the CBD and North Shore • Strengthens travel and capacity within the Homebush to CBD corridor along the existing Inner West Line.	• Requires significant changes to operation of the wider suburban network, including mixing Illawarra locals with the East Hills Line (adding complexity to the network) • In the absence of additional infrastructure upgrades on the suburban network, introduces new unresolved conflicts with the Western Local lines • Difficult and costly conversion of the Airport Line (tunnel) to facilitate metro operations, including significant shut down periods for construction • Technical complexity in the design of a tunnel alignment at Central that ties in with both Inner West and Airport Line • Inconsistent customer experience associated with commuter passengers from the south mixing with airport passengers (with luggage).
Option 3: Inner West to Parramatta and Liverpool	• Improved connectivity from all local stations on the Inner West Line to the CBD and North Shore • Strengthens travel and capacity within the Parramatta to CBD corridor along the existing Inner West Line.	• Requires significant changes to operation of the wider suburban network, including mixing Illawarra locals with the East Hills Line (adding complexity to the network) • Requires significant change to the Cumberland Line services to be converted to metro (with associated capital cost) • Introduces new unresolved conflicts with the Western Local lines.
Option 4: Airport to Revesby only	• Connectivity and a metro service to the International and Domestic Airport • Improved connectivity and capacity from the south (Revesby) to the CBD and North Shore.	• Fails to remove complex rail operations associated with the City Circle and therefore cannot realise the wider suburban benefits associated with a more efficient suburban network • Difficult and costly conversion of the Airport Line (tunnel) to facilitate metro operations, including significant shut down periods for construction • Inconsistent customer experience associated with commuter passengers from the south mixing with airport passengers (with luggage) • Provides excessive capacity for Airport Line patronage.

Options 2, 3 and 4 were discarded due to critical failings. Options 2 and 3, which used the Inner West Line. were considered inferior particularly in terms of system capacity, and would have constructability challenges and high costs. Option 4 via the Airport Line only provided excessive capacity for Airport Line patronage while inadequately addressing network demand and relieving broader network capacity.

The remaining two options (including a preferred sub-option) were short-listed for more detailed assessment:

- Sydney Metro on the Bankstown Line only (modified base case)
- Sydney Metro via the Airport to Hurstville and Revesby (Option 1) with the Bankstown Line remaining as suburban and continuing to operate around the City Circle.

The modified base case also considered improvements to ensure the outcomes of *Sydney's Rail Future* could still be realised, including:

- extension of the Sydney Metro tunnel to Sydenham to avoid residential property acquisition and higher cost of surface capacity augmentation between Redfern and Sydenham (this is being completed as part of the Chatswood to Sydenham component)
- the conversion of 11 stations from Sydenham to Bankstown with an interchange at Bankstown and Sydenham
- the safeguarding of a new Sydney Metro direct link to Liverpool from Bankstown for a fast connection from this regional city to the CBD, and to avoid the conflicts between freight and Sydney Metro services.
- provision for an extension to the Illawarra Line subject to future long term transport and land use planning.

Option 1 (as an alternative to the strategy identified in *Sydney's Rail Future*) was particularly attractive based on the strategic merits of supporting the Global Economic Corridor and converting both the Airport Line and Illawarra Line to Hurstville to metro operations. The Airport Line stations are strategically important, given they are the first point of entry into Sydney and Australia for a significant number of international travellers. Connectivity to Hurstville would support considerable housing and employment growth around the Hurstville precinct.

However, a key issue associated with Option 1 was the constructability and affordability of a large number of complex and expensive projects required to upgrade the Airport tunnel and facilitate other changes to the suburban network. Option 1 would also require a large number of customers on the Bankstown Line to transfer at Central Station if they need to continue into the CBD or further north.

On balance, the conversion of the Bankstown Line as the next stage of the Sydney Metro network provides a significant increase in CBD rail capacity, enables increased frequencies on the T2 (Airport, Inner West and South) Line, and simplifies the rail network by removing the Bankstown Line from the existing, complex rail network.

The Sydney Metro City & Southwest includes the conversion of part of the T3 (Bankstown) Line to metro services between Sydenham and Bankstown. This connection has been identified as a priority for a number of reasons:

- Increased capacity – the Southwest conversion to Bankstown would allow metro services to continue through Sydney's CBD and across the Harbour, facilitating the removal of the Bankstown Line from the City Circle and from the suburban network between Sydenham and Central. This would provide additional capacity for the busy East Hills, South and Inner West lines, by increasing frequencies on the City Circle to 20 trains per hour in peak periods. This would also significantly reduce platform and train crowding. The new metro services would significantly increase capacity of the Bankstown Line.
- Supports growth – the Department of Planning and Environment has initiated urban renewal investigations along the Sydenham to Bankstown corridor. The Sydney Metro City & Southwest project would support growth within this corridor as well as on the busy East Hills Line, by providing much needed additional capacity on both corridors. Strong population growth from Sydney's south west is expected to see forecast demand exceed capacity on the Bankstown Line by around 2021, and on the East Hills Line by around 2025. The Sydney Metro City & Southwest project to Bankstown would provide critical congestion relief to these lines by 2025, and support long-term growth beyond.
- Reduces station crowding – the connection to Bankstown would also eliminate the need to terminate Bankstown Line services at Central, which would be required under alternative operating scenarios. This eliminates accommodating high-volume transfers from the Bankstown Line to other rail services at Central, significantly reducing station crowding, and avoiding the need for major capacity relief.
- Enhances reliability – from the south, network capacity and reliability is constrained by multiple lines merging at Sydenham and Central. Redirecting rail services from the Bankstown Line and into the Sydney Harbour crossing would improve reliability by reducing the number of rail lines sharing the same tracks.
- Simpler conversion – the Bankstown Line has been shown to be less complex to convert to metro operations and segregate from the existing rail network. Compared to other rail lines, such as the Illawarra Line, it does not share operations with other lines or rail freight. The conversion of the Bankstown Line has minimal ancillary infrastructure requirements compared to other lines, such as the East Hills Line and Illawarra Line, which would require additional tunnels and tracks, significant enabling works such as alternative freight routes, and a new train stabling and maintenance facility for Sydney Trains.

3.3 Station options

All 11 stations along the T3 Bankstown Line from Sydenham to Bankstown would be upgraded to provide the standards required for metro services. The option of not upgrading these stations would be the same as the consequences of not proceeding with the project, as described in Section 3.5.

The option of only upgrading some of the stations was discarded, as this has the potential to isolate customers who currently use train services along the Sydenham to Bankstown corridor to access local centres of employment, living and amenity.

Maintaining the existing catchment of train customers along this alignment is critical to achieving the objectives for the project, including encouraging mode shift from cars and/or buses onto trains, delivering customers a more comfortable, reliable and efficient train service, and facilitating transit oriented urban development around existing stations.

The project would include modification of station platforms to allow installation of platform screen doors, and to reduce the gap and elevation difference between the train and the platform. A number of options to ensure that platforms would meet Sydney Metro standards have been considered for platform works at each of the 11 stations from Sydenham to Bankstown. These options are described in Section 6.4.2.

Design development for station platforms, concourses, precincts, rail corridor development and ancillary infrastructure is ongoing for each station. A review of constructability issues and opportunities is also being undertaken as part of the design development process, taking into consideration cost effectiveness, minimising impacts on the environment (including heritage) and the community where possible, and timeframes for construction works. This will determine the construction activities and methodology required at each station. The environmental impact statement will include further detail regarding the assessment of alternatives and options for operational infrastructure and construction of the project.

3.4 Stabling options

Stabling to support the metro network would be required as part of the project. A number of sites have been considered including:

- industrial land in Marrickville, on the northern side of the rail corridor
- within the rail corridor near Punchbowl Station
- the XPT maintenance centre at Meeks Road
- Bankstown Airport
- Meeks Road industrial area.

The XPT maintenance centre at Meeks Road was discounted at the time of the assessment given its importance to the operations of the NSW Trains regional fleet. Bankstown Airport would only be viable if a future extension to Liverpool proceeded, due to the high cost of building it without such an extension. However, Government has not committed to an extension to Liverpool. The Meeks Road industrial area has insufficient capacity and would require a supplementary site such as Punchbowl (with the associated disadvantages of the Punchbowl site, discussed below, and additional costs of two locations).

Punchbowl was considered as an option as the land is already available within the rail corridor. The site would also have a lower cost than some of the alternative options. However, the site was not considered suitable for the following reasons:

- the stabling facility would be at capacity at project opening and would not provide future expansion capacity
- the site is within close proximity to residences and could have a high community impact
- vegetation removal would be required, potentially impacting threatened species and/or vegetation communities that have the potential to occur (as discussed in Section 8.1.8)
- there is no opportunity for provision of maintenance activities, which is considered an operational risk for the Sydney Metro system.

The industrial area in Marrickville was considered to be the preferred stabling option due to:

- the provision for capacity beyond the requirements of project opening
- being able to support maintenance facilities for efficient maintenance and operations
- being better aligned with surrounding land use with no residential properties affected

- limited potential to impact on threatened species and/or vegetation communities that have the potential to occur in the area
- the proposed use of the site for the construction of the tunnel dive structure.

A detailed description of the stabling options considered for the project will be provided in the environmental impact statement. The stabling facility is described further in Section 6.6.3.

3.5 Consequences of not proceeding with the project

Demand on much of Sydney's rail network is nearing capacity during the morning and evening peak periods. Patronage will continue to grow as land is rezoned and/or redeveloped along the Sydenham to Bankstown corridor. Network capacity in the Sydney CBD cannot accommodate growth because of the bottleneck caused by trains having to merge tracks with other lines, wait for opposing trains to cross, or face delays due to slow boarding and alighting.

By 2026, demand for rail transport will grow by 83,900 trips to a total of 249,000 trips in the morning peak (representing a 51 per cent increase in travel demand). The existing transport system cannot provide the capacity to accommodate this forecast growth as:

- the road and bus networks are already heavily constrained and cannot be effectively augmented to accommodate the additional capacity required
- Sydney's rail network is complex and becoming more crowded and more unreliable.

Even with the additional services provided by Stages 1 and 2 of *Sydney's Rail Future* (refer to Section 3.1.3), the rail network will run out of capacity at some point during the mid to late 2020s.

Converting the T3 Bankstown Line to metro would remove the need for Bankstown services to use the City Circle, providing for additional train paths for other lines using the City Circle. Removing T3 Bankstown Line services from the City Circle, in addition to the provision of two additional tracks from Chatswood to the City as part of the Chatswood to Sydenham component, would enable a fundamental change in the suburban network service plan. It would divert passengers from the T1 North Shore, Northern & Western Line, and provide additional capacity on the T2 Airport, Inner West & South Line.

By increasing the reach of the rail network, frequency of services, interchange with other modes, and connections to key destinations, the project is expected to increase accessibility, trip diversity and utilisation of the Sydenham to Bankstown section of the network during both peak and non-peak periods. This would facilitate a greater mode shift to rail from car, particularly during non-peak periods where travel service consumers have greater choice.

The project would facilitate a diverse range of trips, providing a fast journey to work and encouraging trips for other purposes, such as access within the Sydney CBD, local or business trips, access to universities and educational institutions, service and recreational uses.

4. Planning and assessment process

This chapter describes the statutory planning process for the project, and identifies other NSW and Commonwealth legislation and approvals that may apply to the project.

4.1 NSW environmental planning approvals

The EP&A Act and the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) are the primary pieces of legislation regulating land use planning and development assessment in NSW. This legislation is supported by a range of environmental planning instruments including State environmental planning policies (SEPPs) and local environmental plans (LEPs).

Sections 115U and 115V of the EP&A Act provide for the declaration of State significant infrastructure and critical State significant infrastructure (refer to Section 4.1.1). Part 5.1 of the EP&A Act establishes the assessment and approval regime for State significant infrastructure and critical State significant infrastructure (refer to Section 4.1.3).

4.1.1 Critical State significant infrastructure

Sydney Metro City & Southwest has been declared to be critical State significant infrastructure as outlined in Schedule 5 of *State Environmental Planning Policy (State and Regional Development) 2011*. The project forms part of Sydney Metro City & Southwest and therefore is considered to be critical State significant infrastructure.

4.1.2 Planning approval process under Part 5.1 of the EP&A Act

The assessment and approval process for a critical State significant infrastructure project is established under Part 5.1 of the EP&A Act and is shown in Figure 4-1.

This document supports a State significant infrastructure application by Transport for NSW to the Secretary of the Department of Planning and Environment as required by section 115X of the EP&A Act, and seeks the Secretary's environmental assessment requirements for the project (as per section 115Y of the EP&A Act).

An environmental impact statement will be prepared in accordance with the Secretary's environmental assessment requirements and the requirements of Schedule 2, Part 3 of the EP&A Regulation (as per section 115Y(2) of the EP&A Act). The Department of Planning and Environment will place the environmental impact statement on public exhibition for a minimum of 30 days (as per section 115Z of the EP&A Act). During the exhibition period, government agencies, project stakeholders and the community will be able to review the environmental impact statement and will have an opportunity to make a written submission to the Department of Planning and Environment for consideration in its assessment of the project.

At the completion of the public exhibition period, the Department of Planning and Environment will collate and provide Transport for NSW with a copy of all submissions received during the exhibition period. After reviewing the submissions, Transport for NSW will prepare a submissions report that responds to the relevant issues raised. If changes are required to the project as a result of the issues raised or to minimise environmental impact, a preferred infrastructure report may also be required.

If this is required, Transport for NSW would prepare the report to address the changes to the design to minimise impacts and submit this for review to the Department of Planning and Environment. This report would be made available to the public.

Approval from the Minister for Planning is required before Transport for NSW can proceed with the project (as per section 115ZB of the EP&A Act).

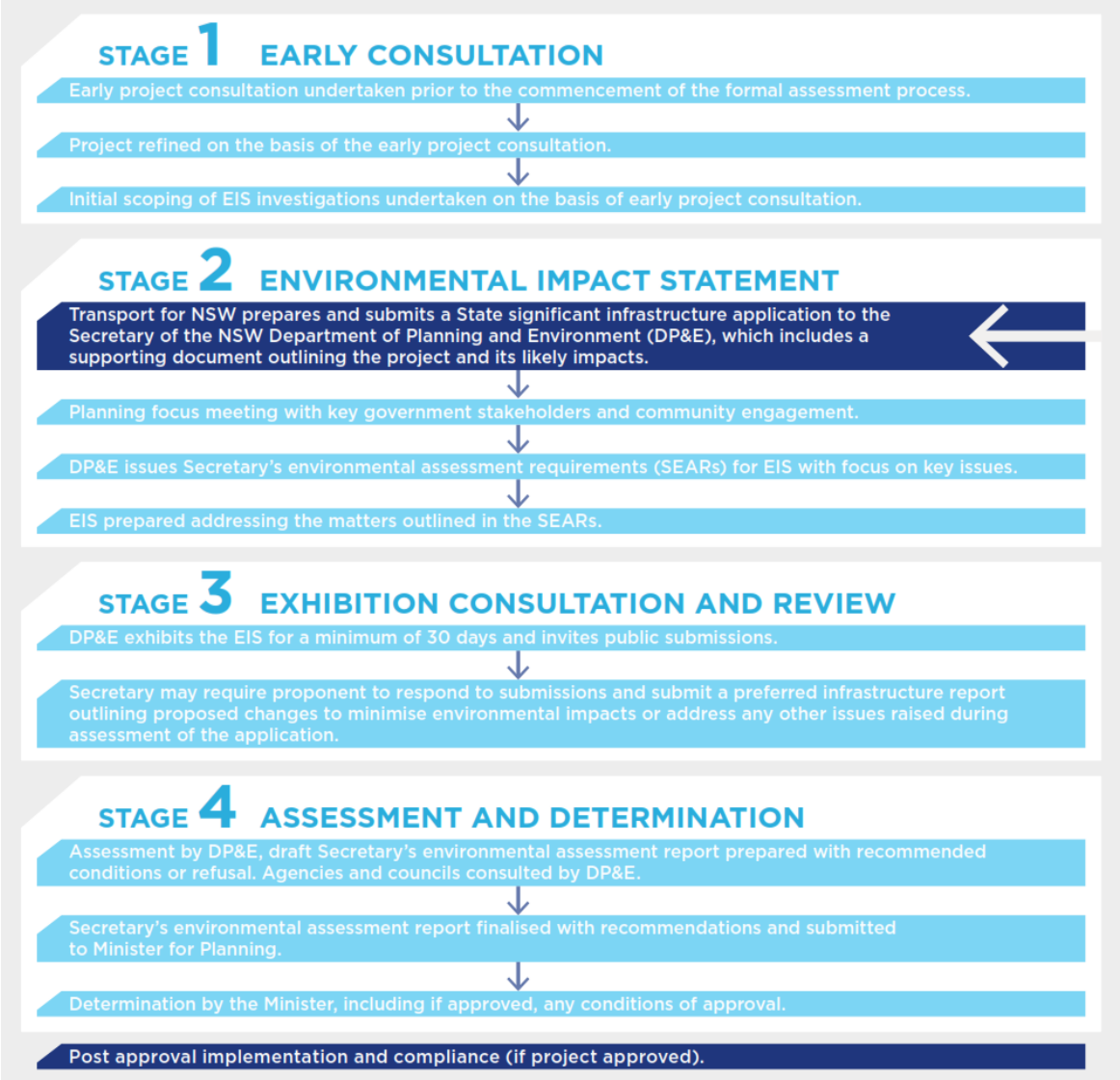

Figure 4-1 The assessment and approval process for critical State significant infrastructure

4.1.3 NSW environmental planning instruments

Section 115ZF of the EP&A Act provides that environmental planning instruments (such as LEPs and SEPPs) do not, with some exceptions, apply to State significant infrastructure projects. Notwithstanding this, the environmental planning instruments that have been considered for consistency are summarised in Table 4-1.

Table 4-1 Environmental planning instruments relevant to the project

Environmental planning instrument	Relationship to project
State Environmental Planning Policy (State and Regional Development) 2011	This SEPP identifies development that is State significant development, State significant infrastructure and critical State significant infrastructure. As outlined in Section 4.1.1, the project has been declared a critical State significant infrastructure as detailed in Schedule 5 of this SEPP.
State Environmental Planning Policy No. 55 – Remediation of Land	*State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55) provides a State-wide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. In accordance with Clause 7(1) of SEPP 55, a consent authority must not consent to the carrying out of development on any land unless: • it has considered whether the land is contaminated • if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or would be suitable, after remediation) for the purpose for which the development is proposed to be carried out • if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land would be remediated before the land is used for that purpose. Section 8.2.2 considers contamination issues associated with the project.

4.2 Requirements under other NSW legislation

In accordance with sections 115ZG and 115ZH of the EP&A Act, some environment and planning legislation does not apply to approved State significant infrastructure or must be applied consistently with an approval for State significant infrastructure (refer to Section 4.2.1).

4.2.1 Approvals or authorisations that are not required or cannot be refused

Section 115ZG of the EP&A Act specifies authorisations that are not required for approved State significant infrastructure. Approvals of potential relevance to the project include:

- permits under sections 201, 205 and 219 of the *Fisheries Management Act 1994* (FM Act)
- approvals under Part 4, excavation permits under section 139 and Division 8 of Part 6 of the *Heritage Act 1977*
- Aboriginal heritage impact permits under section 90 of the *National Parks and Wildlife Act 1974*
- various approvals under the *Water Management Act 2000*, including water use approvals under section 89, and activity approvals (other than aquifer interference approvals) under section 91.

- Similarly, section 115ZG of the EP&A Act specifies directions, orders or notices that cannot be made or given so as to prevent or interfere with the carrying out of approved critical State significant infrastructure. Of relevance to this project would be:
  - an interim protection order (within the meaning of National Parks and Wildlife Act 1974 or the Threatened Species Conservation Act 1995 (TSC Act))
  - an order under Division 1 (Stop work orders) of Part 6A of the National Parks and Wildlife Act 1974, Division 1 (Stop work orders) of Part 7 of the Threatened Species Conservation Act 1995 or Division 7 (Stop work orders) of Part 7A of the Fisheries Management Act 1994
  - an environment protection notice under Chapter 4 of the Protection of the Environment Operations Act 1997
  - an order under section 124 of the Local Government Act 1993.

Section 115ZH of the EP&A Act identifies approvals or authorisations that cannot be refused if they are necessary for carrying out approved State significant infrastructure and are substantially consistent with the Part 5.1 approval. Statutory approvals or authorisations of potential relevance to this project include:

- environment protection licences under Chapter 3 of the *Protection of the Environment Operations Act 1997*
- consent under section 138 of the *Roads Act 1993* from the relevant roads authority for the erection of a structure, or the carrying out of work in, on or over a public road, or the digging up or disturbance of the surface of a road. This approval requirement is most likely to be triggered near station locations.

4.2.2 Other NSW legislation and regulations that may still be applicable

Planning related legislation and regulations that may still be applicable to an approved critical State significant infrastructure project and may, based on the current scope of the project, be relevant are described in Table 4-2.

Table 4-2 Legislation and regulations of potential relevance to the project

Legislation	Requirement
Contaminated Land Management Act 1997	The *Contaminated Land Management Act 1997* outlines the circumstances in which the Environment Protection Authority should be notified in relation to the contamination of land.
Crown Land Act 1989	Ministerial approval is required to grant a 'relevant interest' (i.e. a lease, licence, permit, easement or right of way) over a Crown Reserve if required. The potential for impacts on Crown land would be determined during the design process.
Greater Sydney Commission Act 2015	This Act establishes the Greater Sydney Commission which has a principal objective of leading metropolitan planning for the Greater Sydney Region. The core functions of the Greater Sydney Commission are to provide advice to Government and assist local Councils plans or proposals relating to development in the Greater Sydney Region. The Greater Sydney Commission would not have a formal statutory role for this project but would be consulted with respect to its core functions.
Heritage Act 1977	In accordance with section 146, the Heritage Council must be notified of the location of a relic, which is uncovered during construction and if it is reasonable to believe that the Heritage Council is unaware of the location of the relic.

Legislation	Requirement
Fisheries Management Act 1994	Under section 199 of the Act, a public authority is required to give the Minister written notice of any proposed dredging or reclamation work prior to carrying out or authorising the carrying out of such work. The project may require works within the Cooks River at Canterbury, which may trigger the notification requirements under the Act. This would be confirmed during the design process.
Water Management Act 2000	The *NSW Aquifer Interference Policy* (NSW Office of Water, 2012) documents the NSW Government's intention to implement the requirement for approval of 'aquifer interference activities' under *the Water Management Act 2000*. While the project has the potential to intercept groundwater aquifers, the requirement for aquifer interference approvals has not yet commenced. No other approvals under the act would be required, as outlined in Section 4.2.1.
Native Title (NSW) Act 1994	This Act provides for native title in relation to land or waters. The environmental impact statement will confirm if the project would affect land subject to native title or to which Indigenous Land Use Agreement applies.
Aboriginal Land Rights Act 1983	The *NSW Aboriginal Land Rights Act 1983* establishes the NSW Aboriginal Land Council and local Aboriginal land councils. The Act requires these bodies to: • take action to protect the culture and heritage of Aboriginal persons in the council's area, subject to any other law • promote awareness in the community of the culture and heritage of Aboriginal persons in the council's area. The preamble of the *Aboriginal Land Rights Act 1983* states that land was traditionally owned and occupied by Aboriginal people and accepts that as a result of past government decisions, the amount of land set aside for Aboriginal people was reduced without compensation. To redress the loss of land, Aboriginal land councils can claim Crown land which, if granted, is transferred as freehold title. 'Claimable Crown lands' includes Crown lands that are not lawfully used or occupied and that are not needed, nor likely to be needed, for an essential public purpose. The environmental impact statement will confirm whether any claimable Crown lands would be affected by the project.
Land Acquisition (Just Terms Compensation) Act 1991	This Act would apply to the acquisition of land required for the project.
Waste Avoidance and Resource Recovery Act 2001	This Act encourages the most efficient use of resources in order to reduce environmental harm.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under Part 3 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), approval from the Australian Government Minister for the Environment and Energy would be required for an action that:

- has, will have, or is likely to have a significant impact on a matter of national environmental significance
- is undertaken on Commonwealth land and has, will have, or is likely to have a significant impact on the environment
- is undertaken outside Commonwealth land and has, will have or is likely to have a significant impact on the environment of Commonwealth land
- is undertaken by the Commonwealth and has, will have or is likely to have a significant impact on the environment.

Matters of national environmental significance comprise:

- world heritage properties
- national heritage places
- wetlands of international importance
- Commonwealth-listed threatened species and ecological communities
- Commonwealth-listed migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

Based on desktop assessments to date, no world, national or Commonwealth heritage items are located in the vicinity of the project. The project would not impact upon any Commonwealth Marine areas and the Great Barrier Marine Park, and does not involve a nuclear action or coal seam gas or large coal mine development. The project is unlikely to impact on any Commonwealth land; however, this would be confirmed in the environmental impact statement.

A total of 14 listed threatened ecological communities, 35 threatened flora species, 25 threatened fauna species and eight migratory species listed under the EPBC Act are identified as having potential to occur in the vicinity of the project. One wetland of international significance (Towra Point Nature Reserve) is located eight kilometres downstream of the project area, and impacts are considered unlikely. The potential impacts would be confirmed in the environmental impact statement.

Should significant impacts on any matters of national environmental significance be considered likely, a referral under the EPBC Act would be required.

4.3.2 Native Title Act 1993

The main objective of the *Native Title Act 1993* (Commonwealth) is to recognise and protect native title. Section 8 states that the *Native Title Act 1993* is not intended to affect the operation of any law of a State or a Territory that is capable of operating concurrently with the Act. Searches of the register maintained by the National Native Title Tribunal will be undertaken to confirm if any native title claims are registered with respect to land within the area of the project.

The environmental impact statement will confirm whether any Crown land is required for the project and if this land is subject to a native title claim.

4.3.3 Disability Discrimination Act 1992

The *Disability Discrimination Act 1992* (DDA) aims to eliminate as far as possible discrimination against persons on the ground of disability in areas including access to premises and the provision of facilities, services and land. The project would be designed to be independently accessible and comply with the objectives and requirements of the Act.

4.3.4 Disability Standards for Accessible Public Transport 2002

Section 33.1 of the *Disability Standards for Accessible Public Transport 2002* requires all new public transport premises, infrastructure and conveyances to comply with the requirements of the standard and referenced to the Australian Standards and Design Rules therein, unless unjustifiable hardship is incurred by implementation. The project would be designed to comply with the requirements of the *Disability Standards for Accessible Public Transport 2002*.

4.4 Planning approvals process for rail corridor development

The potential for rail corridor development has been identified at a number of sites along the corridor. These sites include stations; the stabling facility; and sites between stations, any of which might be suitable for development above or adjacent to rail assets. Sydney Metro infrastructure at these sites would be designed to take into account (and make physical provision for) any proposed development.

Provision for rail corridor development may include structural support columns, retaining walls, slabs, and building service utility requirements (water, sewer, power, etc). Elements incorporated into the project design for the purposes of making provision for such future development will be identified and assessed as part of the environmental impact statement. All other aspects of rail corridor development would be subject to separate planning approvals processes.

5. Site description

This chapter provides an overview of the features of the project area, the regional context, and rail facilities relevant to the project.

5.1 Regional context

The project is predominantly located within the existing rail corridor from about one kilometre north-east of Sydenham Station to about one kilometre west of Bankstown Station. The project area passes through a number of suburbs including Sydenham (about 5.5 kilometres south of the Sydney CBD), Marrickville, Dulwich Hill, Hurlstone Park, Canterbury, Campsie, Belmore, Lakemba, Wiley Park, Punchbowl, and Bankstown (about 19 kilometres south-west of the CBD).

As an outcome of the NSW council amalgamation process, a number of new councils commenced operations on 12 May 2016. The project area spans the two new local government areas of the Inner West and Canterbury-Bankstown (covering the areas of the former Bankstown City Council, Canterbury Council and Marrickville Council).

The Sydenham to Bankstown corridor is highly urbanised and extends through densely populated and ethnically diverse regions. The corridor is home to more than 120,000 residents. Of those, around 25 per cent travel by train to work (Department of Planning and Environment, 2015).

A Plan for Growing Sydney (NSW Government, 2014a) identifies the important role that growth and investment in strategic centres, including Bankstown and Liverpool, have in providing more jobs closer to home. Western Sydney has around 47 per cent of Sydney's residents, 36 per cent of Sydney's jobs and one-third of Sydney's gross regional product (NSW Government, 2014a) and this is set to continue to grow. By 2031, an extra one million people will live west of Homebush (NSW Government, 2014a). Residents in western Sydney are also more dependent on cars for transport than any other part of Sydney, with the average vehicle kilometres travelled per person in Liverpool twice that of residents in inner Sydney or the eastern suburbs (NSW Government, 2014a).

The Greater Sydney Commission is responsible for Greater Sydney regional planning in a partnership between State and local government. Sydney district planning will guide the delivery of *A Plan for Growing Sydney* across six districts that form Greater Sydney. The project would be located within the South District.

5.1.1 Existing rail facilities

The existing rail transport network within the vicinity of the project consists of the Sydney Trains suburban rail network, Sydney Light Rail and the Australian Rail Track Corporation (ARTC) managed metropolitan freight network. The existing and planned rail infrastructure network (excluding Sydney Metro) within the vicinity of the project is shown in Figure 5-1.

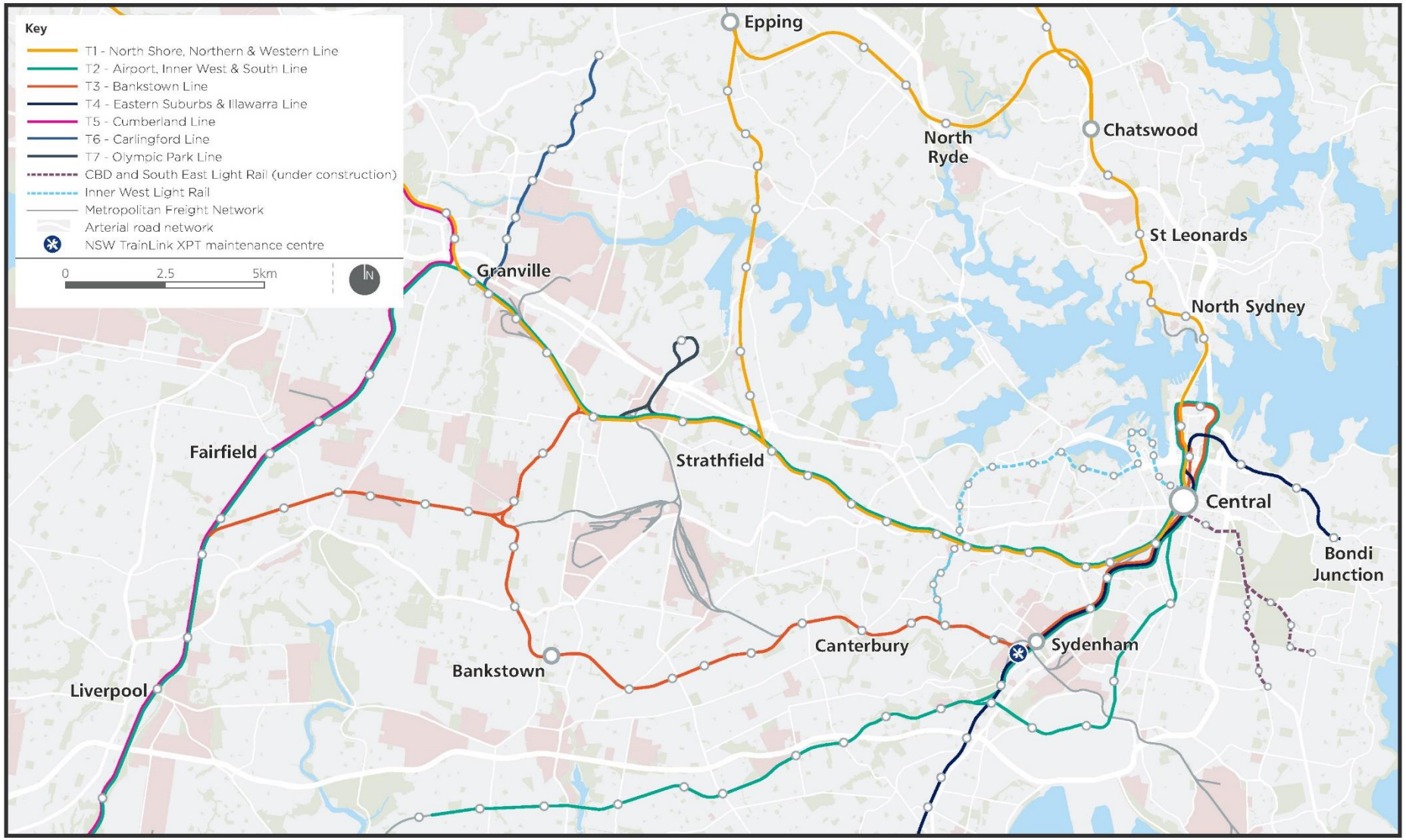

Figure 5-1 Rail networks in the region

5.1.2 Suburban rail

Sydney Trains provides train services throughout the Sydney CBD and metropolitan area. The Sydney suburban rail network incorporates seven rail lines comprising:

- T1 – North Shore, Northern & Western Line
- T2 – Airport, Inner West & South Line
- T3 – Bankstown Line
- T4 – Eastern Suburbs and Illawarra Line
- T5 – Cumberland Line
- T6 – Carlingford Line
- T7 – Olympic Line.

The Sydney Trains network in the project area includes the T3 Bankstown Line, which connects western Sydney suburbs including Liverpool and Lidcombe to the Sydney CBD. At Sydenham Station, this train line merges with the T2 Airport Line. Customers can change between the T3 Bankstown, T2 Airport and T4 Illawarra lines at Sydenham Station.

The project area encompasses 11 existing stations along the T3 Bankstown Line, including Sydenham, Marrickville, Dulwich Hill, Hurlstone Park, Canterbury, Campsie, Belmore, Lakemba, Wiley Park, Punchbowl and Bankstown stations.

The busiest stations by patronage along the T3 Bankstown Line are Bankstown, Campsie and Sydenham, with over 11,000 customer movements per day at each station. This is in contrast to the stations of Hurlstone Park and Canterbury, with customer movements of fewer than 4,000 at each station (Transport for NSW, 2014).

Of the 11 stations within the project area, Sydenham and Bankstown have the largest numbers of customers changing from one mode of travel to another (i.e. between suburban train lines and buses or cars).

5.1.3 Metropolitan freight network

The ARTC is responsible for the operation and management of 8,500 kilometres of private rail network in Australia. ARTC's network includes the metropolitan freight network (under lease), which is a series of dedicated freight lines within the Sydney metropolitan area. The metropolitan freight network includes two tracks that run parallel to the T3 Bankstown Line in the project area, between Campsie and Marrickville. This line connects Port Botany and Cooks River Yard with Chullora Terminal, Enfield Intermodal Terminal, and the Enfield marshalling yards. The line extends west from Chullora to Sefton Park Junction where it connects with the Southern Sydney Freight Line. The line provides onward connections to the Main North Line, Main South Line, Main West Line and Illawarra Line. Freight rail traffic is projected to grow in coming years due to increases in container traffic through Port Botany and development of new facilities (such as intermodal terminals) along the metropolitan freight network.

5.1.4 Light rail

The Inner West Light Rail network consists of the 12.8 kilometre long L1 Dulwich Hill Line between Central Station and Dulwich Hill.

The Dulwich Hill light rail station includes a single platform with lift and stair structures, drop off zone and commuter parking which is shared with the adjacent Dulwich Hill Station. At Dulwich Hill, light rail customers can walk about 130 metres to Dulwich Hill Station and change onto the Sydney Trains T3 Bankstown Line.

The CBD and South East Light Rail is currently under construction. Once built, customers will be able to travel from Dulwich Hill to Circular Quay or to Kingsford and Randwick on the light rail network.

