NSW GOVERNMENT | sydney METRO

West

Scoping Report

Westmead to The Bays and Sydney CBD

Request for Secretary's Environmental Assessment Requirements

Cover: Artist’s impression of Parramatta Metro Station.

Executive Summary

Executive Summary

Overview and need

Mass transit services are a fundamental part of a growing international city.

Public transport improvements between Sydney's three cities – the Eastern Harbour City, Central River City and Western Parkland City – are part of Transport for NSW's Future Transport Strategy 2056 (Transport for NSW, 2018a).

Sydney Metro West is a critical step in the delivery of Future Transport Strategy 2056. It would provide a fast, reliable and frequent rail service between Greater Parramatta and the Sydney CBD and would:

- Relieve the congested T1 Western Line, T9 Northern Line (previously T1 Northern Line) and T2 Inner West Line
- Provide travel time savings for customers in Western Sydney and along the Greater Parramatta to Sydney CBD corridor
- Reduce station crowding at some stations
- Provide rail transport to areas where it is currently not available
- Connect Greater Parramatta and the Sydney CBD to support the vision for a metropolis of three cities
- Support delivery of the '30-minute city' as identified in Future Transport Strategy 2056
- Reinforce the role of Greater Parramatta as the Central River City
- Improve connectivity to major attractions and key precincts located along the corridor, including Sydney Olympic Park and The Bays Precinct
- Support urban renewal and increased housing supply
- Increase accessibility across Sydney and provide customers with a new world-class metro service.

Sydney Metro West

Sydney Metro (as 'the proponent') is seeking planning approvals as follows:

- Approval for the whole Sydney Metro West at concept level (this application)
- Approval of Stage 1. Stage 1 would involve the major civil construction work between Westmead and The Bays Precinct (this application)

Future stage(s) would include the remaining major civil construction work from The Bays Precinct to the Sydney CBD, rail systems fit-out, station fit-out, aboveground building construction, and operation of the metro line (future application(s)).

Sydney Metro West Concept

Sydney Metro West (the Concept) would involve construction and operation of a metro rail line around 24 kilometres long between Westmead and the Sydney CBD.

Key components are expected to include:

- About 24 kilometres of twin tunnels between Westmead and the Sydney CBD
- New metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays and Sydney CBD. Potential stations at Rydalmere and Pyrmont are also under investigation
- A turn-up-and-go metro service operating early morning to late at night, between Westmead and Sydney CBD
- Pedestrian links and connections to other modes of transport (such as the existing suburban rail network and other parts of the metro network), and surrounding land uses

- Modification to existing suburban stations and associated rail infrastructure (such as overhead wiring, signalling, access tracks/paths and rail corridor fencing) at Westmead and North Strathfield
- Services within each of the metro stations, including mechanical and fresh air ventilation equipment and electrical power substations to supply power for operation
- Services facilities at Rosehill (within the Clyde stabling and maintenance facility construction site), Silverwater and one between Five Dock and The Bays Precinct for fresh air ventilation and emergency evacuation
- A stabling and maintenance facility at Clyde, including associated aboveground and belowground tracks to connect to the mainline tunnels
- Alterations to pedestrian and traffic arrangements, cycling and public transport (e.g. bus) infrastructure around the new stations
- Ancillary facilities to support construction.

Components of the Concept are subject to further design, and changes or clarifications may be made during the ongoing design development and community consultation processes.

Stage 1 Major construction between Westmead and The Bays Precinct

Stage 1 would involve major civil construction work between Westmead and The Bays Precinct, including:

- Enabling work
- Tunnel excavation including tunnel support activities
- Station excavation for the new metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays
- Shaft excavation for services facilities at Rosehill (within the Clyde stabling and maintenance facility construction site), Silverwater and between Five Dock and The Bays Precinct
- Civil work for the stabling and maintenance facility at Clyde including earthworks and structures for crossings of A'Becketts Creek and Duck Creek
- A concrete segment facility for use during construction located at the Clyde stabling and maintenance facility construction site
- Excavation of a tunnel dive structure and associated tunnels at Rosehill to support a connection between the Clyde stabling and maintenance facility and the mainline metro tunnels.

Planning and assessment process

Sydney Metro is seeking a declaration for Sydney Metro West to be State significant infrastructure and critical State significant infrastructure under sections 5.12(4) and 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), respectively.

Therefore, Sydney Metro West would be subject to assessment and approval by the Minister for Planning and Public Spaces under Part 5, Division 5.2 of the EP&A Act.

Purpose of this document

This document supports the Sydney Metro West Concept and concurrent Stage 1 State significant infrastructure application to the Minister for Planning and Public Spaces under section 5.15 of the EP&A Act, to obtain the Secretary's Environmental Assessment Requirements for the Concept and Stage 1 Environmental Impact Statement.

Key environmental issues

A preliminary environmental risk analysis has identified key environmental issues which are relevant to the assessment of the Concept and Stage 1. These are summarised in Table E-1.

Table E-1: Key environmental issues

Key issues	Concept	Stage 1
Construction traffic and transport	Yes	Yes
Construction noise and vibration	Yes	Yes
Non-Aboriginal heritage	Yes	Yes
Aboriginal heritage	Yes	Yes
Property and land use	Yes	Yes
Landscape character and visual amenity	Yes	Yes
Contamination	Yes	Yes
Social impacts and community infrastructure	Yes	Yes
Business impacts	Yes	Yes
Hydrology and flooding	Yes	Yes
Cumulative impacts	Yes	Yes

A preliminary environmental assessment of potential impacts has confirmed the above issues have the potential to result in a significant impact (without the adoption of adequate mitigation measures). Detailed assessment of these issues and the other environmental issues identified would be carried out as part of an Environmental Impact Statement.

While not identified at this stage as key issues, other issues that will be included in the assessment of the Concept and Stage 1 are:

- Operational traffic and transport (Concept only)
- Operational noise and vibration (Concept only)
- Groundwater and geology
- Soils and water quality
- Biodiversity
- Air quality
- Greenhouse gas
- Climate change adaptation
- Waste management and resource use
- Hazard and risk.

Next steps

Following receipt of the Secretary's Environmental Assessment Requirements, Sydney Metro will prepare and publicly exhibit an Environmental Impact Statement in accordance with the requirements of Division 5.2 of the EP&A Act. The Environmental Impact Statement will include:

- The strategic need and justification for Sydney Metro West
- A description of the Concept for which approval is being sought
- A description of the Stage 1 components and construction activities
- A description of the existing environment relevant to Sydney Metro West and an assessment of potential direct and indirect impacts on key environmental issues during construction and operation
- A description of the existing environment relevant to Stage 1 and an assessment of potential direct and indirect impacts on key and other potential environmental issues during construction
- For the Concept, identification of further environmental assessment required for future stages
- For Stage 1, identification of measures to be implemented to avoid, minimise, manage, mitigate, offset and/or monitor potential impacts
- Identification and consideration of issues raised by stakeholders and the community during preparation of the Environmental Impact Statement.

During public exhibition of the Environmental Impact Statement, the community will be encouraged to have their say and make a formal submission.

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1 Introduction

1 Introduction

This chapter provides an overview of the Sydney Metro West Concept and Stage 1, including the strategic planning context and key features. The purpose and structure of this report are also provided.

1.1 Overview

Sydney Metro is Australia's biggest public transport project. Services between Tallawong Station in Rouse Hill and Chatswood started in May 2019 on this new stand-alone metro railway system, which is revolutionising the way Sydney travels.

Sydney Metro's program of work is shown in Figure 1-1 and includes:

- Sydney Metro Northwest – This project is now open, with a fully automated metro train running every four minutes in the peak in each direction between Tallawong Station in Rouse Hill and Chatswood
- Sydney Metro City & Southwest – A new 30-kilometre metro line extending the new metro network from the end of Sydney Metro Northwest at Chatswood, under Sydney Harbour, through the Sydney CBD and south west to Bankstown. It is due to open in 2024 with an ultimate capacity to run a metro train every two minutes each way under the centre of Sydney
- Sydney Metro West (this project) – A new 24-kilometre metro line that would connect Greater Parramatta with the Sydney CBD. Confirmed stations include Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays and Sydney CBD. This infrastructure investment would double the rail capacity of the Parramatta to Sydney CBD corridor with a travel time target between the two centres of about 20 minutes
- Sydney Metro Greater West – A new metro rail line that would connect the city's greater west with the new international airport and Western Sydney Aerotropolis, with services anticipated to start at the same time as the new airport.

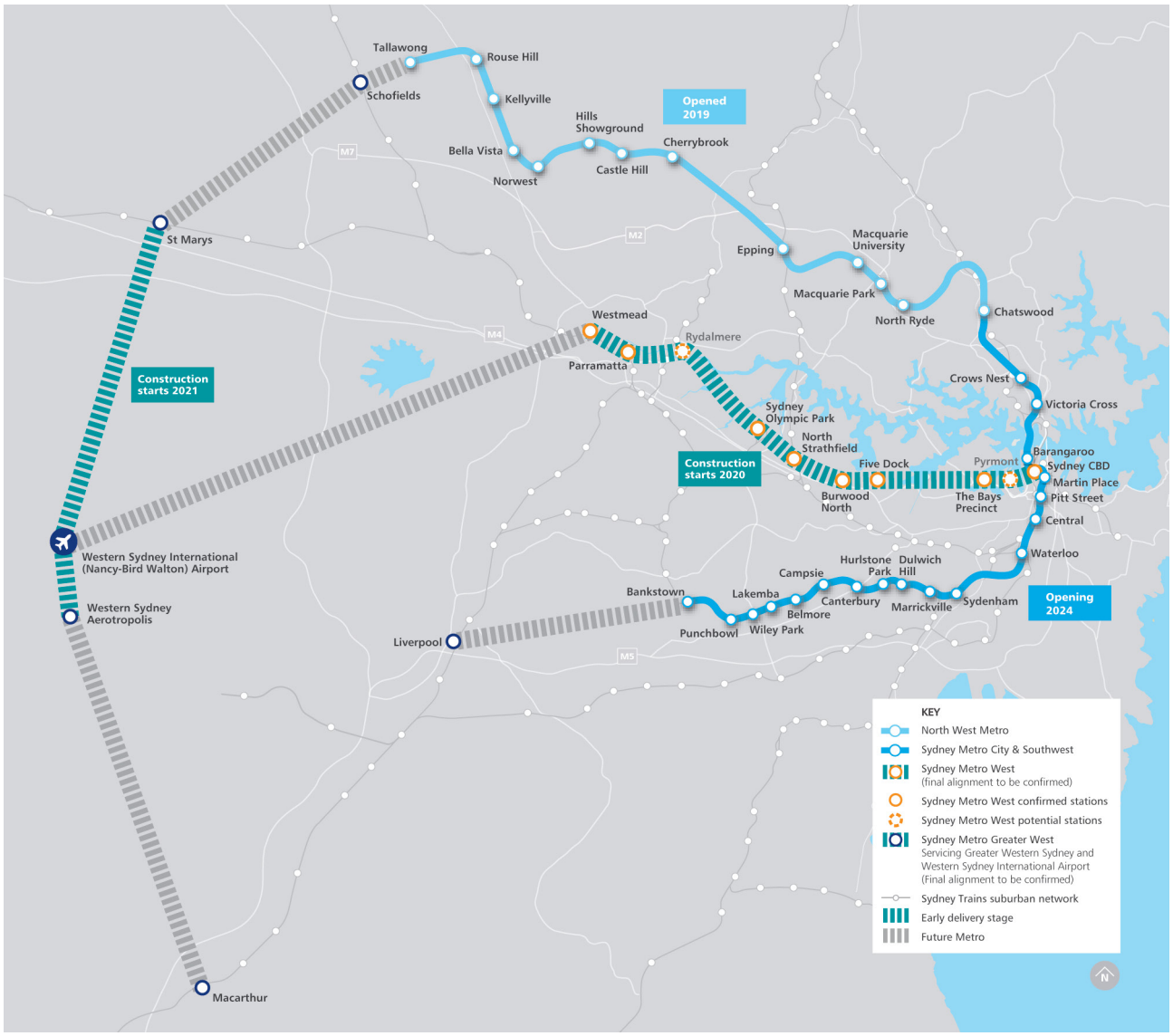

Figure 1-1: Sydney Metro network

The NSW Government has introduced a number of plans and reforms to support Sydney's ongoing growth.

Sydney Metro West is identified in these plans and in a number of key strategic planning documents including the Greater Sydney Region Plan: A Metropolis of Three Cities – connecting people (Greater Sydney Commission, 2018a), Building Momentum State Infrastructure Strategy 2018-2038 (Infrastructure NSW, 2018) and Future Transport Strategy 2056 (Transport for NSW, 2018a).

At completion, Sydney Metro West would:

- Provide a direct, fast and frequent connection between Parramatta and the Sydney CBD, linking communities along the way that have previously not been serviced by rail
- Relieve the congested T1 Western Line, T9 Northern Line (previously T1 Northern Line), and T2 Inner West Line
- Double the rail capacity between the Sydney and Parramatta CBDs
- Significantly boost economic opportunities for Greater Parramatta by connecting it to broader skilled labour and markets that are currently constrained
- Support new residential and employment zones along the Greater Parramatta to Sydney CBD corridor, including at Sydney Olympic Park and The Bays Precinct – providing improved transport for the forecast additional 420,000 new residents and 300,000 new workers expected to be located within the corridor over the next 20 years

- Allow customers fast and easy transfers with the T1 Western Line at Westmead, T9 Northern Line at North Strathfield and the suburban rail network and Sydney Metro in the Sydney CBD
- Allow for transfers with the future Parramatta Light Rail (Stage 1) at Westmead and Parramatta, as well as the planned Parramatta Light Rail (Stage 2) at Sydney Olympic Park.

Sydney Metro (as 'the proponent') is seeking planning approval as follows:

- Approval for the whole Sydney Metro West at concept level (this application)
- Approval of Stage 1. Stage 1 would involve the major civil construction work between Westmead and The Bays Precinct (this application)
- Future stage(s) would include the remaining major civil construction work from The Bays Precinct to the Sydney CBD, rail systems fit-out, station fit-out, aboveground building construction, and operation of the metro line (future application(s)).

1.2 Background to Sydney Metro West

1.2.1 History

Sydney Metro and Transport for NSW are implementing a three-tiered rail network for Sydney, comprising:

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

This network delineation was first proposed in Sydney's Rail Future (Transport for NSW, 2012a) and has been the basis for the development of the Sydney Metro network.

Congestion on the T1 Western Line is one of the most pressing challenges for the Sydney rail network. Demand for the T1 Western Line already exceeds capacity at peak times.

The need to upgrade capacity between Parramatta and the Sydney CBD was reinforced in February 2016 when Infrastructure Australia identified connectivity between Parramatta and the Sydney CBD as a national infrastructure priority.

In November 2016 the NSW Government announced Sydney Metro West as the State's next major public transport project, with a direct connection between Greater Parramatta and the Sydney CBD, and stations at Sydney Olympic Park and The Bays Precinct.

In March 2018 the NSW Government expanded the scope of Sydney Metro West to include a station at Westmead and a station to provide for an interchange with the T9 Northern Line. The NSW Government also announced that options for intermediate stations at Camellia/Rydalmere, Burwood North/Kings Bay/Five Dock, and Pyrmont were being considered.

1.2.2 Strategic context

Sydney is a global city and will experience significant population and employment growth in the coming decades. Investment in public transport will play an important role supporting this growth, ensuring Sydney's future liveability and global competitiveness.

By 2056, Sydney is expected to transform into a metropolis of three cities as shown in Figure 2-1 in Chapter 2 (Strategic justification and need), where people will live within 30 minutes of their jobs, education, health facilities and services. Sydney Metro West would be the mass transit link to connect the Central River City (Greater Parramatta) and the Eastern Harbour City (Sydney CBD) and support this transformation.

Sydney Metro West would provide a fast, reliable and frequent link between Greater Parramatta and the Sydney CBD to:

- Relieve the congested T1 Western Line, T9 Northern Line and T2 Inner West Line
- Provide travel-time savings for customers in Western Sydney and along the corridor
- Reduce station crowding at some stations

- Provide rail transport to areas where this is currently not available
- Connect Greater Parramatta and the Sydney CBD and support the vision for a metropolis of three cities
- Support the delivery of the '30-minute city' as identified in Future Transport Strategy 2056
- Reinforce Greater Parramatta as the Central River City
- Improve connectivity to major attractions and key precincts located along the corridor, including Sydney Olympic Park and The Bays Precinct
- Support urban renewal and increase housing supply
- Increase accessibility across Sydney and provide customers with a new world-class metro service.