5.1.5 Regional rail

Other rail infrastructure in the area includes the NSW TrainLink XPT maintenance centre located at the junction of the T3 Bankstown Line and the T4 Illawarra Line at Meeks Road, west of Sydenham Station.

5.2 Description of the project area

5.2.1 Built environment

The project area is predominantly located within an existing rail corridor located in well-established urban areas. The main land uses surrounding the project area include residential, industrial and commercial. Residential land uses form the most prominent land use, with residential receivers generally located about 15 to 25 metres from the nearest existing track. In some locations, a local road separates the track and dwellings.

Higher density residential areas, characterised by townhouses, multi-dwelling buildings and multi-storey apartment buildings, are concentrated in Campsie, Lakemba and Bankstown (west of Stacey Street). Residential land uses are predicted to increase in density as proposed urban renewal progresses. The desired future character for the area involves increased housing densities near the project area, particularly in close proximity to rail stations and local centres (Department of Planning and Environment, 2015).

Lower density residential areas near the project area are characterised by single detached and semi-detached housing which is predominately located adjacent to the local centres of Marrickville, Sydenham, Dulwich Hill, Canterbury, Hurlstone Park, Bankstown (east of Stacey Street) and Punchbowl (west of the station).

Most local centre main streets near to the project area feature two-storey buildings with shop housing above. There are also more recent developments in the area, such as those on Campsie's main street, which are characterised by four to six storey developments, with shops on the ground floor and housing above.

Many of the local centres near the project area provide mixed use activities that include commercial, residential, retail, cultural, education, civic, health, special use, and recreation. The local centres at Bankstown and Campsie are large mixed use precincts, with Bankstown the larger of the two. Most other local centres provide for smaller scale mixed use activities.

A number of educational institutions are located in the project area at distances of between 25 and 75 metres from the rail corridor. Some of these facilities are located directly adjacent to the rail corridor and have direct line of sight to it. Other community facilities in the area include child care centres, places of worship and medical facilities.

Active recreation areas located directly adjacent to the project area include public sports fields and stadiums (e.g. Belmore Sportsground). A number of passive recreation areas are also located in the area, such as parks, nature reserves and social facilities such as barbecue areas.

Commercial land uses in the project area are generally located around stations. Industrial land uses are focused around Sydenham.

All stations within the project area are heritage listed, with the following stations listed on the NSW State Heritage Register:

- Sydenham Railway Station Group
- Marrickville Railway Station Group
- Canterbury Railway Station Group
- Belmore Railway Station Group.

Section 8.1.3 provides additional information on non-Aboriginal heritage along and in the vicinity of the project area.

The road network corridors located near the project area include:

- New Canterbury Road (A34)
- King Georges Road (A3)
- Stacey Street (A6)
- Princes Highway (A36)
- Hume Highway (A22).

The existing rail corridor is crossed by a number of road and pedestrian bridges which facilitate north-south access across it (see Section 6.5).

The cycle network near the project area features three key links:

- 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.

Footpaths and dedicated road crossings are generally provided for pedestrian use. However, pedestrian connectivity within centres such as Bankstown and Sydenham is reduced due to the large size of street blocks, the major roads and the rail corridor.

5.2.2 Natural environment

There is limited native vegetation present within the project area. However, some riparian vegetation is present along the edges of the Cooks River at Canterbury. Much of the land within the rail corridor is vegetated with grasses, small shrubs and a variety of weeds, while some areas of bare ground are also present. Vegetation mapping (National Parks and Wildlife Service, 2002) does not show any native vegetation as mapped within the rail corridor. Fauna species that are likely to occur would predominantly be common species, typical of modified urban environments (see Section 8.1.8).

The rail corridor between Sydenham Station and Punchbowl Station drains to the Cooks River and its tributaries, while the section of the corridor between Punchbowl Station and Bankstown Station drains to Salt Pan Creek via the stormwater drainage network. The stormwater drainage network controls stormwater flows for smaller storm events throughout the project area. There are numerous stormwater drainage crossings of the rail corridor. This network manages stormwater flows predominantly from the roads and impervious areas of the catchments, crossing beneath the rail line via culverts at low points (see Section 8.1.4).

5.3 Land ownership

Land ownership within the project area is a combination of RailCorp owned land, privately owned land, and land owned and/or managed by the local council or other public authorities.

6. Project description

This chapter provides an indication of the key project features, including the alignment, the proposed works at stations and other ancillary infrastructure, and metro operations. An outline of the construction works is also provided.

6.1 Overview and key components

The project involves converting the existing 13.5 kilometre section of the T3 Bankstown Line from Sydenham to Bankstown to a metro line. The conversion of the line would also include upgrading 11 existing stations to the standards required for metro service, including full accessibility, and a stabling facility built to support the operations of Sydney Metro City & Southwest.

All project components described are subject to further design, and changes or clarifications may be made during the ongoing design development and community consultation processes.

The location of the project, including track works and station works, is shown on Figure 6-1 to Figure 6-6. The key components are expected to include:

- upgrades to the existing stations, including changes to station platform or concourse positions, and changes to station layouts, to meet Sydney Metro operational requirements, including full accessibility
- a new stabling facility for Sydney Metro trains located on industrial land in Marrickville, on the western side of the rail corridor adjacent to the tunnel dive structure
- utility and rail system protection and relocation works within the construction footprint and public areas
- adjustment of existing track alignments and overhead wiring along the line to meet Sydney Metro operational requirements
- installation of Sydney Metro rail systems, including signalling, electrical, radio and communications systems, masts, cable containment systems, equipment buildings and electrical transformers
- adjustment of existing Sydney Trains rail systems, including removal of existing junctions to segregate the metro tracks from the adjacent Sydney Trains tracks, and removal of any redundant Sydney Trains systems (e.g. signalling, communications)
- connection of the project to Sydney Metro tracks at the tunnel dive structure constructed as part of the Chatswood to Sydenham component, located north-east of Sydenham Station
- provision of new, or replacement of existing, turn back facilities and track crossovers
- modifications to existing, and new, access tracks/paths, rail corridor fencing, and noise walls
- installation of high security fencing along the entire corridor to prevent both deliberate and unintentional access to the automated train operation area
- works to suit the new station layouts, potentially including changes to existing, or provision of new, pedestrian paths, bicycle facilities, kiss and ride facilities, commuter car parking, bus interchange areas, and associated footpath/road works in the vicinity of stations

- upgrade of existing bridges/underpasses that cross over and under the rail corridor, including provision of anti-throw screens, vehicle safety barriers, and pier collision protection or potential replacement of existing bridges/underpasses (subject to asset condition assessment and detailed design)
- stormwater drainage works, including upgrades of existing track/corridor drainage, and modifications to Sydney Water and council stormwater assets outside the rail corridor
- modifications/upgrades to existing embankments and cuttings (if required)
- construction of new traction substations to provide power to trains, including a new associated feeder route from an existing Ausgrid electrical substation at Punchbowl
- provision of track works on the existing Sydney Trains network at Bankstown Station and a turnback west towards Yagoona to facilitate altered train operations
- track works to the north and south of Sydenham on the T2 Airport and T4 Illawarra Lines, and at the NSW TrainLink XPT maintenance centre at Meeks Road west of Sydenham Station, to facilitate track separation
- adjustment of existing track alignments along the line to meet Sydney Trains, NSW Trains, and freight operational requirements whilst Sydney Trains continue to operate the line
- provision for rail corridor development of residual lands within station precincts or along the rail corridor (e.g. construction of footings, columns, beams, retaining walls, and other enabling structures and service infrastructure for any future buildings)
- temporary ancillary facilities to support the construction of the project including construction compounds and other construction work areas
- provision for an active transport corridor to facilitate strategic walking and cycling connections between Sydenham and Bankstown
- implementation of temporary transport measures during rail possession periods while work is undertaken.

The project would interchange with Sydney Trains services at Sydenham Station and Bankstown Station. Once the project is operational, Sydney Trains would no longer operate on the Bankstown Line between Sydenham and Bankstown stations.

To enable earlier opening of City & Southwest, Transport for NSW will consider how the delivery of components of the project as described in this application could be accelerated. This would involve a separate delivery contract for the work at Sydenham Station and junction. Delivery of elements earlier may involve a separate planning approval process to the main conversion of the Bankstown Line as described in this application, in order to best align with the construction contracts and how the work is sequenced. Further details on how City & Southwest would be delivered would be provided within the Environmental Impact Statement released later this year.

Figure 6-1 The project – Map 1

Figure 6-2 The project – Map 2

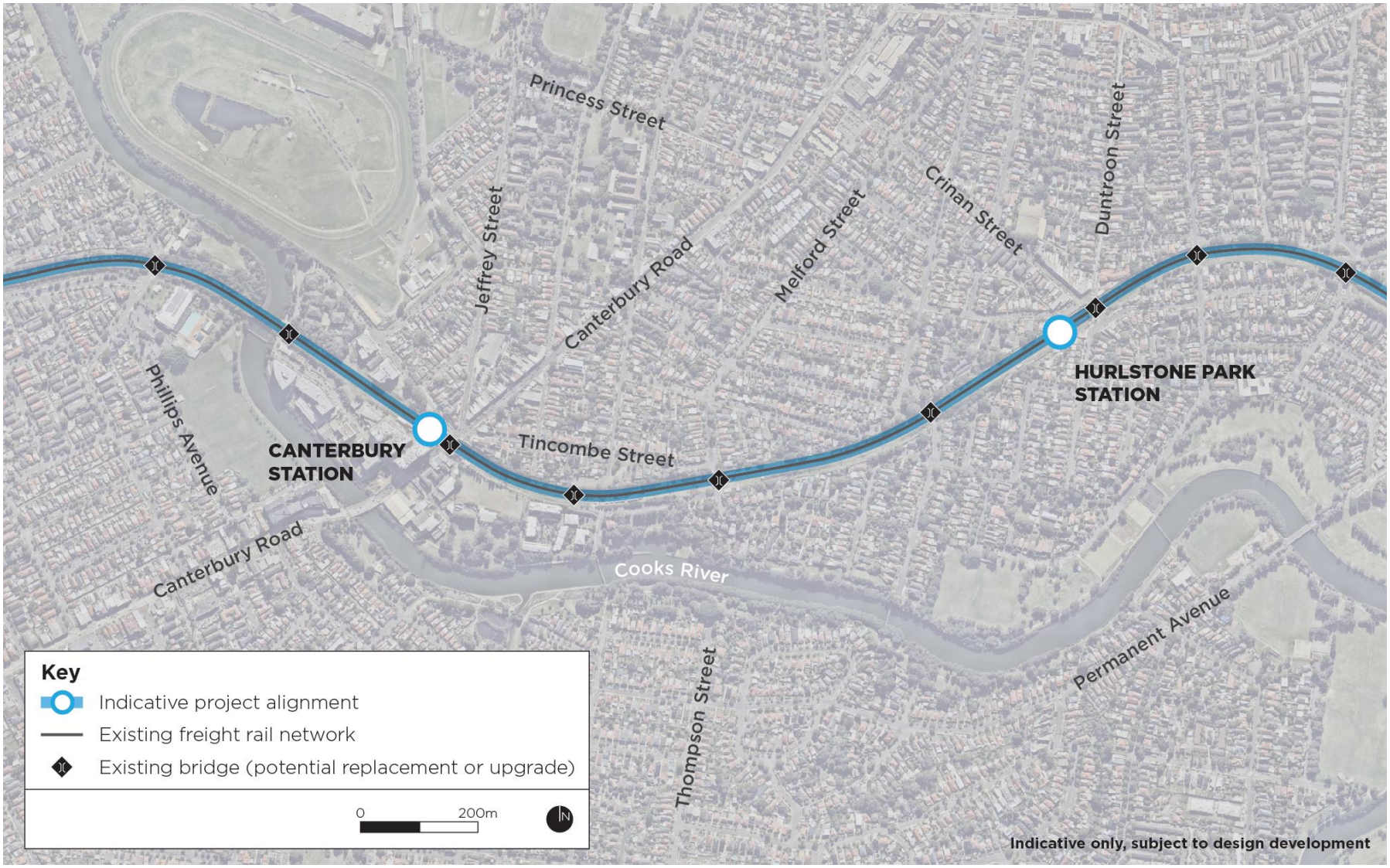

Figure 6-3 The project – Map 3

Figure 6-4 The project – Map 4

Figure 6-5 The project – Map 5

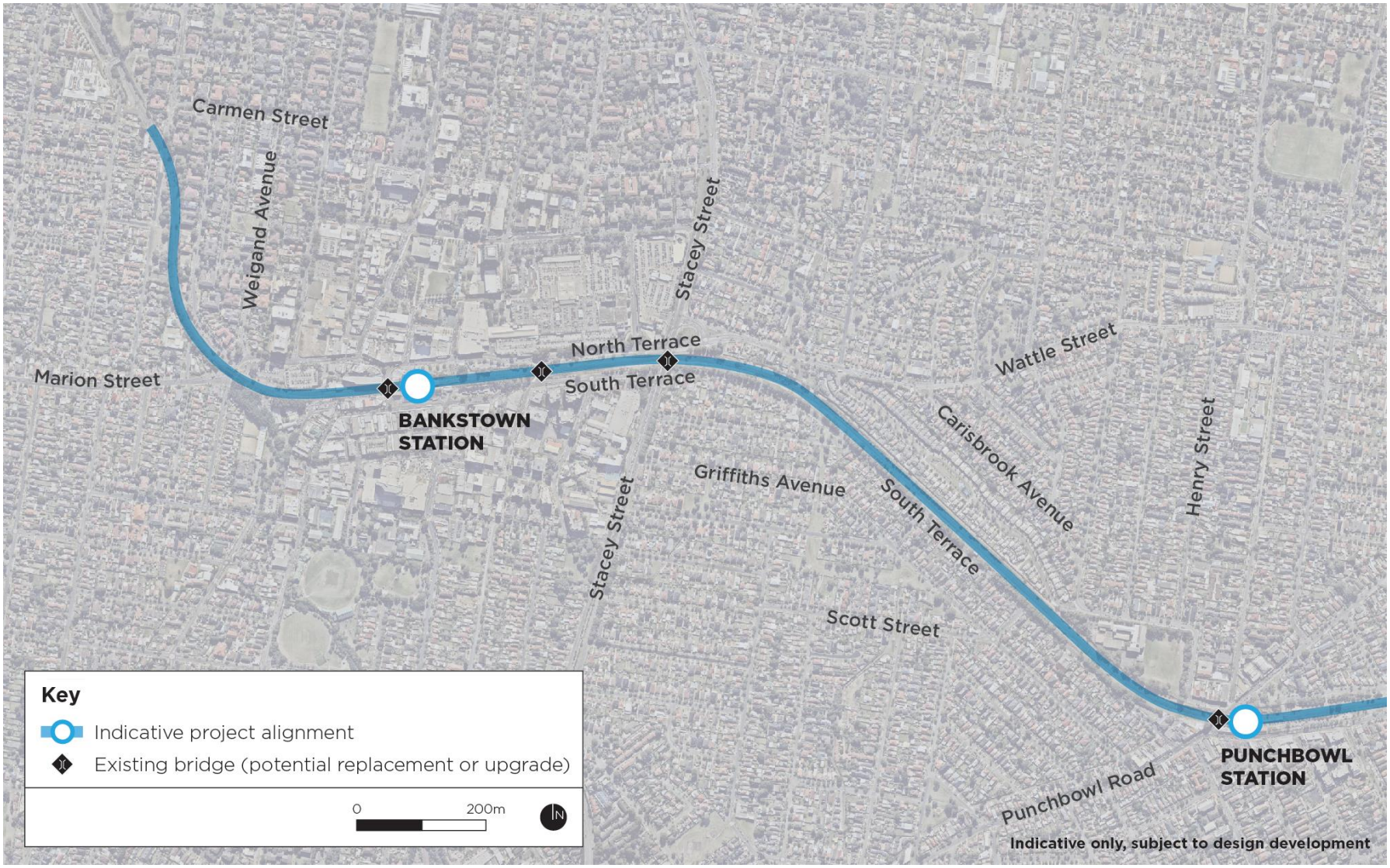

Figure 6-6 The project – Map 6

6.2 Operation of the project

The project would be operated as part of the overall Sydney Metro network.

The fully automated Sydney Metro would deliver a step-change in the capacity and customer experience of Sydney's transport network, with a high capacity, turn-up-and-go service consistent with customer expectations. The metro trains would operate independently from the existing suburban rail network with a high level of reliability.

6.2.1 Frequency of service

At opening, the project would operate six car trains at least every four minutes during peak periods (between 15 and 20 trains per hour) and at least every ten minutes in off peak periods. Interchange facilities would be provided at Sydenham and Bankstown stations to provide customers with efficient connections between Sydney Metro and Sydney Trains services.

6.2.2 Hours of operation

The first metro service to depart Cudgegong Road Station (Sydney Metro Northwest) and Bankstown Station (as part of the Sydenham to Bankstown upgrade) would arrive at Central Station in the early morning. The last metro service to arrive at Cudgegong Road and Bankstown stations would depart Central Station late at night (around midnight and potentially later on weekends). The operating hours could be extended to accommodate for planned special events.

The operating hours would be determined as part of the development of services schedules for the project, taking into account customer and maintenance access requirements.

6.2.3 Train types

Trains operating on the Sydney Metro network would be new-generation, single-deck metro trains (similar to those being introduced on Sydney Metro Northwest). The trains would deliver a fast, safe and reliable journey for customers, with high performance standards and good customer amenities. The key features of these trains include:

- fully automatic, driverless trains, with passengers able to see from one end of the train to the other
- three doors per side per carriage, for faster boarding and alighting
- provision of accessible priority seating for those with a disability or using a wheelchair or mobility device, the elderly, or those travelling with a pram or luggage
- emergency intercoms inside trains and customer service assistants at every station and moving throughout the network day and night
- two multi-purpose areas per train for prams, luggage and bicycles
- on-board real time travel information and live electronic route maps
- level access between the platform and train
- a new generation of fast, safe and reliable metro trains.

The Sydney Metro network would be able to carry more passengers per hour than would be the case with double-deck trains. This is because single-deck trains allow customers to get on and off at stations more efficiently and faster than double-deck trains, which reduces dwell times (the time a train is stopped at a station). Platform screen doors at stations would keep objects and people away from the edge and allow trains to get in and out of stations much faster. The modern signalling technology is also more efficient for running the trains by providing fully

automated trains and less dwell times at stations, which would increase the capacity of the metro network.

An artist's impression of the type of train proposed is provided as Figure 6-7.

Figure 6-7 Artist impression of a metro train

6.3 Track alignment

The alignment of the project would be along the existing T3 Bankstown Line rail corridor from Sydenham in the east to Bankstown in the west. The alignment of the track would generally remain similar to the existing alignment. However, in some locations, particularly around stations, tracks would be adjusted to meet any new station platform locations or alignments. Other key changes to the track alignment are expected to occur at the following locations:

- around Sydenham and Bankstown stations to facilitate the separation of the metro tracks from the Sydney Trains network
- at the stabling facility
- at the location of the new turnbacks and crossovers.

Works to realign sections of the track would generally occur within the existing rail corridor.

The project would use the existing Sydney Trains tracks where possible. In some locations, there may be a need to upgrade the existing track including ballast.

6.3.1 Turn back and crossover facilities

Turn back and crossover facilities are likely to be required at the following locations:

- track crossover north of Sydenham Station platforms
- crossovers and other track work to connect to the stabling facility
- potential reconfiguration of track crossovers in the Campsie area
- turnback in the vicinity of Belmore Sportsground
- turnback in the vicinity of Lakemba Station
- replacement of the existing track crossover east of Bankstown Station, location to be determined during detailed design
- a reconfigured rail junction and turnback west of Bankstown Station for Sydney Trains services.

These locations would be confirmed as part of the design development.

6.4 Stations

The existing stations from Sydenham to Bankstown (as described in Section 5.1.2) would be located on and serviced by the new metro line. Due to the operational requirements of Sydney Metro trains, a number of modifications would be required to stations, along with other improvement works in the surrounding station precincts. The sections below outline the type of work that would potentially be undertaken to upgrade stations to metro standards. Ongoing design development for the project would confirm which works are required at each station.

6.4.1 Design principles for metro stations

Preliminary design principles have been developed to guide the design of the stations. These principles will ensure that appropriate design quality is achieved for internal spaces and the public domain. They will also address relevant council strategies and guidelines and the draft architecture and design policy for NSW, *Better Placed* (Government Architect, 2016). The design principles will be detailed in the environmental impact statement and will consider the following station aspects:

- **Functionality, accessibility and circulation** – ensure that access between the metro stations and other forms of transport is safe, quick and efficient and available to all members of the community, including those with accessibility issues such as parents with prams and those with a disability.
- **Customer information and wayfinding** – ensure that movement around stations and precincts is made easy with clear signage, and that information about metro services are readily available.
- **Safety** – ensure the safety of all customers and staff.
- **Customer comfort and amenity** – ensure that stations do not become overcrowded and that suitable furniture is provided on platforms.
- **Provision for retail areas** – consider the provision of retail areas within the station that meet customer needs and activate public areas.
- **Environment and sustainability** – consideration of sustainability measures (e.g. use of natural light or use of low maintenance materials) which can be implemented.

6.4.2 Platform works

The project includes the modification of station platforms to allow installation of platform screen doors, and to reduce the gap and elevation difference between the train and the platform.

The extent of work to platforms at each station would vary. Platform works may include the following:

- Replacement of existing platforms: existing platforms would be demolished and replaced with new platforms in their existing or slightly adjusted locations. This would occur where existing platforms need to be upgraded due to their age, or where upgrades are required to meet Sydney Metro standards.
- Fixed or mechanical gap fillers on platforms where required: mechanical gap fillers (i.e. mechanisms that automatically narrow the gap between the platform and the train when the train arrives at the platform) would be installed to ensure that the gap and height difference between the platform and the train is minimised.

- Extension or shift of platform position along existing corridor: platforms would be shifted along the rail corridor (in line with the existing corridor/track) to optimise the platform for the metro trains. At these locations, the existing platforms may be extended to provide for the desired length.
- Change in platform alignment: existing platform structures would be replaced with straighter platforms, with associated changes to the position of the track and other infrastructure. The platforms would integrate with the existing station and would generally remain within the existing railway corridor.

The project would interchange with Sydney Trains services at Sydenham and Bankstown stations. At Sydenham Station, two of the existing platforms (platforms 1 and 2) would be extended and modified for metro services, and existing platforms 3, 4, 5, and 6 would continue to be used by trains operating on the Sydney Trains network. At Bankstown Station, new platforms would be constructed beyond the Sydney end of the existing platforms for metro services, and existing platforms would be retained for Sydney Trains services.

Platforms would comply with the requirements of the *Disability Discrimination Act 1992* (i.e. DDA compliant). This would include, but not be limited to, works such as ensuring that the platforms slope away from the tracks.

Platforms would be fitted with platform screen doors, which operate similarly to lift doors in that they only open with the train doors once an arriving train has stopped, and close simultaneously with the train doors. Platform screen doors provide an enhanced level of customer safety as they prevent access to the track by providing a solid barrier along the edge of the platform.

6.4.3 Station works

In addition to platform works, the following works would potentially be required at stations:

- new station concourse and station entrance locations, including new stairs, ramps and new or relocated lifts to access the station and station platforms, and to link various transport nodes
- connection between Sydney Metro platforms and Sydney Trains platforms at Sydenham and Bankstown stations
- new or upgraded station buildings and possible removal of existing station buildings, depending on the final platform location and station design
- changes to the location of station accesses
- ancillary station works to meet Sydney Metro requirements, including but not limited to seating, canopies, lighting, CCTV, ticket barriers/gates, way finding signage, tactile surfaces etc.

Upgraded stations would be DDA compliant, and would include for example DDA compliant lifts and/or ramps.

All stations in the project area have some form of transport interchange. This is primarily with buses; however light rail is also located near Dulwich Hill Station. The project would potentially require changes to existing interchange arrangements or other changes within the vicinity of the stations. Potential works at stations are as follows:

- provision of new and/or relocated bicycle parking facilities
- bus interchange changes, including changes to location of bus stops
- new or relocated kiss and ride facilities
- new or relocated taxi ranks

- new or relocated accessible parking spaces at the station
- changes to commuter car parking arrangements in the vicinity of the stations and at other locations in the project area
- changes to the surrounding road network including pedestrian crossings, pedestrian paths, traffic islands and potential closures or adjustments to road carriageways.

6.4.4 Rail corridor development

Ongoing design development is considering the development potential of any residual lands located within the vicinity of the stations, along the rail corridor, and at the Sydney Metro Trains Facility South. This could involve development integrated with the stations, adjacent to stations, over or adjacent to rail, where existing in-corridor development is to be removed, or where suitable residual land is identified.

Where required, the project would be designed to ensure that the potential for future development is considered (e.g. construction of footings, columns, beams, retaining walls, and other enabling structures and service infrastructure for any future buildings).

The rail corridor development (excluding the enabling structures and service infrastructure for which provision would be made for and approval will be sought under the environmental impact statement) would be subject to a separate approval process.

6.5 Bridge works

The existing rail corridor is crossed by a number of road and pedestrian bridges, some of which would be impacted by the project. An investigation of each bridge along the corridor is being undertaken as part of the ongoing design development. Bridge works would potentially include:

- protection of bridge piers to current standards for both the construction and operation phases
- adjustment to piers and abutments due to changes in track alignments or to meet existing standards
- addition of vehicle barriers and anti-throw screens
- replacement of bridge due to track realignment, to provide better gradients, or to meet existing standards.

6.6 Operational ancillary infrastructure

6.6.1 Traction and electrical substations/power supply

As the metro network would be operated independently from the existing Sydney Trains network, the T3 Bankstown Line would no longer be powered via existing Sydney Trains traction substations. Several new traction substations would be required to power the project. The locations of new traction substations would be located within the rail corridor.

To provide a power supply to the new traction substations, a 33kV feeder route is required between the rail corridor and an existing Ausgrid electrical substation located at Punchbowl.

The feeder routes would generally follow existing roadways. The preferred locations for the traction substations and feeder routes would be confirmed during ongoing design development.

Upgrade works may also be required to the substation located between Bankstown Station and Yagoona Station.

Electrical transformers would also be required at train stations to power station facilities.

6.6.2 Service facilities

New service facilities would be located within all station works areas. They would be located where possible on vacant land within the existing rail corridor in close proximity to the stations. These facilities would house the following:

- communications equipment
- signalling equipment
- electrical equipment (e.g. padmount electrical transformers)
- other rail systems equipment.

6.6.3 Stabling and metro train maintenance

The stabling and maintenance of metro trains on the metro network would occur at two locations: at Rouse Hill at the Sydney Metro Trains Facility; and at a facility located along the T3 Bankstown Line, the Sydney Metro Trains Facility South. The Sydney Metro Trains Facility is currently under construction as part of Sydney Metro Northwest, and does not form part of the project for which planning approval is currently being sought.

The expansion of the Sydney Metro network with the construction of the project would require additional stabling located within the extent of the project area. The Sydney Metro Trains Facility South would be located on industrial land in Marrickville, on the western side of the rail corridor adjacent to the tunnel dive structure. The size and capacity of the proposed stabling facility would be confirmed, taking into consideration operational requirements.

The facility would also potentially include an administration building, car parking facilities, and a security building at the entrance to the site. There is potential for light maintenance activities to occur at the stabling facility including train washing.

Both the Sydney Metro Trains Facility in Rouse Hill and the Sydney Metro Trains Facility South would be required for stabling and maintenance of the Sydney Metro train fleet.

6.7 Property acquisition

Transport for NSW has made every effort to avoid the need to acquire private property. However, in some cases there has been no alternative but to purchase property to allow construction of this major project.

Acquisition requirements are being investigated as part of design development and construction planning, and are likely to include a mix of private freehold, government freehold and leasehold interests. Temporary leasing and/or use of land may also be required to facilitate construction of the project.

Transport for NSW is bound by NSW Government legislation to act according to specific procedures when acquiring property. This legislation encourages the acquisition of land by agreement rather than by compulsory acquisition wherever possible.

Independent valuers assess the current market value for each property being acquired. In addition to the market value of the property, valuers assess any additional costs that would fairly and reasonably be incurred as a result of the acquisition; such as stamp duty, professional costs (e.g. legal fees, valuation fees, etc.), relocation costs, losses resulting from severance, and losses relating to disturbance.

The valuation informs the offer made to the property owner. Transport for NSW works collaboratively with property owners to ensure that the acquisition process is fair, reasonable and as easy as possible. Properties that need to be acquired are shown in Figure 6-8 to Figure 6-16. Property acquisition is not anticipated at Bankstown or Hurlstone Park at this time.

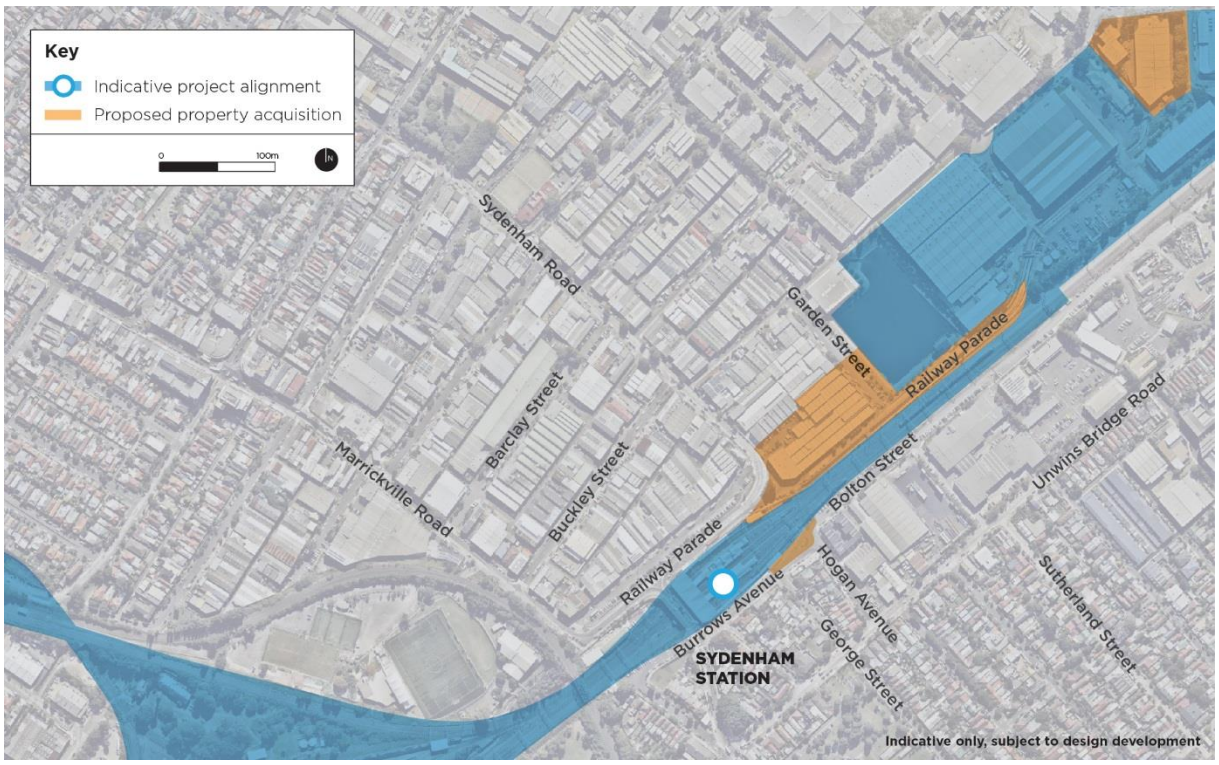

Figure 6-8 Property acquisition at Sydenham

Figure 6-9 Property acquisition at Marrickville

Figure 6-10 Property acquisition at Dulwich Hill

Figure 6-11 Property acquisition at Canterbury

Figure 6-12 Property acquisition at Campsie

Figure 6-13 Property acquisition at Belmore

Figure 6-14 Property acquisition at Lakemba

Figure 6-15 Property acquisition at Wiley Park

Figure 6-16 Property acquisition at Punchbowl

6.8 Other aspects of the project

6.8.1 Adjustments to ARTC and Sydney Trains infrastructure

The conversion of the T3 Bankstown Line from Sydenham to Bankstown to a metro system would require the removal of a number of Sydney Trains' systems (electrical, communications and signalling) and a redistribution of asset responsibilities within the rail corridor. There are some Sydney Trains systems that need to remain in service following the commission of the metro system to support the wider Sydney Train Network. The assets that would remain are existing assets, such as high voltage power supply, and operation and maintenance communication systems for the wider Sydney Trains network.

There would also be adjustments at Sydenham and Bankstown stations to facilitate the operation of the metro system and ongoing Sydney Trains operations at these stations.

Adjustments to the ARTC managed freight network between Sydenham and west of Campsie, and the connection to the XPT maintenance centre at Meeks Road, would be required to ensure that the metro operates as a separate system.

The works required to adjust the Sydney Trains and ARTC networks would be confirmed during ongoing design development in consultation with both stakeholders.

6.8.2 Utility adjustment and relocation

A number of existing utilities occur in close proximity to the project area, both within and outside the rail corridor. These utilities include water infrastructure (drinking water, stormwater and wastewater), gas pipelines, electricity transmission and telecommunication cables. Key utility assets potentially located in the vicinity of the project area include:

- Qenos Ethylene Pipeline between Sydenham Station and Belmore Station
- Transgrid 330kV feeder at Sydenham and Marrickville

- Ausgrid 132kV line at Sydenham
- Ausgrid 33kV line at Sydenham, Marrickville, Canterbury, Campsie
- high pressure Jemena gas mains at Marrickville and Canterbury
- Sydney Water stormwater pit and drainage pumping station and associated drainage channels at Sydenham
- various Sydney Water stormwater and wastewater rail crossings
- various council stormwater rail crossings
- Telstra cable and conduit network at Marrickville
- Optus cable and conduits at Sydenham
- Axicom communications tower (Optus and Vodafone) at Sydenham.

The potential impacts on these and other utilities are being investigated in consultation with the Sydney Metro utility project team, which includes members from the various utility asset owners, and will be confirmed during the design development.

6.8.3 Active transport corridor

The project has been designed to enable the future provision of an active transport corridor. Components of walking and cycling infrastructure within an active transport corridor may be delivered as part of station precinct work. Other parts, such as in areas between stations, may be staged as funding becomes available through development associated with the Department of Planning and Environment's Sydenham to Bankstown Urban Renewal Corridor investigations.

An 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, and retail and commercial precincts.

As a major east-west spine, an active transport corridor would link to existing and future local walking and cycling networks. The corridor could allow for the following elements:

- pedestrian footways
- separated cycleways
- shared zones
- designated pedestrian and cyclist road crossings.

The active transport corridor would be incorporated within Sydney Metro station precinct and rail corridor designs, and existing and known future local infrastructure (such as parks and transport networks), with the view to these being delivered should funding be available.

Parts of the active transport corridor could make use of portions of existing rail corridor land that are no longer required to support rail operations. This would be subject to safeguards to ensure the railway system is reliable and safe to maintain and operate.

The design of the active transport corridor would be completed in consultation with local councils, local community groups, bicycle user groups, Roads and Maritime Services, and relevant utility owners.

6.8.4 Other ancillary works

The project would also involve the following ancillary works:

- earthworks and retaining walls to widen the formation where required
- provision of rail systems (e.g. overhead wiring, signalling, power supply and cable containment structures) for Sydney Metro services
- construction of drainage systems within and outside the rail corridor
- adjustments to the corridor boundary fence and new access gates
- modifications to existing embankments and cuttings
- noise mitigation works such as noise walls.

6.9 Construction

6.9.1 Construction outline

The following typical construction sequence could be expected, based on design development to date:

- site investigations, including the confirmation of utility locations, additional geotechnical and contamination investigations, heritage protection and archival recordings where required
- establish construction work sites and install environmental controls
- enabling works, including utility adjustments and protection, installation of temporary services for the construction period (e.g. power supply), and transport network modifications where required
- construction of the Sydney Metro Trains Facility South, including demolition of existing buildings where required, drainage works, and construction of new track and stabling facilities
- provision for rail corridor development
- station works, including demolition of platform buildings and station concourses where required, platform works, and construction of new platform buildings and concourses
- works on existing bridges crossing the corridor, which would potentially include replacement, upgrade or protection works
- works in the vicinity of the stations, including adjustments to road and pedestrian networks to meet the changes at stations, adjustments to public transport infrastructure (e.g. stops), track works to align with new platform locations or alignments, including turn back facilities
- testing and commissioning
- demobilisation of construction compounds and other construction work areas.

Many of these construction activities could occur concurrently at different locations along the rail corridor. The environmental impact statement will provide an indicative approach to construction at each station and along the length of the corridor.

To maintain required levels of customer and worker safety, some work would need to be undertaken during possession periods (refer to Section 6.9.3). As a result, the construction methodology needs to be planned around these periods. This would result in the work being undertaken in stages. The staging of the proposal and final construction methodology would be

further developed with Sydney Trains during the contract procurement phase, and detailed design development.

6.9.2 Construction sites

Construction sites would generally be located on Sydney Trains owned land and vacant land along the rail corridor in the vicinity of stations, and in suitable areas along the rail corridor between stations. Land within the rail corridor from Sydenham to Bankstown is very limited in some locations, and areas outside the corridor would be required, particularly for the establishment of site offices or larger material storage areas. Larger construction sites would be required at Bankstown and Sydenham due to the extent of works at these stations.

The following factors would be considered when choosing construction site locations:

- location of nearest watercourse and potential for flooding
- location of nearest residential dwellings
- whether there is an existing cleared area or if vegetation clearing is required
- potential for impacts to heritage
- availability of safe construction vehicle access points
- ongoing needs of the existing rail corridor including for maintenance purposes.

6.9.3 Possession periods required for construction

The Sydney Trains network would remain operational during the majority of the construction period.

However, some construction activities, such as major station works, major earthworks and bridge works, would need to be undertaken during rail possession periods (when trains are not running) to remove the risk of affecting operations and risk to rail worker safety.

Due to the scale of the project, the standard Sydney Trains possession arrangement of four weekend possessions per year would not be sufficient. Longer possessions, tailored to facilitate the works, would be required. This would involve closing only those portions of the line necessary to carry out works, but noting that, to facilitate alternative train and bus operational requirements, it would be necessary for possessions to extend beyond Sydenham and Bankstown stations.

The outline of potential rail possessions provided below would be further investigated with Sydney Trains and industry, with the view to minimising disruption to the community.

Standard possessions

Possessions of the rail line would occur on weekends on four occasions over a calendar year.

Additional possessions

There would be additional weekend possessions of the Bankstown Line, over and above the typical four weekends per year under Sydney Trains possession arrangements.

Occasional possessions at Sydenham Station

This would involve possessions of multiple tracks/lines through Sydenham Station during night-times and in some instances continuously for some days at a time, to carry out station and rail systems works at and around Sydenham Station. These possessions would affect trains operating on the East Hills (via Sydenham), Bankstown, and/or Illawarra Lines (T2, T3 and T4 services respectively). The timing of these possessions would need to be determined based on

the alternative configuration required to operate the rail and bus networks, and the ability to provide alternative travel options for the expected patronage.

School holiday possessions

This would involve possessions of the Bankstown Line during each of the December/January school holiday periods, including Christmas and New Year between 2019 and 2024, and two-week school holiday possession of the Bankstown Line in July of each year. Opportunities to minimise the number of such school holiday possessions would be investigated.

Timing construction-phase rail possessions to coincide with school holiday periods where possible is proposed because there is:

- lower patronage on the Sydney Trains network due to the absence of school children and number of parents on leave during these periods
- reduced inconvenience for school children and parents
- less traffic on the surrounding network due to the removal of school traffic, which benefits the operation of rail replacement bus services
- increased availability of buses and drivers for rail replacement services as buses usually used for school routes would be available for use
- greater available capacity on other lines to accommodate customers who would normally travel on the Bankstown Line.

Final possession

This would involve a final possession period of about three to six months' duration at the end of the construction phase. This possession would be required for those works that could only be completed once the Sydney Trains service has ceased operating, in addition to Sydney Metro train testing, system integration and final commissioning works. The duration of the final possession would be made as short as possible, although it is dependent on achieving a safe technical solution to bringing Sydney Metro trains into service. The duration of this possession would be further investigated with industry, with the community informed of any proposed changes once they are confirmed. This final possession is further discussed in Section 8.1.1.

Further information on the timing and duration of possessions would be provided in the environmental impact statement, as well as in community consultation material, which is expected to be released mid-2017.

6.9.4 Changes to operation of the existing rail line

Temporary station closures

The temporary closure of particular stations along the project corridor would be considered during construction planning. This could potentially occur overnight when stations are not in use, or between possession periods (outlined above) for a period of some weeks. This would generally be considered at stations with lower patronage, and where this would enable construction activities to be undertaken more efficiently. The benefit of such closures would be an accelerated construction program in these locations. Temporary rail replacement buses would be provided during these periods.

Temporary transport strategy

A temporary transport strategy will be prepared as part of the environmental impact statement to guide the development of temporary transport plans, which will identify the alternative transport arrangements for customers during each type of rail possession.

The temporary transport strategy would seek to identify:

- temporary transport plan objectives for customers and bus services
- customer markets to be served by temporary transport plans
- the process for developing temporary transport plans, including stakeholder and community consultation
- potential options to maintain public transport connections to and from all affected rail stations
- potential impacts associated with temporary transport options and the level of assessment to be provided in temporary transport plans
- temporary transport facilities and measures required to support the implementation of temporary transport plans, ensuring accessible services are provided
- performance outcomes for temporary transport plans.

Options for temporary transport would be informed through community input, with the approach refined based on further understanding of customer needs and ongoing development of alternatives to deliver improved customer outcomes. Service options currently being considered are shown in Figure 6-17. These could include a mix of the following:

- buses that stop at all stations along the corridor (option 1)
- buses that only stop at a limited number of stations before continuing an express service to the end of journey location (option 2)
- buses that move passengers to another rail line such as the T2 Airport, Inner West & South Line, and T1 North Shore, Northern & Western Line (option 3)
- increase in the frequency of existing bus services at specific locations, acknowledging that customers may prefer to use those instead of the rail replacement bus service (option 4).

6.9.5 Construction timing

Program overview

Subject to approval of the project, construction work would commence in 2018. This would involve pre-construction and enabling works (preliminary construction activities required to facilitate commencement of substantial construction). Following these enabling works, major construction work would commence and take around five years to complete.

Major work at the stations would take around two years per station (depending on the extent of works required). Minor work at stations would be undertaken outside this period. Station work would be staggered throughout the overall construction period so not all stations would be constructed at once. This approach would mean that stations would still be open to customers for the majority of the time that construction of the project is occurring. Once a station upgrade has been completed, the station would continue to be used for Sydney Trains services until the final possession period. Generally, stations would be closed during possession periods. In addition, there may be a need to close some stations for extended periods between two construction phase possessions.

At the end of the five-year major construction work period, a period of rail systems fitout and testing would occur, followed by a possession period of about three to six months of the T3 Bankstown Line between Bankstown and Sydenham stations.

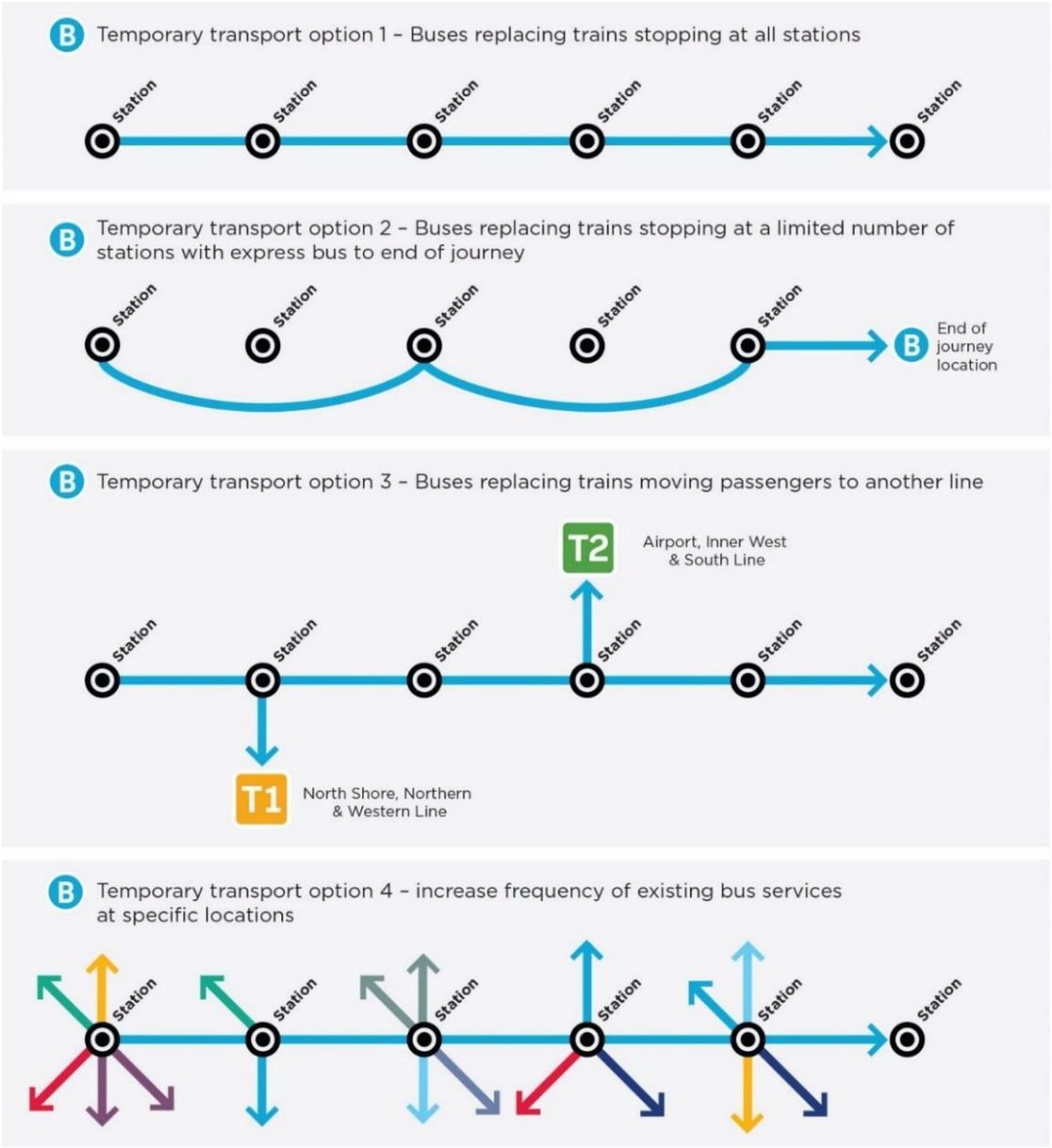

Figure 6-17 Temporary transport options

Phased opening

Transport for NSW is investigating opening Sydney Metro City & Southwest in two phases. Initially, Sydney Metro Northwest services would be extended from Chatswood through to Sydenham Station (phase 1). Some months later, Metro operations would be extended from Sydenham through to Bankstown Station (phase 2), with both stages planned to be completed by the end of 2024.

The phased opening would ensure that the final shutdown of Sydney Trains operations along the Sydenham to Bankstown component would only occur after the opening of the Chatswood to Sydenham component. This would make available a metro service from Sydenham Station to the city and further north whilst the Bankstown Line is being prepared for metro operations. This would mitigate the impact to existing customers who would temporarily need to travel to and from Sydenham via rail replacement bus services, since there would be a frequent turn-up-and-go metro service available at Sydenham for travel to/from the CBD and Sydney's northwest.

Opening of the project in phases would provide customers with the benefit of a progressive rollout of Sydney Metro services starting in 2019 with the opening of Sydney Metro Northwest (Cudgegong Road to Chatswood). The opening of City and Southwest (phase 1) in advance of the Sydenham to Bankstown component would also bring project benefits forward. For example, connecting customers from the Northwest and Sydenham to Sydney's key working centres (i.e. CBD, North Sydney and Macquarie Park); providing interchange to Sydney Metro at Sydenham Station for customers travelling along the T2, T3 and T4 lines; and providing relief at Town Hall and Wynyard stations with the opening of the new CBD stations.

To achieve this earlier opening, consideration will be given to ways in which delivery of components of the project as described in this application could be accelerated, including possible separate planning approval. Further details on how City & Southwest would be delivered would be provided within the Environmental Impact Statement.

7. Preliminary environmental risk analysis

This chapter provides a preliminary environmental risk analysis undertaken for the project to identify the key and other issues for the environmental impact statement.

7.1 Purpose of the environmental risk analysis

The purpose of this preliminary environmental risk analysis is to:

- identify the potential environmental and community risks and issues to be considered in this report and then in detail in the environmental impact statement
- categorise each issue as a 'key issue' or an 'other issue' based on the risk rating.

7.2 Environmental risk analysis methodology

The environmental risk analysis was undertaken in accordance with the principles of the Australian and New Zealand standard *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines*.

This involved ranking the risks by identifying the consequence of the impact and the likelihood of each impact occurring.

An environmental risk workshop was held with key members of the project team to identify the potential impacts and set appropriate consequence and likelihood levels.

As the purpose of the risk analysis at this stage of the project was to categorise issues as 'key' or 'other', the following rules guided the risk process:

- risk ratings were considered at the broader issue level only (for example, construction noise and vibration)
- industry standard practice was considered in determining risk ratings, however project-specific mitigation (which would depend on the outcomes of the environmental impact statement) was not applied
- a residual (post mitigation) risk rating will form part of the environmental impact statement.

The first step in the risk analysis involved identifying the potential consequence and likelihood of impacts. The definitions of the consequence levels used for the assessment are provided in Table 7-1, and the definitions of likelihood are provided in Table 7-2.

The resulting risk matrix is provided in Table 7-3.

Table 7-1 Risk analysis consequence definitions

Consequence level	Definition
Catastrophic	• Long-term (greater than 12 months) and irreversible large-scale environmental, social or economic impacts • Extended substantial disruptions and impacts to stakeholder(s) or customers
Severe	• Long-term (6 to 12 months) and potentially irreversible impacts • Extensive remediation required • Severe disruptions or long-term impacts to stakeholder(s) or customers
Major	• Medium-term (between 3 and 6 months) and potentially irreversible impacts • Considerable remediation required • Major impacts or disruptions to stakeholder(s) or customers
Moderate	• Medium-term (between 1 and 3 months), reversible and/or well-contained impacts • Minor remedial actions required • Moderate impacts or disruptions to stakeholder(s) or customers
Minor	• Short-term (less than 1 month), reversible or minor impacts that are within environmental regulatory limits and within site boundaries • Minor or short-term impacts to stakeholder(s) or customers
Insignificant	• No appreciable or noticeable changes to the environment • Negligible impact to environment, stakeholder(s) or customers

Table 7-2 Risk analysis likelihood definitions

Likelihood	Definition	Probability
Almost certain	Expected to occur frequently during time of activity or project (10 or more times per year)	>90%
Likely	Expected to occur occasionally during time of activity or project (1 to 10 times per year)	75% to 90%
Possible	More likely to occur than not occur during time of activity or project (once per year)	50% to 75%
Unlikely	More likely not to occur than occur during time of activity or project (once every 1 to 10 years)	25% to 50%
Rare	Not expected to occur during the time of activity or project (once every 10 to 100 years)	10% to 25%
Almost unprecedented	Not expected to ever occur during time of activity or project (less than once every 100 years)	<10%

Table 7-3 Risk matrix

Likelihood	Consequence					
	Catastrophic	Severe	Major	Moderate	Minor	Insignificant
Almost certain	Very high	Very high	Very high	High	High	Medium
Likely	Very high	Very high	High	High	Medium	Medium
Possible	Very high	High	High	Medium	Medium	Low
Unlikely	High	High	Medium	Medium	Low	Low
Rare	High	Medium	Medium	Low	Low	Low
Almost unprecedented	Medium	Medium	Low	Low	Low	Low

7.3 Environmental risk analysis

Using the framework described above, a preliminary environmental risk analysis for the project is presented in Table 7-4. The risk analysis identifies an initial risk rating for each of the environmental issues and provides a description of how the risk ratings were derived. Further details regarding the existing environment and potential impacts associated with each environmental issue are provided in Chapter 8. The potential impacts are then provided without mitigation of the impact.

This risk analysis will be re-examined as part of environmental impact statement to consider any additional information available at that time, and to consider the effectiveness of mitigation measures.

Table 7-4 Preliminary environmental risk analysis

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Operational traffic, transport and access				
The project would need to appropriately manage the following potential impacts: Changes (loss) to commuter parking spaces or loading zones. Altered (poorer) pedestrian and cyclist arrangements. Deterioration of bus, taxi and, kiss and ride facilities at or around stations. Changes to interchange arrangements at Sydenham and Bankstown for customers moving between Sydney Trains and metro services.	Minor	Unlikely	Low	Overall, the project would improve the transport system by providing a stand-alone railway network with the capacity to operate 30 trains an hour through the CBD in each direction. The project would increase train frequency in the AM and PM peak with trains running at least every four minutes between Sydenham and Bankstown stations. Trains would run every 10 minutes outside of peak times, compared with the current 15-minute service frequency The project would integrate with the existing transport network and help relieve congestion on the existing rail network. As the project's primary goal is to convert the existing rail line to ensure conformity with Sydney Metro operational requirements, there are limited operational impacts to traffic, transport and access within the wider area when considering the benefits of the project. Customers would benefit from upgraded concourse and platform areas including full accessibility and improved wayfinding. Potential impacts from the project are likely to consist of alterations to parking arrangements and changes to pedestrian and cyclist routes around the stations. These impacts would be offset by the significant traffic transport and access benefits that would be delivered by the operation of the project including improved public transport system capacity and efficiency and accessibility, kiss and ride zones, improved interchange and bicycle facilities and provision for an active transport corridor.

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Construction traffic, transport and access				
The project would need to appropriately manage the following potential impacts: Deterioration of traffic performance on surrounding road network due to construction vehicles, road closures or lane closures. Loss of parking spaces or loading zones due to construction sites and temporary transport arrangements. Reduced pedestrian and cyclist access or flows due to construction. Adverse impacts on the reliability of public transport services (Sydney Trains and buses). Impacts on customer travel during station closures. Closure of the rail line between Sydenham and Bankstown for final conversion to metro, testing and commissioning. Deterioration of traffic performance in the surrounding area due to the rail replacement bus services during rail possession periods. Restricted access to private property. Traffic, pedestrian and cyclist safety.	Major	Almost certain	Very High	Construction of the project would require the use of a substantial number of heavy vehicles to transport materials to and from the sites. Temporary closure of individual stations and the rail network between and the use of replacement buses would temporarily alter and potentially adversely impact customers' travel patterns, including for a period of up to six months. Replacement buses may also impact on the performance of the road network. Additionally, construction may require the temporary or permanent closure of some sections of roadway and alterations to pedestrian and cyclist facilities.

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Operational noise and vibration				
The project would need to appropriately manage the following potential impacts: Adverse airborne noise impacts on surrounding sensitive receivers as a result of higher train speeds and higher service frequency. Adverse airborne noise impacts from upgraded stations including new facilities and upgraded systems such as public address systems. Adverse airborne noise impact from fixed facilities such as the stabling facility and substations.	Major	Likely	High	Diesel freight trains are currently the dominant existing rail noise source in the region between Sydenham to west of Campsie Station. Without mitigation, the project has the potential to increase operational noise levels at surrounding sensitive receivers from increased train speeds and frequency, the introduction of new infrastructure and upgrades to existing facilities. Consideration of feasible and reasonable mitigation measures for operational noise will be considered as part of the assessment process.
Construction noise and vibration				
The project would need to appropriately manage the following potential impacts: Localised adverse airborne noise impacts to sensitive receivers in surrounding areas from track works associated with the modification of existing rail infrastructure. Adverse airborne noise impacts from works to stations and the stabling facility including demolition of existing structures, construction of new structures and buildings, and works in the surrounding station areas. Construction traffic results in a perceptible increase in traffic noise (greater than 2 dB). Vibration from surface works exceeding human comfort or damage levels. Perceived long term construction noise adversely impacting on human health.	Severe	Likely	Very high	Construction of the project would involve the use of multiple construction sites across the length of the project. Construction works are likely to exceed the relevant noise management levels. Additionally, the project would require work outside of standard daytime construction hours.

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Non-Aboriginal heritage				
The project would need to appropriately manage the following potential impacts: Direct impact to State listed heritage items during construction. Direct impacts to local and section 170 listed heritage items during construction. Impacts to the heritage values of conservation areas during construction. Damage to heritage items from construction vibration. Direct impacts on unknown heritage items (e.g. archaeological items) during construction. Indirect impacts on heritage items from construction such as change in visual outlook. Adverse indirect impacts on heritage item values during operation (e.g. change in visual outlook). Ground-borne vibration impacts on heritage listed items during operation.	Major	Almost certain	Very High	Work for the project would occur directly within the curtilage of State significant heritage items. Depending on the final station design and platform layout at each station, there is the potential for some heritage buildings to be removed while other buildings may be relocated or protected. This is currently being determined as part of the design development phase. There are no listed non-Aboriginal archaeological sites within the project area. The area north-east of Sydenham Station has low to moderate archaeological potential for evidence of 20th century brickmaking.
Hydrology and flooding				
The project would need to appropriately manage the following potential impacts: Impacts on flood-prone areas during operation (e.g. increase in flood risk outside the project area). Flooding impacts on project infrastructure during operation. Impacts on construction activities due to flooding. Impacts on flood-prone areas (e.g. increase in flood risk outside the project area) during construction.	Major	Possible	High	A number of sites across the project are located within flood prone land. The protection of the infrastructure from floods and any potential impacts on offsite flood behaviour are anticipated to be manageable through appropriate project design.

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Property and land use				
The project would need to appropriately manage the following potential impacts: Temporary acquisition or leasing of properties for construction. Temporary loss of public open space. Impacts on other infrastructure during construction including utilities and Sydney Trains property. Permanent property acquisition and changes to land use. Future restrictions to development within the corridor due to rail infrastructure.	Moderate	Likely	High	Property acquisition would be required at various locations along the length of the project (see Section 6.7) depending on final platform locations and station layouts, precinct works, the location of the stabling facility, and construction requirements. This is being investigated as part of the design development and construction planning. Temporary leasing and/or use of land may also be required to facilitate construction of the project. The project may also precipitate future development and land use changes associated with the proposed stations. The project may create opportunities for urban renewal or rail corridor development of residual land in the vicinity of stations and along the rail corridor.
Business impacts				
The project would need to appropriately manage the following potential impacts: Disruption to servicing, deliveries and access during both construction and operation. Increased congestion and travel times result in both direct and indirect impacts during construction. Impacts on business during construction due to reduced visibility of businesses, changes to pedestrian and vehicle movements or reduction in amenity. Loss of businesses due to property acquisition. Pre-construction trade not returning once the construction period is complete.	Major	Likely	High	A large number of businesses are located in the vicinity of the project due to works at stations being in areas where businesses are focused. Impacts to businesses would be both direct and indirect. This would potentially include the acquisition of businesses, details of which would be confirmed during ongoing design development. Potential positive business impacts during construction include an increase in passing trade due to construction workers and an increase in trade as materials are sourced from the local area. Impacts to businesses during operation of the project would not be as significant as the construction impacts, however depending on the location of a business, impacts may occur during operation. Positive impacts could include improved amenity and accessibility due to the remodelled stations and improved transport system which is more frequent and reliable.

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Aboriginal heritage				
The project would need to appropriately manage the following potential impacts: Direct impacts on known Aboriginal heritage items. Direct impacts on unidentified Aboriginal heritage items.	Major	Unlikely	Medium	The project is not anticipated to impact on any previously recorded Aboriginal heritage sites. The close proximity of one recorded site will be investigated during preparation of the Aboriginal heritage assessment for the environmental impact statement to determine whether that area of archaeological potential is likely to continue into the proposed construction area. Aboriginal heritage would not be impacted during the operation of the project as widespread ground disturbance and excavation would be restricted to the construction phase.
Landscape character and visual amenity				
The project would need to appropriately manage the following potential impacts: Adverse visual impacts from the presence of construction activities and zones. Adverse impacts on landscape character during construction. Light-spill on sensitive receivers during night construction works. Adverse visual impacts associated with the introduction of new station buildings and concourse, a stabling facility and associated infrastructure including noise attenuation measures. Light spill from upgraded stations or the stabling facility affecting sensitive receivers during operation. Impacts on landscape character from operation of the project, which could include improvements to the public domain around station facilities.	Major	Likely	High	Construction of the project may cause temporary adverse impacts on the landscape and views of the site and surrounding area during construction. These impacts may result from the introduction of construction compounds, construction activities, the removal of vegetation, light spill and changes to traffic movements. Operation of the project may result in both adverse and beneficial impacts to landscape character and views from the introduction/modification of new infrastructure. These impacts would be experienced by those who work, study, visit or access business and community facilities near to the station or stabling facility, residents of the study area, and rail users.

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Soils, contamination and water quality				
The project would need to appropriately manage the following potential impacts: Water quality impacts due to spills and erosion during construction. Exposure of acid sulfate soils during construction. Disturbance of contaminated land during construction. Encountering contaminated building structures during demolition works. Water quality impacts due to spills and erosion from the project site during operation. Contamination of land, groundwater or waterways due to leaks and spills.	Moderate	Possible	Medium	Potential impacts such as erosion and sedimentation, and spill or leaks are anticipated to be manageable through the implementation of standard mitigation measures. The project may encounter contamination at a number of locations. The exposure of any contaminated materials during construction may increase the potential for contaminant mobilisation and may create additional exposure pathways to sensitive receptors including workers, the general public, surface water bodies, groundwater bodies and terrestrial ecosystems. Construction and operation also have the potential to result in contamination of soils and/or groundwater due to spills and leaks of fuel, oils and other hazardous materials.
Groundwater and geology				
The project would need to appropriately manage the following potential impacts: Adverse impacts on groundwater flows, quality and levels due to excavation works required for the project. Ground movement due to excavation including works to existing cuttings.	Moderate	Possible	Medium	There is potential for cutting works to intersect dykes or faults within the project area. Potential impacts can be managed through standard mitigation measures and engineering controls, such as retaining walls, foundation treatment and construction management measures. The operation of the project is not expected to have any further impacts on geology or groundwater along the corridor.

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Social impacts and community infrastructure				
The project would need to appropriately manage the following potential impacts: Adverse amenity impacts on adjacent residents and businesses during construction. Temporary impacts on community values and lifestyle. Temporary access changes to community facilities due to construction activities. Cumulative social issues from overlap with other construction projects. Adverse amenity impacts on adjacent residents, businesses and social infrastructure from operation of the project. Positive social and health outcomes associated with public transport. Perceived adverse impacts on human health from the operation of new traction substations.	Major	Almost certain	Very High	The project would result in temporary impacts to community infrastructure during construction through changes to amenity and access, including during possessions. Construction would also result in temporary impacts on community values and lifestyle for local residents, workers and visitors due to temporary changes to travel patterns and interruptions to transport services. Operation of the project would result in amenity impacts on residents, businesses and social infrastructure. While there would be some potential impacts during operation, the project would result in a number of long term benefits and positive social outcomes. These beneficial outcomes would be a result of improved public transport infrastructure and access, and provision for active transport. This could potentially facilitate increased density and development around the stations, which could result in both adverse impacts and positive benefits.

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Ecology				
The project would need to appropriately manage the following potential impacts: Impacts on endangered populations, threatened species and threatened ecological communities within the construction footprint. Impacts on endangered populations, threatened species and threatened ecological communities outside the construction footprint. Impacts on native vegetation (non-threatened). Impacts on riparian and aquatic habitats from construction. Impacts on groundwater dependent ecosystems. Indirect impacts such as light and noise impacts, sedimentation, spread of weeds	Major	Possible	High	The rail corridor and adjoining urban environments provide habitat for the Long-nosed Bandicoot (*Perameles nasuta*), an endangered population in inner western Sydney. This species has been known to occur along the light rail corridor. The project would be located largely within an existing rail corridor in a highly urbanised environment. There is however potential for impacts on areas that provide known or potential habitat for threatened biota. Any species currently occurring within the project area are likely to be accustomed to impacts such as noise and light spill which are already occurring.
Greenhouse gas and energy				
The project would need to appropriately manage the following potential impacts: Emissions of greenhouse gases from operational and construction energy use, and embodied energy in materials.	Minor	Likely	Medium	Construction would result in the generation of greenhouse gas emissions through combustion of fuel, disposal of construction waste and use of construction materials with a high embodied energy.
Climate change and adaption				
The project would need to appropriately manage the following potential impacts: Impacts of climate change and severe weather events on construction. Impacts of climate change on project infrastructure and functionality.	Major	Unlikely	Medium	Possible measures to address the effects of climate change on the project would be considered during design development.

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Hazard and risks				
The project would need to appropriately manage the following potential impacts: Rupture of, or interference with, underground utilities and services during construction. Transport and storage of hazardous substances and dangerous goods during operation. Transport and storage of hazardous substances and dangerous goods during construction.	Severe	Rare	Medium	Potential hazards and risks during construction and operation would be managed through implementation of appropriate design standards and construction methodologies.
Waste and resource use				
The project would need to appropriately manage the following potential impacts: Impacts associated with the management of waste during operation. Increased resource consumption during operation. Impacts associated with the management of waste during construction. Increased resource consumption during construction.	Minor	Likely	Medium	Volumes of waste generated and resources consumed are anticipated to be similar to other comparable infrastructure projects. While the project would increase demand on local and regional resources, it is unlikely that the project would result in any resource becoming scarce or in short supply.

Potential unmitigated impact	Consequence	Likelihood	Risk rating	Discussion
Cumulative impacts				
The project would need to appropriately manage the following potential impacts: Cumulative impacts from construction of multiple projects on parking, traffic congestion, noise, vibration, visual amenity, loss of public space and business impacts. Cumulative impacts on non-aboriginal heritage from construction and operation of multiple projects. Cumulative flooding impacts during construction and operation.	Major	Likely	High	Construction and operation of the project would be undertaken concurrently with other major projects in the Sydney region. This would result in potential cumulative impacts to amenity, congestion, businesses, flooding and drainage and heritage.
Air quality				
The project would need to appropriately manage the following potential impacts: Impacts to local air quality due to operation of construction plant and equipment. Impacts to local air quality due to increased vehicle movements from replacement bus services and transport of construction materials. Impacts to local air quality due to dust generation from exposed surfaces.	Minor	Likely	Medium	During construction the project is likely to result in local reductions in air quality due to the generation of dust and other particulates and the emissions of gaseous emissions. The impacts resulting from the generation of dust for the project are similar to those experienced on other large infrastructure projects. These impacts can be readily managed through the implementation of standard mitigation measures.

7.4 Issue categorisation

Based on the consequence and likelihood definitions, ‘key’ issues are identified as those with a risk rating of high or very high, while ‘other’ issues are those with a risk rating of low or medium.

7.4.1 Key issues

As presented in Table 7-4, the key issues for the project are determined as:

- traffic, transport and access
- noise and vibration
- non-Aboriginal heritage
- hydrology and flooding
- property and land use
- business impacts
- landscape character and visual amenity
- ecology
- social impacts and community infrastructure
- cumulative impacts.

Section 8.1 provides a preliminary assessment of the above issues and outlines the proposed scope of assessments to be undertaken as part of the environmental impact statement.

7.4.2 Other issues

As presented in Table 7-4, the other issues for the project are determined as:

- Aboriginal heritage
- soils, contamination and water quality
- groundwater and geology
- air quality
- greenhouse gas and energy
- climate change and adaption
- hazard and risks
- water and resource use.

The above issues are not expected to result in any major environmental risks for the project and/or are considered manageable through the implementation of standard mitigation measures and management strategies or other specific strategies to be developed.

Notwithstanding, Section 8.2 considers these issues and identifies additional scope requirements for the environmental impact statement.

8. Preliminary assessment of environmental impacts

This chapter provides a preliminary environmental assessment of the key and other issues identified for the project.

8.1 Key environmental issues

8.1.1 Traffic, transport and access

Existing environment

Overview of the existing transport network

As described in section 5.1, the existing transport network within the vicinity of the project area consists of Sydney Trains suburban rail lines, the ARTC metropolitan freight network, the road network, bus services, light rail, and pedestrian and cyclist facilities. These are further described below.

Suburban rail

In 2013, there were 16,246,081 trips on the T3 Bankstown Line. According to train statistics for 2011, travel on the T3 Bankstown Line in the highest patronage peak, from 6 am-9.30 am, consisted of 25,180 entries and 8,510 exits. The primary destinations were located to the CBD (11,405), Bankstown (4,176), North Shore (1,658) and Western (1,146) lines. The primary origins were from the T3 Bankstown Line (4,176) and the South Line (1,112) (Transport for NSW, Bureau of Transport Statistics, 2014).

There are 11 existing stations on the T3 Bankstown Line within the project area comprising Sydenham, Marrickville, Dulwich Hill, Hurlstone Park, Canterbury, Campsie, Belmore, Lakemba, Wiley Park, Punchbowl and Bankstown.

The existing patronage of these stations is shown in Table 8-1, which details the number of passengers accessing and egressing each train station on a typical weekday in 2013. The station rank, based on station barrier counts, compared to the wider Sydney Trains network is also provided. The table shows that the busiest stations by patronage are Bankstown, Campsie and Sydenham, with over 11,000 movements per day at each station. This is in contrast to the stations of Hurlstone Park and Canterbury with customer movements of less than 4,000 at each station.

Table 8-1 Daily train station patronage

Station	In	Out	Network patronage ranking (out of 178 stations)
Sydenham	5,620	5,620	46
Marrickville	3,740	3,740	63
Dulwich Hill	2,050	2,050	114
Hurlstone Park	1,380	1,380	141
Canterbury	1,920	1,920	118
Campsie	6,750	6,750	38
Belmore	2,820	2,820	88
Lakemba	4,600	4,600	54
Wiley Park	2,190	2,190	111
Punchbowl	3,020	3,020	80
Bankstown	8,600	8,600	28

Source: Transport for NSW, Bureau of Transport Statistics, 2014

Lifts are available at Sydenham, Campsie, Belmore, Lakemba and Bankstown stations. Marrickville Station has recently been upgraded as part of the Transport Access Program, a government initiative to provide better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure. Upgrades include a new raised concourse, platform extensions, new lifts, and taxi, kiss and ride, bicycle parking and accessible parking facilities. The remainder of stations listed in Table 8-1 have low levels of platform accessibility.

Other rail infrastructure in the vicinity of the project area includes the NSW TrainLink XPT maintenance centre located at the junction of the T3 Bankstown Line and the Illawarra Line at Meeks Road, west of Sydenham Station.

Road network

The road network within the broader Sydenham to Bankstown corridor is characterised by the M5 East Motorway, the M5 South Western Motorway and the M1 Southern Cross Drive. The M5 East Motorway connects to the Sydney International Airport, Port Botany, Eastern Distributor and the Cross City Tunnel. As one of the main routes to and from the Sydney CBD from the west, the M5 East carries around 95,000 vehicles per day through the corridor.

Key arterial roads within the project area include:

- A34: New Canterbury Road, which passes through Dulwich Hill, and Canterbury Road that continues through from Hurlstone Park to Bankstown. This route provides an alternative link to the Sydney CBD via the City West Link.
- A3: King Georges Road, which runs north-south through Wiley Park, connecting the M5 South Western Motorway with the M4 Western Motorway. The arterial corridor also connects to the suburbs of Ryde and Macquarie Park via Concord Road.
- A6: 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.
- A36: Princes Highway, which passes through Sydenham in a north-south direction and connects southern Sydney to the Inner West via Parramatta Road.