The Sydney Metro West corridor is characterised by the following key centres:

- Westmead – one of the largest health, education, research and training precincts in Australia
- Parramatta – where the number of jobs is expected to increase to more than 137,000 by 2036 (Greater Sydney Commission, 2018a)
- Sydney Olympic Park – where 34,000 jobs and more than 23,000 residents will be located by 2030 (Sydney Olympic Park Authority, 2018)
- The Bays Precinct – NSW Government's planned new innovation and technology hub where 95 hectares of land would be regenerated
- The Sydney CBD – Australia's largest business district.

Sydney Metro West is part of a broader metro network plan for Sydney which includes the recently opened Sydney Metro Northwest, Sydney Metro City & Southwest (due to open in 2024), and Sydney Metro Greater West anticipated to open when the new Airport opens.

1.2.3 Sydney Metro

Customer experience

Delivering improved outcomes for customers and the transport network are critical to achieving Sydney Metro's vision for a 'world-class metro for Sydney'.

Sydney Metro places the customer at the centre of design with the customer experience incorporating all aspects of a journey from door-to-door. Sydney Metro aims to make it easy for all customers, regardless of trip purpose, to choose public transport.

The Sydney Metro development process includes consideration of the best outcomes for customers, transport integration, and city-shaping and land use benefits. This includes the design of the trains, stations and precincts. Key features aim to deliver an easy customer experience and high-quality integrated transport and land use outcomes.

Sydney Metro features

Sydney Metro is designed to make the customer journey to and from the metro station as seamless as possible, by integrating walking, cycling, bus, ferries, light rail, taxi, on demand vehicle, ride share and kiss and ride infrastructure.

Key features include:

- No timetable – customers can just turn up and go
- 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 on all metro trains
- On-board real time travel information and live electronic route maps.

1.3 Overview of Sydney Metro West

1.3.1 Location

Sydney Metro West would be located largely underground in twin tunnels. Indicative locations of the proposed alignment, stations and the main elements of operational ancillary infrastructure are shown in Figure 1-2.

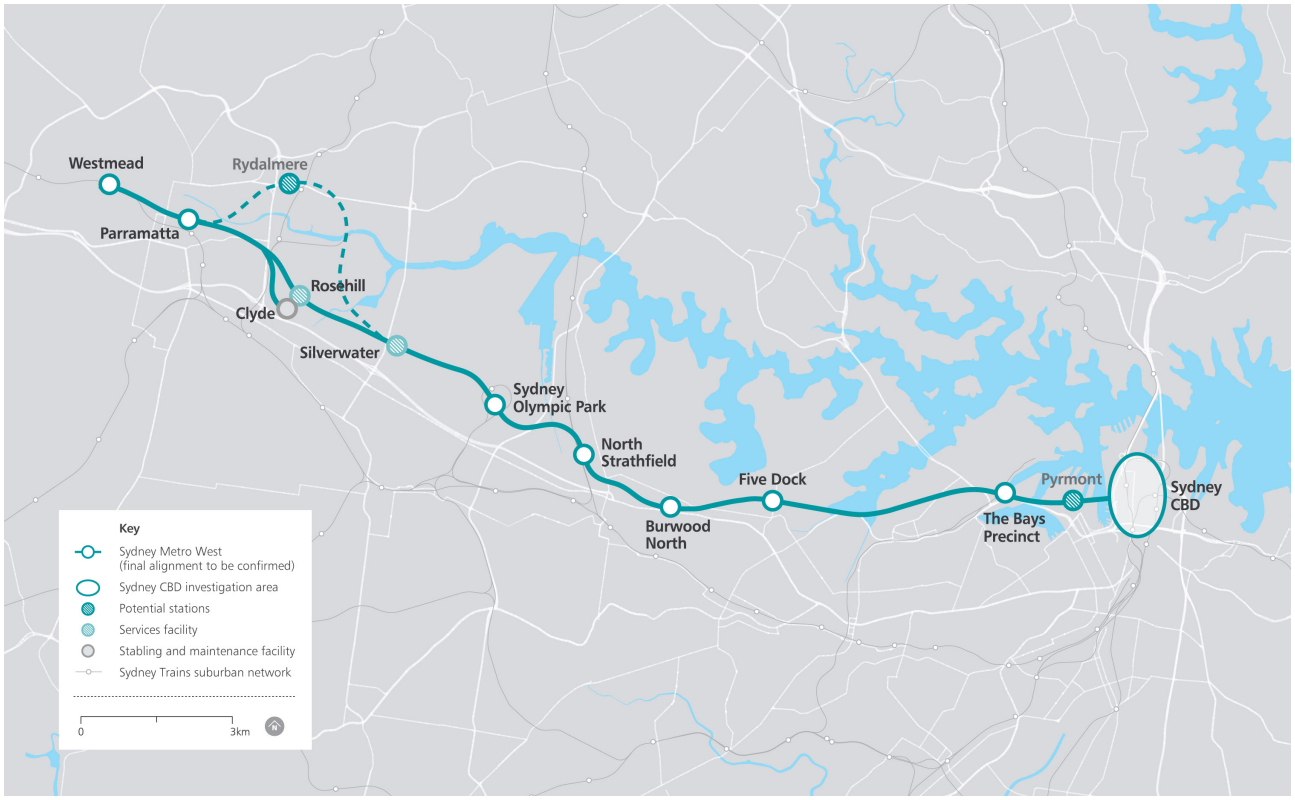

Figure 1-2: Sydney Metro West

1.3.2 The Concept

Sydney Metro West (the Concept) would involve the construction and operation of a metro rail line around 24 kilometres long between Westmead and the Sydney CBD. Key components are expected to include:

- About 24 kilometres of twin tunnels between Westmead and the Sydney CBD
- New metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays and Sydney CBD. Potential stations at Rydalmere and Pyrmont are also under investigation
- A turn-up-and-go metro service operating early morning to late at night, between Westmead and Sydney CBD
- Pedestrian links and connections to other modes of transport (such as the existing suburban rail network and other parts of the metro network) and surrounding land uses
- Modifications to existing suburban stations and associated rail infrastructure (such as overhead wiring, signalling, access tracks/paths and rail corridor fencing) at Westmead and North Strathfield
- Services within each of the metro stations, including mechanical and fresh air ventilation equipment and electrical power substations to supply power for operation
- Services facilities at Rosehill (within the Clyde stabling and maintenance facility construction site), Silverwater and one between Five Dock and The Bays Precinct for fresh air ventilation and emergency evacuation
- A stabling and maintenance facility at Clyde, including associated aboveground and belowground tracks to connect to the mainline tunnels
- Alterations to pedestrian and traffic arrangements, cycling and public transport (e.g. bus) infrastructure around the new stations
- Ancillary facilities to support construction.

A further description of the Concept is provided in Chapter 6 of this report.

The components of Sydney Metro West are subject to further design. Changes and/or clarifications may be made during the ongoing design development and community consultation processes.

1.3.3 Stage 1

Stage 1 would involve major civil construction work between Westmead and The Bays Precinct, including:

- Enabling work
- Tunnel excavation including tunnel support activities
- Station excavation for the new metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays
- Shaft excavation for services facilities at Rosehill (within the Clyde stabling and maintenance facility construction site), Silverwater and between Five Dock and The Bays Precinct
- Civil work for the stabling and maintenance facility at Clyde including earthworks and structures for crossings of A'Becketts Creek and Duck Creek
- A concrete segment facility for use during construction located at the Clyde stabling and maintenance facility construction site
- Excavation of a tunnel dive structure and associated tunnels at Rosehill to support a connection between the Clyde stabling and maintenance facility and the mainline metro tunnels.

Stage 1 is further described in Chapter 8 of this report.

1.4 Purpose and structure of this report

The purpose of this document is to support Sydney Metro's application to the Minister for Planning and Public Spaces for planning approval under section 5.15 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) – with the first step to obtain Secretary's Environmental Assessment Requirements for the Concept and concurrent Stage 1 Environmental Impact Statement.

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

Table 1-1: Structure and content of this report

Chapter	Description
Part A: Introduction and context	
Chapter 1 Introduction	Outlines key elements of Sydney Metro West and the purpose of this report.
Chapter 2 Strategic justification and need	Provides an outline of the justification and need for Sydney Metro West.
Chapter 3 Sydney Metro West development and alternatives	Provides an overview of the development process, and the strategic transport alternatives, and options considered to date, for Sydney Metro West.
Chapter 4 Planning and assessment process	Provides an outline of the statutory approvals framework, including applicable legislation and planning policies.
Chapter 5 Stakeholder and community engagement	Outlines the stakeholder and community engagement carried out to date and the consultation that will occur during the environmental impact assessment process.
Part B: Concept description and preliminary assessment	
Chapter 6 Concept description	Identifies the physical infrastructure, built form and operation.
Chapter 7 Concept preliminary environmental assessment	Provides a preliminary description of the existing environment of the study area, and an initial consideration of the potential direct and indirect impacts that may result during construction and operation of Sydney Metro West.
Part C: Stage 1 description and preliminary assessment	
Chapter 8 Stage 1 description	Provides a description of Stage 1 including likely construction techniques and identifies the location and function of the main construction sites.
Chapter 9 Stage 1 preliminary environmental assessment	Provides a preliminary consideration of the potential direct and indirect impacts that may result during Stage 1.
Part D: Risk analysis and conclusion	
Chapter 10 Preliminary environmental risk analysis	Provides a preliminary environmental risk analysis for the Concept and Stage 1 taking into account the current scope and the receiving environment.
Chapter 11 Summary of proposed Environmental Impact Statement scope	Provides a summary of the proposed scope of further investigations for the Concept and Stage 1 during preparation of the Environmental Impact Statement based on the initial consideration of potential direct and indirect impacts.
Chapter 12 Conclusion	Provides a conclusion to the report and identifies the next steps following receipt of the Secretary's Environmental Assessment Requirements.

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2 Strategic justification and need

2 Strategic justification and need

This chapter outlines the strategic need and justification for Sydney Metro West taking into account the transport and land use challenges that Sydney faces now and into the future. It also provides an outline of consistency with the NSW strategic planning and transport policy framework.

2.1 Background

The Greater Sydney Region Plan: A Metropolis of Three Cities (Greater Sydney Commission, 2018a) sets out the 40-year vision to 2056 and 20-year implementation plan for Greater Sydney to become a global metropolis of three unique and connected cities, the Western Parkland City, Central River City and Eastern Harbour City, as shown in Figure 2-1.

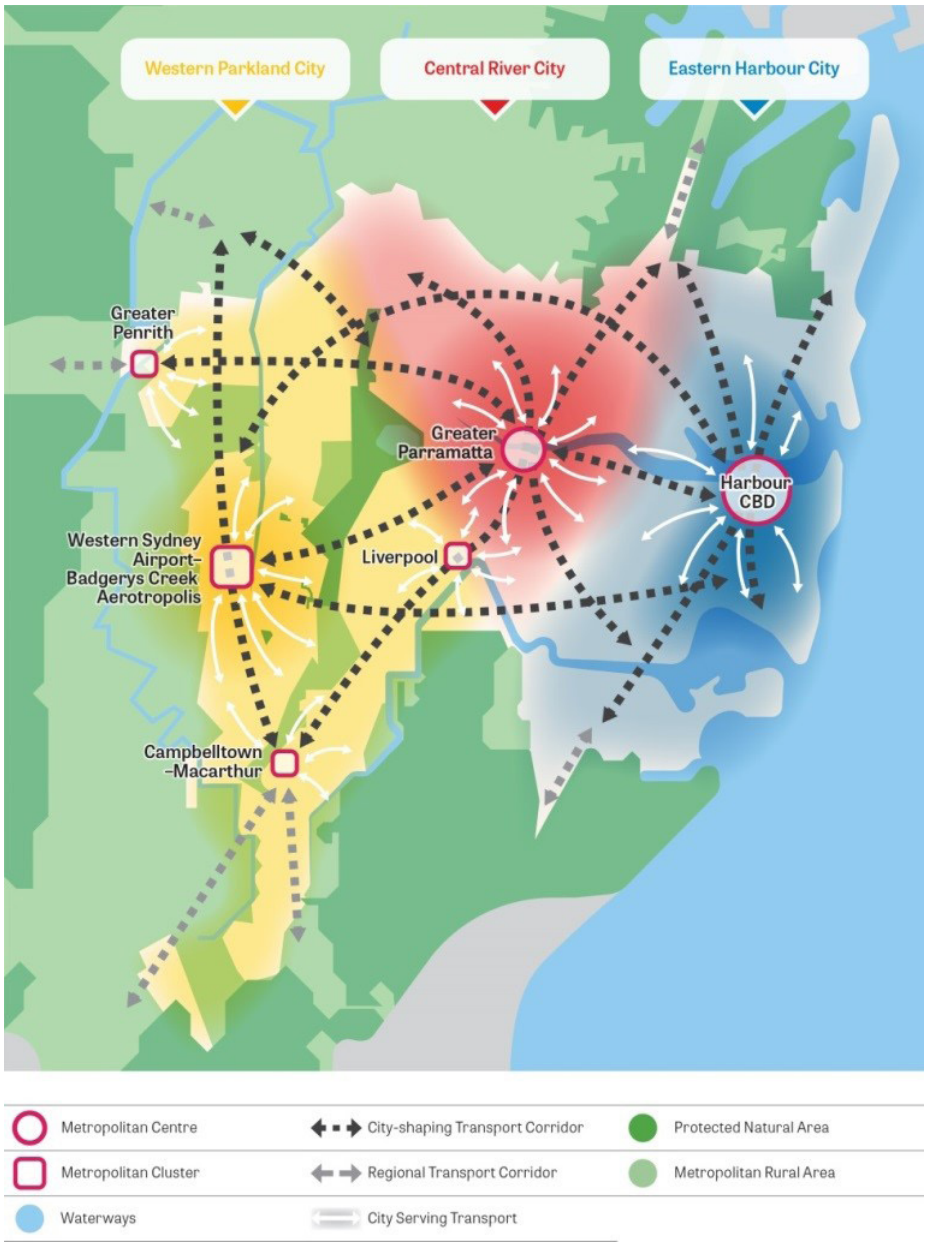

Figure 2-1: A Metropolis of Three Cities (Greater Sydney Commission, 2018a)

By integrating land use, transport and infrastructure across the three cities, people in Sydney will have access within 30 minutes to jobs, schools, hospitals and services.

The plan identifies the following areas of growth over the next 20 years:

- Greater Sydney's population is forecast to increase from 4.7 million to 6.4 million by 2036 and to eight million by 2056
- Target of 725,000 new homes in Greater Sydney, including 207,500 in the Central River City and 157,500 in the Eastern Harbour City
- An additional 817,000 jobs are required to meet the needs of a changing economy and workforce
- Daily trips will increase to 22 million within Greater Sydney, and people's homes, jobs, schools, healthcare and other services will need to be connected to an efficient transport network.

To enable and support this growth, Sydney's mass transit network must be enhanced to better connect economic centres, and to connect people to jobs, as well as to schools, services and attractions.

2.2 Sydney's challenges

2.2.1 Population and economic growth

Sydney is Australia's financial and economic capital, housing half of the country's globally competitive service sector jobs. Greater Sydney is planned to grow significantly from a population of 4.7 million to 6.4 million by 2036 (an additional 1.7 million) and 8.3 million by 2056 (an additional 3.6 million). This is expected to require places for an additional 817,000 jobs and an additional 725,000 homes by 2036 (Greater Sydney Commission, 2018a).

The Greater Parramatta to Sydney CBD corridor is one of the city-shaping transport corridors nominated in the Greater Sydney Region Plan (Greater Sydney Commission, 2018a). It runs through the heart of Parramatta to the Sydney CBD and includes one of Australia's largest health, education and research precincts in Westmead, the rapidly growing central CBD at Parramatta, the lifestyle precinct at Sydney Olympic Park, the planned innovation and technology hub at The Bays Precinct and the global centre that is the Sydney CBD.

The corridor is of national economic significance. It already contains a number of high productivity jobs and has some of the most productive centres in Greater Sydney with the Sydney CBD generating $96 billion of gross domestic product per year.

Recognising the importance of the corridor, a number of land use planning and development initiatives have commenced. These include:

- State significant precincts including Parramatta North, Sydney Olympic Park and The Bays Precinct as identified by the Department of Planning, Industry and Environment
- Precinct planning including Wentworthville, Westmead, Camellia, Telopea, Carter Street, Rhodes East and Burwood, Strathfield and Homebush as defined by the Department of Planning, Industry and Environment
- The Greater Parramatta Growth Area as defined by the Department of Planning, Industry and Environment and the Greater Parramatta to Olympic Park Peninsula Infrastructure Compact being managed by the Greater Sydney Commission
- Significant urban renewal areas in the Parramatta Road Corridor Urban Transformation Strategy area.