- A22: Hume Highway, which traverses Bankstown in an east-west direction and connects Sydney's western suburbs to Parramatta Road and the Inner West.

In addition to the above, east-west arterial roads provide alternative routes. These include:

- Unwins Bridge Road at St Peters
- Lakemba Street at Lakemba
- Wattle Street at Bankstown/Punchbowl.

Numerous sub-arterial roads provide connections from the surrounding areas to New Canterbury Road and Canterbury Road which run the length of the project area.

Key sub-arterial routes that provide movement functions and linkages through the town centres in the project 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
- The Boulevarde, Wiley Park
- Punchbowl Road and The Boulevarde, Punchbowl
- North Terrace and South Terrace, Bankstown.

The majority of the arterial and sub-arterial road network experiences substantial congestion, especially during the peak periods.

Within the project area, rail overbridges and underbridges provide access for vehicles and pedestrians across the rail corridor.

Bus network

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. 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.

Light rail

Dulwich Hill light rail station is the terminus for the Inner West Light Rail line, which operates between Dulwich Hill and Central via Lilyfield and Pyrmont (described in Section 5.1.4). It has frequent services over extended periods and plays an important role in connecting the Inner West to the Sydney CBD.

Australian Rail Track Corporation (ARTC) metropolitan freight network

The Metropolitan Freight Line extends from North Strathfield/Lidcombe to Marrickville and runs parallel to the T3 Bankstown Line until west of Campsie where it turns north. This line is the central point of Sydney's freight rail network with access to the Chullora Terminal, Enfield Intermodal Terminal and Enfield marshalling yards. The line extends west from Chullora to Sefton Park Junction where it connects with the Southern Sydney Freight Line. The Botany Rail Line extends from Marrickville to Port Botany, providing a key linkage for freight movements from Port Botany to the metropolitan freight network.

Pedestrian and cyclist network

There is a relatively undefined, disjointed cycle network within the project area, which consists of short, unmarked on-road cycle routes.

In 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.

The local pedestrian network consists of footpaths and dedicated road crossings, with reduced permeability within centres such as Bankstown and Sydenham due to large street blocks, major roads and the rail corridor. The areas surrounding the project generally have a high volume of pedestrians who access interchanges and commercial precincts.

Parking

The corridor from Sydenham to Bankstown contains a variety of car parking opportunities for customers of Sydney Trains services. These include formal park and ride spaces on RailCorp land, public car parks, as well as on-street parking within the streets surrounding train stations.

Potential construction impacts

Potential traffic, transport and access impacts include:

- impacts on the reliability of suburban and intercity rail servicesas a result of the closure of stations to safely and efficiently complete certain construction activities
- impacts on customers during possession periods required to facilitate construction, testing and commissioning of metro trains and finalise any remaining modifications to stations (described in Section 6.9.4).
- increased demand for rail services on other lines in the wider area including the T2 Inner West and T1 North Shore, Northern & Western lines
- temporary closure of stations between rail possession periods (about four weeks) at stations with lower patronage

- deterioration of traffic performance in the surrounding area due to the operation of rail replacement bus services. Impacts are likely to be greatest in the vicinity of train stations and along the proposed rail replacement bus routes
- temporary road closures and traffic diversions may be required outside of the rail corridor. Impacts are likely to be greatest in the vicinity of road bridges across the rail line, especially in suburbs where there are fewer alternative crossings of the rail line
- deterioration of traffic performance on the surrounding road network due to the movement of construction vehicles. These impacts are likely to be greatest at construction sites within the vicinity of stations (given existing capacity constraints), at construction compounds, and in the vicinity of bridges if closures are required
- delays or other impacts on the reliability of existing bus services due to potential diversions of bus services on an already constrained road network, an increase in bus services as a result of the introduction of rail replacement buses, and heavy vehicle movements on the road network
- impacts on access to private properties
- impacts on availability of public parking as a result of any reduction in the availability of commuter parking during construction
- impacts on the safety of motorists, pedestrians and cyclists due to potential conflicts with construction vehicles.

Arterial roads would be used whenever possible to provide access and egress to and from construction sites within the rail corridor. Notwithstanding this, there is likely to be a need to use the local road network for short distances. This will be identified in the environmental impact statement.

Potential operational impacts

The design of the project would aim to avoid or reduce impacts associated with operational traffic, transport and access. Potential impacts during operation include:

- changes to commuter parking
- changes to interchanges around the stations and provision of kiss and ride facilities
- changes to local roads and existing access due to the new stabling facility
- changes to loading zones
- provision of bicycle facilities
- changes to pedestrian and cyclist arrangements.

As discussed in Chapter 2, the project would also deliver major traffic, transport and access benefits including:

- increased frequency of trains
- increased capacity and reliability of Sydney's rail network
- improved travel times between key destinations within Sydney's Global Economic Corridor
- reduced crowding on trains and stations on the existing Sydney rail network
- improved accessibility at stations
- improved connectivity and interchange opportunities between public transport modes

- safeguarding the provision of an active transport corridor to facilitate strategic walking and cycling connections between Sydenham and Bankstown.

Proposed investigations and assessment for the environmental impact statement

As discussed in Section 6.9.4, a temporary transport strategy will be prepared as part of the environmental impact statement to guide the development of a temporary transport plan, which will identify the alternative transport arrangements for customers during rail possessions (as described in Section 6.9.3).

A detailed traffic and transport impact assessment will be undertaken as part of the environmental impact statement to assess the impacts of the construction and operation of the project on traffic, transport and access. This assessment will identify and determine the significance of potential impacts, and provide mitigation measures where such potential exists. The following documents and government guidelines will be considered during the preparation of the traffic and transport impact assessment:

- *Guide to Traffic Management – Part 3 Traffic Studies and Analysis* (Austroads, 2013)
- *NSW Bicycle Guidelines* (Roads and Traffic Authority, 2003)
- *Guide to Traffic Generating Developments Version 2.2* (Roads and Traffic Authority, 2002).

The local and regional traffic network will be considered in the assessment. In particular, this will include:

- identification of haulage routes, site access and egress points
- assessment of a baseline scope for temporary transport arrangements and a summary of other options (identified in the temporary transport strategy) and any associated road network impacts and/or modifications
- identification and consideration of potential cumulative impacts caused due to multiple construction sites and/or additional vehicles generated as a function of the implementation of temporary transport arrangements
- daily and peak traffic movements likely to be generated by each component of the project, including rail replacement bus services, and the cumulative impacts of this traffic on the local and regional traffic network, including the operation of nearby intersections within the vicinity of the stations
- changes to travel times for public transport services, in particular rail and bus, and for private motorists
- impacts on the overall efficiency, ease, comfort, reliability and convenience of the public transport system (rail and bus)
- impacts on vehicular, pedestrian, cyclist and public transport access
- impacts on emergency services
- impacts on commuter parking
- arrangements to preserve residential and business accesses
- a temporary transport strategy to guide the implementation of temporary transport arrangements during rail possessions (as described in Section 6.9.3)
- opportunities for the integration of rail and bus services during construction and operation, including modal interchange facilities, local bus services, strategic corridors and external network connections, as well as access and mobility considerations for the stations

- measures to minimise or mitigate identified impacts. Available measures will be considered in accordance with relevant best practice guidelines.

Consultation will be undertaken with Roads and Maritime Services, Transport for NSW and local councils as part of the traffic and transport impact assessment.

8.1.2 Noise and vibration

Existing environment

Existing noise and vibration sources

The existing noise environment varies along the length of the project. The dominant noise sources that are likely to influence background noise levels include:

- road traffic noise
- suburban rail line operations and associated station activities (including light rail at Dulwich Hill)
- operation of diesel trains along ARTC freight tracks between Sydenham and west of Campsie
- aircraft noise
- industrial activities within existing industrial areas, including those in Sydenham and Marrickville
- commercial activities in commercial centres located around most stations
- occasional major sporting events at large sports facilities including Canterbury Park Racecourse and Belmore Sportsground.

Further discussion on the existing acoustic environment (including the results of unattended and attended noise monitoring) will be provided in the environmental impact statement.

Nearby receivers

The project area follows the existing rail line from Sydenham to Bankstown, which runs through developed areas consisting of the following:

- Residential land uses: residential land uses surrounding the project are dominated by single storey dwellings, however some areas contain multi-level buildings. Residential receivers are generally located 15 to 25 metres from the nearest existing track, and in some locations have a local road between the track and the dwelling.
- Education institutions: a number of educational institutions are located along the corridor at distances of between 25 and 75 metres from the nearest track. Some of these facilities (e.g. Punchbowl Boys High School) are located directly adjacent to the rail corridor and have direct line of sight.
- Community facilities: there are a number of community facilities, such as childcare centres, places of worship, and medical facilities located along the corridor at varying distances from the nearest track.
- Recreation areas: a number of active recreation areas are located directly adjacent to the corridor, including public sports fields and stadiums (e.g. Belmore Sportsground). A number of passive recreation areas are also located along the corridor, including parks, nature reserves and barbecue areas.

- Commercial and industrial land uses: commercial and industrial areas are located along the corridor, with commercial land uses generally centred around stations, and industrial land uses concentrated in Sydenham. Commercial properties are generally not considered to be sensitive to noise and vibration, however in some situations they can be (e.g. dental surgeries, doctor surgeries). Industrial land uses are generally not considered to be sensitive to noise and vibration.

Potential construction impacts

Construction of the project may result in noise and vibration impacts on surrounding areas containing sensitive receivers. Construction activities with the greatest potential to result in noise and vibration impacts include:

- track works associated with modification of existing rail infrastructure, including rail track slewing, communications, signalling, relocation of subterranean services, and overhead wiring works
- modifications and upgrade works to stations, including demolition of existing structures, construction of new structures and buildings, including any works in the surrounding area
- construction of operational ancillary infrastructure such as traction substations and stabling
- the movement of construction road traffic associated with the delivery of plant, equipment and materials and spoil removal
- temporary changes in traffic volumes along some routes during possession periods and associated potential noise and vibration impacts from rail replacement buses.

The degree of construction noise and vibration impact on individual sensitive receivers would depend on the distance of construction activities to nearby sensitive receivers, the nature of the works, and the time of day or night that the works take place.

The project would potentially require works to be undertaken during weekends and at night. Works conducted outside of standard daytime construction hours (i.e. out of hours works) increase the potential for noise and vibration impacts on surrounding sensitive receivers due to lower background noise levels and the potential for sleep disturbance.

Construction noise and vibration impacts are anticipated to exceed the noise management levels derived from the *Interim Construction Noise Guideline* (Department of Environment and Climate Change and Water, 2009a) at some locations. There is also the potential for construction vibration impacts at sensitive receiver buildings and heritage structures within the project area.

Potential operational impacts

The project has the potential to increase operational noise levels at surrounding sensitive receivers due to the influence of the following:

- Airborne noise exposure from metro trains operating on surface track may be higher than that of existing passenger services due to considerably higher train speeds and higher service frequencies.
- Operational noise from upgraded railway stations including new/upgraded station facilities (such as lifts, escalators, air conditioning and public address systems).
- Airborne noise from fixed facilities such as traction substations.
- Airborne noise from the operation of the stabling facility which would operate during the night time period.

Noise emissions from freight operations along the freight line in the project area are generally the dominant existing rail noise source in the region. Freight service frequencies are anticipated to increase over the next 10 to 20 years. The number of freight services forecast for operation during the project assessment timeframes will be considered in the environmental impact statement.

Proposed investigations and assessment for the environmental impact statement

A detailed construction and operational noise and vibration impact assessment will be undertaken as part of the environmental impact statement to assess the noise and vibration impacts on surrounding sensitive receivers and land uses.

The following guidelines will be considered during the preparation of the noise and vibration assessment:

- *Construction Noise and Vibration Strategy* (Transport for NSW, 2016b)
- *Interim Construction Noise Guideline* (Department of Environment Climate Change and Water, 2009a)
- *NSW Industrial Noise Policy* (Environment Protection Authority, 2000)
- *Rail Infrastructure Noise Guideline* (Environment Protection Authority, 2013)
- *Assessing Vibration: A technical guideline* (Department of Environment and Conservation, 2006).

The noise and vibration impact assessment will consider the following in relation to the construction phase:

- nature of construction activities
- intensity and duration of noise and vibration impacts
- nature, sensitivity and impact on potentially affected receivers
- impacts associated with any works proposed to be undertaken outside standard daytime construction hours
- other factors that may influence the timing and duration of construction activities (such as traffic management)
- feasible and reasonable mitigation and management measures to address identified construction noise impacts.
- In relation to operational noise and vibration, the assessment will consider:
- airborne noise, ground-borne noise, and vibration impacts
- impacts on sensitive receivers (schools, hospitals, and aged care facilities) and sensitive structures (particularly heritage structures and key utilities/infrastructure)
- appropriate mitigation and management measures to address identified operational noise impacts.

8.1.3 Non-Aboriginal heritage

Existing environment

Heritage context

First proposed in 1892, the T3 Bankstown Line has a rich and layered history of expansion and change across three key phases. The first section of the line, connecting Sydenham to Belmore, was completed in 1895 to relieve pressure on the existing southern line to Liverpool. Stations at Marrickville, Canterbury and Belmore were constructed with elaborate, polychrome brick platform buildings. The intermediate stations at Dulwich Hill, Hurlstone Park and Campsie had more modest weatherboard platform buildings.

In 1909, the line was extended to Bankstown, adding Lakemba (1919), Punchbowl (1929) and Bankstown stations (1909). With completion of the adjacent Metropolitan Goods Line in 1917, a complex layer of rail infrastructure was added. This resulted in fundamental changes to numerous stations, and a shift in the way the corridor fit within the growing suburbs.

In 1926, the T3 Bankstown Line became the second rail line in Sydney to be electrified. The Punchbowl Maintenance Depot was also built in the same year. The Punchbowl facility closed in 1994. Electrification allowed the introduction of single deck Bradfield designed trains.

The completion of each section of the Bankstown line encouraged development in the surrounding area, with large landholders seizing the opportunity to subdivide their land into smaller suburban allotments. Of note, Wiley Park Station was a 1930s addition to the transport-land use history, reflecting the need to service the growing population in the area. The station is significant as, unlike other stations in the rail network, it was a station that was not financed and constructed by the State Government, but by the local council.

Database searches

The following sections provide a listing of non-Aboriginal heritage items, conservation areas and areas of archaeological potential located within or immediately adjacent to the project area.

The following registers were searched for listed heritage items as part of the preliminary heritage assessment:

- World Heritage Register
- National Heritage List
- NSW State Heritage Register (SHR)
- Roads and Maritime Services section 170 (s170) Heritage and Conservation Register
- RailCorp s170 Heritage and Conservation Register
- Sydney Water s170 Heritage and Conservation Register
- Ausgrid s170 Heritage and Conservation Register
- *Marrickville Local Environmental Plan 2011* (Marrickville LEP)
- *Canterbury Local Environmental Plan 2012* (Canterbury LEP)
- *Bankstown Local Environmental Plan 2015* (Bankstown LEP).

The results of the heritage register searches are provided in Table 8-2 and Table 8-3, and shown in Figure 8-1 to Figure 8-4.

Existing heritage listed items

The heritage register search conducted as part of the preliminary assessment identified that there are 50 listings of non-Aboriginal heritage sites within or adjacent to the project area (as shown in Figure 8-1 to Figure 8-4).

No properties on the World Heritage or National Heritage lists are located within the vicinity of the project.

Table 8-2 Summary of listed heritage items

Item	Listing name	Listing	Significance
Sydenham Railway Station Group	Sydenham Railway Station Group	SHR (No. 01254) RailCorp s.170 (No. 4801154)	State
	Sydenham Railway Station Group, including interiors	Marrickville LEP (I286)	State
Sydenham Pit and Drainage Pumping Station 1	Sydenham Pit and Drainage Pumping Station 1	SHR (No. 01644)	State
	Sydenham Pit & Drainage Pumping Station No.001	Sydney Water s.170 (No. 4571743)	State
	Flood storage reserve and brick drain (Sydenham Pit and Drainage Pumping Station 1)	Marrickville LEP (I81)	State
Sewage Pumping Station 271	Sewage Pumping Station 271	SHR (No. 01342)	State
	Sewage pumping station 271, chimney stack and two storey residence, including interiors	Marrickville LEP (I67)	State
	Sewage Pumping Station No 271	Sydney Water s.170 (No. 4571727)	State
Marrickville Railway Station Group	Marrickville Railway Station Group	SHR (No. 01186) RailCorp s.170 (No. 4801091)	State
	Marrickville Railway Station Group	Marrickville LEP (I89)	State
Old Sugar Mill	Old Sugarmill	SHR (No. 00290)	State
	Canterbury Sugar Mill (former)	Canterbury LEP (I82)	State
Canterbury Railway Station Group	Canterbury Railway Station Group	SHR (No. 01109) RailCorp s.170 (No. 4801100)	State
	Federation railway station buildings	Canterbury LEP (I67)	State

Item	Listing name	Listing	Significance
Belmore Railway Station Group	Belmore Railway Station Group	SHR (No. 01081) RailCorp s.170 (No. 4801084)	State
	Federation railway station buildings	Canterbury LEP (I11)	State
Sydenham (Illawarra Line) Underbridge	Sydenham (Illawarra Line) Underbridge	RailCorp s.170 (No. 4805746)	Local
Brick Retaining Walls	Brick Retaining Walls	Marrickville LEP (I287)	Local
Marrickville (Meeks Road) Railway Substation	Marrickville (Meeks Road) Railway Substation	RailCorp s.170 (No. 4801091)	Local
Dulwich Hill Railway Station Group	Dulwich Hill Railway Station Group	RailCorp s.170 (No. 4801909)	Local
Stone house, including interiors	Stone house, including interiors	Marrickville LEP (I114)	Local
Federation Commercial Building	Federation Commercial Building	Canterbury LEP (I41)	Local
Inter War Commercial Building – Station House	Inter War Commercial Building – Station House	Canterbury LEP (I42)	Local
War Memorial Clock Tower	War Memorial Clock Tower	Canterbury LEP (I34)	Local
Federation Urban Park, ANZAC Park	Federation Urban Park, ANZAC Park	Canterbury LEP (I36)	Local
Inter War Court House (former Campsie Court House)	Inter War Court House (former Campsie Court House)	Canterbury LEP (I44)	Local
Federation house (former station master's cottage)	Federation house (former station master's cottage)	Canterbury LEP (I72)	Local
Post-war bus shelter and public lavatories	Post-war bus shelter and public lavatories	Canterbury LEP (I29)	Local
Inter war hotel (former Hotel Canterbury)	Inter war hotel (former Hotel Canterbury)	Canterbury LEP (I68)	Local
Federation railway bridge	Federation railway bridge	Canterbury LEP (I72)	Local
Campsie Railway Station Group	Campsie Railway Station Group	RailCorp s.170 (No. 4801101)	Local
	Federation railway station buildings	Canterbury LEP (I40)	State
Hurlstone Park Railway Station Group	Hurlstone Park Railway Station Group	RailCorp s.170 (No. 4802051)	Local
	Victorian and Federation railway station buildings	Canterbury LEP (I124)	Local
Hurlstone Park (Foord Ave – M24+m25) Underbridge	Hurlstone Park (Foord Ave – M24+m25) Underbridge	RailCorp s.170 (No. 4805737)	Local
	Railway underbridge	Canterbury LEP (I126)	Local

Item	Listing name	Listing	Significance
Inter War Post Office Building – Lakemba Post Office	Inter War Post Office Building – Lakemba Post Office	Canterbury LEP (I145)	Local
Lakemba Railway Station Group	Lakemba Railway Station Group	RailCorp s.170 (No. 4801916)	Local
	Federation railway station buildings	Canterbury LEP (I143)	Local
Inter War Water Pumping Station – Lakemba Pumping Station (WP0003)	Inter War Water Pumping Station – Lakemba Pumping Station (WP0003)	Canterbury LEP (I158)	Local
Punchbowl Railway Station Group	Punchbowl Railway Station Group	RailCorp s.170 (No. 4802009)	Local
	Federation railway station buildings	Canterbury LEP (I155)	Local
War Memorial and Street Trees	War Memorial and Street Trees	Canterbury LEP (I152)	Local
Wiley Park Railway Station Group	Wiley Park Railway Station Group	RailCorp s.170 (No. 4801946)	Local
	Inter war railway station buildings	Canterbury LEP (I159)	Local
Bankstown Railway Station Group	Bankstown Railway Station Group	RailCorp s.170 (No. 4802067)	Local
	Bankstown Railway Station building and platform	Bankstown LEP (I3)	Local
	Bankstown Parcels Office (former)	Bankstown LEP (I4)	Local
Electricity Substation No. 275	Electricity Substation No. 275	Ausgrid s.170 (No. 3430425)	Local
Electricity Substation No. 143	Electricity Substation No. 143	Ausgrid s.170 (No. 3430296)	Local

Heritage conservation areas

The project passes through or adjacent to four heritage conservation areas listed in the Marrickville LEP as described in Table 8-3 and shown in Figure 8-1 and Figure 8-2.

In addition, a proposal to list areas surrounding Hurlstone Park Station as a heritage conservation area is currently being considered by Inner West Council.

Table 8-3 Listed heritage conservation areas

Heritage conservation area	Register listings	Heritage significance
Wells Avenue Conservation Area	Marrickville LEP	Local
Collins Street Conservation Area	Marrickville LEP	Local
South Dulwich Hill Heritage Conservation Area	Marrickville LEP	Local
Inter-War Heritage Conservation Area Group—Hollands Avenue; Jocelyn Avenue and Woodbury Street	Marrickville LEP	Local

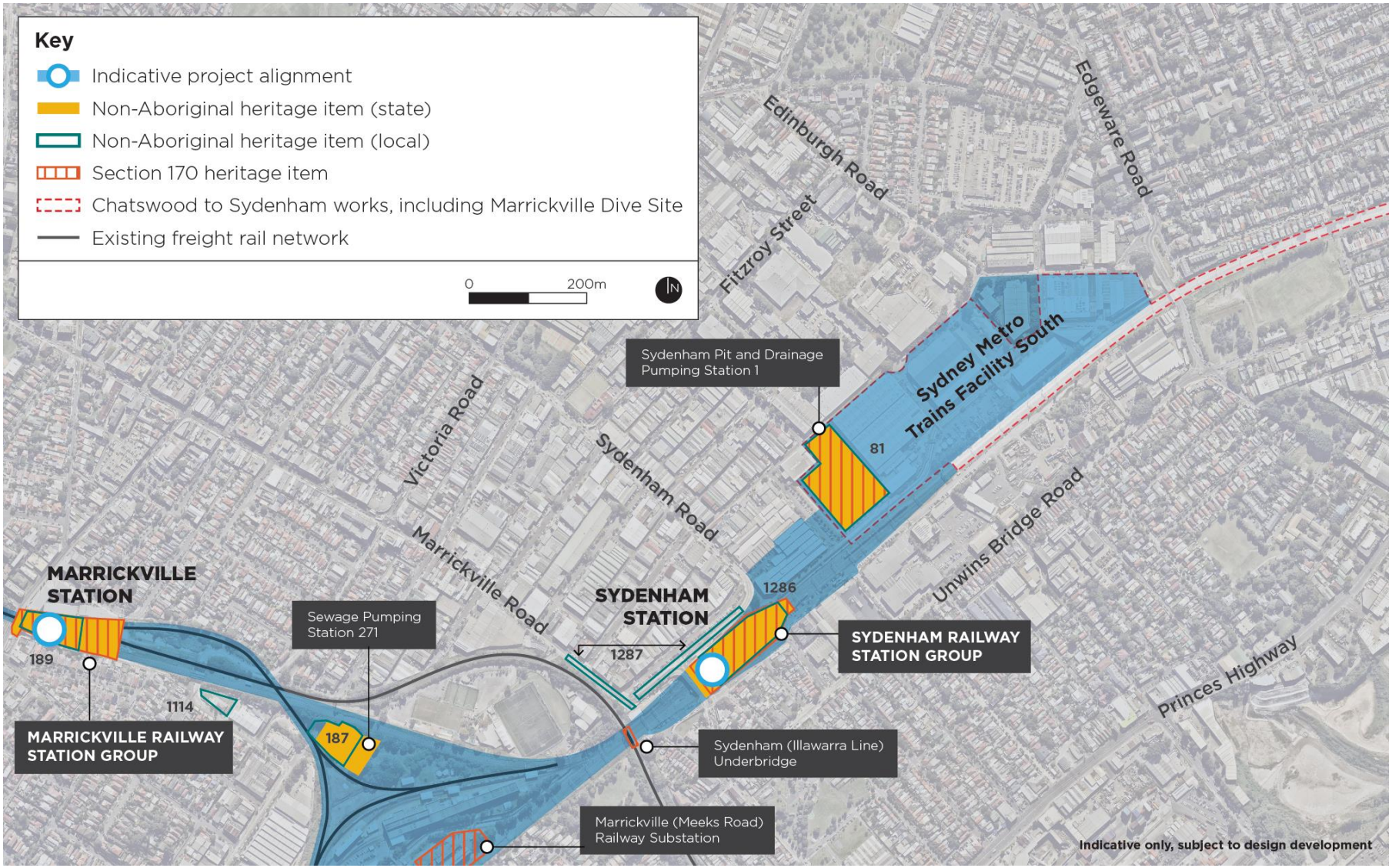

Figure 8-1 Listed heritage items (non-Aboriginal) – map 1

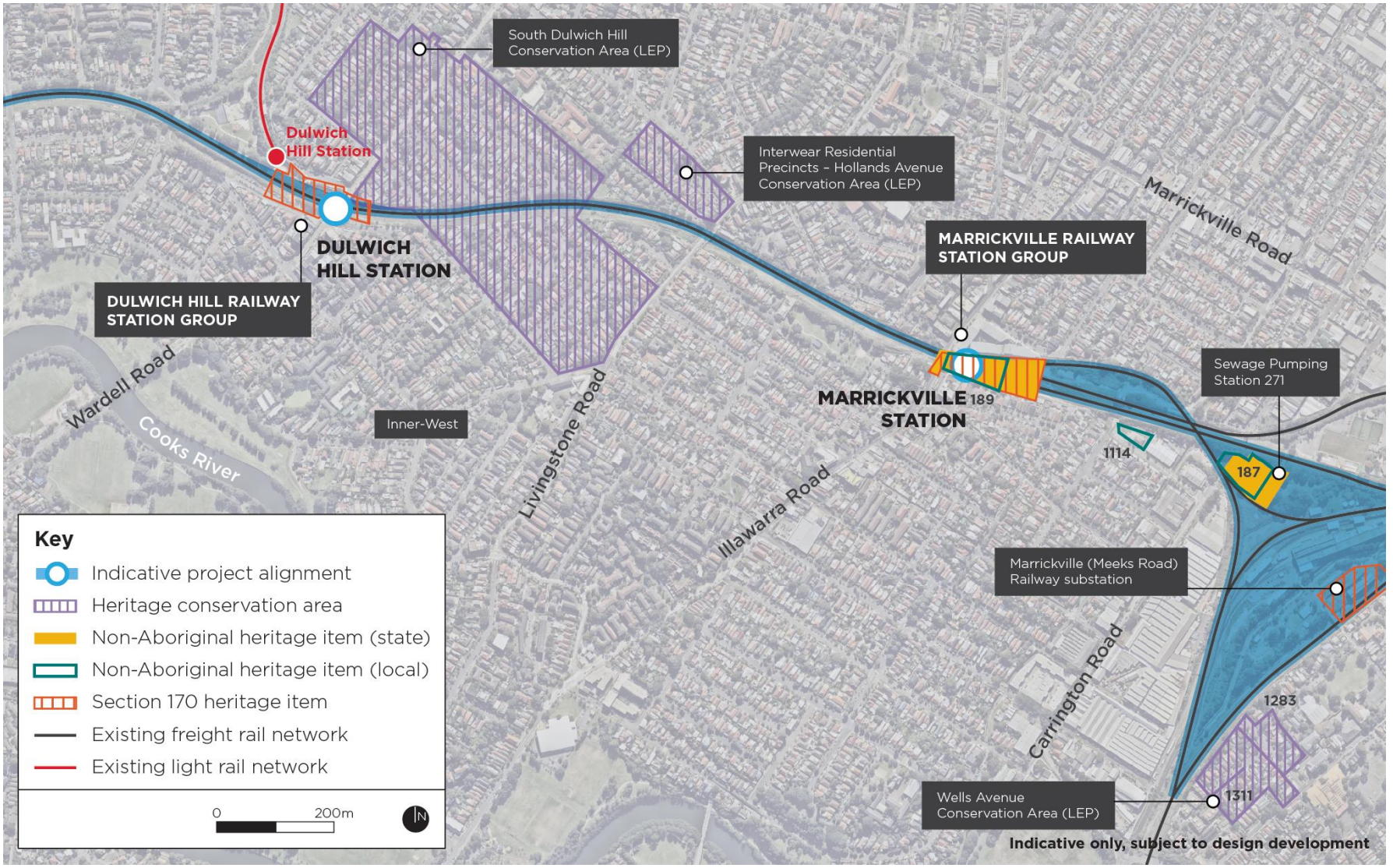

Figure 8-2 Listed heritage items (non-Aboriginal) – map 2

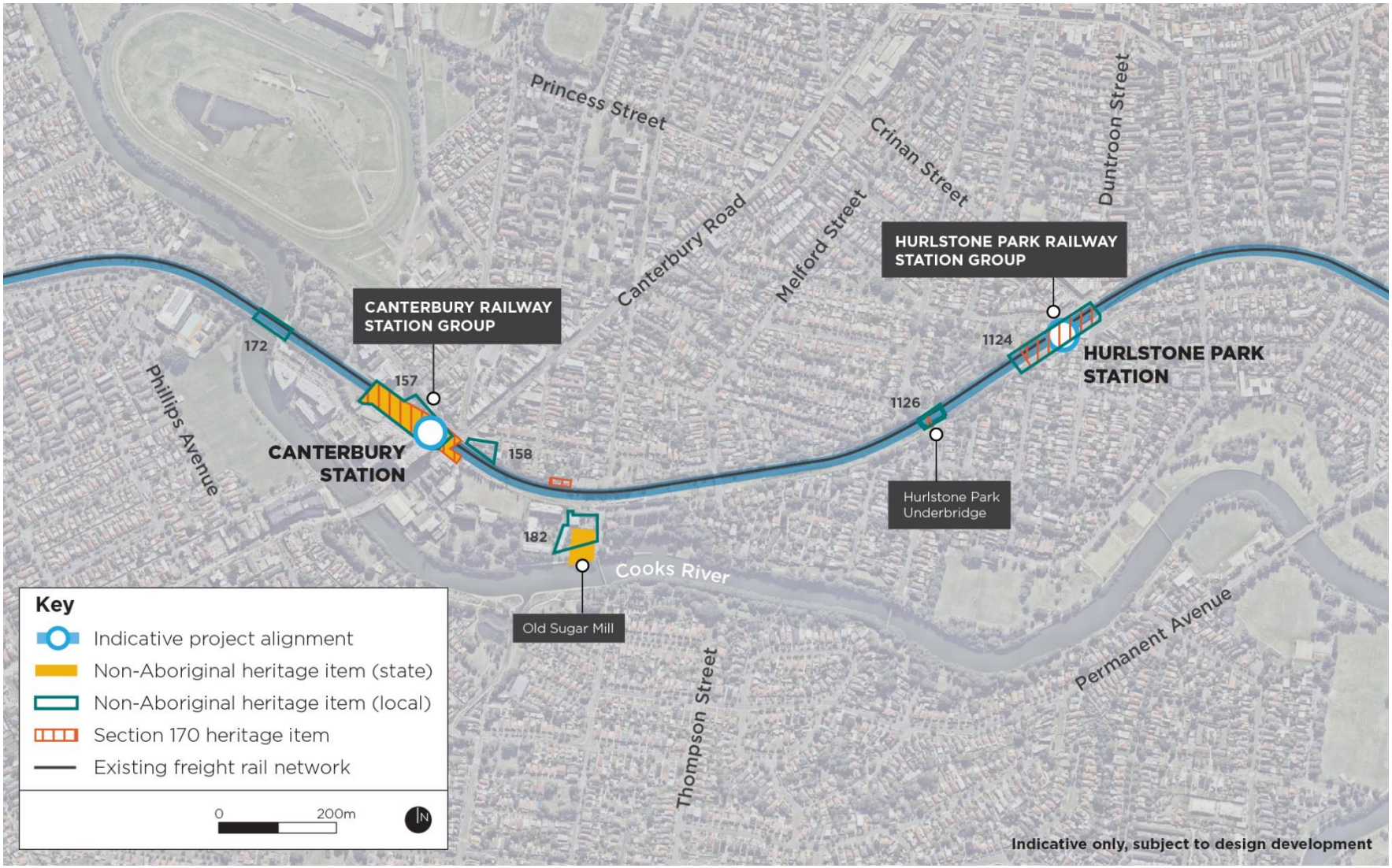

Figure 8-3 Listed heritage items (non-Aboriginal) – map 3

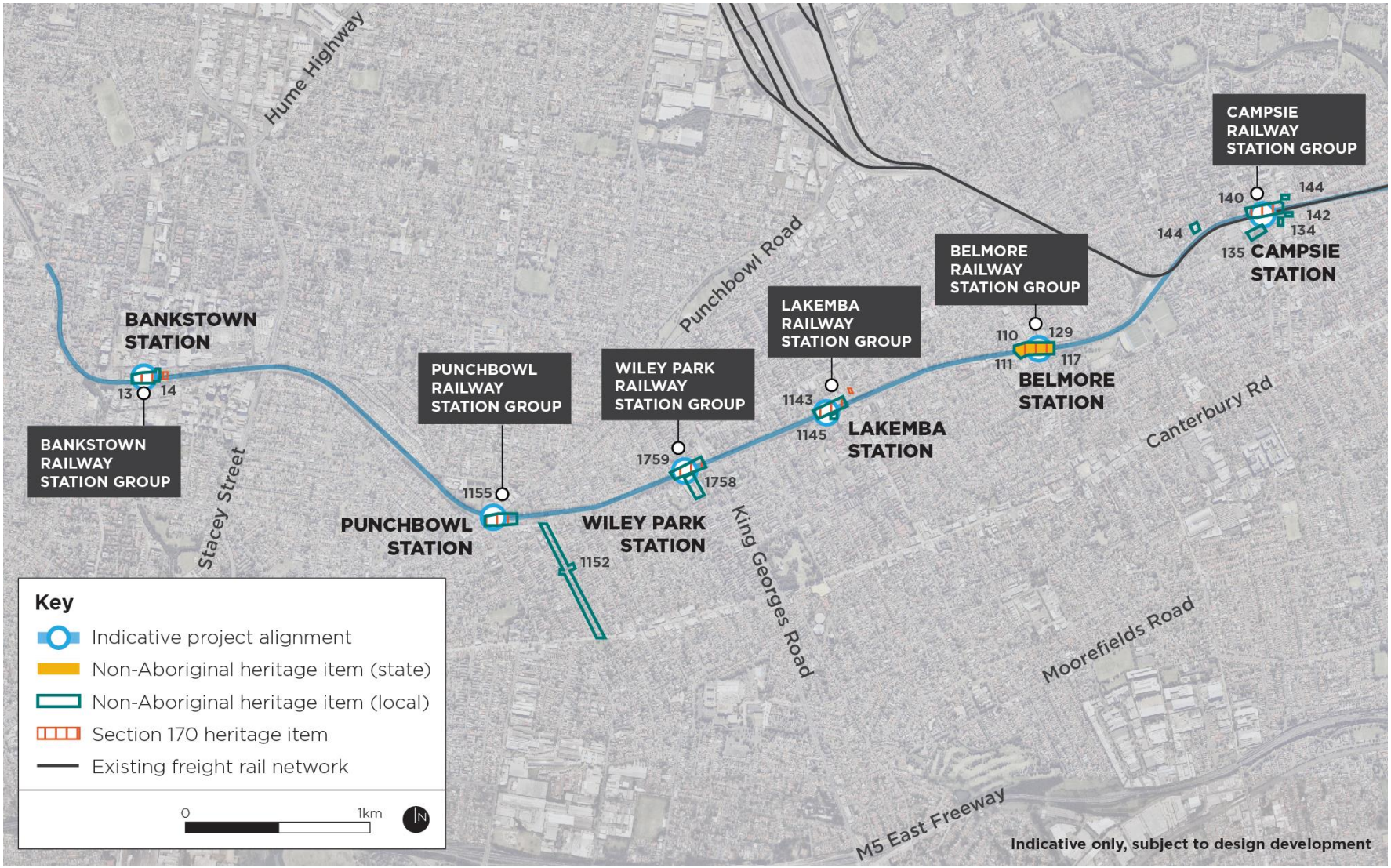

Figure 8-4 Listed heritage items (non-Aboriginal) – map 4

Archaeological potential and significance

The heritage register search conducted as part of the preliminary assessment identified that there are no listed non-Aboriginal archaeological sites within the project area.

Earlier investigations identified that the area north-east of Sydenham Station has low to moderate archaeological potential for evidence of 20th century brickmaking, including evidence of clay extraction pits and postholes associated with buildings.

Potential construction impacts

Construction of the project has potential to impact non-Aboriginal heritage as a result of:

- undertaking construction within the curtilage of stations listed on the State heritage register (such as platform and concourse works) and the proposed stabling facility location, including:
  - Sydenham Pit and Drainage Pumping Station 1
  - Sydenham Railway Station Group
  - Marrickville Railway Station Group
  - Canterbury Railway Station Group
  - Belmore Railway Station Group
- undertaking construction within the locally listed stations, such as platform and concourse works, including:
  - Dulwich Hill Railway Station Group
  - Hurlstone Park Railway Station Group
  - Campsie Railway Station Group
  - Lakemba Railway Station Group
  - Punchbowl Railway Station Group
  - Wiley Park Railway Station Group
  - Bankstown Railway Station Group.
- undertaking construction on locally listed bridges, including:
  - Federation Rail Bridge (Charles Street, Canterbury)
  - Hurlstone Park Underbridge
- potential impact to walls adjacent to the Sewage Pumping Station 271
- construction within the heritage conservation areas
- carrying out work that may cause vibration impacts to heritage listed items
- conducting work that may result in impact to areas of potential archaeological significance
- conducting work or establishing site compounds that may result in impact to adjacent heritage items or conservation areas.

Potential operational impacts

Potential non-Aboriginal heritage impacts during operation of the project include impacts on the heritage significance of listed heritage items and conservation areas, due to the establishment of new project infrastructure that detracts from the values of a heritage item and/or changes the visual outlook from a heritage item.

The project provides an opportunity to celebrate the significant history and layering of transport infrastructure over time, as the new metro transport investment is delivered and operated over the next 100 years.

Proposed investigations and assessment for the environmental impact statement

A non-Aboriginal heritage assessment will be undertaken as part of the environmental impact statement. The assessment will be prepared to the standards of the NSW Heritage Council, and with consideration given to relevant guidelines. The assessment will be undertaken in accordance with:

- relevant legislation, including the Heritage Act 1977.
- *Australia ICOMOS Charter for Places of Cultural Significance, The Burra Charter, 2013* (the Burra Charter)
- NSW Heritage Division's 2009 guidelines *Assessing Significance for Historical Archaeological Sites and Relics*
- *NSW Heritage Manual and the Archaeological Assessment Guidelines* (NSW Heritage Office, 1996)
- *Commonwealth EPBC 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (Commonwealth of Australia, 2013a)
- *Commonwealth EPBC 1.2 Significant Impact Guidelines – Actions on, or Impacting upon, Commonwealth Land and Actions by Commonwealth Agencies* (Commonwealth of Australia, 2013b)
- *NSW Skeletal Remains: Guidelines for Management of Human Remains* (Heritage Office, 1998)
- *Criteria for the Assessment of Excavation Directors* (NSW Heritage Council, 2011).

The non-Aboriginal heritage assessment will:

- identify items and areas of heritage significance that would be materially affected by the project during construction and operation, including any buildings, works, relics, gardens, landscapes, views, trees or places of heritage significance
- consider the potential impacts on the values, settings and integrity of heritage areas and items and archaeological resources located near the project, including items both above and below ground and, where such potential exists, the likely significance of those impacts. Impacts to moveable heritage will be assessed where the item has been listed as an element of significance in a current listing, for example, original seating within a railway station group
- outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) in accordance with relevant best practice guidelines.

8.1.4 Hydrology and flooding

Existing environment

Between Sydenham and Punchbowl stations, the rail corridor drains to the Cooks River and its tributaries. The section of the corridor between Punchbowl and Bankstown stations drains to Salt Pan Creek via the stormwater drainage network.

The stormwater drainage network controls stormwater flows for smaller storm events throughout the project area and numerous stormwater drainage crossings of the rail corridor are located along its length. This network manages stormwater flows predominantly from the roads and impervious areas of the catchment areas, crossing beneath the railway corridor in culverts at low points.

Existing watercourses and hydrology

Cooks River

The Cooks River, which has a catchment area of about 102 square kilometres, flows in an easterly direction from Chullora to Botany Bay at Tempe near Sydney Airport. The river is tidally influenced as far as South Enfield. Major tributaries of the river include:

- Coxs Creek
- Cup and Saucer Creek
- Wolli Creek
- Alexandra Canal
- Muddy Creek.

The catchment of the river is highly urbanised with predominantly residential areas. Parkland, commercial and industrial areas are also located within the catchment. Overall, the amount of parkland and open space within the catchment is low, however most of this land is concentrated along the foreshore of the river. This includes wetlands, bushland and riparian vegetation of biodiversity and recreational value.

The river is managed by local councils and Sydney Water. Parts of the river are natural, however other sections were lined with concrete from the 1940s onwards. Sydney Water has undertaken progressive channel naturalisation works at three locations to restore the river closer to its natural state. The former Sydney Metropolitan Catchment Management Authority in consultation with local councils undertook a number of wetland remediation projects along the Cooks River between 2008 and 2012.

The project crosses the Cooks River (or its tributaries) at the following locations:

- the Cooks River around 400 metres west of Canterbury Station
- a tributary of Coxs Creek near Wiley Park Station (at a section of concrete lined channel)
- a tributary of the Cooks River near Sydenham Station (at a section of concrete lined channel).

Salt Pan Creek

Salt Pan Creek has a catchment of about 26 square kilometres and is a tributary of the Georges River. The tidal influence of the creek is as far west as Fairford Road at Bankstown.

The catchment of the creek is highly developed in its upper reaches near the project. The upper reaches of the creek are highly modified and generally concrete lined, with limited vegetation until the Canterbury Road crossing.

A number of wetlands along the creek have been filled, while other wetlands remain as saltmarsh areas. There are also a number of public reserves, and passive and active recreation areas located along the creek banks.

The highly urbanised nature of the catchment means that the rainfall runoff response of the catchment has been altered from a natural state, resulting in changes to the quantity and speed of runoff.

There are no recognised tributaries for the creek on available mapping, however a number of urban channels drain to the upper reaches of the creek.

The project is located in the upper reaches of the Salt Pan Creek catchment. The catchment upstream (north) of the rail corridor is relatively steep, and surface water runoff is managed by a stormwater drainage network. Crossings of the railway line are in the form of culverts and stormwater drains. This includes eight drainage crossings of the rail corridor. The capacities of the drains are less than the five per cent annual exceedance probability event for all but two of the crossings. The other two crossings are estimated to have the capacity for the probable maximum flood.

Flooding

Cooks River

The *Cooks River Flood Study* (Sydney Water, 2009) predicts existing flooding conditions at the railway crossing near Canterbury Road. Mapping indicates that in-channel flood depths of around six metres would be expected at this location. Mapping indicates that the rail line would not be subject to flooding, however this would be confirmed during design development and preparation of the environmental impact statement.

Flood modelling undertaken as part of preliminary design work established that there are existing flooding conditions in the vicinity of Sydenham Station. The study showed that minor flooding would occur in the vicinity of Sydenham Station, with more extensive flooding in the areas surrounding the station, and deep and fast flowing flood waters would occur within the open channel located on the western side of the corridor.

The *Marrickville Valley Flood Study* (NSW Government and Sydney Water, 2013) identified flooding of the tracks and surrounds near Marrickville Station under existing conditions.

Where the project crosses the rail corridor near Wiley Park Station, flooding information was not available at this time.

Salt Pan Creek

The upper reaches of Salt Pan Creek were the subject of a drainage study undertaken by Bankstown Council in 2011. Mapping from the study indicates potential flooding of the railway corridor in a one per cent annual exceedance probability event at several locations. The depth of predicted flooding is unknown at this stage, but in a number of places the flooding is considered to be at drainage crossing locations.

Potential construction impacts

There is potential for impacts on surface hydrology and flooding during the construction phase including:

- increase in downstream flows due to an increase in impervious areas, flow diversions, or other construction activities
- localised flooding due to inappropriate construction stage drainage
- changes to flood storage due to works in the floodplain.

The project would involve connections to the existing stormwater network, which may result in temporary interruption to flows of water through the drainage network. As the construction program would run over several years, the probability of a rainfall event occurring in excess of the minor drainage capacity is high, and appropriate flow or temporary diversion measures would be necessary to avoid flooding. Sediments entering the stormwater network may also potentially result in siltation and blockage.

Where works in the floodplain are extensive (such as stockpiling of soil materials), there may be impacts on flood storage which could raise flood levels elsewhere or otherwise affect flood behaviour.

Potential operational impacts

Potential impacts on surface hydrology and flooding during operation include the following:

- increases in total catchment impervious area
- localised flooding from stormwater drainage
- flood impacts from changes in flood storage.

Increases in impervious areas, as a result of increased track widths or station extent, could result in changes in surface water runoff and increased velocities. This could impact on localised flooding if not adequately catered for in the design development, and increase scouring of surface soil and downstream sedimentation.

Changes to the stormwater drainage network could also cause localised flooding impacts. Impacts to flood levels or flow paths could occur if permanent changes to flood storage take place near any watercourses.

Proposed investigations and assessment for the environmental impact statement

A surface water assessment will be undertaken and will include:

- review of:
  - existing and proposed water quality data and water quality treatment measures
  - existing and post development flooding
  - existing cross drainage location and capacity data
- calculation of proposed change in land use and impacts on pervious/impervious areas to inform likely water quality and quantity outcomes
- an assumption that standard measures for sediment management would be implemented during construction in accordance with *Managing Urban Stormwater – Soils and Construction* (referred to as the Blue Book) (Landcom, 2004)
- identification of feasible surface water quantity measures that will attenuate post development flows
- review of the adequacy of any proposed detention basin sizing or other treatment measures in mitigating impacts
- identification of surface water pollutant retention to satisfy NSW Environment Protection Authority or other industry standards as far as reasonably practical, and within the limitations of available water quality data
- assessment of acid sulphate soil impacts based on proposed changes in water level and likely environmental effects.

8.1.5 Property and land use

Existing environment

The project is located within two local government areas: Inner West and Canterbury-Bankstown. The project would pass through well-established urban areas with land uses ranging from residential to industrial and commercial, varying in built form and density, and containing a range of recreational spaces (such as public open space) and community facilities (such as schools, childcare centres, places of worship and medical facilities).

Existing land use patterns and characteristics of surrounding the project area are summarised in Table 8-4.

Table 8-4 Existing land use patterns

Land use	Pattern/key features
Residential	There are a number of lower density residential areas near the project area, characterised by single detached and semi-detached houses. These areas adjoin local centres, including Marrickville, Sydenham, Dulwich Hill, Canterbury, Hurlstone Park, Bankstown (east of Stacey Street) and Punchbowl (west of the station). Higher density residential areas, which are characterised by townhouses, multi-dwelling buildings, and multi-storey apartment buildings, are concentrated around rail stations and local and neighbourhood centres. Areas of higher density residential near to the project include at Campsie, Lakemba and Bankstown, to the west of Stacey Street. Most local centre main streets near to the project feature predominately retail at ground-level with housing above. There are some newer developments; however, such as those on Campsie's main street, which are characterised by four to six storey buildings, with shops on the ground floor and housing above. The *Sydenham to Bankstown Urban Renewal Corridor Strategy* (Department of Planning and Environment, 2015) indicates a desired future character for the area that involves increased housing densities near the project area, particularly in close proximity to rail stations and local centres. The draft strategy also indicates a future desired character of between three to five storeys, with ground floor shops and housing above, located along town centre main streets such as Haldon Street in Lakemba, Beamish Street in Campsie, and Illawarra Road in Marrickville.
Commercial cores	There are no existing commercial cores within the project area. However, Campsie and Bankstown are large commercial centres that are both the civic and administrative hubs for surrounding areas.
Mixed use	Local centres near the project have a mix of uses, including commercial, residential, retail, cultural, education, civic, health, special use and recreation. The local centres at Bankstown and Campsie are large mixed use precincts, with Bankstown the larger of these.
Education	There are a large number of public, private and religious educational institutions located near the project. These include primary schools and high schools. Bankstown TAFE, which serves a regional catchment, is located about one kilometre from the project.

Land use	Pattern/key features
Health	Canterbury Hospital in Campsie is the only public hospital located near the project. A number of public and private health centres are also located close to the project. These include an Early Childhood Health Centre at Lakemba, and Bankstown Women's Health Centre.
Industrial	There are two industrial areas located near the project, in Sydenham and Marrickville, with some light industrial in Belmore. These industrial areas include manufacturing, logistics, warehousing, urban services and bulky goods retailing. Both areas perform important local and regional economic roles.
Retail	There is one major retail shopping centre (Bankstown Central) located near the project. Bankstown Central services a large area, with other retail centres, such as Campsie Centre, of a much smaller scale. Retail uses are also located in close proximity to other stations in the project area, but these generally only serve the local areas.
Recreational	A number of major recreational facilities are located near the project, including sports fields, golf clubs, a racecourse, aquatic and fitness centres and memorial gardens. There are also a number of local parks that provide opportunities for informal and active recreational uses.
Special uses	Major roads and railway infrastructure account for the majority of special uses near the project. Other special uses include educational establishments, religious facilities, emergency services facilities, health services and facilities, utilities, electricity transmission and distribution, and the Sydney Water stormwater channel and detention basin at Sydenham.

Potential construction impacts

Potential property and land use impacts that could occur during construction include:

- temporary acquisition or leasing of property to enable construction compounds to be established and/or construction work to occur
- temporary loss of public open space and car parking for construction sites
- disruption to utilities, services and transport assets and infrastructure to facilitate construction.

Potential operational impacts

Potential property and land use impacts that could occur during operation include:

- permanent property acquisition to enable establishment and operation of project infrastructure (see Section 6.7)
- future development restrictions within a defined corridor due to rail infrastructure
- indirect positive impacts and land use changes as a result of opportunities for urban renewal near the metro stations
- permanent changes to commuter parking at stations
- rail corridor development.

Proposed investigations and assessment for the environmental impact statement

A property and land use assessment will be undertaken for the environmental impact statement, with reference to relevant guidelines including *Environmental Planning and Impact Assessment Practice Note: Socio-economic Assessment* (Roads and Maritime Services, 2013). The assessment will consider the following:

- existing land uses
- current property ownership
- likely future land use based on review of the Sydenham to Bankstown Urban Renewal Corridor Strategy, and consultation with local councils and Department of Planning and Environment
- direct property and land use impacts
- positive and negative indirect impacts on land use and property including potential opportunities for, and benefits of, urban renewal and development at metro stations
- potential land use integration issues
- mitigation and management measures to minimise the impacts and maximise the benefits of the project on property and land use.

8.1.6 Business impacts

Existing environment

Land uses include a variety of commercial, industrial and retail uses with the potential to be impacted during construction and operation of the project.

The key characteristics of local businesses around each station are summarised in Table 8-5.

Table 8-5 Key business characteristics

Station	Key characteristics
Sydenham	Local businesses vary from small local businesses along Gleeson Avenue and Burrows Avenue, to light industrial and warehousing units around Unwins Bridge Road and Railway Parade. Larger retail uses include the General Gordon Hotel, with other businesses consisting of predominantly smaller scale local shops, including cafes, take away food stores and a station kiosk/newsagent. Much of the retail development around the station is older style, strip retail, with one newer development with shops at ground level and housing. Around Unwins Bridge Road and Railway Parade, larger floorplate industrial and warehouse units accommodate local urban industry such as auto repair businesses.
Marrickville	The business environment is characterised by small scale, local food and beverage retail and service retail including cafes, bakeries and hairdressers. Some local professional service businesses are also present, including solicitors, real estate agents and migration consultants. Building stock is ageing and there is a prevalence of vacant retail premises amongst the local retail and commercial services.
Dulwich Hill	The business environment is characterised by a mix of convenience retail, food and beverage retail, and local commercial services. The area around Dulwich Hill Station retains a level of vibrancy and diversity in its local businesses, with a range of take away food premises, restaurants/cafes, a pharmacy, florist, hairdresser, drycleaner and newsagent.

Station	Key characteristics
Hurlstone Park	The business environment is characterised by older style, strip retail with an increasing presence of newer, shop-top housing style development. Local businesses are generally smaller scale retail and professional services, such as dry cleaners, hairdressers, general store, real estate agents and fresh food markets, with a focus on international foods and products. In comparison to other station precincts, Hurlstone Park has less of a focus on food and beverage retail, with more commercial services including some small scale office premises in converted retail and residential buildings.
Canterbury	The business environment is highly fragmented, and as a result of this, some isolated street blocks are occupied by single, large floorplate buildings and longer blocks displaying more typical local strip retail premises. Due to the location of the station precinct on a main road, there is a bulky goods retail presence, along with the Canterbury Club Hotel and a commercial gym. New development is emerging in the area but much of the building stock is ageing. There are a number of vacancies along the main retail frontages to Broughton Street and Canterbury Road.
Campsie	The business environment is characterised by finer grain, older style main street shops, and supporting local professional and medical services. Unlike many of the other station precincts, Campsie has a strong presence of fashion related retail, consisting predominantly of small independent boutiques and larger discount stores. The precinct has a strong focus on international foods and products with specialist butchers, bakeries and grocers and also includes typical local services such as real estate agents, pharmacies and newsagents.
Belmore	The business environment is dominated by discount bulky goods operations and an increasing prevalence of shop top housing development. Bulky goods premises include independent furniture and mattress stores. Local retail includes a small supermarket/grocer, a bakery, and a small hardware store. Food and beverage retail is present in the form of restaurants and take away food stores. Professional services are limited around the station in comparison with some other station precincts.
Lakemba	The business environment is characterised by small scale, local retail with a focus on international food products including a supermarket and a butcher. Other local businesses include a post office, hairdressers, and take away food premises.
Wiley Park	Wiley Park Station is a relatively small station precinct surrounded by small scale, local retail stores, with high vacancy. Local businesses include a hardware store, take away food store, and a small grocery store. The Wiley Park Hotel is the largest commercial activity in the vicinity of the station.
Punchbowl	This larger station precinct has a predominance of local retail and commercial services, including a pharmacy, hairdressers, newsagents, real estate agents and drycleaners. The precinct also has a stronger presence of medical services than many of the other station precincts, including a large medical/dental centre and physiotherapy practices. Food and beverage retail consists of a mix of fresh and prepared food, with a focus on international food products.

Station	Key characteristics
Bankstown	Bankstown Station is focused around Bankstown City Plaza, a large pedestrianised area bordered by retail uses, public open space and a bus terminal. Bankstown is the largest centre along the project and as such, includes a greater diversity of business activity. Local businesses around the station include banks, a post office and specialist medical services. Food and beverage retail is a mix of franchised fast food and independent cafes/restaurants. Discount stores and independent fashion boutiques are also present, along with a broader range of professional services such as accountants, solicitors and consultants. Bankstown Central Shopping Centre is located on the northern side of the rail corridor to the east of Bankstown Station. This centre contains a wide range of stores from large retail stores such as Myer, Big W, Target, Kmart, IGA and Woolworths, to smaller retails stores.

Potential construction impacts

Potential business impacts that could occur during construction include:

- Disruptions to servicing, deliveries and access – temporary street closures, the relocation/removal of car parking along the street frontage, and the location of construction sites could collectively restrict and hinder servicing, delivery and customer access opportunities, resulting in time and vehicle related costs, as well as lost revenue for businesses.
- Increased traffic congestion and/or travel times – direct and indirect impacts on businesses due to traffic delays and congestion. Businesses may be directly affected by delayed or obstructed access to work places or servicing areas. A business may be indirectly affected by increased traffic, and impacts to travel times for staff or deliveries on major thoroughfares. Service and delivery based businesses may also be impacted by higher vehicle operating costs.
- Loss of power and utilities – businesses may be disrupted by accidental or planned shutdowns of electricity or other utilities. Whilst significant advance notice of shutdowns would be given to all businesses, accidental events would be more difficult to manage.
- Visibility and accessibility – the presence of construction works, hoardings and other structures may reduce the visibility of certain businesses. The works may also alter the paths people use to access stations and mean that people would no longer walk past a particular store. For businesses which rely on passing trade, such as cafes and convenience stores, this could result in a loss of customers and turnover.
- Amenity – deterioration of amenity (particularly due to noise, vibration, and visual and air quality impacts) may result in a reduction in customers for certain businesses such as cafes.
- Property acquisition – some businesses may not be as easily able to relocate as others (for example, those businesses requiring particular machinery/operating conditions).

Some businesses in the project area may also experience positive impacts during construction including:

- Increase in passing trade – depending on their location, some businesses may benefit from a net gain in passing trade owing to changes to pedestrian traffic and vehicle access.

- Trade increase – businesses providing services for construction workers (such as service stations, take-away food shops, convenience stores and hotels) could experience an increase in trade.
- Demand for services – the project could benefit construction related businesses, such as construction recruitment agencies, construction companies and resource suppliers.

Potential operational impacts

Potential business impacts that could occur during the operation of the project include:

- Increased commercial rent – as a result of the likely enhanced attraction of locating a business close to the project corridor, competition for space and thereby commercial rents could increase across the project area. Where this occurs, there would be some negative impacts on smaller businesses that are not able to quickly absorb higher rents, and on businesses that are experiencing challenges to viability.
- Changed behaviour during construction – a forced change in consumer behaviour (such as travel route or diversion) may have longer term effects. For example, an alternative pedestrian route provided during construction (that moves passing trade away from a given business) may result in a permanent change in behaviour or travel direction even when no longer enforced. This can negatively affect businesses from which trade was diverted and conversely may benefit others.
- Altered traffic, access and parking conditions – changed traffic arrangements could collectively restrict and hinder servicing, delivery and customer access opportunities, resulting in time and vehicle related costs as well as lost revenue for businesses.
- Amenity – deterioration of amenity (particularly due to noise and vibration impacts) may result in a reduction in customers for certain business types such as cafes. Conversely, upgraded stations and surrounding areas may improve the visual amenity of the area in the longer term and attract more business.

Notwithstanding the above negative impacts, the project would also result in a number of benefits due to improved public transport facilities, improved travel times for staff, and greater connectivity between key centres of the Global Economic Corridor. These benefits may include:

- increased business activity
- increased trade generation
- increased residential development opportunities
- improved staff access, recruitment and retention
- improved business viability.

These improvements could also lead to higher rental incomes for property owners.

Proposed investigations and assessment for the environmental impact statement

A detail assessment of the impacts on local businesses during construction and operation of the project will be undertaken as a part of the environmental impact statement. The business impact assessment will:

- identify businesses that would be directly impacted by the project
- identify businesses near the project that may be indirectly impacted by the project
- undertake a local business survey to understand the nature of businesses and the local economy

- assess the potential impacts on local businesses, and on the local economy
- identify measures to avoid or mitigate the potential impacts.

8.1.7 Landscape character and visual amenity

Existing environment

The project extends through an environment of varying landscape character and visual sensitivity. An overview of the existing landscape and visual conditions of the project area (focussed around existing stations) is provided in Table 8-6.

Table 8-6 Existing landscape and visual conditions

Location	Existing landscape and visual conditions
Sydenham	Sydenham Station has a State heritage listing and includes surrounding streets of aesthetic significance. There has been a recent upgrade to the station, which includes new platform stairs, lifts, and entry concourse on Gleeson Avenue. Areas to the north and east of the station are predominantly single and double storey industrial buildings. Immediately west of the station, the metropolitan freight network lines to Port Botany crosses via a Pratt truss bridge. Beyond this, the rail corridor splits into the T3 Bankstown Line to the north and the Illawarra Line to the south. The NSW TrainLink XPT maintenance centre is located between these two lines at Meeks Road, west of Sydenham Station. To the south of the station, the landscape is predominantly residential, consisting of single and double storey terraces and detached houses. The station is close to several recreation and open space areas. To the west, Fraser Park is situated north of the T3 Bankstown Line, and Tillman Park is located south of the Illawarra Line, besides the ARTC tracks. Sydenham Green is located south of the station, between Unwins Bridge Road and the Princes Highway.
Marrickville	Marrickville Station has a State heritage listing and includes several ornate platform buildings, booking office and overbridge of 'aesthetic significance'. Passenger rail uses are on the south side of the island platform, with the ARTC tracks running to the north. Marrickville Station is currently being updated to include new platform stairs, lifts, and entry concourse on Illawarra Road. The rail corridor is in cut adjacent to the station, and is set below Illawarra Road so that the heritage station buildings are not visually prominent. Surrounding land uses includes a local commercial precinct along Illawarra Road, consisting predominantly of single and double storey terrace buildings with shopfronts. Adjacent residential areas comprise a mix of terraces, detached houses and unit blocks. A multi-storey mixed use development has recently been built on a triangular site immediately north of the station, including seven storeys of apartments which abut the metropolitan freight network tracks. Several mature trees, which are visible from nearby streets and properties, are located alongside the northern and southern side of the rail corridor. McNeilly Park is located to the west of the station at Warburton Street, immediately south of the rail corridor.

Location	Existing landscape and visual conditions
Dulwich Hill	Dulwich Hill is a predominantly residential suburb with a character of early twentieth century detached houses. The rail corridor is in cut and divides the village centre, which includes a small precinct of heritage character shopfronts and modern mixed use development along Wardell Road. Dulwich Hill Station is of local historical importance. The booking office is an understated building which acts as a local visual landmark, identifying the station entry from Wardell Road. The ARTC tracks, with associated heavy freight rail use, are located on the northern side of the station platform. Commuter car parking is located to the north and south of the railway corridor, seen filtered through small trees. Further to the north, the Inner West Light Rail runs along the former Rozelle freight rail corridor. The Dulwich Hill light rail station is located about 100 metres from the railway station at the western end of Bedford Crescent. To the west, Jack Shanahan Park is located between the light rail network and the ARTC tracks/T3 Bankstown Line at Ness Avenue, with a pathway leading to the Dulwich Hill light rail station.
Hurlstone Park	Hurlstone Park is a predominantly residential suburb, with residential dwellings consisting of mainly detached houses. Hurlstone Park Railway Station and its underbridge at Foord Avenue have local heritage significance. The excavated rock face to the rear of platform 2 is identified as a 'landscape/natural feature'. Passenger rail uses are on the southern side of the island platform, with the ARTC tracks running to the north. The rail corridor is in cut, and the station is accessed via an overbridge and overhead booking office on Floss Street. The overbridge provides elevated views to the northeast and southwest along the rail corridor, with clear views to the station buildings. Hurlstone Park commercial centre is located north of the station, along Crinan Street, consisting predominantly of single and double storey terrace buildings with shopfronts.
Canterbury	Canterbury Station, which is listed on the State heritage register, includes several ornate platform buildings, overhead booking office, signal box and an overbridge of 'aesthetic significance'. Passenger rail uses are located to the south of the island platform and the ARTC tracks to the north. The rail corridor and the station platforms are set below Canterbury Street. North of the station, a large five-way intersection is the focal point of Canterbury's commercial and retail centre, comprising of mainly heritage character shopfronts facing Canterbury Street. South of the station, between the rail corridor and Cooks River, is a precinct of light industry and multi storey residential apartments. A multi storey mixed use development has been recently built along Charles Street, immediately south of the station, including eight storeys of apartments with ground level shops, directly adjacent the rail corridor. There are extensive areas of parkland on the banks of the Cooks River, including Canterbury Park Racecourse, Tasker Park, Heynes Reserve and Sutton Reserve, linked by the Cooks River Cycleway. A number of mature trees are located alongside the rail corridor and along Broughton Street, filtering views to the station and corridor.

Location	Existing landscape and visual conditions
Campsie	Campsie is a major hub for bus and rail transport. The commercial centre of Campsie is centred on Beamish Street, extending north and south of the station. It has a built form of traditional terraced shopfronts with ground level shopfronts and mature street trees. The rail corridor is in cut adjacent to the station and is set below Beamish Street. The station is accessed via a recently upgraded entry concourse on Beamish Street, including new platform stairs and lifts. This entry is integrated into the surrounding built form and is not visually prominent. Campsie Station has local historical significance. It is not visible from the main street, however, streets along the north and south of the rail corridor allow neighbourhood views towards the heritage station buildings filtered through chainmesh fencing, mature street trees and on street car parking. There are views to the rail corridor from Anzac and Carrington Squares in the south. Local visual landmarks include the War Memorial clock tower and inter-war period commercial building on the Anzac Mall to the south of the station, which are also local heritage items. The residential areas surrounding the commercial core consist of a mix of two to three storey residential units and single detached houses on large blocks.
Belmore	The rail corridor splits west of Campsie Station into two branches. The northern branch contains part of the metropolitan freight network, providing a link to the Enfield Intermodal Logistics Centre, and the southern branch contains the T3 Bankstown Line, linking to Belmore Station. The centre of Belmore comprises a commercial precinct running perpendicular to the railway line along Burwood Road, consisting of one to two storey terrace buildings with ground level shopfronts and some larger brick art deco commercial buildings. Belmore Station has a State heritage listing which includes the platform buildings, overhead booking office and overbridge which are considered to be of ‘aesthetic significance’. The railway corridor is in cut in this location, with the station entry on Burwood Road. This building is visually prominent, as formal gardens and commuter car parking, to the north and south of the corridor, provide visual separation between the station building and adjacent built form. The Canterbury Leagues Club building, and its elaborate landscape entrance on Bridge Road, is a key landmark within the locality. The Belmore Sports Ground and Terry Lamb Reserve, are located to the south of the rail corridor, east of the station, and are connected to the station via a linear park running along the rail corridor. A linear park is also located between Wortley Avenue and Railway Parade and the corridor to the north of the rail corridor and west of the station. Residential areas surrounding Bridge Road commercial precinct include a mix of two to three storey residential units, and single detached houses and terraces set within tree-lined streets.

Location	Existing landscape and visual conditions
Lakemba	Lakemba Station has local historical significance. The station is accessed via a recently upgraded entry concourse with stair and lift access to the platform and a footbridge linking the station with Railway Parade in the north and The Boulevarde to the south. The new footbridge is a visually prominent feature. At the southern station entrance, the war memorial (local heritage item) set within a small square lawn area is a local visual landmark, framed by planting along the rail corridor boundary. The rail corridor is in cutting, traveling in an east-west direction perpendicular to Haldon Street. Several mature trees and shrubs have been planted along the railway embankments and adjacent streets. Commuter parking is located either side of Haldon Street. The Lakemba commercial area faces the station on Railway Parade and The Boulevarde, and consists mainly of one to two storey terrace buildings with ground level shopfronts. A prominent five storey building (Telstra) in Croydon Street is incongruous with the surrounding streetscape. The Uniting Church, at the corner of Haldon Street and The Boulevarde, is a local visual landmark. There is little public open space in the commercial precinct or surrounding area. Areas surrounding Haldon Street commercial precinct include a mix of two and three storey and single detached houses, commonly with tree lined streets, including Federation weatherboard and Inter-war house styles.
Wiley Park	Wiley Park Station is located on King Georges Road, a major north south route which is six to seven lanes wide. This local shopping precinct includes a mix of heritage character and contemporary shopfronts of one to two storeys. An art deco style brick corner building located adjacent to the station is a local visual feature. This streetscape also includes a number of residential developments ranging from two to six storeys in height and of mixed architectural quality. The station platforms are located in cut, and the overhead booking office is elevated above the station facing King Georges Road. This building is surrounded by single storey shopfronts and is therefore not visually prominent. Wiley Park Railway Station has a local heritage listing and is identified as having some ‘aesthetic significance’ due to its 1930s platform buildings and overhead booking office. Due to a number of contemporary alterations to the station, including skillion roofs, palisade fencing, and platform access ramps, the character is of mixed visual quality. The station is surrounded by a wide turfed corridor with scattered trees which filter views from the surrounding residential areas to the north and south. A footpath extends east from the station to Railway Parade and west to Urunga Parade to the north of the corridor, and The Boulevarde provides an east west route to the south and parallel to the corridor.

Location	Existing landscape and visual conditions
Punchbowl	Punchbowl Station has local historical significance. The overhead booking office and footbridge have some heritage character, whereas the remainder of the station has been subject to modern additions and alteration, creating a mixed character. The station platforms are located in cut, and the main station entry is located on Punchbowl Road. The booking office is raised on a steel frame and is aligned at a 45-degree angle to the adjacent four lane road bridge, creating a juxtaposition between the station and surrounding streetscape. To the north of the station, a large park provides a visual setting for the entry, whereas to the south the entry is enclosed by terraced shopfronts and surrounded by a commuter carpark. The commercial centre of Punchbowl extends north and south along Punchbowl Road, and east along The Boulevarde. This precinct includes a mix of heritage character shopfronts and modern mixed use developments, and forms a dense urban centre around the station. A brick building of heritage character on the corner of Punchbowl Road and The Boulevarde includes a clock tower which is a local visual landmark. Opposite this, a group of mature eucalypt trees within the rail corridor mark the bridge crossing and soften views to the urban streetscape.
Bankstown	Bankstown Station is located in the heart of the Bankstown town centre. This precinct includes a mix of heritage character shopfronts and modern mixed use developments and forms a dense urban centre around the station. Bankstown Station has local heritage significance. The station includes heritage buildings on the platform, overhead booking office, footbridge and a former parcels office. The station is accessed from North Terrace and Bankstown City Plaza. The streets of North Terrace, Old Town Centre Plaza and South Terrace enclose the station. Extensive public realm works have been undertaken in this precinct, including the pedestrianisation of the North Terrace overbridge, which crosses the western end of the railway station and runs parallel to the footbridge. High quality plazas and parkland have been established to the north and south of the station, and a bus interchange plaza has been established on the south at the Bankstown City Plaza and South Terrace. These plazas include a framework of semi-mature trees which filter and frame views. A palm tree, located adjacent to the eastern end entrance portico of the former parcels office, is potentially an original planting from the 1940s. The station buildings can be seen from the North Terrace and South Terrace, however, they are largely integrated into surrounding commercial development along the Bankstown City Plaza bridge and extending along North Terrace. Bankstown Central Shopping Centre is located on the northern side of the rail corridor to the east of Bankstown Station. This centre is a prominent development on the northern side of the corridor due to its size and bulk.

Potential construction impacts

The construction of the project may cause temporary impacts on the landscape and views of the project area and surrounding public domain areas. These impacts would be experienced by those who work, study, visit or access business and community facilities near to the station, residents surrounding the project area, and rail users.

These impacts may result from:

- the establishment of construction compounds, worksites, stockpiles, particularly adjacent to stations
- removal of vegetation to accommodate the works
- light spill from construction sites during any out-of-hours construction
- temporary traffic disruptions including lane closures
- construction vehicle movements within construction worksites and along haulage routes, and parking, footpath diversions and relocations
- works to upgrade station facilities including platforms and canopies
- works to upgrade bridge structures.