Westmead, Parramatta, Sydney Olympic Park, The Bays Precinct and the Sydney CBD account for more than 60 per cent of planned population growth and more than 80 per cent of planned jobs growth in the corridor by 2036.

2.2.2 Transport capacity, accessibility and reliability

Sydney's suburban heavy rail network is the backbone of the city's public transport system, which connects the city's skilled workforce with high value employment land located in Sydney's established and growing economic corridors. Over the past five years, there has been about a 29 per cent increase in demand across the heavy rail train network. Sydney Trains shows that Sydney's suburban heavy rail train network now carries 420 million passengers per year, up from 326 million passenger trips five years ago. This is an increase of more than 90 million journeys.

Sydney's growing population will continue to increase demand on the existing transport network. By 2056, NSW transport networks will need to accommodate 28 million trips per day (Transport for NSW, 2018a).

Key challenges include increasing capacity on the network to ease congestion and support growing demand, as well as providing rail services to areas that have not previously been serviced.

The existing T1 Western Line currently moves around 19,100 people in the one-hour AM peak (8am–9am) and will be overcrowded by the early 2030s, despite ongoing upgrade work and additional services. Around 43,700 people in the one-hour AM peak move from Parramatta to the Sydney CBD on all lines (T1 Western Line, T9 Northern Line, T2 Inner West Line, and intercity services), which collectively operate at about 85 per cent of total capacity.

The reliability and capacity of Sydney's rail network, particularly in the Greater Parramatta to Sydney CBD corridor, is currently constrained by a number of factors, which include:

- The large number of lines which converge in the western rail corridor between Greater Parramatta and the Sydney CBD including the T1 Western Line, T9 Northern Line and T2 Inner West Line. This limits the capacity to increase rail services between Parramatta and the Sydney CBD
- Train timetables that require trains with different service patterns to share the same track which can result in slower trains delaying all services (including fast and express trains), and requires customer journey trade-offs or further investment in the track network
- Crowded trains with two doors, double decks 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 customers to board and alight). Longer dwell times challenges on-time running of services, and leads to fewer services operating in a given time period
- Crowded CBD stations that rely on stairs instead of escalators as the principal means of accessing platforms and concourse levels
- Sharing of rail infrastructure with freight services, which impacts passenger rail services.

Additionally, access to public transport is limited at key precincts in Sydney which are forecast to have significant employment and housing growth, including:

- Sydney Olympic Park is currently serviced by the T7 Olympic Park Line. Customers on the T7 Olympic Park Line are required to transfer at Lidcombe to travel to or from the Parramatta or Sydney CBDs
- The Bays Precinct which is set to undergo urban transformation and become a major employment hub and destination. There is no rail connection to White Bay, and capacity constraints on Victoria Road and the Anzac Bridge limit the opportunity to increase bus services. A mass transit solution is required to accommodate growth at The Bays Precinct.

Greater Sydney has significantly higher car mode shares than other international cities. This increases travel times for commuters and businesses, reduces reliability and safety and increases noise and pollution for pedestrians and cyclists.

2.2.3 The relationship between transport accessibility and land use change

There is an intrinsic link between public transport and land use change. Public transport accessibility makes particular locations more attractive. Transport accessibility and amenity are critical to supporting employment, housing supply and urban renewal opportunities and ultimately to support Sydney's economic and population growth.

Significant growth is planned for the Greater Parramatta to Sydney CBD corridor, consistent with NSW and Australian Government's integrated land use and transport plans. Transport accessibility and amenity issues, including crowding and capacity constraints in the Western rail corridor, as well as traffic congestion from high levels of car use, are limiting the achievement of planned growth because these precincts are less attractive to households and developers.

2.3 Key benefits of Sydney Metro West

2.3.1 Transport benefits

The key transport related benefits of Sydney Metro West are summarised in Table 2-1.

Table 2-1: Transport related benefits

Benefit	Discussion
Increased transport network capacity	Sydney Metro West would effectively double rail capacity from Parramatta to the Sydney CBD. At ultimate capacity, it would be able to move more than 40,000 people an hour in each direction and would complement the suburban and intercity services between Parramatta and the Sydney CBD.
Increased accessibility to key centres	Sydney Metro West would substantially improve the public transport network accessibility to key economic centres across the Greater Parramatta to Sydney CBD corridor. It would: • Substantially increase accessibility to the future key centre at The Bays Precinct which is not currently serviced by the existing suburban rail network • Substantially increase rail services and overall rail capacity to Westmead, Parramatta, Sydney Olympic Park and the Sydney CBD.
Increased public transport network reach and use	Sydney Metro West would increase the reach and use of Sydney's public transport network by: • Providing new stations at localities not serviced by the existing suburban rail network, including Burwood North, Five Dock and The Bays Precinct • Increasing the Parramatta and Sydney CBD rail catchment areas • Providing a more direct connection to Sydney Olympic Park • Providing additional interchange capability at Westmead, North Strathfield and in the Sydney CBD.
Improved travel times	Sydney Metro West would create a significant opportunity to improve travel times by providing: • More direct routes in between areas with existing rail services • Access to rail services in areas that currently do not have train stations • Reduced crowding on trains and at some stations, leading to improved service reliability • A high-frequency service, with customers able to 'turn-up-and-go' and no longer relying on timetables. The largest travel-time saving would be experienced in areas where: • New stations are provided in areas not currently serviced by the existing suburban rail network, such as Burwood North, Five Dock and The Bays • More direct routes are provided, such as trips from Parramatta to the Sydney CBD and to and from Sydney Olympic Park • Customers can more efficiently transfer between services at new stations – including at Westmead and North Strathfield.

Benefit	Discussion
Reduced train crowding	By providing additional rail services, Sydney Metro West would reduce train crowding in the western rail corridor which is forecast to reach capacity by the early-2030s. Train crowding relief would occur on parts of the T1 Western Line and T9 Northern Line due to direct interchange with Sydney Metro West, as well as the T2 Inner West Line services. Reduced train crowding would help improve the reliability of Sydney Trains services and improve customer comfort.
Reduced station crowding	The introduction of new rail services and infrastructure, including new stations in the Parramatta and Sydney CBDs, would reduce congestion and help alleviate platform and station crowding. Reduced platform and station crowding would shorten the time spent by customers in heavily crowded platform conditions and improve network performance by allowing reduced station dwell times (and therefore improved travel times). Sydney Metro West would help to reduce crowding at: • The busiest CBD stations • The existing Parramatta Station due to the delivery of a new metro station in Parramatta and interchange at Westmead. Existing stations at Strathfield, Epping and Burwood stations would also experience reduced crowding.
Opportunity to optimise the bus network	The additional mass transit accessibility and amenity provided by Sydney Metro West would provide the opportunity to optimise the bus network. This could include additional feeder services to Sydney Metro West stations and re-deployment of existing parallel bus services that would duplicate parts of the Sydney Metro West alignment. This would maintain the level of bus services across the network while providing the opportunity to: • Reduce the number of buses on congested corridors such as Parramatta Road and Victoria Road • Increase bus services on other parts of the network with lower levels of mass transit accessibility and amenity • Improve bus travel times to major destinations along the Metro West corridor.
Road user and community benefits	Sydney Metro West would provide the opportunity for a mode shift from car to public transport, which could result in road user travel time savings. The potential reduction in private vehicle car use could create benefits in the form of: • Car use travel time savings and improved reliability for remaining car users • Reduced vehicle operating costs • Reduced environmental impacts such as air pollution, greenhouse gas, noise and water pollution.
Improved resilience to incidents on the network	Forced rail network shutdowns during unplanned and planned events (including periodic maintenance) impact on customer service provision and access to key destinations. Sydney Metro West would provide an additional, high-capacity public transport link in the corridor, separated from the Sydney Trains rail network. This would provide customers with alternative routes and additional connectivity with transfer opportunities to the wider rail network which would reduce the impact on customers during major incidents and increase the resilience of the network.

2.3.2 Productivity benefits

By improving the connections between key economic centres, Sydney Metro West would foster significant growth in jobs, including directly supporting the creation of new jobs within the corridor particularly at key precincts including Westmead, Parramatta, Sydney Olympic Park and The Bays Precinct. Sydney Metro West would also support:

- Enhanced international competitiveness through increased accessibility to world-class precincts which would be expected to attract international visitors, jobs and investment
- A move to productive jobs by attracting knowledge-based industries that would want to take advantage of the corridor's premier location and presence of knowledge industries in key areas
- Connectivity benefits by enabling an increase in the effective employment density in the corridor and a reduction in travel time. This would effectively bring businesses closer together and support increased knowledge transfer, collaboration and innovation.

2.3.3 City-shaping benefits

The key city-shaping related benefits of Sydney Metro West are summarised in Table 2-2.

Table 2-2: City-shaping related benefits

Benefit	Discussion
Supporting planned growth	New and improved public transport access offers opportunities for transit-oriented development, encourages urban renewal, and allows more efficient use of land within station catchments. Sydney Metro West would support growth (jobs, homes and residents) that is planned for the Greater Parramatta to Sydney CBD corridor. This planned growth may not otherwise be achieved as transport accessibility and amenity would constrain take-up of growth by businesses, workers and residents. Sydney Metro West would help implement the vision for 30-minute cites as outlined in the Greater Sydney Region Plan (see Section 2.4.3), by providing customers an easy connection to key destinations including cities, major health and education precincts, diverse employment centres and residential precincts.
Increased all day accessibility	By connecting customers to a diverse range of destinations (cities, major health and education precincts, diverse employment centres, residential precincts and recreational areas) and by providing a turn-up-and-go service, Sydney Metro West would enable a wide range of trip purposes, which lends itself to higher all-day usage.
Reduced public infrastructure provision and household energy consumption	Sydney Metro West would support urban renewal along the corridor. Development within the corridor would provide the opportunity for new homes that use less electricity, gas and water than larger homes in greenfield areas on the urban fringe, reducing the cost of living for these households and greenhouse gas emissions.
Housing supply and affordability	Housing affordability is a key issue in Sydney mainly due to strong demand for new homes, limited future housing supply and a relative lack of housing diversity (and associated diversity in housing prices). With planned improvements in land use, Sydney Metro West would support a broader range of housing opportunities, which can offer improved and more affordable housing with better access to services and employment, and improved liveability.
Social equity	Sydney Metro West would support the creation of jobs and housing opportunities in Western Sydney, allowing people to live near their place of work. The improved west to east connections would also increase employment options for people in Western Sydney and increase access to services such as education institutions.
Sustainability, health and amenity benefits	With planned changes to land use, improved accessibility via Sydney Metro West, and by enabling new homes and jobs, people are expected to relocate to the Greater Parramatta to Sydney CBD corridor. This would promote more sustainable travel behaviours and enhanced liveability through: • Incidental levels of exercise with customers able to walk and cycle to the station • Amenity and place-making benefits from enhanced pedestrian environments and active transport links • Opportunities for urban renewal and integrated station and precinct development along the corridor, resulting in better access to jobs and services and improved social cohesion • Potential to reduce travel related stress for people who switch modes in peak hour travel, by decreasing the time spent travelling in congested conditions.

2.4 Consistency with strategic planning and policy

Sydney Metro West is consistent with key Government planning strategies, as outlined in this section.

2.4.1 Building Momentum: NSW State Infrastructure Strategy 2018-2038

The NSW State Infrastructure Strategy (Infrastructure NSW, 2018) sets out independent advice on NSW's infrastructure needs and priorities over the next 20 years across all sectors including transport.

The Strategy specifically recommends "that Transport for NSW complete the Sydney Metro West business case ...and continue to progress corridor planning and protection activities for future links in the Central River City and Western Parkland City".

Sydney Metro West also supports several of the Strategy's key recommendations including:

- Support the development of a three-city metropolis for Greater Sydney by investing in transport infrastructure that provides high-frequency and high-volume access to, and connectivity between, each of the three cities, while enhancing local amenity
- Invest in transport infrastructure that is integrated with land use to create opportunities for agglomeration and enhance productivity, liveability and accessibility, in support of the policy goal of a '30-minute city'.

2.4.2 Greater Sydney Region Plan: A Metropolis of Three Cities

Sydney Metro West is identified in the Greater Sydney Region Plan 2056 (Greater Sydney Commission 2018a) as being able to significantly enhance the intercity linkage between the Central River City of Greater Parramatta and the Eastern Harbour City of the Sydney CBD. Sydney Metro West is also identified as a catalyst for realising the vision of the Greater Parramatta and the Olympic Peninsula region, which will be a place for new business, housing choice, education, research, entertainment and tourism.

Sydney Metro West would support key directions outlined in the Greater Sydney Region Plan including by:

- Providing infrastructure to support the three cities including the '30-minute city' concept where people will have access to jobs, schools, hospitals and services within 30 minutes
- Connecting the Eastern Economic Corridor with the Greater Parramatta and Olympic Peninsula Economic Corridor
- Supporting greater housing supply.

2.4.3 Central City District Plan

The Central City District Plan (Greater Sydney Commission, 2018b) is the 20-year plan for the implementation of the 40-year vision for Greater Sydney detailed in the Greater Sydney Region Plan. Sydney's Central River City includes Greater Parramatta as its key Metropolitan Centre, acknowledging its function in providing world-class health, education and research institutions as well as finance, business services and administration.

Priorities for the Central River City include growing a stronger and more competitive Greater Parramatta and a better connected and competitive Greater Parramatta and the Olympic Peninsula Economic Corridor, and to deliver 30-minute cities through integrated land use and transport planning.

Sydney Metro West is identified as being able to support these priorities by enhancing transport connections to and within Greater Parramatta and the Olympic Peninsula, and providing the opportunity for new housing and office floor space, and improving access to jobs.

2.4.4 Eastern City District Plan

The Eastern City District Plan (Greater Sydney Commission, 2018c) is the 20-year plan to implement the vision for Greater Sydney established in the Greater Sydney Region Plan. The Eastern City District includes the Sydney CBD as its major Metropolitan Centre, acknowledging its role as Australia's established global gateway and financial capital.

Priorities of the plan which are aligned to Sydney Metro West include supporting the city by aligning infrastructure and land use planning, growing a stronger internationally-competitive Sydney CBD, delivering integrated land use and transport planning and a 30-minute city.

2.4.5 Greater Parramatta and the Olympic Peninsula Vision

Greater Parramatta and the Olympic Peninsula Vision (Greater Sydney Commission, 2016) details the strategic direction for Sydney's 'true centre'.

Sydney Metro West aligns with the directions to encourage investment in the economic anchors of Parramatta-Westmead and Sydney Olympic Park, support 30-minute cities within these locations and beyond and support high quality public spaces to enhance liveability.

The vision is further developed in the Greater Sydney Region Plan (refer to Section 2.4.2), in which Sydney Metro West is also described as a catalyst for realising the vision of the Greater Parramatta and the Olympic Peninsula region. Sydney Metro West provides strong support for this vision through the delivery of stations in Westmead, Parramatta and Sydney Olympic Park.

2.4.6 Smart Cities

The *Smart Cities Plan* (Australian Government, 2016) sets out the Australian Government's vision for cities, and a plan for maximising their potential. It includes three pillars: smart investment, smart policy and smart technology.

Central to a smart investment approach is prioritising projects that meet broader economic and city objectives such as accessibility, jobs, affordable housing and healthy environments. Sydney Metro West is consistent with this approach with its support for 30-minute cities and improved connections to key destinations including major health and education precincts, diverse employment centres and residential precincts.

As part of the Sydney Metro network, Sydney Metro West also embraces new transport technology with new-generation trains that would deliver fast, safe and reliable journeys for customers with high performance standards and good customer amenities.

2.5 Consistency with NSW strategic transport infrastructure policy

2.5.1 Future Transport Strategy 2056

Future Transport Strategy 2056 (Transport for NSW, 2018a) is Transport for NSW's 40-year strategy to support growth and the NSW economy, focusing on customer needs and the technological, economic and social changes ahead. Future Transport's investment priorities for Greater Sydney will be guided by the vision of a metropolis of three cities.

The three-cities vision will require a sustained and staged investment program to protect transport corridors and develop a connected mass transit network across the city. These investments will provide improved public transport, congestion management and urban renewal outcomes, enabling capacity on existing road and rail corridors and supporting renewal and walkability by drawing traffic away from centres.

The strategy sets a vision for the future city-shaping transport network (shown on Figure 2-2) including major transport corridors which provide high speed and volume linkages between centres and shape the locational decisions of residents and businesses.

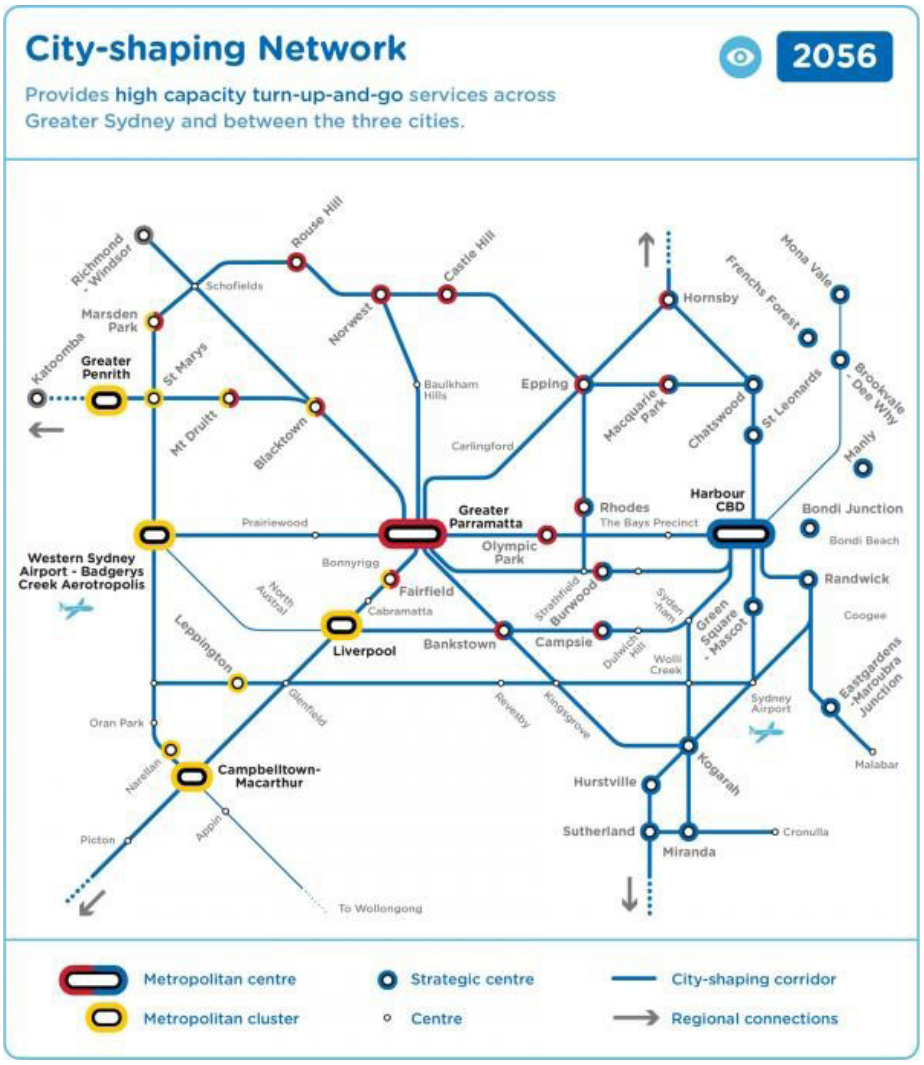

Figure 2-2: City-shaping network 2056 – Future Transport Strategy (Transport for NSW, 2018a)

The corridor between Greater Parramatta and the Sydney CBD, connected via Sydney Olympic Park and The Bays Precinct is identified as a city-shaping corridor. Sydney Metro West would help fulfil the vision of this corridor.

Sydney Metro West would also accommodate future city-shaping corridors identified in the strategy and would safeguard for possible future extensions.

Future Transport Strategy 2056 identifies Sydney Metro West as a committed project connecting the Central River City to the Eastern Harbour City in the 0 to 10 year planning horizon.

2.5.2 Sydney City Centre Access Strategy

The Sydney City Centre Access Strategy (Transport for NSW, 2013) 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. The strategy 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 heart 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 and improve the customer experience.

Several key transport challenges for the Sydney CBD are discussed in the strategy, including public transport capacity (in particular the T1 Western Line) and meeting future demand for access to the city centre. Sydney Metro West is a key initiative which would be able to address this demand for services to the Sydney CBD.

2.6 Objectives of Sydney Metro West

Sydney Metro West's objectives are separated into network and corridor objectives. The network objectives represent the outcomes to be achieved by Sydney Metro West in its full configuration, including potential western and eastern extensions. The corridor objectives include the specific plans and needs of the geographic area between Greater Parramatta and the Sydney CBD.

Sydney Metro West network objectives

- Ensure transport services are meeting the needs of customers
- Deliver outcomes that align with and support key strategic land use and transport frameworks including the Smart Cities Plan, Greater Sydney Region Plan, Future Transport Strategy and the relevant District Plans
- Boost Sydney's international competitiveness, productivity and employment growth by supporting new and existing strategic centres
- Support future housing needs by increasing housing supply, choice and affordability
- Improve liveability and provide a catalyst for positive change by supporting urban renewal opportunities, enhancing housing supply and supporting productivity of centres
- Improve access to and resilience of the transport network through integrated land use and transport planning, including integration of Sydney Metro West with other modes
- Ensure value for money and a sustainable and deliverable solution.

Sydney Metro West Greater Parramatta to Sydney CBD corridor objectives

- Contribute towards the vision for a three cities metropolis established by the Greater Sydney Commission including the '30-minute city' concept
- Support additional housing supply and employment growth opportunities and support urban renewal initiatives within the Greater Parramatta to Sydney CBD corridor including key government precincts such as Greater Parramatta and Olympic Peninsula and The Bays Precinct
- Achieve customer outcomes including relieving congestion on the busy T1 Western Line and T2 Inner West Line, increased rail patronage and mode shift, reduced travel times between key destinations, providing new access to mass transit rail and relieving bus and road congestion in the western corridor.

2.7 Justification for Stage 1

Seeking planning approval for the major civil construction work between Westmead and The Bays Precinct as Stage 1 would allow:

- Earlier commencement of critical construction activities, facilitating earlier opening and realisation of the benefits of Sydney Metro West
- Additional community and stakeholder consultation, and additional time to solve certain design elements including the station location and tunnel alignment through the complex Sydney CBD environment, and the end-state design of stations including urban design, transport integration and place-making outcomes.

3 Sydney Metro West development and alternatives

3 Sydney Metro West development and alternatives

This chapter describes the evaluation process undertaken to determine the preferred option. An overview is provided of the strategic alternatives, the alignment and station options considered, and the strategic station options that were subsequently evaluated.

3.1 Overview of the Sydney Metro West development process

The Sydney Metro West development process has been driven by the identified strategic need to improve connectivity between Greater Parramatta and the Sydney CBD, and has included:

- Development of a solution to improve transport capacity and amenity between Parramatta and the Sydney CBD, and support population growth
- Consideration of alignment options and the type of service, including determining the optimal balance of travel times between the Parramatta and Sydney CBDs, and the number of stations to enable people to access metro services
- Analysis of options for station locations
- Analysis of options for a stabling and maintenance facility
- Analysis of options for the approach to tunnelling
- Investigations into safeguarding measures for potential future extensions of Sydney Metro West.

Development has been carried out in consultation with stakeholders and the community. This is further detailed in Chapter 5.

3.2 Strategic alternatives

3.2.1 Do nothing

Demand on much of Sydney's rail network is nearing capacity during the morning and evening peak periods. To ensure continued growth in productivity, cater for forecast employment and population growth, and sustain the city's liveability, Sydney's transport capacity will need to substantially increase.

If the additional mass transit capacity offered by Sydney Metro West does not proceed, it is expected that:

- The T1 Western Line, T9 Northern Line and T2 Inner West Line will continue to operate at capacity at peak times, with very limited capacity for new growth in the corridor
- The road network in the corridor will continue to operate at capacity in peak times, creating congested roads and increased travel times for motorists and bus customers
- The lack of transport connectivity at key precincts such as Sydney Olympic Park and The Bays Precinct will not be adequately addressed
- The long-term public transport capacity requirements for the projected population and employment growth between Parramatta and the Sydney CBD would not be met
- Growth would more likely be accommodated on Sydney's urban fringe, contributing to continuing urban sprawl and congestion; or within existing communities, potentially impacting local character and amenity
- There would be reduced potential for development of precincts and new housing stock
- There would be reduced productivity and international competitiveness due to congestion and reduced clustering of businesses in economic centres within the Parramatta to Sydney CBD corridor.

3.2.2 Regulatory, governance and better-use reforms

The NSW Government has considered a range of regulatory, governance and better-use reforms to improve transport and land use outcomes, cater to growing transport demand and meet Sydney's growing population needs. These reforms include continued implementation of rail network improvements such as automated signalling and increased frequency of rail services as part of the More Trains, More Services program; more efficient use of roads; more frequent bus and ferry services and bus priority initiatives. Reviews of transport legislation to allow for more flexible services and integrated transport and land use planning have also been investigated.

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

3.2.3 Transport mode alternatives

Further investment in road, bus and light rail as a strategic alternative to the Sydney Metro West has been considered including new motorways, suburban rail connections, bus rapid transit services, and increased ferry services.

With respect to buses and light rail, these are complementary modes, bringing customers to and dispersing them from the major transport hubs serviced by suburban and metro rail services. Buses can potentially 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.

Ferry services tend to be slower than rail services. Ferry travel times between Parramatta and the Sydney CBD are also impacted by speed restrictions on the Parramatta River, and natural low tides between Rydalmere and Parramatta reduce reliability.

The NSW Government is currently investing in projects to improve transport and land use outcomes in the Greater Parramatta to Sydney CBD corridor. These include Parramatta Light Rail Stages 1 and 2, the Parramatta Road Corridor Urban Transformation Strategy and road projects such as WestConnex.

The current and planned light rail network will largely serve local demand focused on the Parramatta and Sydney CBDs and provide feeder services to mass transit spines (currently heavy rail), rather than providing connectivity across the entire corridor.

While current initiatives are important to service key precincts within the corridor, these projects cannot wholly support the large hourly commuter movements required in and out of Parramatta and the Sydney CBD.

3.2.4 Rail network options

The NSW Government is currently investing in improvements to the suburban rail network, including through the More Trains, More Services program, which includes extra rail services, new trains on the suburban network and upgraded rail infrastructure.

As part of the program, in late 2017, an extra four express services were provided between Parramatta and the Sydney CBD in both the morning and afternoon peaks, increasing the service to 20 trains per hour.

While the More Trains, More Services program is important to accommodate customer growth and continually increase demand across the existing rail network, an additional solution is required to meet demand for rail services between Parramatta and the Sydney CBD in the long term. So that joint objectives are achieved, the More Trains, More Services program would need to be integrated with Sydney Metro West.

Additionally, these improvements to the existing rail network are unable to support opportunities related to housing growth and the development of new precincts. Without the provision of new stations, these improvements will not provide services to new rail catchments and key precincts currently not serviced by rail, including The Bays Precinct and direct services to Sydney Olympic Park.

3.3 Travel time between Parramatta and the Sydney CBD

A guiding principle for Sydney Metro West is to offer a faster trip than would be possible on the existing T1 Western Line between Parramatta and the Sydney CBD. The fastest travel time between Parramatta and Wynyard stations on the existing rail network is 31-33 minutes. Travel time between the two cities is important to support both the '30-minute city' concept and to facilitate improved customer, transport and land use outcomes.

This principle has influenced further development of Sydney Metro West, including alignment and station options.

The optimum travel time between Parramatta and the Sydney CBD is about 20 minutes. A travel time target of about 20 minutes delivers a balance of fast travel times and associated travel time benefits, new stations within the corridor to create new rail catchments and improved transport connectivity.

3.4 Strategic alignment and service alternatives

A key consideration in decision making around alignment options is the balance between travel times and number of stations. Options investigated were:

- About four to five stations from Greater Parramatta to the Sydney CBD (inclusive).
  This option would achieve a higher speed but service a smaller number of stations. This option was found to be limited in its ability to service a large catchment due to a minimal number of stations
- About nine to 10 stations from Greater Parramatta to the Sydney CBD (inclusive), with anchor precincts at Parramatta, Sydney Olympic Park, The Bays and Sydney CBD.
  This option was found to achieve a balance between an efficient travel time between Greater Parramatta and the Sydney CBD, and the ability to service a large catchment area and key precincts
- About 11 to 12 stations from Greater Parramatta to the Sydney CBD (inclusive).
  This option would service a large catchment due to a higher number of stations but result in a higher travel time (greater than the optimum time of about 20 minutes) between Greater Parramatta and the Sydney CBD. An 11 to 12 station option north of Parramatta River was also investigated however this alignment would be unable to service key precincts including Sydney Olympic Park.

This evaluation concluded that a service with about nine to 10 stations was the preferred option as it could achieve a balance between travel times and an optimal number of stations to service a large catchment. This preference was the basis for further development of the Concept, which involved considering station location options as well as other criteria including horizontal curves, vertical grades, geology, and the need to avoid underground infrastructure such as major utilities and basements. Options investigated for station locations are detailed in Section 3.5.

3.5 Station location options

The evaluation of station location options has followed a three-phase process:

- Strategic station locations: Identified the key locations to be serviced at Parramatta, Sydney Olympic Park, The Bays Precinct and Sydney CBD
- Preliminary station locations:
  - Identified that adding Westmead as a core station provided significant benefits
  - Assessed and shortlisted station option pairs for Westmead and Parramatta and to connect to the T1 Western Line
  - Assessed station location options between Parramatta and Sydney Olympic Park
  - Assessed and shortlisted station options to connect to the T9 Northern Line
  - Assessed and shortlisted station options between the T9 Northern Line and The Bays Precinct
  - Identified the preferred locality for connecting to the Sydney CBD.
- Shortlisted station locations: Involved detailed assessment of the shortlisted station locations.

An additional phase is currently underway (strategic station options) to investigate the potential for additional stations at Rydalmere and Pyrmont.

Options to be investigated for metro stations were identified through:

- Engagement with community and stakeholders including local councils and industry
- A strategic station location process by Sydney Metro
- Consultation with key government stakeholders including the Department of Planning, Industry and Environment, the Greater Sydney Commission, other sections of Transport for NSW and the Department of Premier and Cabinet.

Activities undertaken to support the station location options evaluation included:

- Feedback from community and industry engagement
- Land use and transport modelling
- Scoping design, technical feasibility and engineering studies
- Feedback from key stakeholder workshops and working groups.

3.5.1 Strategic station locations

Preliminary investigations identified that stations at Parramatta, Sydney Olympic Park, The Bays Precinct and Sydney CBD would provide connections to key centres along the corridor and were core to the Concept (referred to as 'core stations').

These station locations were publicly announced in November 2016. An interchange with the T1 Western Line was also determined to be a key element of the Concept to provide relief to this service, which was expected to be severely overcrowded by the 2030s. The benefits and reasoning for each of the core stations is provided in Table 3-1.

Table 3-1: Core station evaluation

Core station	Evaluation
Parramatta	A new metro station at Parramatta would reinforce its role as the metropolitan centre of the Central River City with access to reliable, high capacity public transport. This would support connectivity to employment, in an area where the number of jobs is expected to increase over the next 20 years to 137,000 (Greater Sydney Commission, 2018a) and connect Sydney's second CBD to key employment centres across Greater Sydney. Sydney Metro West would also enable more customers to travel to Greater Parramatta from the east during the AM peak – supporting the development of Sydney as a multi-centric city.
Sydney Olympic Park	A metro station would enable full realisation of the Sydney Olympic Park lifestyle super precinct as a centre of recreation, entertainment, knowledge intensive jobs and higher-density living. Mass transit would support the 34,000 jobs and more than 23,000 residents that will be located in the area by 2030 (Sydney Olympic Park Authority, 2018), and significantly enhance public transport connectivity.
The Bays Precinct	The Bays Precinct is set to be Sydney's new world-class destination and employment hub where 95 hectares of land is being regenerated. Sydney Metro West would enable The Bays Precinct to be developed to its full potential, with a focus on improved international competitiveness and knowledge based jobs.
Sydney CBD	A metro station in the Sydney CBD would allow easy access to the existing public transport network, Sydney Metro Northwest (recently opened), and Sydney Metro City & Southwest (currently under construction). Sydney Metro West would provide a direct connection from the Sydney CBD to current and future employment centres such as Greater Parramatta, Sydney Olympic Park and The Bays Precinct. It would also improve accessibility to Sydney's cultural, recreational and tourism attractions. There is also potential to provide congestion relief to the existing Town Hall and Wynyard stations.