Potential operational impacts

The operation of the project may result in both adverse and beneficial impacts on the landscapes and views at the site and surrounding area. These impacts would be experienced by those who work, study, visit or access business and community facilities near to the station, residents of the project area, and rail users.

These impacts may result from:

- alterations to stations including platform straightening, canopies, glass doors, signage, ticketing equipment etc.
- power supply upgrades and traction substations
- operation of the stabling facility
- light spill from stations
- the obstruction of views to heritage character station elements and heritage landscapes
- access upgrades including lift and stair upgrades
- alteration of wayfinding and improved visual prominence of stations
- introduction and augmentation of noise walls.

Proposed investigations and assessment for the environmental impact statement

A visual and urban design impact assessment will be undertaken as part of the environmental impact statement. The assessment will:

- describe the visual character and unique qualities of the project area
- interpret the design to identify the visual character and urban design of the project
- consider the heritage and other social values of the site to establish the potential sensitivity of receptors and visual absorption capacity
- consider land use changes where they may influence the character of the existing site

- consider potential cumulative impacts associated with the construction and operation of other major projects near the project area
- identify the visual impacts of the project during daytime and night-time conditions (including lighting), and throughout construction and operation
- identify the landscape (urban design) impacts of the project throughout construction and operation
- identify measures to avoid, minimise and/or mitigate potential impacts.

Photomontages will be included in the environmental impact statement.

8.1.8 Ecology

Approach and methodology

Review of vegetation mapping and aerial photography

A review of aerial photographs and vegetation mapping was undertaken to identify areas of native vegetation that may be present and impacted by the project. Resources reviewed included:

- *Native Vegetation of the Sydney Metropolitan Area* (Office of Environment and Heritage, 2013)
- regional-scale vegetation mapping of the project area (Tozer et. al., 2010)
- *Vegetation of the Cumberland Plain* (National Parks and Wildlife Service, 2002)
- aerial photography of the project area.

Database review

A desktop database review was undertaken to identify threatened flora and fauna species, populations and ecological communities (biota) listed under the TSC Act and FM Act, and matters of national environmental significance listed under the EPBC Act, that could be expected to occur in the project area, based on previous records, known distribution ranges, and habitats present. These will also be used to obtain the necessary site data to perform calculations under the Framework for Biodiversity Assessment (Office of Environment and Heritage, 2014a). Biodiversity resources pertaining to the project area and locality (i.e. within a 10 kilometre radius of the project area) that were reviewed include:

- Commonwealth Department of the Environment protected matters search tool, for matters of national environmental significance known or predicted to occur in the locality (Department of the Environment, 2016a)
- Commonwealth Department of the Environment online species profiles and threats database (Department of the Environment, 2016b)
- Office of Environment and Heritage Wildlife Atlas database (licensed) for records of threatened species, populations and endangered ecological communities listed under the TSC Act that have been recorded within the locality of the project (Office of Environment and Heritage, 2016a)
- Office of Environment and Heritage threatened biota profiles for descriptions of the distribution and habitat requirements of threatened biota (Office of Environment and Heritage, 2016b), which was used to identify the suite of threatened ecological communities that could potentially be affected by the project and to inform habitat assessments

- Department of Primary Industries online protected species viewer for records of threatened aquatic species in the locality (Department of Primary Industries, 2016a)
- The NSW Department of Primary Industries *Threatened Fish and Marine Vegetation – Find a Species by Geographic Region* online search tool for Hawkesbury/Nepean catchment management area (Department of Primary Industries, 2016b).

Following collation of database records and threatened species and community profiles, a 'likelihood of occurrence' assessment would be prepared for threatened and migratory species and ecological communities, with reference to the broad vegetation types and habitats likely to be contained within the project area. This will be further refined following field surveys and verification of vegetation types, and identification and assessment of habitat present within the project area.

Existing environment

Native vegetation and fauna habitats

The project is largely located within an existing rail corridor located in a highly urbanised environment. There is limited native vegetation present within the project area as a result of past development. There is some riparian vegetation present along the edges of the Cooks River at Canterbury. Most of the rail corridor is vegetated with grasses, small shrubs and a variety of weeds, while some areas of bare ground are also present.

Vegetation mapping (National Parks and Wildlife Service, 2002) does not show any native vegetation within the rail corridor. Vegetation (i.e. trees) located within the rail corridor are likely to be planted, rather than remnant vegetation. Patches of remnant or regenerating vegetation (if present) may comprise potential habitat for threatened ecological communities and/or threatened plants. For example, understorey species representative of the Sydney Turpentine Ironbark threatened ecological community may be present within the rail corridor between Dulwich Hill and Hurlstone Park stations.

Fauna species that are likely to occur would predominantly be common species, typical of modified urban environments. Despite the highly modified environment present, the rail corridor and adjoining urban environments provide habitat for the Long-nosed Bandicoot (*Perameles nasuta*), an endangered population in inner western Sydney. This species has been known to occur along the light rail corridor (previously the freight corridor) (NSW Scientific Committee, 2011). The threatened Grey-headed Flying Fox is also likely to forage in vegetation in the project area on occasion.

Riparian vegetation along the banks of the Cooks River may provide habitat for water birds, as well as other common birds, skinks and possums. In the vicinity of the project area, the river does not contain any natural banks; as such, no mudflats or saltmarsh are likely to be present in this location. Planted trees and remnant or regenerating vegetation may provide temporary foraging habitat for some wide-ranging threatened and migratory fauna species during their movements through the urban landscape. Bridges and culverts may provide roosting habitat for microchiropteran bats. Some microchiropteran bat species may also forage along the rail corridor and riparian areas.

Vegetation mapping and identification of flora and fauna species will be undertaken during field surveys.

Threatened ecological communities

Twenty-six threatened ecological communities listed under the TSC Act have been identified as having the potential to occur. Fourteen of these communities are also listed under the EPBC Act.

No intact or extensive patches of threatened ecological communities are expected to occur in the project area based on a review of existing vegetation mapping and the highly cleared and modified nature of the environment.

Threatened flora species

A total of 45 threatened flora species listed under the TSC Act have been recorded or are predicted to occur. Of these, 32 threatened flora species are also listed under the EPBC Act. Most of these threatened species would be unlikely to occur, as they rely on specific habitat that is not present in the project area. Threatened species with some potential to occur, given nearby records and potential presence of suitable habitat, include:

- *Pultenaea parviflora*, listed as an endangered species under the TSC Act and a vulnerable species under the EPBC Act
- *Pultenaea pedunculata*, listed as an endangered species under the TSC Act
- *Wilsonia backhousei,* listed as a vulnerable species under the TSC Act
- *Acacia pubescens,* listed as a vulnerable species under the TSC Act and the EPBC Act
- *Thesium australe*, listed as a vulnerable species under the TSC Act and the EPBC Act.

In addition, three threatened species commonly used as street trees and garden plants may also occur:

- *Eucalyptus scoparia*, listed as an endangered species under the TSC Act and a vulnerable species under the EPBC Act
- *Eucalyptus nicholii,* listed as a vulnerable species under the TSC Act and the EPBC Act
- *Syzygium paniculatum,* listed as an endangered species under the TSC Act and a vulnerable species under the EPBC Act.

These species do not naturally occur in the project area, either because they are outside their natural range (*Eucalyptus scoparia and E. nicholii*), or their preferred habitat (rainforest) is not present (*Syzygium paniculatum*).

The potential for these threatened plant species to occur and be impacted by the project will be further assessed through field surveys and the assessment to be completed as part of the environmental impact statement.

Threatened fauna species

A total of 71 threatened fauna species have been recorded or are predicted to occur. Of these, 70 are listed under the TSC Act and 25 are listed under the EPBC Act. Given the lack of native woodland vegetation, wetlands or estuarine mudflats, most of these threatened fauna species or populations would not occur. Species most likely to occur in the project area include:

- the Grey-headed Flying-fox (*Pteropus poliocephalus*), listed as a vulnerable species under the TSC Act and the EPBC Act
- a number of microchiropteran bats, such as the Eastern Bentwing Bat (*Miniopteris schreibersii oceanensis*) and Large-footed Myotis (*Myotis macropus*), listed as vulnerable species under the TSC Act
- a range of threatened bird species listed under the TSC Act or the EPBC Act that may forage in planted trees or along the Cooks River on occasion.

The potential for these threatened fauna species to occur and be impacted by the project will be further assessed through field surveys and the assessment to be completed as part of the environmental impact statement.

Two threatened fish species listed under the FM Act and/or the EPBC Act have been recorded or are predicted to occur. No habitat for these species is likely to occur in the project area. An assessment of impacts on aquatic habitats, including key fish habitat would be conducted with regard to the policy and guidelines for fish habitat conservation and management (Department of Primary Industries, 2013).

Endangered populations

Three endangered flora populations listed under the TSC Act have been recorded and may occur in the project area, although suitable habitat is likely to be limited:

- *Pomaderris prunifolia*
- *Marsdenia viridiflora* subsp. *viridiflora*
- Tadgell's Bluebell *Wahlenbergia multicaulis*.

One endangered fauna population listed under the TSC Act has been recorded. The Long-nosed Bandicoot (*Perameles nasuta*) endangered population of inner western Sydney is known to occur within the light rail corridor and adjoining environs between Dulwich Hill and Lewisham West stations and within the Cooks River to Iron Cove Greenway. It is also known to occur in gardens and under houses in the wider area (NSW Scientific Committee, 2011).

The potential impacts of the project on these endangered populations will be further assessed through field surveys and the assessment to be completed as part of the environmental impact statement.

Migratory fauna species

A total of 79 migratory fauna species were identified as having the potential to occur by the protected matters search (Department of the Environment, 2016a). Given the proximity of the project area to the coast, the majority of these are pelagic and marine species, and are not relevant to the project because their habitat is not in the project area and would not be affected by the project. Of the remaining species, there are eight species that may possibly occur in the project area on occasion.

The potential for these migratory species to occur and be impacted by the project will be further assessed in field surveys and with reference to the Commonwealth Department of the Environment significant impact guidelines.

Other ecological matters of national environmental significance

One wetland of international importance, Towra Point Nature Reserve, is located on the southern side of Botany Bay, about eight kilometres downstream of the project and is unlikely to be affected by the project. No other ecological matters of national environmental significance were identified in the protected matters search.

Potential impacts

The project located largely within an existing rail corridor which travels through a highly urbanised environment. There is however potential for impacts on areas that provide known or potential habitat for threatened biota. Key issues for consideration will include the following:

- the Long-nosed Bandicoot Inner Western Sydney Endangered Population listed under the TSC Act, and areas of known habitat within the rail corridor and adjoining environs
- foraging habitat for the threatened Grey-headed Flying Fox (vegetation adjoining the corridor) and foraging and roosting habitat (e.g. culverts and bridges) for threatened microchiropteran bats

- patches of remnant or regenerating vegetation, comprising potential habitat for threatened ecological communities and/or threatened plants
- riparian and aquatic habitats associated with the Cooks River crossing
- potential impacts to street trees, particularly at stations and construction compounds.

The environmental impact statement will consider if the project is likely to have a significant impact on any matters of national environmental significance and if a referral to the Australian Government Minister for the Environment and Energy is required.

Proposed investigations and assessment for the environmental impact statement

A biodiversity impact assessment will be undertaken as part of the environmental impact statement. The assessment will involve the following:

- An assessment of the potential impacts on threatened biota listed under the TSC Act, appropriate safeguards to avoid or mitigate impacts, and biodiversity offset requirements, in accordance with the *Framework for Biodiversity Assessment* (Office of Environment and Heritage, 2014a) and the *NSW biodiversity offsets policy for major projects* (Office of Environment and Heritage, 2014b).
- An assessment of the potential impacts on aquatic habitats and threatened aquatic fauna, with consideration of the policy and guidelines for fish habitat conservation and management (Department of Primary Industries, 2013) and section 5A of the EP&A Act as applicable.
- An assessment of the likely significance of impacts on any relevant matters of national environmental significance with reference to the EPBC Act significant impact guidelines (Department of the Environment, 2016a).

8.1.9 Social impacts and community infrastructure

Existing environment

The project is located within the suburbs of Bankstown, Punchbowl, Wiley Park, Lakemba, Belmore, Campsie, Canterbury, Hurlstone Park, Dulwich Hill, Marrickville and Sydenham. In 2011, the total population of these suburbs was 139,036 persons.

Residents in these suburbs have a higher reliance on trains for travel to work, compared to other suburbs in Sydney, as highlighted by journey to work data (Australian Bureau of Statistics, 2011). In 2011, about 17 per cent of residents travelled to work by train, compared to 4 per cent who travelled to work by bus, and 39 per cent by car (includes all modes of travel to work including where more than one mode was used). This is compared to Greater Sydney, with 12 per cent travelling to work by train, six per cent by bus, and 54 per cent by car.

The areas surrounding the stations and adjacent to the rail line include social infrastructure such as schools, child care centres, parks, sports grounds, aquatic centres, medical centres, community centres and spaces, recreational facilities, emergency services, shopping areas and cultural facilities (e.g. places of worships).

Potential construction impacts

Potential social impacts that could occur during construction include:

- Temporary impacts on community values and lifestyle for local residents, workers and visitors due to temporary changes to travel patterns and interruptions to transport services. Groups who may be particularly vulnerable to these impacts include people with limited English language skills, older people, children (including school children), and people with a disability.
- Amenity impacts on adjacent residents, businesses and social infrastructure. These impacts may include noise, vibration, air quality and visual changes resulting from construction activities. Some residents may be more vulnerable to these impacts, and some community facilities may be more sensitive (e.g. child care centres).
- Temporary access restrictions or changes resulting from construction sites and activities. This may impact how people access social infrastructure, and how they travel and behave in the areas surrounding the rail line. This may also be a particular concern for emergency services as an example.
- Cumulative social issues resulting from the potential for overlap with construction associated with urban renewal around train stations.

Potential operational impacts

Potential social impacts that could occur during operation would relate to amenity impacts on adjacent residents, businesses and social infrastructure. These impacts may include long-term changes to noise levels, vibration, and visual aspects, with some residents and community facilities potentially more sensitive to these impacts.

While there would be some potential impacts during operation, the project would result in a number of long term benefits and positive social and health outcomes. These beneficial outcomes would be a result of improved public transport infrastructure, and may lead to the following benefits:

- reduced reliance on travel by motor vehicles
- increased incidental exercise for people who walk and cycle to train stations
- improved local air quality resulting from less motor vehicle movements
- decreased risk of road safety incidents occurring due to less trips made by motor vehicles
- improved accessibility around and within train stations, particularly for people with reduced mobility such as people with a disability, older people and parents with prams
- improved visual amenity around and within train stations resulting from urban design and public domain improvements
- improved accessibility resulting from increased public transport use.

Proposed investigations and assessment for the environmental impact statement

An assessment of potential social impacts of the construction and operation of the project will be undertaken as part of the environmental impact statement, and will include:

- identification of the social area of influence (social study area)
- understanding the existing social environment of the project area, including social infrastructure facilities
- identification of key stakeholders and early consultation with relevant groups

- identification and assessment of potential social benefits and impacts
- development of a set of impact management strategies to avoid, minimise and manage the social impacts and enhance social benefits arising from the project.

8.1.10 Cumulative impacts

Overview of cumulative impacts

Cumulative impacts that may occur during the construction and operation of the project can generally be categorised as either:

- Type 1: Different impacts upon the same receiver – these may arise as the result of an accumulation of impacts of a different nature at the same location. For example, the combined effect of construction noise and visual impacts may give rise to an overall significant impact on business viability, whereas individually these impacts may not be as significant.
- Type 2: Cumulative impacts generated by the project – these may arise as a result of the accumulation of impacts of the same type at a number of different locations. For example, a small number of truck movements generated at different construction sites associated with the project may collectively give rise to an overall significant impact.
- Type 3: Cumulative impacts with other projects – these may arise as a result of the combination of similar impacts from multiple projects. For example, the noise-related impacts of the project may be magnified by their association with other major noise-emitting projects nearby.

The extent to which another development or activity could interact with the construction and/or operation of the project would depend on its scale, location and/or timing of construction. Generally, the largest cumulative impacts would be expected to occur in situations where multiple long-duration construction activities are undertaken close to, and over a similar timescale of, construction activities for the project.

Other known developments

Publicly announced projects that have the potential to result in cumulative impacts with the project include:

- Sydney Metro City & South West – Chatswood to Sydenham
- WestConnex – King Georges Road Interchange Upgrade
- WestConnex – New M5 (Stage 2)
- WestConnex – M4-M5 Link (Stage 3)
- Marrickville Metro shopping centre redevelopment
- Former Sunbeam Factory mixed use residential redevelopment at Campsie
- Sydenham to Bankstown Urban Renewal Corridor strategy.

Potential construction impacts

Potential cumulative impacts that could arise in situations where the construction of the project occurs concurrently with other known developments include:

- Construction traffic – cumulative impacts may occur where multiple construction projects use the same construction traffic routes at the same time. Cumulative impacts could include traffic congestion (particularly if truck movements occur during peak hour and if

truck queuing occurs), and amenity impacts (such as noise, visual and air quality) on sensitive receivers near these construction traffic routes.

- Loss of on-street parking and/or other kerbside uses (such as loading zones) – construction of the project has the potential to affect the supply of some on-street parking and other kerbside uses (such as loading zones). Parking availability could be further affected by other projects, where these could affect the location and/or number of parking spaces.
- Disruptions to the reliability of public transport – station closures and the use rail replacement buses could result in longer commuter travel times.
- Construction noise, vibration and visual amenity – there is potential for impacts from the project to be exacerbated by other nearby construction sites operating either simultaneously with the project or very shortly before or after the project. Cumulative impacts could include construction fatigue due to longer periods of construction noise on a daily basis and an overall basis, increased overall noise levels, night works that persist for longer at night or persist for more consecutive nights, and increased extent and/or duration of visual amenity impacts.
- Loss of public open space – the availability of public open space could be temporarily reduced due to the establishment of multiple construction compounds and/or work sites. The community's enjoyment of nearby public open spaces (that are not directly affected by construction) could be affected by increased construction noise and visual amenity impacts.
- Business impacts – businesses could be affected by various cumulative impacts, such as the loss of on-street parking for customers, disruptions to loading zones and deliveries, and/or the loss of and disruption to ground-floor retail spaces.

Potential operational impacts

Potential cumulative impacts that could arise due to the concurrent operation of the project and other known developments include:

- Non-Aboriginal heritage impacts – project infrastructure (such as station buildings) in the vicinity of other surrounding developments could impact on the setting or heritage significance of heritage listed items and/or heritage conservation areas. This impact could particularly occur where a large number of State and locally listed heritage items are situated close to the project and other known developments.

Proposed investigations and assessment for the environmental impact statement

Details of known surrounding developments with the potential to interact with the construction and/or operation of the project will be identified through consultation with stakeholders and a review of relevant local environmental plans, Department of Planning and Environment's major projects database, and local council development application registers. Potential cumulative impacts arising from the interaction of these projects will be identified and assessed in a qualitative manner. Management and mitigation measures will be proposed if required.

8.2 Other environmental issues

8.2.1 Aboriginal heritage

Existing environment

Historical background

Evidence of Aboriginal occupation within NSW dates back around 50,000 to 60,000 years at Lake Mungo (in NSW's southwestern region, about 110 kilometres northeast of Mildura) and up to 30,000 years at Parramatta. Aboriginal people lived in small family or clan groups that were associated with particular territories or places.

The language group spoken across Sydney was known as Darug. The Darug language group is thought to have covered the area south from Port Jackson, north from Botany Bay, and west from Parramatta (Attenbrow, 2010).

Previously registered Aboriginal heritage sites

An extensive search of the NSW Office of Environment and Heritage's Aboriginal Heritage Information System (AHIMS) database was carried out in April 2016. An area of approximately 14.5 kilometres (east-west) by 2.2 kilometres (north-south) was included in the search. The search did not identify any recorded Aboriginal sites along the rail corridor between Sydenham and Bankstown stations.

A total of seven sites were identified in the broader search area outside of the rail corridor. The closest registered site to the project area is Fraser Park potential archaeological deposit (PAD). The listed coordinates on the AHIMS site register place this site about 280 metres west of Sydenham Station in a heavily developed commercial area off Sydney Street, Marrickville. However, as the name of the site is 'Fraser Park', the location of the PAD could be intended to be Fraser Park, immediately north of the rail corridor near Sydenham and south of the Botany goods line. This will be investigated further as part of the environmental impact statement.

The other sites are all located more than one kilometre from the project area within the vicinity of the Cooks River and Wolli Creek. Table 8-7 summarises the results of the extensive search of the AHIMS database.

Table 8-7 Summarised AHIMS extensive search results

Site ID	Site name	Site type	Distance from project area	Location
45-6-2654	Fraser Park potential archaeological deposit	Potential archaeological deposit	Adjacent (north)	Marrickville
45-6-2198	View Street	Midden	1,300m (south-west)	Wolli Creek
45-6-2358	K1 (same as site 45-6-2198)	Midden	1,300m (southwest)	Wolli Creek
45-6-1496	Shea's Creek	Midden	1,300m (south-west)	Earlwood
45-6-0615	Undercliffe Road	Midden, shelter with art	1,500m (south-west)	Earlwood
45-6-2547	Nanny Goat Hill 1; NGH 1	Open camp site	1,600m (south-west)	Turrella
45-6-2568	Wolli Creek	Shelter with deposit	1,950m (south)	Earlwood

Archaeological potential and significance

A preliminary assessment of the underlying geology of the proposal area indicates the main areas with potential for deep Quaternary period soils and sediments are along the margins of Cooks River and around Sydenham. The remainder of the proposal area is located across Ashfield Shale and Hawkesbury Sandstone, with soils generally consisting of relatively shallow residual soils. There is potential for more complex soil profiles across steeper and low-lying portions of the proposal area associated with underlying Hawkesbury Sandstone.

The area indicated for the stabling facility at Marrickville has previously been identified as an area of archaeological potential. This area has the potential for deep Quaternary soil profiles, subject to impacts from historical period disturbance such as extraction of raw material for brick-making, canal construction and construction of other infrastructure.

Site inspections and an assessment of archaeological potential will be conducted as part of Aboriginal heritage assessment for the environmental impact statement. Due to the modified nature of the existing corridor, it is anticipated that the assessment of archaeological potential will focus on potentially buried areas of archaeological sensitivity in relation to proposed construction impacts. This will include an assessment of recorded Aboriginal site 45-6-2645 (Fraser Park potential archaeological deposit), which is located adjacent to the project area.

Potential construction impacts

Construction of the project is not anticipated to impact on any previously recorded Aboriginal heritage sites. The close proximity of recorded Aboriginal site 45-6-2645 (Fraser Park potential archaeological deposit) will be investigated during preparation of the Aboriginal heritage assessment to determine whether that area of archaeological potential is likely to continue into the project area.

Although the original landform contexts along the existing rail line are likely to have been largely modified, there is potential for Aboriginal sites to be located in any intact natural contexts that may remain within the rail corridor. There is also potential for buried areas of archaeological sensitivity beneath the rail easement. Therefore, construction has the potential to inadvertently impact on unrecorded Aboriginal sites and/or areas of archaeological sensitivity.

Conservation of identified Aboriginal sites and/or areas of archaeological sensitivity is recommended for consideration during design development. Where conservation is not possible, the Aboriginal heritage assessment prepared for the environmental impact statement will include mitigation measures such as:

- comprehensive Aboriginal stakeholder consultation in accordance with the Office of Environment and Heritage *Aboriginal cultural heritage consultation requirements for proponents 2010*
- archaeological test/salvage excavation.

Potential operational impacts

Aboriginal heritage would not be impacted during the operation of the project. Therefore, Aboriginal heritage is not considered to be a key issue during operation.

Proposed investigations and assessment for the environmental impact statement

An Aboriginal heritage assessment will be prepared as part of the environmental impact statement. The Aboriginal heritage assessment for the environmental impact statement will further consider the archaeological potential of the project area. It will also document mitigation measures that would be implemented to minimise the risk of impacting on previously unrecorded items of Aboriginal heritage significance and/or areas of Aboriginal cultural sensitivity during construction.

The following guidelines will be considered during the preparation of the Aboriginal heritage assessment:

- *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (Department of Environment, Climate Change and Water, 2011a)
- *Aboriginal Cultural Heritage Consultation requirements for proponents* (Department of Environment and Climate Change, 2010)
- *NSW Skeletal Remains: Guidelines for Management of Human Remains* (Heritage Office, 1998)
- *Criteria for the assessment of excavation directors* (NSW Heritage Council, 2011).

The Aboriginal heritage assessment will identify the potential for the project to disturb Aboriginal heritage (sites, objects, remains, values, features or places) and, where this is the case, will:

- determine, in consultation with relevant stakeholders, the significance of the heritage resources to the Aboriginal community
- determine the extent and significance of impact to those resources as a result of construction and/or operation of the project
- identify any requirements for in situ conservation of items and/or areas (as appropriate), the need for further archaeological testing and/or detailed archaeological excavations
- identify appropriate measures to avoid, minimise and/or mitigate potential impacts
- determine any requirement for further Aboriginal stakeholder consultation.

8.2.2 Soils, contamination and water quality

Existing environment

Soils

Soils within the project area are identified from the Soil Landscapes of the Sydney 1:100,000 Sheet (Chapman et al, 2009). The project area comprises an interchanging mix of Blacktown, Birrong and Disturbed Terrain soil landscapes. Relevant characteristics of these landscapes are provided in Table 8-8.

Table 8-8 Soil landscapes within the project area

Soil landscape	Limitations
Blacktown (Bt)	• Gently undulating rises on Wianamatta Group shales and Hawkesbury shale • Moderately reactive highly plastic subsoil • Low soil fertility • Poor soil drainage
Birrong (Bg)	• Level to gently undulating alluvial floodplain draining Wianamatta Group shales • Localised flooding • High soil erosion hazard • Saline subsoil • Very low soil fertility • Seasonal waterlogging
Disturbed terrain (xx)	• Level plain to hummocky terrain, extensively disturbed by human activity, including complete disturbance, removal or burial of soil • Dependent on nature of fill material • Mass movement hazard • Unconsolidated low wet-strength materials • Impermeable soil • Poor drainage • Localised very low fertility • Toxic materials

Acid sulfate soils

Acid sulfate soils and potential acid sulfate soils are naturally occurring soils containing iron sulfides which, on exposure to air, oxidise and create sulfuric acid. This increase in acidity can result in the mobilisation of aluminium, iron and manganese from the soils. Acid sulfate soil planning maps have been developed by the NSW Government to better manage works that could disturb acid sulfate soils. The maps establish five classes of land based on the probability of acid sulfate soils occurrence and the type of works that might disturb them. These classes are defined in Table 8-9.

Table 8-9 Acid sulfate soils plan classes

Acid sulfate soils class	Work which would potentially expose acid sulfate soils
Class 1	Any work
Class 2	Work beyond the natural ground surface and work by which the water table is likely to be lowered.
Class 3	Work beyond one metre below the natural ground surface and work by which the water table is likely to be lowered beyond one metre below the natural ground surface.
Class 4	Work beyond two metres below the natural ground surface and work by which the water table is likely to be lowered beyond two metres below the natural ground surface.
Class 5	Work within 500 metres of adjacent Class 1, 2, 3, or 4 land which are likely to lower the water table below 1 metre AHD on adjacent Class 1, 2, 3 or 4 land.

A search of the Australian Soils Resource Information System indicated the project area is located on land classified with an acid sulfate soil class 1, 2, 3, 4 and 5. The majority of the project area comprises class 5 soils and is at a low risk of impacts associated with acid sulfate soils. Areas close to watercourses, namely the Cooks River at Canterbury, have been identified as containing acid sulfate soils class 1, 2 and 4.

Contamination

There are a number of current and former land uses within and adjacent to the project area which may have resulted in contamination. These include rail (including maintenance) and industry. Typical sources of contamination associated with rail corridors include:

- use of fill material of unknown origin in the railway corridor
- presence of asbestos and other hazardous materials associated with historical structures, train brake shoes etc
- fuel and chemical spills associated with train and railway infrastructure maintenance.

A search of the NSW Environment Protection Authority Contaminated Sites Register and Record of Notices (under section 58 of the *Contaminated Land Management Act 1997*) did not identify any sites within 500 metres of the project area.

Water quality

Cooks River

Poor water quality in the Cooks River means that it is considered unfit for contact by humans (Cooks River Alliance, 2014). Sewage overflow, illegal dumping and litter are considered to be the main sources of pollution in the catchment. An ongoing plan of management for the Cooks River is in place. The plan targets, amongst other objectives, the improvement of water quality.

Objectives identified by the NSW Government for the Cooks River in relation to water quality and river flows include aims such as:

- protection of aquatic ecosystems, visual amenity, recreational activities
- maintaining natural flow variability and rates of change in water levels
- maintaining and rehabilitating estuarine processes and habitats.

The plan identifies that flow regimes are already substantially altered and that a return to pristine aquatic ecosystems is unlikely; however, improvements in water quality should still be targeted.

Salt Pan Creek

Past development within the catchment, including industrial areas and other influences such as litter, sewer overflows and a landfill operation, have resulted in historically poor water quality within the creek. Water quality within the creek has since improved as a result of the installation of water quality treatment devices in the catchment, a public education program and other controls. Following the above measures water quality has improved to ‘good’ (Georges River Combined Councils’ Committee Inc. undated).

Water quality and river flow objectives for Salt Pan Creek (as a tributary of the Georges River) would be the same as those for the Cooks River described above. As with the Cooks River, reestablishment of pristine aquatic ecosystems is considered impractical but there is potential for substantial improvement.

Potential construction impacts

Soil erosion

Construction of the project would expose the natural ground surface and sub-surface through the removal of vegetation, overlying structures (such as buildings and footpaths), and excavation of construction footprints for stations, structures and foundations. The exposure of soil to water runoff and wind could increase soil erosion potential, particularly where construction is undertaken in soil landscapes characterised by a high and extreme erosion hazard. There is the potential that exposed soils and other unconsolidated materials (such as spoil, sand and other aggregates) could be transported from the construction sites into surrounding waterways via stormwater runoff.

Given the relatively small areas of surface disturbance anticipated during construction, and the overall topography of those parts of the project (generally slightly undulating), soil erosion would be adequately managed with standard mitigation measures.

Acid sulfate soils

The exposure of acid sulfate soils during excavation could result in the release of acid sulfates, which would damage surrounding vegetation and drainage lines. Given the risk of encountering acid sulfate soils during construction at the Cooks River at Canterbury, mitigation measures will be developed as part of the environmental impact statement to identify, contain and monitor acid sulfate soils (if encountered) throughout construction. Potential risks associated with encountering acid sulfate soils will be further considered as part of the environmental impact statement.

Contamination

There is the potential for contamination to be encountered at a number of locations throughout the project area. Contaminants that could be encountered during excavation and other ground disturbing activities include contamination associated with:

- leaks and spills from fuel storage infrastructure (hydrocarbons and heavy metals)
- processing of heavy end hydrocarbons, heavy metals and metalloids
- land reclamation and other uncontrolled fill material (metals, hydrocarbons, pesticides, polychlorinated biphenyl and asbestos)
- former and current industrial land uses (hydrocarbons, heavy metals and metalloids, solvents, phenolics, pesticides, heavy metals and metalloids and asbestos in soil)
- existing railways and associated activities (metals, hydrocarbons, pesticides, nutrients, phenols, carbamates, pesticides, herbicides and asbestos in soils)
- railway buildings to be upgraded and other structures which would be acquired and demolished for the project.

The exposure of any contaminated materials during construction may increase the potential for contaminant mobilisation and may create additional exposure pathways to sensitive receptors including workers, the general public, surface water bodies, groundwater bodies and terrestrial ecosystems. Potential risks associated with encountering contaminated soils and groundwater will be considered as part of the environmental impact statement.

Construction also has the potential to result in contamination of soils and/or groundwater due to spills and leaks of fuel, oils and other hazardous materials. These impacts are anticipated to be readily manageable through standard mitigation measures.

Water quality

Construction has the potential to impact water quality in nearby watercourses and receiving catchments through the pollution of stormwater runoff with sediments, fuel and other hazardous materials from construction sites. These impacts would be adequately managed with standard mitigation measures. These measures would be consistent with the principles and practices detailed in *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004). Given that potential impacts could be readily manageable through standard mitigation measures, surface water quality is not considered to be a key issue for the project.

Potential operational impacts

Soils

The project is not expected to have operational impacts relating to soils.

Contamination

Operation of the project has the potential to result in contamination of soils and/or groundwater due to spills and leaks of fuel, oils and other hazardous materials from trains, maintenance vehicles and other project infrastructure. These impacts would be managed through standard mitigation measures.

Water quality

Operation of the project is not anticipated to result in substantial impacts to surface water quality. All surface water runoff from the project would be similar to the existing situation, with all water to be collected in the existing, or to be reworked, track drainage.

Runoff from above ground project elements (such as station buildings) has the potential to be contaminated with sediments, fuel/oils (for example, from maintenance vehicles) and/or other pollutants (such as litter), which could enter the surrounding stormwater system.

Such water quality risks would be relatively minor and could be adequately managed with standard mitigation measures.

Proposed investigations and assessment for the environmental impact statement

A soils and water quality assessment will be undertaken as part of the environmental impact statement and will include:

- review of further detailed information to inform the assessment of impact:
  - existing and proposed water quality data and water quality treatment measures
  - existing and post developed flooding
  - existing cross drainage location and capacity data
  - *Acid Sulfate Soils Assessment Guidelines* (Department of Planning, 2008)
- calculation of proposed change in land use and impacts on pervious/impervious areas to inform likely water quality and quantity outcomes
- an assumption of use of standard methods for sediment management during construction in accordance with Managing Urban Stormwater – Soils and Construction (referred to as the Blue Book) (Landcom, 2004)
- identification of feasible surface water quantity measures that will attenuate post development flows
- review of the adequacy of any proposed detention basin sizing or other treatment measures in mitigating impacts

- identification of surface water pollutant retention to satisfy NSW Environment Protection Authority or other industry standards as far as reasonably practical and within the limitations of available water quality data
- identify the potential to disturb acid sulfate soils and the associated impacts
- consider the potential impacts associated with erosion and sedimentation
- assessment of acid sulfate soil impacts based on proposed changes in water level and likely environmental effects.

A high level, desktop contamination assessment will be undertaken for the project, and mitigation measures will be proposed, where appropriate. The following government guidelines will be considered as relevant during the preparation of the contamination assessment:

- *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)
- *Guidelines for Consultants Reporting on Contaminated Sites* (Office of Environment and Heritage, 2000)
- *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (Department of Environment and Climate Change, 2009).

The contamination assessment will include:

- a review of previous contamination assessments (where available) or assessments undertaken as part of the design development
- a review of historical aerial photography of the project area (to identify potential contamination sources along and/or adjacent to the project)
- a review of publicly available data (web-based information searches)
- recommendations for additional investigations and/or management of potentially contaminated sites which could be encountered during construction.

8.2.3 Groundwater and geology

Existing environment

Topography

From Sydenham to Canterbury, the ground surface is generally flat at about 15 metres Australian height datum, then undulates gently from 25 to 50 metres Australian height datum from Campsie to Bankstown. A series of cuts and embankments were built for the current T3 Bankstown Line over the undulating sections of the corridor.

Geology

The project area lies within the Sydney Basin, which is a large structural and topographic basin. During the Permian and Triassic Periods (298 to 200 million years ago), the Sydney Basin was infilled with a thick sequence of sediments deposited in both fluvial and marine conditions. These sediments now form a range of sedimentary rocks, from claystones to sandstones, often interbedded or interlaminated.