3.5.2 Preliminary station locations

This phase identified and assessed station location options including connections to the T1 Western Line, T9 Northern Line and Sydney CBD.

Westmead as a core station location

Westmead is home to one of the largest health, education, research and training precincts in Australia, and is a key provider of jobs for the Greater Parramatta and Western Sydney region. Westmead provides direct health services to almost 10 per cent of Australia's population (Deloitte and Westmead Alliance, 2016) and by 2026 will have more than 2.8 million outpatient visits and over 160,000 emergency department presentations every year (Greater Sydney Commission, 2018).

Westmead is an engine for health innovation and a major contributor to the Australian Government's national innovation and science agenda. Westmead produces world-leading scientists and analysts, and is home to successful health research collaborations, including translational research which aims to 'translate' research into meaningful health outcomes.

The Westmead health and education precinct spans more than 75 hectares and comprises over 400,000 square metres of high-end health-related developments, including four major hospitals, three world-leading medical research institutes, and the largest research-intensive pathology service in NSW.

Servicing the precinct with metro would provide a significant opportunity to underpin the new vision for Westmead by offering improved accessibility to and from the precinct and attracting global practices and businesses. Westmead was therefore added as a core station location.

Connecting with the T1 Western Line – Westmead and Parramatta

A metro station interchanging with the T1 Western Line would offer significant relief to the existing T1 services and would provide customers travelling to the Sydney CBD with faster travel times and expand the 30-minute catchment for Greater Parramatta. A connection along the T1 Western Line may facilitate land use change with residential and employment growth opportunities and provide wider accessibility and journey time savings across Greater Sydney.

Table 3-2 provides a summary of the station combinations evaluated.

Table 3-2: Westmead and Parramatta – preliminary station location options evaluation

Locality	Preliminary evaluation	Shortlisted
Westmead North and Parramatta Station	This option would provide a station in Westmead North and one at the existing Parramatta Station where it would interchange with the T1 Western Line, T5 Cumberland Line and the T2 Inner West Line. This option would relieve the busy T1 Western Line at Parramatta serving the greatest number of existing rail customers and providing an interchange with the existing bus network. This option would reinforce Parramatta Station as one of the busiest on the network. This option would enable a metro station at Westmead to be closer to the health precinct and support delivery of the Westmead health and education super precinct. It would also offer customers an opportunity to transfer to and from Parramatta Light Rail.	Yes
Westmead Station and Parramatta CBD	This option would provide an interchange with T1 Western Line services at the existing Westmead Station and a new metro station in the Parramatta CBD. A new metro station in the northern part of the commercial district of Parramatta, in the heart of the Parramatta CBD, would serve the greatest number of jobs and provide fast and efficient connections with the Sydney CBD. It would create a second gateway, and reinforce Parramatta's status as the Central River City. A new transport node could be established around a new station, providing much needed relief to the existing Parramatta Station and bus layover areas. This option would offer the opportunity to create a high-quality interchange for customers at Westmead with the T1 Western Line and T5 Cumberland Line, T-way bus services and Parramatta Light Rail. A new metro station at the existing Westmead Station would improve accessibility to the Westmead health and education super precinct, while also supporting renewal of Westmead South.	Yes
Westmead Station and Parramatta Station	Duplicating connections to the T1 Western Line at both existing stations would dilute the opportunity to both reinforce Parramatta as the Central River City and relieve the T1 Western Line.	No
Westmead North and Parramatta CBD	This option would not provide a direct connection with the T1 Western Line and therefore would not provide relief to the existing suburban rail network.	No
Westmead Station and South Parramatta	A South Parramatta station would be further from the core activity of the Parramatta CBD, relative to other options considered.	No
Westmead North and South Parramatta	This option would not provide a direct connection with the T1 Western Line and therefore would not provide relief to the existing suburban rail network.	No

Between Parramatta and Sydney Olympic Park – Greater Parramatta to the Olympic Peninsula area

Table 3-3 provides a summary of the station combinations evaluated in the Greater Parramatta to the Olympic Peninsula area.

Table 3-3: Greater Parramatta to the Olympic Peninsula – preliminary station location options evaluation

Locality	Preliminary evaluation	Shortlisted
Rydalmere	A metro station in Rydalmere could support urban renewal opportunities within the station catchment, including education, residential and mixed-use employment. Rydalmere could provide customer benefits to a growing catchment and transport integration with links to the future Parramatta Light Rail and bus routes along Victoria Road delivering improved accessibility. A station in this locality may not align with the NSW Government's current strategic land use vision for essential urban services in this area (Greater Sydney Commission, 2016).	Yes
Camellia	A new metro station could be located in the future Camellia Town Centre, offering an opportunity for an interchange with the future Parramatta Light Rail and supporting urban renewal of the Camellia Peninsula. This option would present considerable constructability challenges in relation to contamination and flooding.	Yes
North Auburn	This option would present significant constructability-related challenges, and the alignment would limit the ability to efficiently provide a station location in Parramatta.	No
Ermington	This option would result in a less efficient alignment between Sydney Olympic Park and Greater Parramatta, resulting in longer travel times for customers.	No
Silverwater	A station in this locality would not align with the NSW Government's current strategic land use vision for essential urban services in this area (Greater Sydney Commission, 2016).	No
Newington	A station in this locality would not align with the current strategic land use vision for this area which seeks to retain the existing residential community without any significant increase in density, enabling the retention and protection of essential industrial and urban services land in adjoining Silverwater (Greater Sydney Commission, 2016).	No
North Lidcombe	A station in this locality would not align with current strategic land use frameworks, which seek to retain existing urban services. This option would have a highly constrained catchment due to transport and geographical barriers and would present significant constructability-related challenges.	No

While Camellia and Rydalmere were initially found to be the preferred locations from the options assessed in this area, it was determined that further analysis of this area was required due to:

- The strategic vision for land use in the area broadly between Parramatta and Sydney Olympic Park is to retain industrial or urban services functions
- Community and stakeholder consultation and feedback during round two of engagement particularly in relation to Silverwater and Newington.

The area between Parramatta and Sydney Olympic Park was therefore identified as a strategic option and progressed to the strategic station options phase. Information on further and ongoing assessment of station location options in this area is detailed in Section 3.5.4.

Connection with the T9 Northern Line

Providing a metro station that interchanges with the T9 Northern Line would offer significant relief to existing services, provide customers with faster travel times and expand the 30-minute catchment for Greater Parramatta. The station would provide an attractive interchange option for customers and extend the catchment of Sydney Metro West to Sydney's North. A connection along the T9 Northern Line may facilitate land use change with residential and employment growth opportunities and provide wider accessibility and journey time savings across greater Sydney.

Along the T9 Northern Line, four stations were subject to a preliminary station assessment; of these, two were shortlisted for further evaluation. Table 3-4 provides a summary of the station combinations evaluated.

Table 3-4: Connection to the T9 Northern Line – preliminary station location options evaluation

Locality	Preliminary evaluation	Shortlisted
Rhodes	Rhodes is located on a peninsula, which makes a connection at this location challenging from a constructability point of view, increasing water crossings and impacts to the alignment, and therefore travel time for customers.	No
Concord West	A Concord West station location would have a relatively small walking catchment due to large open spaces nearby but would provide opportunities for integration with the local bus network.	Yes
North Strathfield	A North Strathfield station location would support urban renewal within the Homebush precinct redevelopment area. The station would reach a significant walking catchment and offer a more efficient alignment (and therefore improved travel times for customers travelling from Parramatta to the Sydney CBD).	Yes
Strathfield	The existing Strathfield Station is constrained in terms of capacity and this option would duplicate the existing T1 Western Line services between Parramatta and the Sydney CBD.	No

Between the T9 Northern Line and The Bays Precinct

Currently, public transport accessibility between the T9 Northern Line and The Bays Precinct is largely limited to road-based transport. There are opportunities to provide customers with significant travel-time improvements, connect more of the workforce to jobs within 30 minutes and integrate with the bus network.

Table 3-5 provides a summary of the station combinations evaluated.

Table 3-5: Between the T9 Northern Line and The Bays Precinct – preliminary station location options evaluation

Locality	Preliminary evaluation	Shortlisted
Concord	Concord is characterised by lower density residential land use with significant green space. There is limited employment activity within the locality and limited opportunity for residential and employment uplift. Heritage attributes and green space in the locality would also require careful consideration.	No
Mortlake	Mortlake is a peninsula constrained by the Parramatta River. There is limited employment activity within the locality, and employment and residential uplift is very limited due to the constraints and land use in the locality. Recent medium-density residential development and the presence of waterbodies and green space limit opportunities for uplift in the locality. The location would present constructability and deliverability challenges due to interaction with multiple water crossings, varied elevation (impacting station depth), and a potentially inefficient alignment.	No
Burwood North	The Burwood North locality is within the Parramatta Road Corridor Urban Transformation Strategy area and characterised by mixed uses along Parramatta Road and along Burwood Road towards the Burwood strategic centre. A station at Burwood North could support employment growth and intensification of existing land uses in the surrounding catchment, with particular opportunities for residential growth. It would open a new rail catchment to provide customer benefits with a more frequent, reliable and fast mass transit service, and would provide an opportunity to integrate with the existing bus network. A station in this locality would offer a relatively efficient corridor alignment that supports efficient travel times between the Parramatta and Sydney CBDs.	Yes
Burwood	As the T1 Western Line currently provides a high level of rail service to Burwood, customers in the locality would receive relatively less improvement to service frequency, travel time and improved access to other station locations. As Burwood is located significantly south of The Bays Precinct and Sydney Olympic Park, this inefficient alignment would deliver longer travel times as a result of this station location. The intensive use of the rail corridor would also affect the constructability at this location and impact on current rail services.	No

Locality	Preliminary evaluation	Shortlisted
Kings Bay	Kings Bay is characterised by mixed land use on nearby Parramatta Road including residential, retail, light industrial and education. There is employment and mixed residential land use within the locality with opportunity for employment uplift. The delivery of a metro station would provide customer benefits through a more frequent, reliable and fast service to an area that does not currently connect with mass transit, and presents a transport interchange opportunity with local bus services on Parramatta Road. A station in this locality would offer a corridor alignment that supports efficient travel times between the Parramatta and Sydney CBDs.	Yes
Five Dock	Five Dock is characterised by mixed land uses, including lower density residential and mixed uses on Great North Road. A metro station would provide customers with a more frequent, reliable and fast service to an area that does not currently connect with mass transit. Five Dock is recognised as a location for bus interchange and active transport connectivity. A metro station in this locality could offer a relatively efficient corridor alignment that supports efficient travel times between the Parramatta and Sydney CBDs.	Yes
Ashfield	Ashfield would provide limited support for additional renewal and growth, as development is already occurring in the short and medium term. Ashfield is also currently served by T1 Western Line services at the existing rail station. This option would also result in an inefficient north-south alignment to connect to The Bays Precinct, which would increase journey times for customers.	No
Haberfield	Haberfield is characterised by lower density residential land use with limited employment activity and heritage attributes in the area. This locality would also have constructability and deliverability challenges due to interaction with the Rozelle Interchange (tunnel) and Hawthorne Canal. It would also have an inefficient alignment to The Bays Precinct, which would increase travel times.	No
Drummoyne	Drummoyne would present constructability and deliverability challenges due to interaction with multiple water crossings, the varied elevation in the locality that would impact station depth, and an inefficient alignment that would increase travel time between the Parramatta and Sydney CBDs.	No
Lilyfield	Lilyfield is characterised by lower density residential land use, some green space and heritage restrictions. The locality would present highly difficult constructability and deliverability challenges due to interactions with the Rozelle Interchange and Hawthorne Canal. Initial investigations suggest this location would require a very deep station, resulting in greatly increased access and transfer times for customers.	No
Leichhardt North	Leichhardt North would present constructability and deliverability challenges due to interaction with the Rozelle Interchange and Hawthorne Canal. Initial investigations suggest this location would require a very deep station, resulting in greatly increased access and transfer times for customers.	No
Leichhardt	Leichhardt is characterised by lower density residential land use, limited employment activity within the existing locality, and limited scope for employment uplift due to the heritage values of the area. The locality would present constructability and deliverability challenges due to interaction with the Rozelle Interchange and Hawthorne Canal.	No
Annandale North	Annandale North presents lesser opportunity to connect to employment activity, and growth in employment and population at this locality. Any station option would also require careful consideration of heritage conservation areas. This option would also result in an inefficient north-south alignment to connect to The Bays Precinct, which would increase journey times for customers.	No

Connecting into the Sydney CBD

The Sydney CBD is one of the most productive and well-connected areas in Australia. A connection to the Sydney CBD would:

- Connect customers to high value employment and support efficient business-to-business links
- Offer greater choice for customers and travel time savings to the Sydney CBD
- Enable new interchange opportunities with the existing suburban and intercity rail network and the future Sydney Metro network
- Provide relief to existing Sydney CBD stations.

Further investigation is currently underway to identify an optimum location within the Sydney CBD.

Outcome of preliminary station locations assessment

The preliminary station locations assessment concluded:

- Westmead was included as a core station location
- The shortlisted pairs for station locations at Westmead and Parramatta and to connect to the T1 Western Line were Westmead North/Parramatta Station and Westmead Station/Parramatta CBD
- No obvious station location was identified for the area between Parramatta and Sydney Olympic Park. This area was therefore carried forward for further assessment as part of the strategic station options phase
- The shortlisted locations for the T9 Northern Line connection were Concord West and North Strathfield
- The shortlisted locations for the area between the T9 Northern Line and The Bays Precinct were Burwood North, Kings Bay and Five Dock
- The preferred location for the Sydney CBD connection requires further investigation to identify the optimum location.

3.5.3 Shortlisted station location options

Detailed assessment of shortlisted stations through assessment against the network objectives was carried out.

Input to these assessments included additional land use and transport modelling, technical design and engineering assessments, urban design and place-making assessments, customer testing, a second round of community and industry consultation, and multiple meetings and workshops with key stakeholders.

The performance of each of the shortlisted station options was assessed in detail against the Sydney Metro West objectives and scored as ‘strong alignment’ (green), ‘some or neutral alignment’ (orange) or ‘no or negative alignment’ (red). The results are summarised in Table 3-6 and discussed further below.

Table 3-6: Performance of shortlisted options against the network objectives

Shortlisted station location option	Evaluation criteria						
	Strategic alignment	Productivity & jobs	Housing supply	Urban renewal & place-making	Customer benefits	Transport integration	Deliverability & value
Station locations in Westmead and Parramatta and T1 Western Line connection							
Westmead Station and Parramatta CBD	🟢	🟡	🟢	🟢	🟢	🟢	🟡
Westmead North and Parramatta Station	🟡	🟢	🟢	🟢	🟡	🟡	🔴
T9 Northern Line connection							
Concord West	🟡	🟡	🟡	🟡	🟡	🟢	🟢
North Strathfield	🟡	🟢	🟢	🟢	🟢	🟢	🟡
Between the T9 Northern Line and The Bays Precinct							
Burwood North	🟢	🟢	🟢	🟢	🟢	🟡	🟡
Five Dock	🟡	🟢	🟡	🟡	🟢	🟢	🟡
Kings Bay	🟡	🟡	🟡	🟢	🟢	🟡	🟡

Station locations in Westmead and Parramatta and T1 Western Line connection

The assessment of the Westmead Station and Parramatta CBD pair identified that this option would:

- Support the vision for a metropolis of three cities (Greater Sydney Commission, 2018a) by reinforcing Parramatta with a multi-nodal transport offering
- Provide relief to the existing Parramatta Station
- Deliver strong place-based outcomes in Parramatta CBD by supporting the delivery of part of the Civic Link between the existing Parramatta Station and the Cultural Precinct along the Parramatta River
- Substantially relieve the T1 Western Line through the provision of a metro station interchanging with the existing suburban rail services at Westmead
- Serve the health and education precinct to the north as well as the planned precinct to the south
- Offer a new multimodal transport interchange at Westmead, integrating with Parramatta Light Rail, T-way buses and suburban rail services.

The assessment of the Westmead North and Parramatta Station pair identified that this option would:

- Result in increased pressure on the existing Parramatta Station and bus layover, requiring significant capacity increase
- Have major construction challenges due to the presence of sensitive receivers surrounding the hospital precinct at Westmead North and the need for a substantial intervention to the existing Parramatta Station
- Offer benefits to customers who already experience an existing high level of service in the catchment of Parramatta Station, rather than extending the mass transit catchment to the north of the Parramatta CBD
- Potentially pose limitations on construction of future mass transit corridors in Parramatta indicated in the Future Transport Strategy 2056.

Subsequently, Westmead Station and Parramatta CBD was identified as the preferred option to connect to the T1 Western Line and serve Greater Parramatta.

T9 Northern Line connection

The assessment identified that a metro station at North Strathfield would support and facilitate urban renewal within the Homebush Precinct as identified in the Parramatta Road Corridor Urban Transformation Strategy and enable an efficient tunnel alignment into Sydney Olympic Park Metro Station.

Relative to the North Strathfield option, a metro station at Concord West would provide less support for growth in homes and jobs within a walkable catchment of the station. Additionally, a metro station at Concord West would result in a less efficient alignment to Sydney Olympic Park Metro Station and potentially increase overall travel times between Parramatta and the Sydney CBD.

As a result, North Strathfield was identified as the preferred station to connect to the T9 Northern Line.

Between the T9 Northern Line and The Bays Precinct

Burwood North and Five Dock are both recommended to be included as station locations.

The assessment identified that:

- A metro station at Burwood North would create a multi-nodal, integrated transport offering along Burwood Road with two mass transit nodes supporting the Burwood Strategic Centre to the south and the Parramatta Road Corridor Urban Transformation Strategy area to the north. The station would offer customers significant travel time savings as well as improved connections with key bus corridors coming from the local peninsulas of Concord and Abbotsford as well as Burwood Road
- A metro station at Five Dock would open a new rail catchment and deliver significant travel time savings of more than 30 minutes for customers travelling to the Sydney CBD and about 30 minutes for customers travelling to the Parramatta CBD. Five Dock could provide an efficient bus to metro interchange and help relieve the bus network along Parramatta Road, Victoria Road, the Drummoyne peninsula and parts of the Inner West entering the Sydney CBD
- The Burwood North and Five Dock station location options present an opportunity to function as a pair of stations. The delivery of both stations would service a greater catchment over this length of the corridor
- Relative to the Burwood North and Five Dock options Kings Bay would support a smaller station catchment (as its catchment is limited by Canada Bay and surrounding green space), deliver a smaller increase in productivity and have less opportunity for integration with the wider transport network
- Kings Bay would not support additional intermediate locations, as its catchment would overlap significantly with both the Burwood North and Five Dock options, limiting the opportunity to service a larger catchment. The majority of the catchment serviced by a Kings Bay station would be able to be serviced with a combination of Burwood North and Five Dock metro stations.

Burwood North and Five Dock were identified as preferred options for the area between the T9 Northern Line connection and The Bays Precinct.

Outcome of shortlisted station locations assessment

The assessment of shortlisted metro station locations identified the following preferred station options:

- Westmead Station and Parramatta CBD for the Greater Parramatta area and to connect to the T1 Western Line
- North Strathfield as the T9 Northern Line connection
- Burwood North and Five Dock for the area between the T9 Northern Line and The Bays Precinct.

Design refinement for preferred station locations

The preferred metro station locations are further described in Chapter 6. During the development of preferred station designs alternative station configurations may be considered, including:

- Orientation of station buildings and associated infrastructure and access arrangements to provide effective and efficient access for customers, accessibility of station entry points, and integration with surrounding land uses

- The need to minimise environmental and property impacts
- Constructability
- The need to not preclude the potential for future integrated station and precinct development above or around the station.

Further detail on design refinements of station orientation and access arrangements will be included in the Environmental Impact Statement where relevant.

3.5.4 Strategic station options

An additional phase is ongoing to determine further station locations to be included as part of Sydney Metro West.

The strategic station options phase includes further evaluation of potential station locations between Parramatta and Sydney Olympic Park and at Pyrmont. Further analysis is required to determine the inclusion of these additional station options as part of the Concept. This will include analysis of community and stakeholder feedback, additional land use and transport modelling, technical considerations, and consideration of strategic planning at precincts under investigation.

Between Parramatta and Sydney Olympic Park

As identified during the preliminary station location assessment, further assessment of a potential station between Parramatta and Sydney Olympic Park was required.

This assessment involved collaboration with the Department of Planning, Industry and Environment to investigate the long term land use outcomes between Parramatta and Sydney Olympic Park, and considered feedback received during the community consultation period in April 2018.

A summary of the station locations options assessment for the area between Parramatta and Sydney Olympic Park is provided in Table 3-7.

Table 3-7: Performance of station options between Parramatta and Sydney Olympic Park against the network objectives

	Evaluation criteria						
Shortlisted station location option	**Strategic alignment**	**Productivity & jobs**	**Housing supply**	**Urban renewal & place-making**	**Customer benefits**	**Transport integration**	**Deliverability & value**
Rydalmere	🟢	🟢	🟢	🟢	🟢	🟡	🟡
Camellia	🟡	🟡	🟡	🟡	🟢	🟡	🔴
Rosehill	🟡	🟡	🟢	🟡	🟢	🟡	🔴
Silverwater East	🟡	🟢	🔴	🔴	🟡	🟡	🟢
Silverwater West	🟡	🟢	🟡	🟡	🟡	🟡	🟡

The assessment shows that the preferred option for a station between Parramatta and Sydney Olympic Park is at Rydalmere. A station at Rydalmere would support the growth and development of a diverse and connected Parramatta CBD, and would provide significant opportunity for urban renewal, housing and employment growth while maintaining the existing essential urban services land use in the broader area.

Pyrmont

Pyrmont has been identified as an additional station which has potential to strategically enhance Sydney Metro West.

A metro station at Pyrmont would:

- Provide customers with access to the commercial and entertainment precinct, with key destinations including the International Convention Centre and Sydney Fish Markets, as well as a pedestrian connection along Pyrmont Bridge to the western side of the Sydney CBD
- Enable connections between Sydney, Pyrmont and The Bays Precinct to support the creation of an expanded and connected Sydney CBD
- Deliver a direct rail service to a catchment not currently serviced by rail, and an opportunity to create an interchange with Inner West Light Rail and bus services.

A metro station at Pyrmont would present some constraints and challenges in relation to:

- Barriers to pedestrian movement which may constrain the catchment of a metro station – including steep topography throughout the peninsula and around the waterfront; retaining walls and cuttings around the L1 Dulwich Hill light rail; and major at-grade intersections at Fig Street and Bank Street entrances to the Western Distributor
- Minimising or avoiding impacts on heritage items in the area, including the Union Square conservation area, as well as relocation of major utilities
- Alignment diversion and speed restrictions between the proposed The Bays Station and Sydney CBD Station locations which may impact travel times.

3.6 Stabling and maintenance facility

A stabling and maintenance facility to support an efficient, safe and reliable metro network would be required for Sydney Metro West.

An initial assessment included consideration of the following location options for a stabling and maintenance facility:

- Camellia/Rosehill
- Northmead
- Silverwater
- Rydalmere
- Clyde
- Options further west, including Girraween and Greystanes.

Following initial assessment, Northmead, Silverwater and Rydalmere were not taken forward for further investigation. Due to the relatively small land holdings in these areas, a large number of private properties and businesses would need to be acquired. This would also impact on the viability of the remaining land use and businesses in the localities. Additionally, sites in Northmead and Rydalmere have been identified for future developments, which a stabling and maintenance facility may not support.

Options further west, including Girraween and Greystanes were also not taken forward for further assessment. These sites would be located about five kilometres west of the proposed metro terminus at Westmead Metro Station. This would result in inefficient operations and 'dead running' of rolling stock (where trains operate without carrying passengers, generally to and from a stabling facility).

Following initial assessment, the former Shell refinery site (now the Viva Energy property) in the Camellia/Rosehill area and the Clyde site were identified as the possible locations for the stabling and maintenance facility. However, the Camellia/Rosehill location would present some challenges in relation to flooding and previous substantial contamination, which may pose constraints to construction methodology, program, cost, and worker health and safety.

The Clyde site would also require management of flooding and existing contamination, however these issues can be more easily managed, and was found to be the least constrained of all options assessed and provides for the efficient operation of the line.

3.7 Tunnel construction

Principles influencing the selection of tunnel boring machine launch and retrieval sites include:

- Availability of land to support tunnel boring machine launch activities, with a preference for government-owned and underutilised land, in order to minimise the need for property acquisition
- Ability to support shorter tunnelling distances – distances under 10 kilometres are generally more manageable, reduce the need for tunnel boring machine repairs and maintenance, and can provide a short transportation distance for segments, materials and workers from the support site to the tunnelling face
- Access to arterial roads from the site to enable efficient transportation of tunnel boring machines, segments, spoil and other materials, and minimise impact to local streets
- Ability to minimise impacts on sensitive receivers, the road network and residential areas
- Topography, proximity to adjacent infrastructure, and engineering requirements
- Co-location with future operational infrastructure to limit property acquisition requirements
- Reduce the number of tunnel boring machines.

Taking into account these principles, preferred options were selected for the tunnel boring machine launch and retrieval sites. Key options also considered how to optimise the tunnelling strategy, by focussing on locations at either end of the tunnels and also locations that are approximately in the middle of the tunnel alignment.

Tunnel boring machine launch sites

- Westmead Metro Station construction site is required to be a launch or retrieval site as it would be at the western end of Stage 1
- The Bays Station construction site is required to be a launch or retrieval site as it would be at the eastern end of Stage 1
- Sydney Olympic Park would need to be a launch or retrieval site as it would provide an optimised tunnelling strategy by providing a relatively even distance for tunnel boring machine drives to the east and west.

The tunnel boring machine launch and retrieval sites identified are:

- The Bays Station construction site was identified as a preferred launch site, as it would provide sufficient land to support tunnel boring machine launch activities and would minimise impacts on sensitive receivers (there are no residential properties within the immediate vicinity). Road network impacts could also be minimised, with the opportunity for deliveries and spoil removal by barge
- The Sydney Olympic Park construction site was identified as a preferred retrieval site, as it would provide sufficient land to support tunnel boring machine retrieval activities due to its open cut-and-cover construction method and surrounding wide modern streets. The site would minimise impacts on residential properties relative to other nearby site options and would have direct access to the arterial road network and the M4 motorway
- Westmead Metro Station construction site would be the other preferred launch site, providing convenient access to the arterial road network and the M4 motorway.

The preferred tunnelling strategy would minimise the number of tunnel boring machines. It would launch two tunnel boring machines from Westmead Metro Station construction site, and two tunnel boring machines from The Bays Station construction site, with retrieval for both sets of tunnel boring machines at the Sydney Olympic Park Metro Station construction site.

Sydney Metro is currently investigating options for managing the tunnel boring machines at the end of the line in the Sydney CBD.

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4 Planning and assessment process

4 Planning and assessment process

This chapter describes the statutory planning process for Sydney Metro West and identifies other NSW and Commonwealth legislation and approvals which may apply.

4.1 NSW environmental planning approvals

The Environmental Planning and Assessment Act 1979 (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.

Clause 79 of the State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) provides that development for the purpose of a railway and rail infrastructure facilities may be carried out by or on behalf of a public authority without development consent on any land. Sydney Metro West is characterised as being for the purpose of a railway and rail infrastructure facilities for the purposes of the Infrastructure SEPP, and is to be carried out by Sydney Metro, being a public authority. Accordingly, Sydney Metro West is permissible without obtaining development consent under Part 4 of the EP&A Act.

4.1.1 State significant and critical State significant infrastructure

Sections 5.12 and 5.13 of the EP&A Act provide for the declaration of State significant infrastructure and critical State significant infrastructure (refer to Section 4.1.2 of this report). Sydney Metro will seek a specific declaration for Sydney Metro West as State significant infrastructure and critical State significant infrastructure under sections 5.12(4) and 5.13 of the EP&A Act, respectively. Schedule 5 of State Environmental Planning Policy (State and Regional Development) 2011 would also be amended to include Sydney Metro West as critical State significant infrastructure.

The requirements of Clause 192 of the EP&A Regulation for applications seeking approval of the Minister for Planning and Public Spaces to carry out State significant infrastructure are addressed in Appendix A.

4.1.2 Planning approval process under Division 5.2 of the EP&A Act

The assessment and approval process for a State significant infrastructure project is established under Part 5, Division 5.2 of the EP&A Act. Staged infrastructure applications can be made under section 5.20 of the EP&A Act. A staged infrastructure application sets out the concept for the proposed infrastructure and can also set out details of Stage 1. The assessment and approval process for staged State significant infrastructure is shown in Figure 4-1.

This document supports a State significant infrastructure application for the Concept and Stage 1 made by Sydney Metro and submitted to the Secretary of the Department of Planning, Industry and Environment as required by section 5.15 of the EP&A Act. The application seeks the Secretary's Environmental Assessment Requirements for the Concept and Stage 1 (as per section 5.16 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.

The Department of Planning, Industry and Environment will place the Environmental Impact Statement on public exhibition for a minimum of 28 days (as per Schedule 1, Division 2, clause 12 of the EP&A Act). During the exhibition period, the community, project stakeholders and government agencies will be able to review the Environmental Impact Statement and provide a written submission to the Department of Planning, Industry and Environment for consideration in its assessment of the Concept and Stage 1.

At the completion of the public exhibition period, the Department of Planning, Industry and Environment will collate and provide Sydney Metro with a copy of all submissions received during the exhibition period. After reviewing the submissions, Sydney Metro will prepare a submissions report that responds to the relevant issues raised. If changes are required to the Concept or Stage 1 as a result of the issues raised or to minimise environmental impacts, a Preferred Infrastructure Report may also be required. If this is required, Sydney Metro would prepare the report to address the changes to the design to minimise impacts and submit this for review to the Department of Planning, Industry and Environment. This report would be made available to the public.

Approval from the Minister for Planning and Public Spaces is required before Sydney Metro can proceed with Stage 1 (as per section 5.14 of the EP&A Act). Further Environmental Impact Statements will be required for subsequent stages of the Concept.

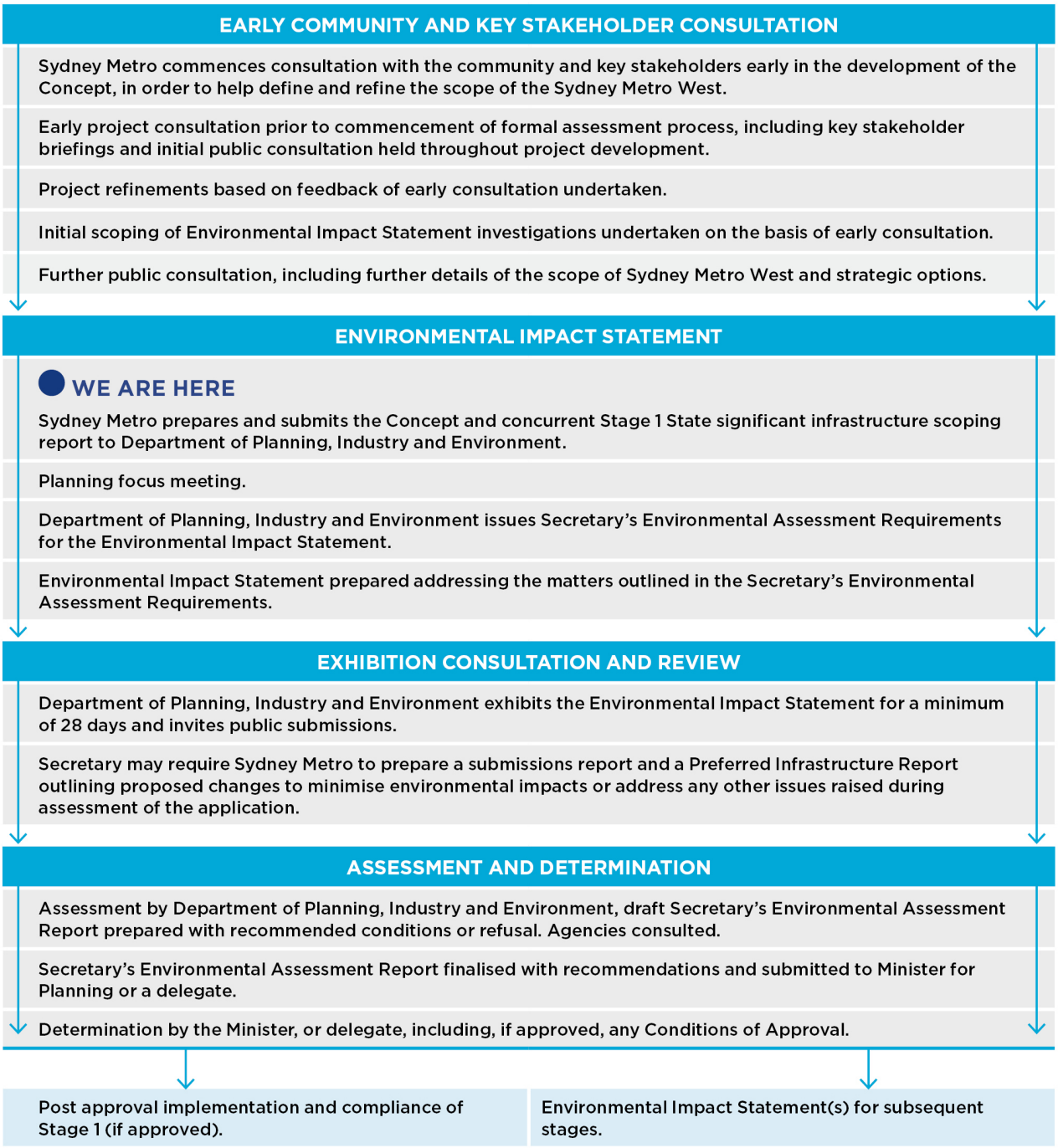

Figure 4-1: The assessment and approval process for Sydney Metro West

4.1.3 NSW environmental planning instruments

The declaration of Sydney Metro West as critical State significant infrastructure would be made through the provisions of the State Environmental Planning Policy (State and Regional Development) 2011, as discussed in Section 4.1.1 of this report. Section 5.22 of the EP&A Act provides that environmental planning instruments (such as local environmental plans and SEPPs) do not, with some exceptions, apply to State significant infrastructure projects. Notwithstanding, the environmental planning instruments that have been considered for consistency are summarised in Table 4-1.