The *Sydney 1:100,000 Geological Series Sheet 9130* (NSW Department of Mineral Resources, 1983) indicates that the stratigraphy encountered along the Sydenham to Bankstown rail corridor comprises:

- man-made fill (e.g. embankments)
- Quaternary sediments (e.g. alluvium, estuarine deposits)
- Wianamatta Group:
  - Bringelly Shale: siltstone and claystone interbedded with fine sandstone
  - Minchinbury Sandstone: fine to medium sandstone
  - Ashfield Shale: sequence of massive siltstone and interlaminated mudstone and fine to medium sandstone (laminites)
- Mittagong Formation: interbedded fine to medium sandstone and shale, often disturbed
- Hawkesbury Sandstone: medium to coarse quartzic sandstone, either massive, cross bedded or with occasional shale interbeds
- dykes (volcanic intrusions).

Due to a regional dip towards the west, the surface geology progressively tends towards more recent units as the corridor heads westwards.

The geology expected along the T3 Bankstown Line is:

- Ashfield Shale from Sydenham to Marrickville
- Mittagong Formation and Hawkesbury Sandstone from Marrickville to Canterbury
- Ashfield Shale from Canterbury to Punchbowl
- Bringelly Shale from Punchbowl to Bankstown.

There are also localised occurrences of:

- Minchinbury Sandstone close to Wiley Park
- Quaternary deposits in Sydenham and the Cooks River crossing, where valleys were backfilled with alluvium and estuarine deposits
- dykes: close to Hurlstone Park and Belmore.

Faults are mapped as intersecting the rail corridor at Bankstown, and inferred to cross the corridor at Hurlstone Park and Marrickville. These can be associated with subvertical joint swarms, low angle thrusts and a deep weathering profile.

Limited geotechnical data is currently available along the corridor. Based on a desktop review and past investigations of the cuttings, the cuttings typically occur in residual soils or weathered rock. The shales will typically have a thick weathering profile which consists of medium to high plasticity clays. The sandstone usually has a thinner (a few meters thick) weathering profile, which consists of medium to high plasticity clays, silty sands and ironstone gravels.

Groundwater

Aquifer systems

The groundwater system is expected to consist of a deep groundwater system (where groundwater flows through joints and other discontinuities in the underlying rock) and a more localised surface, or 'perched', groundwater system (where groundwater flows through overlying alluvium, residual soils and fill). The residual soil above the Bringelly and Ashfield Shale can act as an aquitard.

Groundwater has been observed to flow from open cuttings along the T3 Bankstown Line. The surface groundwater system is likely to be recharged by rainfall and percolation from irrigation of residential gardens and open spaces, as well as incidental runoff from impervious surfaces such as roads and footpaths.

Groundwater levels

Groundwater levels in the surface groundwater system are expected to range between two and five metres below ground level.

Groundwater flows

A review of the NSW Office of Water's database indicates that typical groundwater flows through the Mittagong Formation and Hawkesbury Sandstone are about 0.2 to 0.3 litres per second, while flows through the Ashfield Shale are likely to be less than 0.01 litres per second. This indicates that groundwater flows within the project area are relatively low.

Potential construction impacts

Potential groundwater and geology issues during construction are relatively minor as result of limited excavation work being required for the project. Excavation works required would be relatively shallow with the following work requiring excavations:

- bridge and culvert works
- embankments and cuttings including retaining walls
- station upgrades
- any utility works including service routes.

Piling works required for the project have the potential to impact on groundwater as levels are relatively high, at two to five metres below ground level. There is potential for cutting works to intersect dykes or faults, this would potentially require specialist management from both a structural stabilisation and groundwater viewpoint. Potential impacts can be effectively managed by the implementation of standard mitigation measures and engineering controls, such as retaining walls, foundation treatment and construction management measures.

Potential operational impacts

As the project involves continuing use of the existing rail corridor for rail related activities, the operation of the project is not expected to impact on geology or groundwater along the corridor.

Proposed investigations and assessment for the environmental impact statement

A geotechnical assessment will be prepared as part of the environmental impact statement. It will involve

- a desktop review of all available data within the project area
- review of any geotechnical information obtained as part of the ongoing design development
- a site visit of selected locations within the project area to confirm the results of the desktop assessment.

Any additional requirements in regards to geology or groundwater would also be identified as part of the environmental impact statement.

8.2.4 Air quality

Existing environment

Air quality within the project area is typical of an urban area that consists of primarily residential land uses. The industrial area near Sydenham mainly consists of warehousing and does not contribute significantly to local air quality.

Local air quality is primarily impacted upon by vehicles on the local road network, in particular vehicles on major roads such as Stacey Street/Fairford Road at Bankstown, King Georges Road at Wiley Park, Canterbury Road at Canterbury, and Princes Highway at Sydenham (south-west of the station). Air quality within the project area is also impacted by the operation of diesel freight trains along the rail corridor between Sydenham and west of Campsie.

A search of the Australian Department of the Environment and Energy's National Pollutant inventory (2016) identified that there is only one air pollution source located in close proximity to the project, this being the Sydney Trains Maintenance Centre at Sydenham. All other sources identified are located away from the rail corridor to the north and south.

The NSW Office of Environment and Heritage operates a number of air quality monitoring stations within the Sydney Basin. Air quality at these monitoring stations is considered indicative of the overall Sydney Basin. Data sourced from monitoring stations at Chullora and Earlwood (the closest stations to the project) show that concentrations of air pollutants meet the applicable air quality criteria during 2015/16.

Potential construction impacts

Dust generation

The majority of air quality impacts would be associated with the generation of dust as a result of the following construction activities:

- excavation, handling, stockpiling, loading/unloading and transport of spoil
- demolition of buildings and other structures, and the handling, stockpiling and transport of demolition material
- transport, loading/unloading, stockpiling and handling of imported construction materials such as imported fill
- creation of exposed surfaces through the clearing of vegetation, stripping of topsoil and other overlying structures (such as road and footpath pavements), which would increase the potential for dust emissions to be generated by wind erosion
- movement of construction plant, vehicles and equipment along unsealed haulage routes and surfaces.

The above construction activities also have the potential to result in the production of airborne contaminates due to the disturbance of contaminated material or demolition of structures containing asbestos and other potentially hazardous materials.

Without appropriate management of dust generation, the above activities could result in a reduction in local air quality and the deposition of dust on nearby sensitive receivers. The impacts resulting from the generation of dust for the project are similar to those experienced on other large infrastructure projects. These impacts can be readily managed through the implementation of standard mitigation measures.

Gaseous emissions

Gaseous emissions would generally be restricted to minor localised emissions of carbon monoxide, oxides of nitrogen, sulfur dioxide and volatile organic compounds. These pollutants would be generated during the combustion of fuel in construction plant, machinery and equipment, as well as from the handling and/or onsite storage of fuel and other chemicals.

Gaseous emissions during construction would be relatively minor and would be adequately managed with standard mitigation measures.

Potential operational impacts

No significant air quality impacts are expected during operation. Only electric trains would operate on the new metro tracks, with diesel freight services to continue on the section of the line between Marrickville and west of Campsie.

Although there may be localised air quality impacts at the source of power generation, the overall impact from increased power generation to run the trains is expected to be minor.

The project is also expected to result in benefits for local air quality, as the operation of Sydney Metro overall would potentially result in a modal shift from road to rail. A reduction in car use would improve air quality due to a reduction in gaseous emissions.

Proposed investigations and assessment for the environmental impact statement

The environmental impact statement will include an air quality chapter which will assess the impacts on air quality. This assessment will:

- identify and describe the background air quality environment based on a desktop assessment
- identify potential sources of air emissions during both construction and operation of the project
- identify potential sensitive receivers likely to be impacted by emissions to air from the project
- identify and describe mitigation measures using the principles of avoid, minimise, mitigate.

8.2.5 Greenhouse gas and energy

Potential construction impacts

Construction would result in the generation of greenhouse gas emissions. The volume of greenhouse gas emissions generated would depend on the type and quantity of construction materials used, construction methodologies and equipment used, and the overall design (for example, station and platform design). Activities that are anticipated to result in the largest quantities of greenhouse gas emissions include:

- combustion of fuel in construction plant, equipment and vehicles
- disposal of construction waste (indirect emissions would be generated by the decomposition of the waste material at waste handling facilities)
- use of construction materials with a high embodied energy - for example, construction materials (such as steel and concrete) require a considerable amount of energy to manufacture and transport.

It will not be possible to completely avoid the generation of greenhouse gas emissions during construction. However, opportunities to reduce the volume of greenhouse gas emissions will be identified in the environmental impact statement and could include:

- minimising the quantity of fuel and electricity used by construction plant and equipment through the use of biofuels, electricity derived from renewable sources, and energy-efficient work practices (such as using fuel-efficient equipment and avoiding unnecessary idling of construction plant and equipment)
- minimising the quantity of fuel used in the transport of construction materials and spoil through sourcing materials from local suppliers and disposing of spoil at nearby waste handling facilities
- minimising the embodied energy of materials used by substituting materials with high embodied energy for a suitable material with a lower embodied energy (for example, using recycled concrete to reduce the volume of 'new' concrete required)
- minimising onsite electricity consumption by using electricity derived from renewable sources
- offsetting a proportion of the project's electricity needs through the generation or purchase of 'green power' or carbon offsets.

Overall, the emission of greenhouse gas during construction is not considered to be a key issue.

Potential operational impacts

Greenhouse gas emissions during operations would be associated with the consumption of electricity to power the metro trains, signalling, lighting, closed-circuit television and communications systems, station facilities (including lighting and lifts), and other rail infrastructure and systems.

There would also be emissions from the disposal of waste and use of materials during rail maintenance activities (such as fuel, concrete and replacement of steel rails and structures).

Overall, the operation of Sydney Metro overall would potentially result in a mode shift from road to rail for some customers. This has the potential to reduce greenhouse gas emissions associated with road transport compared to the emissions that would otherwise occur if the project were not delivered.

Opportunities to reduce the project's demand on electricity (and, therefore, greenhouse gas emissions) and to offset greenhouse gas emissions associated with operational electricity use would be identified in the project's sustainability strategy.

Because greenhouse gas emissions during operation of the project would be manageable through design and standard mitigation measures, they are not considered to be a key issue.

Proposed investigations and assessment for the environmental impact statement

A greenhouse gas and energy assessment will be included in the environmental impact statement.

The following government guidelines will be considered during preparation of the greenhouse gas and energy assessment:

- *NSW Sustainable Design Guidelines* (Version 3.0) (Transport for NSW, 2013b)
- *Carbon Estimate and Reporting Tool* (Transport for NSW, 2015b).

The environmental impact statement will:

- identify the potential greenhouse gas emissions from the project during construction and operation
- identify mitigation measures to reduce potential emissions of greenhouse gas.

8.2.6 Climate change and adaption

Potential construction impacts

Climate change risks during construction would primarily be associated with the occurrence of severe weather events, such as the increased frequency and severity of rainfall events placing increased pressure on erosion and sediment control measures and/or resulting in the flooding of work sites.

These risks are anticipated to be adequately managed with standard mitigation measures, such as increasing the capacity of erosion and sediment controls, and minimising construction impacts on the capacity of existing stormwater drainage systems. Therefore, climate change is not considered to be a key issue during construction.

Potential operational impacts

Climate change risks during operation of the project are anticipated to include:

- Increased maximum temperatures and the frequency of heatwaves, which may affect the integrity of project infrastructure (this could include sagging of overhead wires, overheating of trains, warping of tracks etc) and affect customer and staff comfort.
- Increased frequency and severity of extreme rainfall events, which may exceed the design capacity of the drainage system and lead to flooding of project infrastructure or areas surrounding the project.
- Changes in seasonality and the amount of precipitation, which may affect project infrastructure (due to changes in soil moisture content and groundwater flows), project landscaping (such as the viability of plantings at stations), and limit opportunities to capture, treat and reuse stormwater as an alternative water source for various components of the project (such as station toilets).

Possible measures to address the effects of climate change on the project have been considered during the design development. A climate change risk assessment has been undertaken and mitigation measures are being considered, including designing project infrastructure to be resilient to the predicted changes in extreme weather events, based on the latest industry standards.

Proposed investigations and assessment for the environmental impact statement

The environmental impact statement will include a climate change adaptation assessment. The following government guidelines will be considered as relevant during the preparation of the climate change adaptation assessment:

- *State of the Climate 2014* (Bureau of Meteorology and CSIRO, 2014)
- *Climate change in Australia – Projects for Australia's NRM Regions, East Coast Cluster Report* (Bureau of Meteorology and CSIRO, 2015)
- *Metropolitan Sydney Climate change snapshot* (Office of Environment & Heritage, 2015)
- *TfNSW Climate Risk Assessment Guidelines* (Transport for NSW, 2016)

- *State of the Climate Reports and Summary Information* (National Centers for Environmental Information – National Oceanic and Atmospheric Administration)
- *Commonwealth Scientific and Industrial Research Organisation's Climate Change in Australia Technical Report 2007* (this is based on the Intergovernmental Panel on Climate Change's Fourth Assessment Report, 2007)
- *ISO 31000-2009; Risk Management – Principles and Guidelines*
- *AS 5334 – Climate Change Adaptation for Settlements and Infrastructure* (Australian Standard AS 5334:2013, 2013)
- *Climate Change Impacts and Risk Management – A Guide for Business and Government (*Australian Greenhouse Office, 2006)
- *Floodplain Risk Management Guideline: Practical consideration of Climate Change* (Department of Environment and Climate Change, 2007)
- *Floodplain Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments* (Department of Environment, Climate Change and Water, 2010)
- *Flood Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments* (Department of Environment, Climate Change and Water, 2011b)
- *Guidelines for Climate Change Adaptation* (Infrastructure Sustainability Council of Australia, 2013).

The climate change adaptation assessment will:

- identify possible climate related impacts with an emphasis on any that are projected to undergo a substantial change
- identify project components that may be vulnerable to the climate change impacts such as increased or more intense rainfall
- identify possible current and future controls that may increase the resilience of particular project components to climate impacts
- recommend what should be considered, and how to establish if further information is needed, to adequately assess climate change risk.

8.2.7 Hazard and risks

Potential construction impacts

The following hazards have the potential to occur during construction:

- The onsite storage, use and transport of chemicals, fuels and materials - to manage this risk, all hazardous substances that may be required for construction would be stored and managed in accordance with the *Work Health and Safety Act 2011* and the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005).
- The rupture of, or interference with, underground services - to manage this risk, dial before you dig searches would be undertaken, and non-destructive digging would be used to identify the presence of services at the start of construction.

Because construction hazards and risks would be adequately managed with standard mitigation measures, they are not considered to be a key issue.

Potential operational impacts

The main hazard likely to be encountered during operation of the project is the storage, use and transport of chemicals, fuels and materials. To manage this risk, all hazardous substances that may be required during operation would be stored and managed in accordance with the *Work Health and Safety Act 2011* and the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005).

Because operational hazards and risks would be adequately managed with standard mitigation measures, they are not considered to be a key issue.

The project would involve the construction of new traction substations which have the potential to introduce risks associated with electric and magnetic fields. The traction substations would be located within the rail corridor away from public areas. Design of the traction substations would comply with the requirements of the *Draft Radiation Standard – Exposure Limits for Magnetic Fields* (Australian Radiation Protection and Nuclear Safety Agency, 2006).

Proposed investigations and assessment for the environmental impact statement

A high level, desktop hazard and risk assessment will be undertaken for the project and mitigation measures will be proposed, where appropriate. The following guidelines will be considered as relevant during the preparation of the hazard and risk assessment:

- Hazardous and Offensive Development Application Guidelines: Applying SEPP 33 (Department of Planning, 2011)
- International Standard (ISO/IEC 31010) Risk Management – Risk Assessment Technique
- Australian Code for the Transport of Dangerous Goods by Road and Rail (7th edition) (National Transport Commission, 2007)
- *Code of Practice for the Safe Removal of Asbestos 2nd edition* (National Occupational Health and Safety Commission, 2005)
- *Storage and Handling of Dangerous Goods Code of Practice* (NSW WorkCover, 2005).

8.2.8 Waste and resource use

Potential construction impacts

Waste

A variety of solid and liquid wastes would be generated during construction. The main construction activities anticipated to generate waste are outlined in Table 8-10 along with the likely waste materials produced.

Table 8-10 Indicative types of waste generation during the construction of the project

Waste-generating activity	Waste materials produced
Station excavations, cuttings and general earthworks	Spoil comprising virgin excavated natural material; potential contaminated materials and potential acid sulfate soils
Pre-cast concrete manufacture	Concrete slurry, concrete waste, timber formwork
Demolition of buildings and other structures	Concrete, bricks, tiles, timber (treated and untreated), metals, plasterboard, carpets, electrical and plumbing fittings and furnishings (such as doors and windows), hazardous waste (including asbestos)

Waste-generating activity	Waste materials produced
Dust suppression, wash down of plant and equipment, and staff amenities at construction compounds (such as toilets)	Sediment-laden and/or potentially contaminated wastewater, sewage and grey water, including groundwater inflows to station excavations
Station fit-out and general construction activities and resource use	Concrete waste, timber formwork, scrap metal, steel, concrete, plasterboards, cable and packaging materials
Maintenance of construction plant, vehicles and equipment	Adhesives, lubricants, waste fuels and oils, engine coolant, batteries, hoses and tyres
Activities at offices and crib rooms	Putrescibles, paper, cardboard, plastics, glass and printer cartridges
Clearing and grubbing of vegetation, landscaped and/or turfed areas	Green waste

The quantity of construction waste likely to be generated by the project would be considered in the environmental impact statement. The largest volumes of construction waste would be generated during the demolition of buildings and other structures (general construction wastes such as steel and concrete).

The quantity of waste would be comparable to similar infrastructure projects and would be adequately managed with standard mitigation measures. The disposal of this waste is not anticipated to result in substantial environmental impacts and, as such, is not considered to be a key issue.

All wastes would be managed using the waste hierarchy approach of waste avoidance, waste re-use before consideration of waste disposal. All wastes 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 NSW Environment Protection Authority resource recovery exemptions.

Resource use

Resources used during construction would include:

- electricity
- fuel
- lubricating oil
- concrete
- steel
- water
- paving materials
- glass
- timber.

Water resources would be required for activities such as compaction of pavement materials and dust suppression. Water resources could be sourced from within or outside the project area. Higher quality water for some construction activities may be sourced from potable water supplies. The final volume, source and quality requirements for water would be determined during the design development process and reflected in the environmental impact statement.

The quantity of resources required would be considered in the environmental impact statement. Mitigation measures would be developed to reduce the project's demand on resources. While the project would increase demand on local and regional resources, it is unlikely that the project would result in any resource becoming scarce or in short supply. Therefore, resource use is not considered to be a key issue during construction.

Potential operational impacts

Waste

The main types of activities anticipated to generate waste during operation are outlined in Table 8-11 along with the likely waste materials produced.

Table 8-11 Indicative types of waste generated during operation

Waste-generating activity	Waste materials produced
Disposal of general litter in station bins and cleaning activities associated with trains, stations and other infrastructure	General non-recyclable and putrescible waste (such as food waste from station rubbish bins), recyclable wastes such as plastics and aluminium cans, office waste including paper and plastics
Infrastructure maintenance	Cable and conduit off-cuts from maintenance of track electrical infrastructure, solvents, paints, adhesives, cleaning fluids, greases, acids and alkali materials, and spent spill kit absorbent materials used to clean up accidental spills during maintenance, waste water from cleaning of station facilities
Stormwater ingress into stations and/or sections of the track	Sediment-laden and/or potentially contaminated wastewater
Use of station customer facilities (such as toilets)	Sewage and grey water

With the implementation of standard work practices during routine maintenance and repair activities, the overall impact of operational waste streams and volumes would be minimal. The disposal of this waste is not anticipated to result in substantial environmental impacts and, therefore, is not considered to be a key issue.

Resource use

Resources used during the operation of the project would include:

- electricity
- water
- steel (during maintenance of rail infrastructure)
- concrete (during the maintenance of rail infrastructure)
- fuel, lubricating oil and grease
- cleaning chemicals.

Resource use during operation would primarily be associated with electricity to power the metro trains, signalling, lighting, closed-circuit television and communications systems, station facilities (including lifts), and other rail infrastructure and systems.

Opportunities to reduce the project's demand on electricity would be identified in the project's sustainability strategy. Refer to Section 8.2.5 for further detail regarding greenhouse gas and energy.

While the operation of the project would increase demand on local and regional resources (particularly electricity), it is unlikely that the project alone would result in any resource becoming scarce or in short supply. Therefore, resource use is not considered to be a key issue during operation of the project.

Proposed investigations and assessment for the environmental impact statement

A desktop waste and resource assessment will be undertaken as part of the environmental impact statement. The assessment will include:

- A review of the likely waste streams and volumes during construction and operation, including spoil, wastewater and demolition materials.
- A review of the likely resources required during construction and operation, including energy, fuel and steel.
- Development of management strategies to adequately address waste and resource use during construction and operation. Measures would include:
  - Managing construction waste through the waste hierarchy established under the *Waste Avoidance and Recovery Act 2001* (i.e. avoidance of waste, resource recovery, disposal of waste)
  - Establishing targets for the beneficial reuse of spoil, wastewater and other construction wastes in accordance with the project's sustainability strategy
  - Developing procedures for the assessment, handling, stockpiling and disposal of potentially contaminated materials and wastewater, in accordance with the NSW Office of Environment and Heritage's *Waste Classification Guidelines* (Environment Protection Authority, 2014)
  - Identifying opportunities to reduce the project's demand on electricity and other resources.

9. Consultation

This chapter provides an outline of the consultation undertaken on the project to date and the proposed consultation for the project.

9.1 Overview

Stakeholder and community consultation undertaken for Sydney Metro City & Southwest forms an integral part of informing and scoping investigations for the Sydenham to Bankstown environmental impact statement.

In June 2014, the NSW Government announced that Sydney Metro City & Southwest would extend Sydney Metro Northwest (formerly North West Rail Link) under Sydney Harbour, through the Sydney CBD and on to Bankstown along the existing Sydney Trains T3 Bankstown Line.

Engagement with the community and stakeholders began in June 2014 and will continue during preparation of the environmental impact statement.

Key stakeholders for the project include (but are not necessarily limited to):

- state agencies (e.g. Department of Planning and Environment, Roads and Maritime Services, NSW Environmental Protection Authority, NSW Department of Primary Industries Office of Water, and the Office of Environment and Heritage)
- local government (the Inner West and Canterbury-Bankstown councils)
- public utilities, and business and industry groups near the project
- directly impacted communities
- the broader community.

This chapter describes the consultation activities undertaken to date, and activities proposed during preparation of the environmental impact statement.

9.2 Communication objectives

The NSW Government is interested in community and stakeholder feedback on the project.

The Sydney Metro communication objectives include to:

- communicate the rationale for the project and the broader network benefits it will deliver, including how it fits into the NSW Government's plans to increase Sydney's rail capacity
- communicate the Sydney Metro concept and timing
- build community and key stakeholder relationships and maintain goodwill
- provide information about the planning approvals process and encourage community participation

The project team has developed a comprehensive community and stakeholder engagement program to proactively engage with local communities, key stakeholders and government agencies.

9.3 Consultation to date

Transport for NSW began consulting and engaging with key stakeholders prior to the preparation of the environmental impact statement for the Chatswood to Sydenham component of Sydney Metro City & Southwest. This includes:

- early stakeholder consultation following the announcement of Sydney Rapid Transit in June 2014
- project scope consultation and engagement following the June 2015 announcement by the Premier of NSW regarding the name change of the Sydney Rapid Transit project, and that funding had been secured to progress planning on Sydney Metro City & Southwest
- engagement following the project update announcement in November 2015
- industry consultation in June and December 2015 and April and September 2016
- engagement (for the Chatswood to Sydenham component) following the announcement of the Waterloo Station location in February 2016, the Blues Point temporary site in February 2016, the Marrickville dive site pre-cast facility in April 2016, and the display of the Chatswood to Sydenham Environmental Impact Statement from 11 May 2016 to 27 June 2016.

The key engagement activities are described in the following sections.

9.3.1 Early stakeholder consultation

Since the announcement of the project in June 2014, consultation has consisted of briefings with key stakeholders including Government agencies, transport infrastructure stakeholders, local councils, Aboriginal groups and universities. This included the following key stakeholders:

- Department of Planning and Environment
- Roads and Maritime Services
- NSW Trains
- Sydney Trains
- Australian Rail Track Corporation Ltd
- UrbanGrowth NSW
- City of Sydney Council
- Marrickville Council (prior to amalgamation)
- Liverpool Council
- City of Canterbury Council (prior to amalgamation)
- Infrastructure Partnerships Australia
- Sydney Chamber of Commerce
- Tourism and Transport Forum
- Property Council
- Australasian Railway Association
- Metropolitan Local Aboriginal Land Council
- Western Sydney University
- The University of Sydney.

This early consultation was accompanied by information distributed to the wider community through:

- media releases
- information available at the Sydney Metro Northwest community information centres at George Street in Sydney and Castle Hill (formerly North West Rail Link)
- websites for Sydney Metro Northwest and Transport for NSW
- fact sheet – 'More trains, faster services right across Sydney' (June 2014)
- fact sheet – 'Transforming Sydney' (November 2014).

9.3.2 Project scope consultation and exhibition

On 4 June 2015, the Premier of NSW announced a change to the name of the Sydney Rapid Transit project and that funding had been secured to progress planning on Sydney Metro City & Southwest. The announcement also initiated a round of community consultation undertaken to

- collect stakeholder and community feedback on the project
- inform the environmental impact statement for the tunnelling line from Chatswood to Sydenham
- inform the metro conversion of the T3 Bankstown line from Sydenham to Bankstown).

During this period, consultation was completed along the project corridor between Chatswood and Bankstown.

This consultation phase was not a statutory consultation process and was carried out to proactively engage with the community prior to the commencement of the formal environmental impact statement process for both components of Sydney Metro City & Southwest. Engagement activities have continued since then, as discussed in this section.

Public information and engagement

Table 9-1 identifies the activities used to provide up-to-date information to the community and stakeholders.

Table 9-1 Community contact and information points

Activity	Establishment date	Detail
Community Information Line (toll free)	4 June 2015	1800 171 386
Community email address	4 June 2015	sydneymetro@transport.nsw.gov.au
Website	4 June 2015	www.sydneymetro.info This website includes an online forum function to collect feedback on various aspects of the project including station locations along Sydney Metro City & Southwest
Postal address	4 June 2015	Sydney Metro City & Southwest PO Box K659, Haymarket, NSW 1240
Transport for NSW Community Information Centre	4 June 2015	388 George Street, Sydney

Activity	Establishment date	Detail
Sydney Metro Northwest Community Information Centre*	4 June 2011*	Shop 490, Castle Towers Shopping Centre Old Castle Hill Road, Castle Hill
Place Managers	April 2015	Four Place Managers have been employed on the project to cover the following areas: Chatswood to Sydney Harbour Sydney CBD, Central to Marrickville Sydenham to Bankstown Line.

**Note 1: The Transport for NSW community information centre has been operating in Castle Hill for a number of years, providing information on the North West Rail Link, now known as Sydney Metro Northwest. From 4 June 2015, the centre began providing information on Sydney Metro City & Southwest.*

These activities were accompanied by:

- community information sessions (attended by just under 800 people)
- media releases
- advertisements in local newspapers including foreign language newspapers
- booklet – 'Project Overview' (June 2015)
- newsletter – 'Have your say, more choice, more opportunity with metro rail' (June 2015), delivered to 220,000 properties within about one kilometre of the proposed alignment and station locations, and 3,500 newsletters handed out at Sydney Trains stations (Martin Place, St Leonards, Town Hall, Chatswood, North Sydney).

Stakeholder meetings

Key stakeholders were briefed via meetings, presentations and phone calls. The meetings were designed to:

- ensure stakeholders were adequately briefed on the project (including the project area and station locations)
- ensure issues and concerns were understood, captured and addressed in the development of the project
- receive feedback.

Briefings were held with transport action groups, local councils, local members of parliament, tourism groups, property groups, universities and other interest groups.

Community information sessions

Table 9-2 provides a list of the community information sessions held during the project scope consultation and engagement phase (4 June – 17 July 2015). Just under 800 people attended these information sessions.

Table 9-2 Community information sessions during the project scope phase

Date	Time	Location
Saturday 13 June 2015	10 am – 2 pm	Dougherty Community Centre (Auditorium) 7 Victor Street, Chatswood
Wednesday 17 June 2015	4 – 8 pm	North Sydney Harbour View Hotel, 17 Blue Street, North Sydney
Thursday 18 June 2015	4 – 8 pm	Marrickville Metro, 34 Victoria Road, Marrickville
Thursday 18 June 2015	4 – 8 pm	Transport for NSW City Information Centre, Ground floor, 388 George Street, Sydney
Saturday 20 June 2015	9 am – 1 pm	Crows Nest Markets, Ernest Place, Crows Nest
Saturday 20 June 2015	10 am – 2 pm	Redfern Oval Community Room, 51 Redfern Street, Redfern
Tuesday 23 June 2015	4 – 8 pm	Canterbury-Hurlstone Park RSL, 20–26 Canterbury Road, Hurlstone Park
Saturday 27 June 2015	10 am – 2 pm	Bankstown Sports Club, 8 Greenfield Parade, Bankstown

Invitations to attend the community information sessions were included in the 'Have your say, more choice, more opportunity with metro rail' newsletter that was delivered to properties within about one kilometre of the proposed alignment and station locations.

Invitations to attend the community information sessions were also advertised in local and foreign language newspapers, the Sydney Metro City & Southwest Project Overview booklet and via the Sydney Metro City & Southwest website.

Online forum

During the project scope consultation and exhibition phase, the Sydney Metro City & Southwest website included an online forum for public feedback about the proposal. One of the objectives of the forum is to collect feedback from the local community on the planning process and how they would like to see the project delivered and impacts managed. A number of questions were posted on the forum in a staged approach to ensure regular engagement via the project website. The forums covered proposed station locations, station options, and management of construction impacts such as noise and vibration, and traffic.

9.3.3 Industry consultation

Four briefings were held from June 2015 to September 2016. The briefings detailed plans for Sydney Metro City & Southwest, the scope of works and the process for industry to contribute to the project and take part in its delivery. Industry representatives from Australian and international firms were invited to attend the briefings via:

- Sydney Metro City & Southwest website
- advertisements in Australian and international newspapers
- direct invitation.

Table 9-3 lists the industry briefings held, their location and the number of industry representatives that attended.

Table 9-3 Industry consultation

Date	Location	Approximate number of industry representatives who attended	Information provided
16 June 2015	Roslyn Packer Theatre, Walsh Bay	500	Booklet – 'Delivering Sydney Metro, Industry Briefing' – June 2015.
4 December 2015	Civic Pavilion in The Concourse, Chatswood	460	Booklet – 'Sydney Metro, City & Southwest Industry Briefing' – December 2015.
16 April 2016	Civic Pavilion in The Concourse, Chatswood	450	Booklet – 'Sydney Metro, City & Southwest Industry Briefing' – April 2016.
1 September 2016	Sofitel Wentworth, Sydney	470	Booklet – 'Sydney Metro, City & Southwest Industry Briefing' – September 2016.

9.4 Consultation during preparation of the environmental impact statement

The project team will continue to consult with the community and stakeholders during the preparation of the environmental impact statement for this component of Sydney Metro City & Southwest. A number of activities are planned during the preparation of the environmental impact statement to collect feedback from stakeholders and to further inform the investigations being carried out for the project. Key elements of this consultation are outlined below.

9.4.1 Place Managers

Place Managers will continue their role as a vital link in maintaining close and ongoing contact with local communities and stakeholders during preparation of the environmental impact statement. They will seek to understand local issues and bring this feedback to the project team.

9.4.2 Interactive online forums

During the second half of 2015, Transport for NSW sought further feedback from stakeholders via an interactive online forum. One of the objectives of the forum was to collect feedback from the local community on the planning process and how they would like to see the project delivered and impacts managed.

During the project scope engagement period, from 4 June to 17 July 2015, the forum sought feedback on Sydney Metro and particularly the proposed station options around Barangaroo, Waterloo or The University of Sydney, St Leonards or Crows Nest and the Artarmon Industrial Area. There were 8,699 visitors to the forum.

In August 2015, the forum sought feedback on the planning process and how the project should be delivered and impacts managed. There were 2,140 visitors to the forum.

Stakeholders were encouraged to visit the web forum via posts on the Sydney Metro Facebook page and via direct email to the project's email subscription list (at the time there were over 7,000 Facebook followers and 6,000 email recipients).

9.4.3 Community contact and information

The community contact and information tools outlined in Table 9-4 will remain in place for the duration of the environmental impact statement and for the remainder of the planning and approval process.

Table 9-4 Community contact and information points available during the planning and approval process

Activity	Detail
Community Information Line (toll free)	1800 171 386
Community email address	sydneymetro@transport.nsw.gov.au
Website	www.sydneymetro.info
Postal address	Sydney Metro City & Southwest PO Box K659, Haymarket, NSW 1240
Transport for NSW Community Information Centre	388 George Street, Sydney
Sydney Metro Northwest Community Information Centre	Shop 490, Castle Towers Shopping Centre Old Castle Hill Road, Castle Hill
Place Managers	Chatswood to Sydney Harbour, CBD, Marrickville, and Sydenham to Bankstown.

9.4.4 Government agency consultation

As part of the Department of Planning and Environment planning process, a planning focus meeting with government stakeholders will be held to discuss the scope of the environmental impact statement. Transport for NSW's Government agency consultation lead will continue to focus on cross-agency integration and communication. Regular meetings will be held with a variety of government stakeholders to ensure key issues are appropriately addressed.

9.4.5 Major stakeholder consultation

Transport for NSW's stakeholder consultation team will ensure local members of parliament, councils, peak bodies and industry groups are proactively engaged and informed about the project. Regular briefings will be held to keep stakeholders informed and to ensure key issues raised are addressed.

There will also be ongoing consultation with specific groups to inform technical assessments.

9.5 Public exhibition of environmental impact statement

Public exhibition of the environmental impact statement will be for a minimum of 30 days as required by section 115Z of the EP&A Act. Advertisements will be placed in newspapers to advise of the public exhibition and where the environmental impact statement can be viewed, as well as details on proposed community consultation activities and information sessions.

Consultation activities during the public exhibition of the environmental impact statement will be consistent with those undertaken for the project scope exhibition and will include:

- environmental impact statement summary document
- media releases
- information sessions
- community event stalls

- doorknocks
- newsletter letterbox drop
- project website and online forums
- newspaper advertising
- displays at local councils
- stakeholder meetings
- local business engagement
- government stakeholder engagement.

Submissions report

At the completion of the public exhibition period, the Department of Planning and Environment will collate and provide Transport for NSW with a copy of all submissions received. After reviewing the submissions, Transport for NSW will prepare a submissions report that responds to the relevant issues raised. The submissions report will be made publicly available on the Department of Planning and Environment website.

9.6 Consultation during construction

Should the project be approved, the project team would continue to consult with the community and key stakeholders during construction. In general, this consultation would involve:

- ongoing consultation with key stakeholders, local councils and other government agencies
- provision of regular updates to the nearby community including advice regarding upcoming works
- development and implementation of a community complaints and response management system
- Place managers
- regular project update newsletters
- 1800 complaints and enquiries line
- updated information regarding works on the Sydney Metro website.

10. Summary of proposed environmental impact statement scope

This chapter provides a summary of the proposed scope of investigations and assessment to be undertaken as part of the environmental impact statement.

The environmental impact statement scope will focus on undertaking further detailed specialist investigations for the 'key' environmental issues, based on the potential significance of the resulting impacts.

Further investigation of the 'other' environmental issues will also be undertaken. These investigations will be used to confirm the current assumption that the 'other' environmental issues would not result in a significant impact on the environment, and could be appropriately managed through the design and/or application of best practice environmental management and mitigation measures. Should any 'other' environmental issue be identified as being significant during the environmental assessment process, the likely impacts would be assessed and documented in the environmental impact statement.

10.1 Proposed environmental impact statement scope for key issues

Table 10-1 provides a summary of the proposed environmental impact statement assessment scope for 'key' environmental issues. This scope will be refined (if necessary) following receipt of the Secretary of the Department of Planning and Environment's environmental assessment requirements for the project.

Table 10-1 Proposed environmental impact statement scope for key issues

Issue	Proposed environmental impact statement scope
Traffic, transport and access	A temporary transport strategy will be prepared as part of the environmental impact statement to guide the development of a temporary transport plan, which will identify the alternative transport arrangements for customers during rail possessions. A detailed traffic and transport impact assessment will be prepared as part of the environmental impact statement. This assessment will identify and determine the significance of potential impacts and provide mitigation measures where such potential exists. The following documents and government guidelines will be considered: • *Guide to Traffic Management – Part 3 Traffic Studies and Analysis* (Austroads, 2013) • *NSW Bicycle Guidelines* (Roads and Traffic Authority, 2003) • *Guide to Traffic Generating Developments Version 2.2* (Roads and Traffic Authority, 2002). The local and regional traffic network will be considered in the assessment of construction and operational traffic impacts. In particular, this will include: • Identification of haulage routes, site access and egress points. • Assessment of a baseline scope for temporary transport arrangements and a summary of other options (identified in the temporary transport strategy) and any associated road network impacts and/or modifications. • Identification and consideration of potential cumulative impacts caused due to multiple construction sites and/or additional vehicles generated as a function of the implementation of temporary transport arrangements.

Issue	Proposed environmental impact statement scope
	• Daily and peak traffic movements likely to be generated by each component of the project including rail replacement bus services, and the cumulative impacts of this traffic on the local and regional traffic network, including the operation of nearby intersections in the vicinity of the station. • Changes to travel times for public transport services, in particular rail and bus, and for private motorists. • Impacts on the overall efficiency, ease, comfort, reliability and convenience of the public transport system (rail and bus). • Impacts on vehicular, pedestrian, cyclist and public transport access. • Impacts on emergency services. • Impacts on commuter parking. • Arrangements to preserve residential and business accesses. • Opportunities for the integration of rail and bus services during construction and operation, including modal interchange facilities, local bus services, strategic corridors and external network connections, as well as access and mobility considerations for the stations. • Measures to minimise or mitigate identified impacts. Available measures will be considered in accordance with relevant best practice guidelines. Consultation will be undertaken with Roads and Maritime Services, Transport for NSW and relevant local councils as part of the traffic and transport impact assessment.
Noise and vibration	A detailed construction and operational noise and vibration impact assessment will be prepared as part of the environmental impact statement. The following guidelines will be considered: • *Construction Noise and Vibration Strategy* (Transport for NSW, 2016b) • *Interim Construction Noise Guideline* (Department of Environment Climate Change and Water, 2009a) • *NSW Industrial Noise Policy* (Environment Protection Authority, 2000) • *Rail Infrastructure Noise Guideline* (Environment Protection Authority, 2013) • *Assessing Vibration: A technical guideline* (Department of Environment and Conservation, 2006). The noise and vibration impact assessment will consider the following in relation to the construction phase: • nature of construction activities • intensity and duration of noise and vibration impacts • nature, sensitivity and impact on potentially affected receivers • impacts associated with any works proposed to be undertaken outside standard daytime construction hours • other factors that may influence the timing and duration of construction activities (such as traffic management) • feasible and reasonable mitigation and management measures to address identified construction noise impacts. In relation to operational noise and vibration, the assessment will consider: • airborne noise, ground-borne noise and vibration impacts • impacts on sensitive receivers (schools, hospitals, and aged care facilities) and sensitive structures (particularly heritage structures and key utilities/infrastructure) • appropriate mitigation and management measures to address identified operational noise impacts.

Issue	Proposed environmental impact statement scope
Non-Aboriginal heritage	A non-Aboriginal heritage assessment will be prepared as part of the environmental impact statement to the standards of NSW Heritage Council guidelines. The assessment of potential non-Aboriginal heritage impacts will also consider the following guidelines: • *Commonwealth EPBC 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (Commonwealth of Australia, 2013a) • *Commonwealth EPBC 1.2 Significant Impact Guidelines – Actions on, or Impacting upon, Commonwealth Land and Actions by Commonwealth Agencies* (Commonwealth of Australia, 2013b) • *NSW Skeletal Remains: Guidelines for Management of Human Remains* (Heritage Office, 1998) • *Criteria for the Assessment of Excavation Directors* (NSW Heritage Council, 2011). The non-Aboriginal heritage assessment will: • Identify items and areas of heritage significance that would be materially affected by the project during construction and operation including any buildings, works, relics, gardens, landscapes, views, trees or places of heritage significance. • Consider the potential impacts on the values, settings and integrity of heritage areas and items and archaeological resources located near the project, including items both above and below ground and, where such potential exists, the likely significance of those impacts. Impacts to moveable heritage will be assessed where the item has been listed as an element of significance in a current listing, for example original seating within a railway station group. • Outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) in accordance with relevant best practice guidelines.
Hydrology and flooding	A surface water assessment will be undertaken as part of the environmental impact statement and will include: • Review of: - existing and proposed water quality data and water quality treatment measures - existing and post development flooding - existing cross drainage location and capacity data. • Calculation of proposed change in land use and impacts on pervious/impervious areas to inform likely water quality and quantity outcomes. • An assumption that standard measures for sediment management would be implemented during construction in accordance with *Managing Urban Stormwater – Soils and Construction* (referred to as the Blue Book) (Landcom, 2004). • Identification of feasible surface water quantity measures that will attenuate post development flows. • Review of the adequacy of any proposed detention basin sizing or other treatment measures in mitigating impacts. • Identification of surface water pollutant retention to satisfy NSW Environment Protection Authority or other industry standards as far as reasonably practical and within the limitations of available water quality data. • Assessment of acid sulphate soil impacts based on proposed changes in water level and likely environmental effects.

Issue	Proposed environmental impact statement scope
Property and land use	A property and land use assessment will be prepared as part of the environmental impact statement with reference to relevant guidelines including *Environmental Planning and Impact Assessment Practice Note: Socio-economic Assessment* (Roads and Maritime Services, 2013). The assessment will consider the following: • existing land uses • current property ownership • likely future land use based on review of the Sydenham to Bankstown Urban Renewal Corridor Strategy and consultation with local councils and Department of Planning and Environment • direct property and land use impacts • positive and negative indirect impacts on land use and property including potential opportunities for, and benefits of, urban renewal and development at metro stations • potential land use integration issues • mitigation and management measures to minimise the impacts and maximise the benefits of the project on property and land use.
Business impacts	A detailed assessment of the impacts on local businesses will be undertaken as part of the environmental impact statement. The business impact assessment will: • identify businesses that would be directly impacted by the project • identify businesses near the project that may be indirectly impacted by the project • undertake a local business survey to understand the nature of businesses and the local economy • assess the potential impacts on local businesses, and on the local economy • identify measures to avoid or mitigate the potential impacts.
Landscape character and visual amenity	A visual and urban design impact assessment will be undertaken as part of the environmental impact statement. The assessment will: • describe the visual character and unique qualities of the project area • interpret the design to identify the visual character and urban design of the project • consider the heritage and other social values of the site to establish the potential sensitivity of receptors and visual absorption capacity • consider land use changes where they may influence the character of the existing site • consider potential cumulative impacts associated with the construction and operation of other major projects near the project area • identify the visual impacts of the project during daytime and night-time conditions (including lighting), and throughout construction and operation • identify the landscape (urban design) impacts of the project throughout construction and operation • identify measures to avoid, minimise and/or mitigate potential impacts. Photomontages will be included in the environmental impact statement.

Issue	Proposed environmental impact statement scope
Ecology	A biodiversity impact assessment will be prepared as part of the environmental impact statement, involving. • An assessment of the potential impacts of the project on threatened biota listed under the TSC Act, appropriate safeguards to avoid or mitigate impacts and biodiversity offset requirements in accordance with the *Framework for Biodiversity Assessment* (Office of Environment and Heritage, 2014a) and the *NSW biodiversity offsets policy for major projects* (Office of Environment and Heritage, 2014b). • An assessment of the potential impacts on aquatic habitats and threatened aquatic fauna, with consideration of the policy and guidelines for fish habitat conservation and management (Department of Primary Industries, 2013) and section 5A of the EP&A Act as applicable. • An assessment of the likely significance of impacts on any relevant matters of national environmental significance with reference to the EPBC Act significant impact guidelines (Department of the Environment, 2016a).
Social impacts	A social impact assessment will be prepared as part of the environmental impact statement and will include: • identification of the social area of influence (social study area) • understanding the existing social environment of the project area including social infrastructure facilities • identification of key stakeholders and early consultation with relevant groups • identification and assessment of potential social benefits and impacts • development of a set of impact management strategies to avoid, minimise and manage the social impacts and enhance social benefits arising from the project.
Cumulative impacts	Details of known surrounding developments with the potential to interact with the construction and/or operation of the project will be identified through consultation with stakeholders and a review of relevant local environmental plans, Department of Planning and Environment's major projects database and local council development application registers. Potential cumulative impacts arising from the interaction of these projects will be identified and assessed in a qualitative manner. Management and mitigation measures will be proposed, if required.

10.2 Proposed environmental impact statement scope for other environmental issues

Table 10-2 provides a summary of the proposed environmental impact statement assessment scope for 'other' environmental issues. This scope will be refined (if necessary) following receipt of the Secretary of the Department of Planning and Environment's environmental assessment requirements for the project. Should any 'other' environmental issue be identified as being significant during the environmental assessment process, the likely impacts will be adequately assessed and documented in the environmental impact statement.

Table 10-2 Proposed environmental impact statement scope for other issues

Issue	Proposed environmental impact statement scope
Aboriginal heritage	An Aboriginal heritage assessment will be prepared as part of the environmental impact statement. The Aboriginal heritage assessment for the environmental impact statement will further consider the archaeological potential of the project area. It will also document mitigation measures that would be implemented to minimise the risk of impacting on previously unrecorded items of Aboriginal heritage significance and/or areas of Aboriginal cultural sensitivity during construction. The following guidelines will be considered during the preparation of the Aboriginal heritage assessment: • *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (Department of Environment, Climate Change and Water, 2011a) • *Aboriginal Cultural Heritage Consultation requirements for proponents* (Department of Environment and Climate Change, 2010) • *NSW Skeletal Remains: Guidelines for Management of Human Remains* (Heritage Office, 1998) • *Criteria for the assessment of excavation directors* (NSW Heritage Council, 2011). The Aboriginal heritage assessment will identify the potential for the project to disturb Aboriginal heritage (sites, objects, remains, values, features or places) and, where this is the case, will: • determine, in consultation with relevant stakeholders, the significance of the heritage resources to the Aboriginal community • determine the extent and significance of impact to those resources as a result of construction and/or operation of the project • identify any requirements for in situ conservation of items and/or areas (as appropriate), the need for further archaeological testing and/or detailed archaeological excavations • identify appropriate measures to avoid, minimise and/or mitigate potential impacts • determine any requirement for further Aboriginal stakeholder consultation.
Soils, contamination and water quality	A soils and water quality assessment will be undertaken as part of the environmental impact statement and will include: • Review of further detailed information to inform the assessment of impact: - existing and proposed water quality data and water quality treatment measures - existing and post developed flooding - existing cross drainage location and capacity data - *Acid Sulfate Soils Assessment Guidelines* (Department of Planning, 2008). • Calculation of proposed change in land use and impacts on pervious/impervious areas to inform likely water quality and quantity outcomes. • An assumption of use of standard methods for sediment management during construction in accordance with *Managing Urban Stormwater – Soils and Construction* (referred to as the Blue Book) (Landcom, 2004). • Identification of feasible surface water quantity measures that will attenuate post development flows. • Review of the adequacy of any proposed detention basin sizing or other treatment measures in mitigating impacts.

Issue	Proposed environmental impact statement scope
	• Identification of surface water pollutant retention to satisfy NSW Environment Protection Authority or other industry standards as far as reasonably practical and within the limitations of available water quality data. • Identify the potential to disturb acid sulfate soils and the associated impacts. • Consider the potential impacts associated with erosion and sedimentation. • Assessment of acid sulfate soil impacts based on proposed changes in water level and likely environmental effects. A high level, desktop contamination assessment will be undertaken for the project and mitigation measures will be proposed, where appropriate. The following government guidelines will be considered as relevant during the preparation of the contamination assessment: • *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) • *Guidelines for Consultants Reporting on Contaminated Sites* (Office of Environment and Heritage, 2000) • *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (Department of Environment and Climate Change, 2009). The contamination assessment will include: • a review of previous contamination assessments (where available) or assessments undertaken as part of the design development • a review of historical aerial photography of the project area (to identify potential contamination sources along and/or adjacent to the project) • a review of publicly available data (web-based information searches) • recommendations for additional investigations and/or management of potentially contaminated sites which could be encountered during construction.
Groundwater and geology	A geotechnical assessment will be prepared as part of the environmental impact statement. It will involve: • a desktop review of all available data within the project area • review of any geotechnical information obtained as part of the ongoing design development • a site visit of selected locations within the project area to confirm the results of the desktop assessment. • Any additional requirements in regards to geology or groundwater would also be identified as part of the environmental impact statement.
Air quality	The environmental impact statement will include an air quality chapter which will assess the impacts on air quality. This assessment will: • identify and describe the background air quality environment based on a desktop assessment • identify potential sources of air emissions during both construction and operation of the project • identify potential sensitive receivers likely to be impacted by emissions to air from the project • identify and describe mitigation measures using the principles of avoid, minimise, mitigate.

Issue	Proposed environmental impact statement scope
Greenhouse gas and energy	A greenhouse gas and energy assessment will be included in the environmental impact statement. The following government guidelines will be considered as relevant during the preparation of the greenhouse gas and energy assessment: • *NSW Sustainable Design Guidelines* (Version 3.0) (Transport for NSW, 2013b) • *Carbon Estimate and Reporting Tool* (Transport for NSW, 2015b). The environmental impact statement will: • identify the potential greenhouse gas emissions from the project during construction and operation • identify mitigation measures to reduce potential emissions of greenhouse gas.
Climate change and adaptation	The environmental impact statement will include a climate change adaptation assessment. The following government guidelines will be considered as relevant during the preparation of the climate change adaptation assessment: • *State of the Climate 2014* (Bureau of Meteorology and CSIRO, 2014) • *Climate change in Australia – Projects for Australia's NRM Regions, East Coast Cluster Report* (Bureau of Meteorology and CSIRO, 2015) • *Metropolitan Sydney Climate change snapshot* (Office of Environment & Heritage, 2015) • *TfNSW Climate Risk Assessment Guidelines* (Transport for NSW, 2016) • *State of the Climate Reports and Summary Information* (National Centers for Environmental Information – National Oceanic and Atmospheric Administration) • *Commonwealth Scientific and Industrial Research Organisation's Climate Change in Australia Technical Report 2007* (this is based on the Intergovernmental Panel on Climate Change's Fourth Assessment Report, 2007) • *ISO 31000-2009; Risk Management – Principles and Guidelines* • *AS 5334 – Climate Change Adaptation for Settlements and Infrastructure* (Australian Standard AS 5334:2013, 2013) • *Climate Change Impacts and Risk Management – A Guide for Business and Government (*Australian Greenhouse Office, 2006) • *Floodplain Risk Management Guideline: Practical consideration of Climate Change* (Department of Environment and Climate Change, 2007) • *Floodplain Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments* (Department of Environment, Climate Change and Water, 2010) • *Flood Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments* (Department of Environment, Climate Change and Water, 2011b) • *Guidelines for Climate Change Adaptation* (Infrastructure Sustainability Council of Australia, 2013). The climate change adaptation assessment will: • identify possible climate related impacts with an emphasis on any that are projected to undergo a substantial change • identify project components that may be vulnerable to the climate change impacts such as increased or more intense rainfall • identify possible current and future controls that may increase the resilience of particular project components to climate impacts

Issue	Proposed environmental impact statement scope
	• recommend what should be considered, and how to establish if further information is needed, to adequately assess climate change risk.
Hazard and risks	A high level, desktop hazard and risk assessment will be undertaken for the project and mitigation measures will be proposed, where appropriate. The following guidelines will be considered as relevant during the preparation of the hazard and risk assessment: • *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (Department of Planning, 2011) • International Standard (ISO/IEC 31010) Risk Management – Risk Assessment Technique • *Australian Code for the Transport of Dangerous Goods by Road and Rail* (7th edition) (National Transport Commission, 2007) • *Code of Practice for the Safe Removal of Asbestos 2nd edition* (National Occupational Health and Safety Commission, 2005) • *Storage and Handling of Dangerous Goods Code of Practice* (NSW WorkCover, 2005).
Waste and resource use	A desktop waste and resource assessment will be undertaken as part of the environmental impact statement. The assessment will include: • A review of the likely waste streams and volumes during construction and operation, including spoil, wastewater and demolition materials. • A review of the likely resources required during construction and operation, including energy, fuel and steel. • Development of management strategies to adequately address waste and resource use during construction and operation. Measures would include: - Managing construction waste through the waste hierarchy established under the *Waste Avoidance and Recovery Act 2001* (i.e. avoidance of waste, resource recovery, disposal of waste) - Establishing targets for the beneficial reuse of spoil, wastewater and other construction wastes in accordance with the project's sustainability strategy - Developing procedures for the assessment, handling, stockpiling and disposal of potentially contaminated materials and wastewater, in accordance with the NSW Office of Environment and Heritage's *Waste Classification Guidelines* (Environment Protection Authority, 2014) - Identifying opportunities to reduce the project's demand on electricity and other resources.

11. Conclusion

The *NSW Long Term Transport Master Plan* (Transport for NSW, 2012b) sets the direction for transport planning for the next 20 years, providing a framework for transport policy and investment decisions. An integral component of the *NSW Long Term Transport Master Plan* is *Sydney's Rail Future* (Transport for NSW, 2012a), which provides a plan to modernise Sydney's rail network by investing in new services and upgrading existing infrastructure.

Sydney Metro is a major rail network identified in *Sydney's Rail Future*. Sydney Metro consists of Sydney Metro Northwest (previously known as the North West Rail Link) and Sydney Metro City & Southwest. Transport for NSW is proposing to undertake the Sydenham to Bankstown upgrade project as the second component of Sydney Metro City & Southwest.

The project involves converting the existing T3 Bankstown Line from Sydenham to Bankstown to a metro line. The conversion of the line would also include the upgrade and conversion of 11 existing stations located along the existing line to the standards required for metro services, including for accessibility, and a stabling facility to support the operation of Sydney Metro City & Southwest. This would deliver a more accessible, frequent and reliable rail service to people and communities along the Sydenham to Bankstown corridor.

The Sydney Metro network would also increase rail network capacity by introducing new high-capacity lines connecting the Sydney CBD to other key economic centres in the broader Sydney area. The project would, from the outset, enable an increase in services on the Sydney rail network.

Removing T3 Bankstown Line services from the City Circle would facilitate an increase in frequency and reliability of services on the various parts of the T2 Airport, Inner West and South Line and around the City Circle by eliminating several merges that currently occur. Increasing rail line capacity through Sydney's CBD would also divert passengers from the T1 North Shore, Northern & Western Line.

Travel time savings would be experienced by existing rail service customers (who would directly benefit from shorter travel times), new rail customers (who would transfer from road-based transport such as buses and cars to rail) and road users (who would potentially experience less congestion). The Sydenham to Bankstown component would facilitate increases in services from eight an hour in the peak to at least 15 (and up to 20) new metro trains every hour. Off-peak services would be every 10 minutes, eliminating the need for a timetable. Journey times from Bankstown to the CBD would be up to 10 minutes faster.

Sydney Metro City & Southwest has been declared to be critical State significant infrastructure as outlined in Schedule 5 of *State Environmental Planning Policy (State and Regional Development) 2011*. The project forms part of Sydney Metro City & Southwest and therefore is considered to be critical State significant infrastructure. Therefore, the project would be subject to assessment and approval by the Minister for Planning under Part 5.1 of the EP&A Act.

This document supports an application to the NSW Minister for Planning seeking the Secretary's environmental assessment requirements for the environmental impact statement. It has been prepared based on the indicative locations and design as described in this report, for the purposes of informing the preparation of the Secretary's environmental assessment requirements. The project components, location and design will be subject to further changes as part of the ongoing design development and community consultation and clarifications may be made during the environmental impact assessment process.

A preliminary environmental risk analysis for the project has identified the following 'key' environmental issues:

- traffic, transport and access
- noise and vibration
- non-Aboriginal heritage
- hydrology and flooding
- property and land use
- business impacts
- landscape character and visual amenity
- ecology
- social impacts and community infrastructure
- cumulative impacts.

A preliminary environmental assessment of the project's potential impact has confirmed that the above issues have the potential to result in a significant impact (without the adoption of mitigation measures). Detailed assessment of these issues, and other potential environmental issues, would be undertaken as part of an environmental impact statement.

Following the receipt of the Secretary's environmental assessments requirements, Transport for NSW will prepare and publicly exhibit an environmental impact statement, in accordance with the requirements of Part 5.1 of the EP&A Act. The environmental impact statement will include:

- a description of the project, including its components and construction activities
- a description of the existing environment and an assessment of potential direct and indirect impacts on the key and other potential environmental issues during construction and operation of the project
- identification of measures to be implemented to avoid, minimise, manage, mitigate, offset and/or monitor potential impacts of the project
- identification and consideration of issues raised by stakeholders and the community.

12. References

Attenbrow, V. 2010. *Sydney's Aboriginal Past: Investigating the archaeological and historical records*, UNSW Press.

Australian Bureau of Meteorology and CSIRO. 2014. *State of the Climate 2014.* Canberra, Australia.

Australian Bureau of Meteorology and CSIRO. 2015. *Climate change in Australia – Projects for Australia's NRM Regions, East Coast Cluster Report.* Canberra, Australia.

Australian Bureau of Statistics. 2011. *Bankstown, Punchbowl, Wiley Park, Lakemba, Belmore, Campsie, Canterbury, Hurlstone Park, Dulwich Hill, Marrickville, Sydenham (suburbs), Greater Sydney (Greater Capital City Statistical Area)*, Basic Community Profile. Viewed 13 April 2016. http://www.abs.gov.au/websitedbs/censushome.nsf/home/data?opendocument&navpos=200.

Australian Greenhouse Office. 2006. *Climate Change Impacts and Risk Management – A Guide for Business and Government*.

Australian Radiation Protection and Nuclear Safety Agency. 2006. *Draft Radiation Standard – Exposure Limits for Magnetic Fields*.

Australian Standard AS 5334:2013. 2013. *Climate change adaptation for settlements and infrastructure – A risk based approach*.

Austroads. 2013. *Guide to Traffic Management – Part 3 Traffic Studies and Analysis*. NSW.

Bankstown City Council. 2011. *Salt Pan Creek Stormwater Catchment Study 2007 Report including 2009 Addendum*.

Bureau of Meteorology and CSIRO. 2014. *State of the Climate 2014*.

Bureau of Meteorology and CSIRO. 2015. *Climate change in Australia – Projects for Australia's NRM Regions, East Coast Cluster Report*.

Chapman G.A., Murphy, C.L., Tille P.J., Atkinson G. and Morse R.J. 2009 Ed. 4. *Soil Landscapes of the Sydney 1:100,000 Sheet map*, Department of Environment, Climate Change and Water, Sydney.

Commonwealth of Australia. 2013a. *Commonwealth EPBC 1.1 Significant impact guidelines – matters of national environmental significance*.

Commonwealth of Australia. 2013b. *Commonwealth EPBC 1.2 Significant impact guidelines – actions on, or impacting upon, Commonwealth land and actions by commonwealth agencies.*

Cooks River Alliance. 2014. *Cooks River Alliance Management Plan*. Online resource https://www.strathfield.nsw.gov.au/assets/Corporate-Reports/Corporate-Reports/Cooks-River/Cooks-River-Alliance-Management-Plan-2014-2017.pdf.

Department of Environment and Climate Change. 2007. *Floodplain Risk Management Guideline: Practical consideration of Climate Change*.

Department of Environment and Climate Change. 2009. *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*.

Department of Environment and Climate Change. 2010. *Aboriginal Cultural Heritage Consultation requirements for proponents*.

Department of Environment and Conservation. 2006. *Assessing Vibration: a technical guideline*.

Department of Environment, Climate Change and Water. 2009a. *Interim Construction Noise Guideline.*

Department of Environment, Climate Change and Water. 2010. *Floodplain Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments*.

Department of Environment, Climate Change and Water. 2011a. *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW*.

Department of Environment, Climate Change and Water. 2011b. *Flood Risk Management Guide: Incorporating sea level rise benchmarks in flood risk assessments*.

Department of the Environment. 2016a. *Protected Matters Search*. Department of the Environment.

Department of the Environment. 2016b. *Species Profile and Threats Database*. Online resource http://www.environment.gov.au/cgi-bin/sprat/public/sprat.p.

Department of Planning. 2008. *Acid Sulfate Soils Assessment Guidelines*.

Department of Planning. 2011. *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33*.

Department of Planning and Environment. 2015. *Sydenham to Bankstown Urban Renewal Corridor Strategy.* October 2015.

Department of Primary Industries. 2013. *Policy and guidelines for fish habitat conservation and management*.

Department of Primary Industries. 2016a. *Online Records Viewer*. Online resource http://www.dpi.nsw.gov.au/fisheries/species-protection/records.

Department of Primary Industries. 2016b. Find a species by geographic region. NSW Department of Primary Industries. Fishing and Aquaculture. Priorities Action Statement. Profiles for species populations and ecological communities. Online resource http://pas.dpi.nsw.gov.au/Species/Species_byRegion.aspx.

Department of Urban Affairs and Planning and Environment Protection Authority. 1998. *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land.*

Environment Protection Authority. 2000 *NSW Industrial Noise Policy.*

Environment Protection Authority. 2013. *Rail Infrastructure Noise Guideline.*

Environment Protection Authority. 2014. *Waste Classification Guidelines.*

Georges River Combined Councils' Committee Inc. Undated. *2014-2015 River Health Report Card.*

Government Architect. 2016. *Better Placed*.

Greater Sydney Commission. 2016. *Draft South District Plan: go-creating a greater Sydney*.

Heritage Office. 1996. *NSW Heritage Manual* and the *Archaeological Assessment Guidelines.*

Heritage Office. 1998. *NSW Skeletal Remains: Guidelines for Management of Human Remains*.

Heritage Office. 2009. *Assessing Significance for Historical Archaeological Sites and Relics* 2009.

Infrastructure Sustainability Council of Australia. 2013. *Guidelines for Climate Change Adaptation.*

Intergovernmental Panel on Climate Change. 2007. *Fourth Assessment Report.*

Landcom. 2004. *Managing Urban Stormwater: Soils and Construction Volume 1.*

National Centers for Environmental Information – National Oceanic and Atmospheric Administration. 2016. *State of the Climate Reports and Summary Information.* Online resource http://www.ncdc.noaa.gov/sotc/.

National Occupational Health and Safety Commission. 2005. *Code of Practice for the Safe Removal of Asbestos 2nd edition [NOHSC:2002(2005)].*

National Parks and Wildlife Service. 2002. *Native vegetation of the Cumberland Plain* http://www.environment.nsw.gov.au/resources/nature/vegmapCumberlandPlain08Syd-StGeorge.pdf Office of Environment and Heritage NSW.

National Transport Commission. 2007. *Australian Code for the Transport of Dangerous Goods by Road and Rail (7th edition).*

NSW Department of Mineral Resources. 1983. *Geology of the Sydney 1:100,000 sheet 9130*.

NSW Government and Sydney Water. 2013. *Marrickville Valley Flood Study Final Report*.

NSW Government. 2014a. *A Plan for Growing Sydney: A strong global city, a great place to live, Sydney.*

NSW Government. 2014b. *Rebuilding NSW: State Infrastructure Strategy 2014*, Sydney.

NSW Government. 2015. *State Priorities: NSW Making it Happen*, available online at: https://www.nsw.gov.au/making-it-happen.

NSW Heritage Council. 2011. *Criteria for the assessment of excavation directors.*

NSW Scientific Committee. 2011. *Long-nosed Bandicoot Perameles nasuta Geoffroy, 1804 in inner western Sydney - endangered population listing.* http://www.environment.nsw.gov.au/determinations/longnosedbandicootfd.htm. Office of Environment and Heritage NSW.

Office of Environment and Heritage. 2000. *Guidelines for Consultants Reporting on Contaminated Sites.*

Office of Environment and Heritage. 2013. *The Native Vegetation of the Sydney Metropolitan Area*.

Office of Environment and Heritage. 2014a. *Framework for Biodiversity Assessment.* http://www.environment.nsw.gov.au/biodivoffsets/140675fba.htm. Office of Environment and Heritage NSW.

Office of Environment and Heritage. 2014b. *NSW biodiversity offsets policy for major projects.* http://www.environment.nsw.gov.au/biodivoffsets/bioffsetspol.htm Office of Environment and Heritage NSW.

Office of Environment and Heritage. 2015. *Metropolitan Sydney Climate change snapshot.* Office of Environment and Heritage, NSW.

Office of Environment and Heritage. 2016a. *Atlas of NSW Wildlife*. http://www.bionet.nsw.gov.au/ Office of Environment and Heritage NSW.

Office of Environment and Heritage. 2016b. *Threatened Species profiles website* http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx Office of Environment and Heritage NSW.

Roads and Maritime Services. 2013. *Environmental Planning and Impact Assessment Practice Note: Socio-economic Assessment.*

Roads and Traffic Authority. 2002. *Guide to Traffic Generating Developments Version 2.2*.

Roads and Traffic Authority. 2003. *NSW Bicycle Guidelines.*

SGS Economics. 2016. *Australian Cities Accounts 2014-15*, available online at: http://www.sgsep.com.au/about/latest-news/australian-cities-accounts-2014-15 (viewed 8 April 2016).

Sydney Water. 2009. *Cooks River Flood Study.*

Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. and Cox, S. 2010. *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Cunninghamia* 11(3): 359-406.

Transport for NSW. 2012a. *Sydney's Rail Future: Modernising Sydney's Trains*.

Transport for NSW. 2012b. *NSW Long Term Transport Master Plan*.

Transport for NSW. 2012c. *Greenhouse Gas Inventory Guide for Construction Projects.*

Transport for NSW. 2013a. *Sydney City Centre Access Strategy*.

Transport for NSW. 2013b. *NSW Sustainable Design Guidelines for Rail* (Version 3.0).

Transport for NSW. 2013c. *Sydney's Bus Future*.

Transport for NSW, Bureau of Transport Statistics. 2014. *Station barrier counts.* Online resource http://www.bts.nsw.gov.au/Statistics/Rail/default.aspx?FolderID=223.

Transport for NSW. 2015a. *Sydney Metro Chatswood to Sydenham State Significant Infrastructure Application Report.*

Transport for NSW. 2015b. *Carbon Estimate and Reporting Tool* (Version 1.1). Online resource http://www.transport.nsw.gov.au/projects/Planning-and-assesment/sustainability.

Transport for NSW. 2016b. *Construction Noise and Vibration Strategy*.

Transport for NSW. 2016c. *TfNSW Climate Risk Assessment Guidelines.*

WorkCover NSW. 2005. *Storage and Handling of Dangerous Goods Code of Practice.*

Glossary and abbreviations

Term/abbreviation	Definition
A Plan for Growing Sydney	*A Plan for Growing Sydney* (NSW Government, 2014a) sets out the NSW Government's strategy for accommodating Sydney's future population growth over the next 20 years
AHIMS	Aboriginal Heritage Information Management System
ARTC	Australian Rail Track Corporation
AS	Australian Standard
CBD	central business district
CCTV	closed-circuit television
Chatswood to Sydenham	The Chatswood to Sydenham project forms one of the two core components of Sydney Metro City & Southwest. It comprises the establishment of two underground metro tracks between Chatswood and Sydenham. The tracks would be in twin tunnels about 15 kilometres long and involve constructing metro stations at Crows Nest, Victoria Cross, Barangaroo, Pitt Street and Martin Place and underground platforms at Central Station, and a new underground station at Waterloo
DEC	the former NSW Department of Environment and Conservation; now the NSW Office of Environment and Heritage
dive structure	refers to the change in grade from the surface to the tunnel portal (refer to tunnel portal)
dwell time	the length of time that a train is stopped at a station
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	NSW *Environmental Planning and Assessment Regulation 2000*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FBA	Framework for Biodiversity Assessment
Global Economic Corridor	Sydney's key employment and economic areas are clustered along a corridor that runs from Port Botany and Sydney Airport to Macquarie Park known as the Global Economic Corridor
ISO	International Organisation for Standardisation
LEP	local environmental plan
LGA	local government area
NSW	New South Wales
NSW Long Term Transport Master Plan	the *NSW Long Term Transport Master Plan* (Transport for NSW, 2012b) is the NSW Government's 20 year plan to improve the NSW transport system by delivering an integrated, modern transport system that puts the customer first
OEH	NSW Office of Environment and Heritage
POEO Act	NSW *Protection of the Environment Operations Act 1997*
(the) project	refers to the Sydenham to Bankstown upgrade (the subject of this report)

Term/abbreviation	Definition
Rebuilding NSW	*Rebuilding NSW: State Infrastructure Strategy 2014* (NSW Government, 2014b) outlines the NSW Government's plan to invest $20 billion in new productive infrastructure to sustain productivity growth in NSW's major centres and regional communities, as well as to support forecasted population growth of almost six million people in Sydney and more than nine million people in NSW
s170 Register	section 170 Register under the NSW *Heritage Act 1977*
SEPP	State Environmental Planning Policy
Sydenham to Bankstown upgrade	Sydenham to Bankstown ('the project' and the subject of this document), involves upgrading the existing 13.5 kilometre rail line and 11 existing stations from Sydenham to Bankstown to metro standards, and providing a stabling facility to support the operations of Sydney Metro City & Southwest. The project would connect to Sydney Metro tracks at the tunnel dive structure, which would be constructed north-east of Sydenham Station as part of the proposed Chatswood to Sydenham component.
Sydney City Centre Access Strategy	The *Sydney City Centre Access Strategy* (Transport for NSW, 2013a) is the NSW Government's plan to deliver a fully integrated transport network in Sydney's city centre that puts the customer first and meets the city's growing transport task
Sydney Metro	Sydney Metro is a major rail system identified by *Sydney's Rail Future.* Sydney Metro consists of Sydney Metro Northwest and Sydney Metro City & Southwest
Sydney Metro City & Southwest	Sydney Metro City & Southwest comprises an extension of the Sydney Metro Northwest (formerly the North West Rail Link) from Chatswood under Sydney Harbour, through the central business district of Sydney, and west to Bankstown. Sydney Metro City & Southwest involves two core components – the Chatswood to Sydenham project and the Sydenham to Bankstown upgrade (the subject of this report)
Sydney Metro Northwest	Sydney Metro Northwest (formerly the North West Rail Link) comprises a new metro service between Cudgegong Road (in Rouse Hill) and Chatswood. Sydney Metro Northwest is the first component of the NSW Government's plan to develop a metro rail system in Sydney, and is a key initiative outlined in *Sydney's Rail Future* (Transport for NSW, 2012a).
Sydney's Rail Future	*Sydney's Rail Future: Modernising Sydney's Trains* (Transport for NSW, 2012a) is the NSW Government's long-term plan to increase the capacity of Sydney's rail network through investment in new services and upgrading of existing infrastructure. *Sydney's Rail Future* is being delivered in five stages. The project comprises Stage 5 of *Sydney's Rail Future*, which would provide the largest increase in capacity to the Sydney rail network for 80 years
TAFE	Technical and Further Education (TAFE) NSW
the project	refers to the Sydenham to Bankstown upgrade (the subject of this report)
traction substation	an electrical substation that converts electric power to an appropriate voltage, current type and frequency to supply railways with traction current
TSC Act	NSW *Threatened Species Conservation Act 1995*
tunnel portal	refers to the entrance to the tunnel structure