Table 4-1: Environmental planning instruments

Environmental planning instrument	Discussion
State Environmental Planning Policy (State and Regional Development) 2011	State Environmental Planning Policy (State and Regional Development) 2011 identifies development that is State significant development, State significant infrastructure and critical State significant infrastructure. As outlined in Section 4.1.1, Sydney Metro will seek an amendment to Schedule 5 of this SEPP to include Sydney Metro West as critical State significant infrastructure and State significant infrastructure. The approvals process for future integrated station and precinct development is separately discussed in Section 4.4.
Sydney Regional Environment Plan (Sydney Harbour Catchment) 2005	Some elements of the Concept and Stage 1 may be within the defined boundary of the Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005. This plan aims to (amongst other things) protect, enhance and maintain the catchment, foreshores, waterways and islands of Sydney Harbour for existing and future generations.
State Environmental Planning Policy No. 55 – Remediation of Land	The State Environmental Planning Policy No. 55 – Remediation of Land 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), 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 the land would be remediated before the land is used for that purpose. A contamination assessment will be carried out in accordance with the Managing Land Contamination Planning Guidelines SEPP 55–Remediation of Land (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) for the Concept and Stage 1 to inform the design and Environmental Impact Statement.
Sydney Regional Environmental Plan No. 26 – City West	Sydney Regional Environmental Plan No. 26 – City West is relevant to The Bays Precinct. The plan repeals local environmental plans and other planning instruments that would otherwise apply. The plan sets land use, urban design and public domain principles. Consistency with these principles would be considered during future environmental impact assessments.
State Environmental Planning Policy (Coastal Management) 2018	State Environmental Planning Policy (Coastal Management) 2018 gives effect to the objectives of the Coastal Management Act 2016 from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone. Some elements of the Concept are within the defined boundary of the Policy (within land defined as Coastal Environmental Area). The management objectives for this area are: • to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity • to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change • to maintain and improve water quality and estuary health • to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons

Environmental planning instrument	Discussion
State Environmental Planning Policy (Coastal Management) 2018 cont.	○ to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place ○ to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platform. Consistency with these objectives, and potential impacts on mapped coastal wetlands, would be considered during future environmental impact assessments.
Sydney Regional Environmental Plan No. 24 – Homebush Bay Area	Some elements of the Concept and Stage 1, including the Sydney Olympic Park Metro Station, would be within the defined boundary of the Sydney Regional Environmental Plan No. 24 – Homebush Bay Area. The main aims of this plan are to: ○ define objectives for the Homebush Bay Area which encourage co-ordinated and environmentally sensitive development of the Homebush Bay Area ○ guide and co-ordinate the development of the Homebush Bay Area ○ replace planning instruments previously applying to the Homebush Bay Area with a simplified planning framework ○ provide flexible development controls by allowing a wide mix of uses in the Homebush Bay Area ○ provide for the preparation of detailed planning controls to complement the flexible controls in this plan ○ facilitate the development and management of Sydney Olympic Park by the Sydney Olympic Park Authority based on: • masterplans (whether adopted by the Minister under this Plan or approved by the Minister under section 18 of the Sydney Olympic Park Authority Act 2001) • other guidelines and management strategies adopted by the Sydney Olympic Park Authority for the management of Sydney Olympic Park ○ provide for public consultation in the planning and development of the Homebush Bay Area. Sydney Metro West would take into consideration the masterplan development for the Homebush Bay Area and Sydney Metro has commenced consultation with Sydney Olympic Park Authority.
State Environmental Planning Policy No. 19 Bushland in Urban Areas	State Environmental Planning Policy 19 – Bushland in Urban Areas applies to bushland within the urban areas identified in Schedule 1 of the Policy. Of relevance to the Concept, are the Parramatta, Strathfield, Concord, Burwood, Drummoyne, Leichhardt and Sydney local government areas. The aim of the Policy is to protect and preserve bushland for its natural heritage aesthetic, recreational, educational and scientific resource values. The aims of the Policy would be considered during future environmental impact assessments.

4.2 Other NSW legislation

In accordance with sections 5.23 and 5.24 of the EP&A Act, some environmental 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 5.23 of the EP&A Act specifies approvals that are not required for approved State significant infrastructure under Part 5 Division 5.2 of the EP&A Act. Those approvals that would otherwise be required for Sydney Metro West if not for it being State significant infrastructure include:

- Permits under sections 201, 205 and 219 of the *Fisheries Management Act 1994*
- Approvals under Part 4 or excavation permits under section 139 of the *Heritage Act 1977*
- Aboriginal heritage impact permits under section 90 of the *National Parks and Wildlife Act 1974*
- Bush fire safety authority under section 100B of the *Rural Fires Act 1997*
- Various approvals under the *Water Management Act 2000*, including water use approvals under section 89, water management work approvals under section 90 and activity approvals (other than aquifer interference approvals) under section 91.

In addition, Division 8 of Part 6 of the *Heritage Act 1977* does not apply to prevent or interfere with the carrying out of the State significant infrastructure.

Similarly, section 5.23 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 potential relevance to Sydney Metro West would be:

- An interim protection order (within the meaning of *National Parks and Wildlife Act 1974*)
- An order under Division 1 (Stop work orders) of Part 6A of the *National Parks and Wildlife Act 1974*, or Division 7 (Stop work orders) of Part 7A of the *Fisheries Management Act 1994*
- A remediation direction under Division 3 (Remediation directions) of Part 6A of the *National Parks and Wildlife Act 1974*
- An order or direction under Part 11 (Regulatory compliance mechanisms) of the *Biodiversity Conservation Act 2016*
- 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 5.24 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 must be substantially consistent with the Part 5, Division 5.2 approval. Statutory approvals or authorisations of potential relevance to Sydney Metro West include:

- An Environment Protection Licence under Chapter 3 of the *Protection of the Environment Operations Act 1997*
- A consent under section 138 of the *Roads Act 1993.*

4.2.2 NSW legislation and regulations that may still be applicable

Environmental planning related legislation and regulations that may still be applicable to approved critical State significant infrastructure and based on the current scope of Sydney Metro West, may be relevant is identified in Table 4-2.

Table 4-2: NSW legislation and regulations of potential relevance

Legislation	Requirement
Aboriginal Land Rights Act 1983	This Act 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 Act 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.
Biosecurity Act 2015	Under this Act, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.
Contaminated Land Management Act 1997	This Act outlines the circumstances in which notification to the Environment Protection Authority is required in relation to the contamination of land. This may become relevant during construction and/or operation of Stage 1 and subsequent stages. Contamination is further discussed in Section 7.9 and Section 9.9.
Crowns Land Management Act 2016 (NSW)	This Act sets out the requirements for the management of Crown land in NSW, including where councils and other organisations can deal with Crown land. Sydney Metro West passes underneath a number of parcels of Crown land. Land would be managed in accordance with the objectives of this Act as relevant.
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 the NSW Government and assist local council plans or proposals relating to development in the Greater Sydney Region. The Greater Sydney Commission will not have a formal statutory role for Sydney Metro West but will be consulted with respect to its core functions.
Heritage Act 1977 (Section 146)	If a relic is discovered or located, the Heritage Council must be notified 'of the location of the relic, unless he or she believes on reasonable grounds that the Heritage Council is aware of the location of the relic'.
Land Acquisition (Just Terms Compensation) Act 1991	This Act would apply to the acquisition of land required for Sydney Metro West.
Marine Pollution Act 2012	This Act includes provisions to protect the sea and waters from pollution by oil and other noxious substances discharged from vessels. Any construction activities requiring the use of a vessel (e.g. a barge) must comply with the requirements of this Act and the Marine Pollution Regulation 2014.
Native Title (NSW) Act 1994	This Act provides for native title in relation to land or waters. Sydney Metro West does not affect land which is subject to native title claim or determination, or land to which an Indigenous Land Use Agreement applies.

Legislation	Requirement
Protection of the Environment Operations Act 1997	An environment protection licence is required for scheduled activities or development work listed by the Act. Schedule 1 lists activities that require a licence and relevantly include: Part 1, clause 33 railway systems activities meaning: (a) the installation, on site repair, on-site maintenance or on site upgrading of track, including the construction or significant alteration of ancillary work, or (b) the operation of rolling stock on track. Section 120 of the Act prohibits the pollution of waters. Air pollution-related sections 124 to 126 (Chapter 5, Part 5.4, Division 1) of the Act require activities to be conducted in a proper and efficient manner, while section 128 (Chapter 5, Part 5.4, Division 1) of the Act requires that all necessary practicable means are used to prevent or minimise air pollution. Pollution of land and waste is covered by Part 5.6 of the Act. It defines offences relating to waste and sets penalties and establishes the ability to set various waste management requirements via the Protection of the Environment Operations (Waste) Regulation 2014.
Protection of the Environment Operations (Waste) Regulation 2014	This Regulation provides for exemptions from environment protection licencing for certain resource recovery activities and establishes tracking and reporting requirements for the transport of waste. Any waste generated must be tracked and recorded in accordance with the requirements of the Regulation.
Roads Act 1993	Section 138 of this Act states: A person must not (a) erect a structure or carry out a work in, on or over a public road, or (b) dig up or disturb the surface of a public road, or (c) remove or interfere with a structure, work or tree on a public road, or (d) pump water into a public road from any land adjoining the road, or (e) connect a road (whether public or private) to a classified road, otherwise than with the consent of the appropriate roads authority. Under Section 38N of the Transport Administration Act 1988, Section 138 of the Roads Act 1993 does not apply to Sydney Metro activities in relation to classified roads for which a council is the roads authority. However, consent from Roads and Maritime Services is still required under Section 38N(2) of the Transport Administration Act 1988 for those activities described in Section 138(1) of the Roads Act 1993, when carried out in relation to a classified road.
Transport Administration Act 1988	This Act also applies to compulsory acquisitions for the purpose of underground rail facilities.
Waste Avoidance and Resource Recovery Act 2001	This Act encourages the most efficient use of resources in order to reduce environmental harm.
Water Management Act 2000	Temporary dewatering and construction activities that interfere with aquifers are generally identified as aquifer interference activities in accordance with the *Water Management Act 2000* and the NSW Aquifer Interference Policy (Department of Primary Industries, 2012).

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas.

Matters of national environmental significance

Under the EPBC Act, a referral to the Commonwealth Department of the Environment and Energy is required for proposed 'actions' that have the potential to significantly impact on any matter of national environmental significance or the environment of Commonwealth land (including leased land).

Current matters of national environmental significance are:

- World heritage properties
- National heritage places
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally listed threatened species and ecological communities
- Listed migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development.

There is currently a draft agreement between the Commonwealth and NSW relating to environmental impact assessment under the EPBC Act. For critical State significant infrastructure, the assessment bilateral agreement would provide for a single environmental assessment process conducted by NSW.

Issues with respect to matters of national environmental significance are discussed in Sections 7.3 and 9.3 (Non-Aboriginal heritage) and Sections 7.13 and 9.13 (Biodiversity). The significance of impacts in relation to these matters will be considered during the environmental impact assessment process and a decision will be made as to whether Stage 1 is referred to the Commonwealth Department of the Environment and Energy.

4.3.2 Native Title Act 1993

An objective of the Commonwealth *Native Title Act 1993* 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 registers maintained by the National Native Title Tribunal indicate there are no native title claims or any indigenous land use agreements that apply to land within the area of the Concept.

4.3.3 Disability Discrimination Act 1992

The *Disability Discrimination Act 1992* 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. Sydney Metro West would be designed to be independently accessible and in compliance 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 be compliant with the requirements of the standard and referenced to the Australian Standards and Design Rules therein, unless unjustifiable hardship is incurred by implementation. Sydney Metro West would be designed to be compliant with the requirements of the Disability Standards for Accessible Public Transport 2002.

4.4 Planning approvals process for integrated station and precinct development

Sydney Metro West stations would be designed to provide for other requirements associated with possible integrated station and precinct development.

Typical examples of the requirements to support integrated station and precinct development include structural elements and space provisioning for building foyers and entrances, lift wells, and building services. Elements incorporated into the design for the purposes of making provision for future integrated station and precinct development are identified in Chapter 6.

All future integrated station and precinct developments will be subject to a separate planning approvals process including community and stakeholder engagement in accordance with the provisions of the EP&A Act.

There is a possibility that the assessment and approvals process relating to future integrated station and precinct development may result in changes to elements incorporated in the station design for this Concept. Any changes required to the design for the station(s), would be assessed in accordance with statutory requirements.

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5 Stakeholder and community engagement

5 Stakeholder and community engagement

This chapter provides an outline of the consultation undertaken to date and how this consultation has influenced the scope of Sydney Metro West and the Environmental Impact Statement. The proposed consultation for the Concept and Stage 1 is also provided. Further details regarding consultation undertaken to date and a response to issues raised are provided in Appendix B.

5.1 Overview

Stakeholder and community consultation forms an integral part of the development of Sydney Metro West as well as informing and scoping investigations for the Environmental Impact Statement.

In November 2016 the NSW Government announced Sydney Metro West, an underground metro railway which would connect Parramatta and the Sydney CBD.

Since the announcement, ongoing stakeholder engagement and two rounds of community consultation have been undertaken to help define and refine the scope of Sydney Metro West.

Engagement with the community and stakeholders began in June 2017 and will continue during preparation of the Environmental Impact Statement for the Concept and Stage 1. The consultation has pro-actively sought feedback and comments on Sydney Metro West through many forums and channels to inform the development phase and the scope of issues to be assessed in the Environmental Impact Statement.

Key stakeholders for Sydney Metro West include (but are not necessarily limited to):

- Directly impacted communities
- State agencies (including but not limited to Department of Planning, Industry and Environment, Greater Sydney Commission, other sections of Transport for NSW including Roads and Maritime Services, NSW Environment Protection Authority and the former Office of Environment and Heritage)
- Local government (Cumberland Council, City of Parramatta, Municipality of Burwood, Municipality of Strathfield, City of Canada Bay, Inner West Council and the City of Sydney)
- Public utilities and business and industry groups near Sydney Metro West
- Special interest groups including Local Aboriginal Land Councils, Aboriginal stakeholders, and sporting associations and groups
- The broader community.

5.2 Communication and engagement objectives

Sydney Metro is committed to continuing extensive community and stakeholder consultation on Sydney Metro West. The communication and engagement objectives are:

- Communicate the rationale, concept and timing for Sydney Metro West and the broader network benefits it would deliver, including how it fits into the NSW Government's plans to increase Sydney's rail capacity and support integrated transport and strategic land use plans
- Build community and key stakeholder relationships and maintain goodwill
- Encourage participation and obtain government, community and stakeholder input for consideration in development of the scope and its future implementation
- Provide information about the planning approval process and encourage community participation
- Clearly communicate the corridor protection and property acquisition process
- Understand community and stakeholder priorities and concerns so they can be considered in the ongoing refinement and delivery of Sydney Metro West.

The Sydney Metro West team has developed a comprehensive community and stakeholder engagement program and has been proactive in engaging with local communities, key stakeholders, industry and government agencies.

5.3 Consultation to date

Since the announcement of Sydney Metro West by the NSW Government, consultation to date has included ongoing stakeholder consultation with state government departments and agencies, local government and peak organisations. Community and industry consultation has been undertaken over two rounds as follows:

- First round of community and industry consultation from June 2017 to September 2017
- Second round of community and industry consultation from March 2018 to May 2018.

The key consultation and engagement activities are described in the following sections.

5.3.1 Stakeholder consultation

Since the announcement of Sydney Metro West in November 2016, key stakeholders were briefed via meetings, presentations and phone calls. The objectives of the briefings were to:

- Ensure stakeholders were consulted, including on station options
- Ensure issues and concerns were understood, captured and addressed in the development of Sydney Metro West
- Receive feedback.

Consultation briefings have occurred with key stakeholders, including the following government agencies, peak bodies, industry groups and local government:

- Other sections of Transport for NSW (including Sydney Trains, NSW Trains and Roads and Maritime Services)
- UrbanGrowth NSW Development Corporation (now part of Infrastructure NSW)
- Department of Planning, Industry and Environment
- Greater Sydney Commission
- Sydney Olympic Park Authority
- Ministry of Health
- Port Authority of NSW
- Sydney Business Chamber
- Olympic Park Business Association
- Royal Agricultural Society

- Committee for Economic Development of Australia
- Infrastructure Partnerships Australia
- Sydney Olympic Park Business Association
- Tourism Accommodation Australia
- Urban Taskforce
- Western Sydney Business Chamber
- Committee for Sydney
- Cumberland Council
- City of Parramatta
- City of Canada Bay
- Municipality of Strathfield
- Municipality of Burwood
- Inner West Council
- City of Sydney.

High level project information was provided at these briefings including:

- Broader transport context
- Western Sydney Rail Needs scoping study
- Sydney Metro West network objectives
- Government announced precincts at Parramatta, Sydney Olympic Park, The Bays Precinct and the Sydney CBD
- Features of the Sydney Metro Northwest and Sydney Metro City & Southwest projects to meet the needs of customers.

Stakeholder deliberative forum

A stakeholder deliberative forum was held on 30 August 2017 and was attended by 37 senior stakeholders from a range of state, government departments and agencies, councils and some key local institutions. The primary objective of the forum was to identify:

- Work already done on developing a future vision for the corridor by local stakeholders
- Relevant issues and constraints around the nominated precincts
- Stakeholder preferences regarding the number and location of stations, journey times, land use opportunities and feedback on how to connect important destinations
- Possible stabling locations for metro trains.

Ongoing stakeholder engagement

Sydney Metro has attended meetings and workshops with stakeholders and responded to requests for advice and information. This has enabled Sydney Metro to consider ongoing stakeholder input throughout the development phase.

5.3.2 Community consultation

Following the NSW Government's announcement of Sydney Metro West in November 2016, two rounds of community and industry consultation have been undertaken to:

- Increase awareness
- Help define and refine the scope
- Collect community feedback.

During round one, consultation was completed along a broad study area between Greater Parramatta and the Sydney CBD as shown in Figure 5-1.

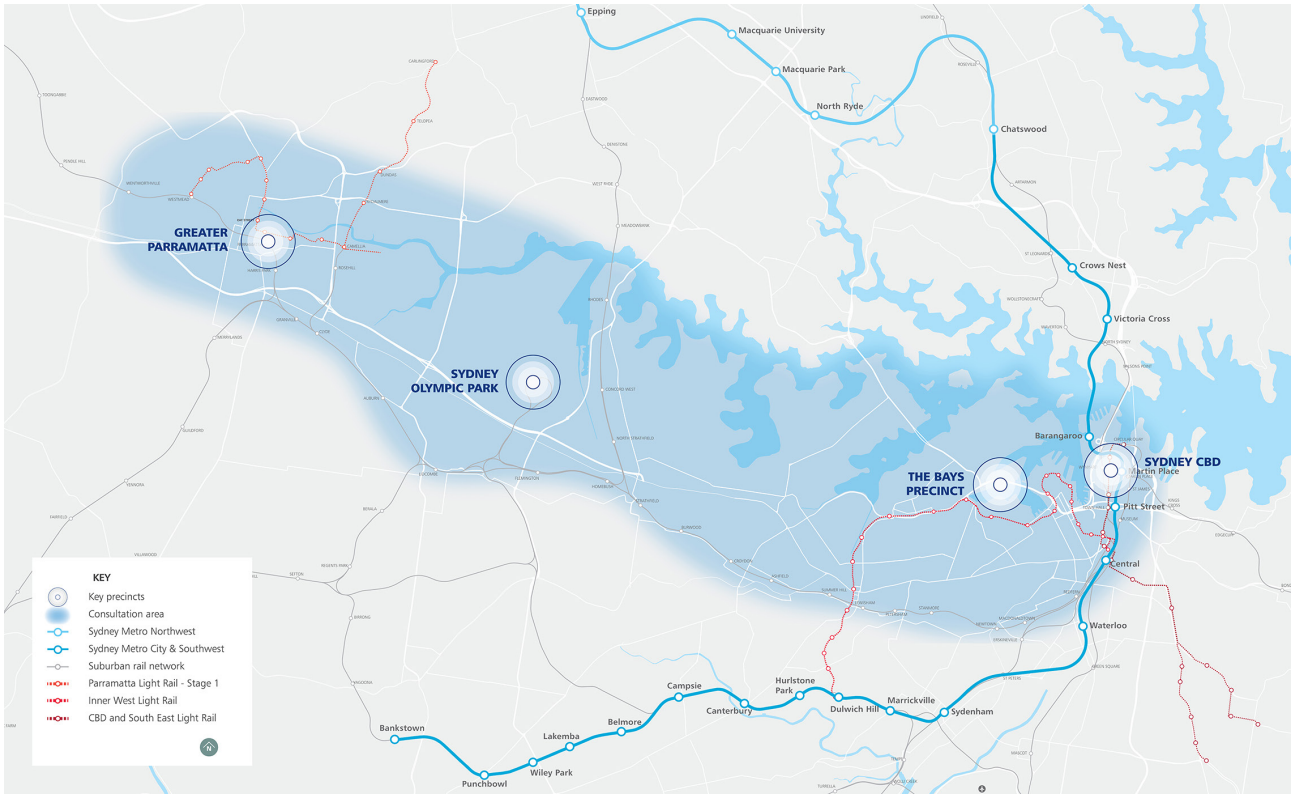


Figure 5-1: Sydney Metro West consultation area – round one

Round two of community consultation activities occurred over a refined area as shown in Figure 5-2.

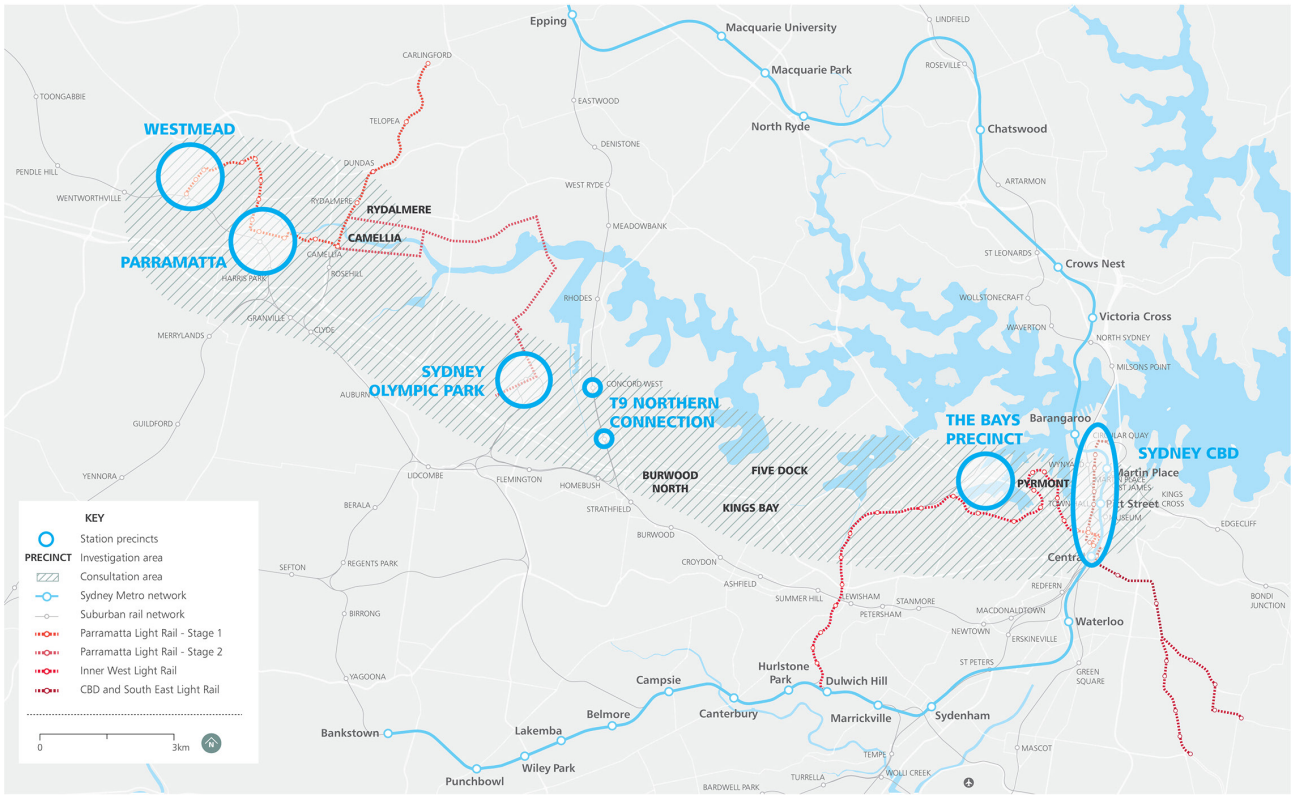


Figure 5-2: Sydney Metro West consultation area – round two

5.4 Public information and engagement

Public consultation was undertaken to engage with the community prior to the planning approvals process. Sydney Metro has used all feasible channels to reach as many people as possible to inform them about Sydney Metro West and call for submissions and feedback. Consultation channels were targeted to reach different geographic areas, demographics, multicultural groups and areas of interest. These included:

- Two rounds of community information sessions
- Letterbox drop to more than 220,000 residents and businesses
- Proactive media strategy, which resulted in broad coverage across Sydney metropolitan and local print, radio and television outlets
- Advertisements in local and multicultural newspapers
- Email alerts to registered community members and stakeholders
- Social media via the Sydney Metro Facebook page, which has a reach of almost 37,000 people
- Paper survey – via completing a form at a public information session
- Online survey – 'Have your say' on the Sydney Metro and Transport for NSW websites
- Two 'Project Overview' information booklets (published in June 2017 and March 2018)
- Newsletter – 'Sydney Metro West – the city's next underground metro railway' (September 2018), delivered via letterbox drop and published on the project website.

In addition, since June 2017, a number of channels have been used to provide current information to the community and stakeholders, and invite feedback. These are outlined in Table 5-1.

Table 5-1: Community contact and information channels

Activity	Details
Community toll free information line	1800 612 173
Community email address	sydneymetrowest@transport.nsw.gov.au
Website	www.sydneymetro.info
Postal address	Sydney Metro West PO Box K659, Haymarket NSW 1240
Facebook page	www.facebook.com/sydneymetro

5.4.1 Community consultation 2017

Round one of community consultation from 27 June 2017 to 3 September 2017 included the public release of a 'Project Overview' document to provide information to the community about Sydney Metro West. This document was available on the Sydney Metro website and at all public information sessions. The residential and business community was invited to attend one of six information sessions staffed by the Sydney Metro West team as outlined in Table 5-2. These sessions were advertised through a number of channels including leaflet drops to 220,000 properties, advertisements in the media, website updates, email alerts to registered community members and Facebook page updates.

Table 5-2: Community information sessions 2017

Date	Time	Location
Thursday 20 July 2017	4pm-7pm	Novotel, Sydney Olympic Park
Saturday 22 July 2017	10am-2pm	
Wednesday 26 July 2017	4pm-7pm	Novotel Sydney Parramatta
Saturday 29 July 2017	10am-2pm	
Thursday 3 August 2017	4pm-7pm	Concord Community Centre
Saturday 5 August 2017	10am-2pm	Leichhardt Town Hall

An online 'Have your say' survey was live during the first round of consultation and paper surveys were also available at public information sessions. The objective of the surveys was to provide people with the opportunity to provide feedback on potential station locations between four key precincts that were initially identified at Parramatta, Sydney Olympic Park, The Bays Precinct and the Sydney CBD.

The survey also included the following questions:

- What suburb do you live in? What do you like about your suburb? This section included specific questions relating to: homes and jobs, transport, local environment, local character, community facilities and what the respondents value most about their suburb.
- What are the most common modes of transport used? How commonly do you use public transport? Modes included: local bus, train, community transport, cycle, walk, school bus, private vehicle, taxi, car share/ride share.
- What are the purposes for using public transport? Response options included: commuting to or from work, business trips, leisure, commuting to school/education facilities, shopping, personal errands, taking children to/from school, etc.
- What do you think should be the top transport priority for your suburb in the future? Response options included: more frequent public transport services, more public transport routes, more reliable bus and train services, more accessible public transport connections, improving cycling infrastructure, improving pedestrian infrastructure and reducing road congestion.
- Building a metro station is an opportunity to give people a chance to live and work closer to a public transport connection. Do you support any of the following potential benefits of Sydney Metro West? Response options included: create more homes and jobs near metro station locations, provide the opportunity to renew and revitalise areas with more cafes, restaurants and shops, a metro train service with faster, more frequent services between Parramatta and the Sydney CBD, reduced crowding on trains, improved transport connections between other transport modes including existing trains, bus and light rail, improved transport options for Western Sydney.
- Is there anywhere else you think would benefit from a metro station between Parramatta and the Sydney CBD including areas to the east and west? Why?
- Do you have any concerns about a metro station being built in your suburb?

During the first round of consultation:

- 280 people attended the public information sessions
- 1,000 people completed the 'Have your say' survey
- 39 people provided submissions
- 504 people registered for project updates.

The issues raised by local government, peak bodies, representative organisations and groups, and the community during the 2017 consultation are summarised in Appendix B.

5.4.2 Community consultation 2018

The second round of community consultation was undertaken between 23 March 2018 and 18 May 2018. A 'Project Overview' Sydney Metro West: A new railway for Western Sydney – Project overview, March 2018, provided further details of the current scope of Sydney Metro West. This included station locations at Westmead, Parramatta, Sydney Olympic Park, The Bays Precinct and the Sydney CBD, and was the basis on which to comment for those lodging submissions. This document was made available on the Sydney Metro website and hard copies were provided at all public information sessions.

As outlined in Table 5-3 consultation in round two included 11 community information sessions staffed by the Sydney Metro West team and advertised using the same channels as for the first round.

Table 5-3: Community information sessions 2018

Date	Time	Location
5 April 2018	4pm–8pm	Skye Hotel Parramatta
7 April 2018	10am–2pm	Skye Hotel Parramatta
10 April 2018	10am–2pm	Westmead Hospital
11 April 2018	4pm–8pm	Concord Community Centre
18 April 2018	11am–1pm	Sydney Masonic Centre CBD
18 April 2018	4pm–7pm	Sydney Masonic Centre CBD
20 April 2018	8:30am–2:30pm	Parramatta Farmer's Market
21 April 2018	10am–2pm	Novotel Sydney Olympic Park
3 May 2018	4pm–8pm	Novotel Sydney Olympic Park
5 May 2018	10am–2pm	National Maritime Museum Pyrmont
8 May 2018	10am–2pm	Westmead Walkway

A number of these sessions also included representation from other relevant projects or agencies:

- The then Department of Planning and Environment
- NSW Health and the Westmead Alliance
- Parramatta Light Rail
- Sydney Metro City & Southwest
- Sydney Olympic Park Authority
- The then UrbanGrowth NSW Development Corporation.

An online community web forum, including an interactive map was launched during the second round of consultation to allow people to provide comments and feedback on the Sydney Metro West alignment, station locations and other relevant issues. Feedback was sought via an online survey ('Have Your Say' survey) and the interactive map and forum (Social Pinpoint). A number of questions were posed in both the online survey and interactive forum in a staged approach to ensure regular engagement with the community.

The interactive map and forum were an icon drag-and-drop format in which respondents could add their responses and comments and pinpoint them to a location on the online interactive map.

Examples of the questions posted on the interactive map and forum include:

- What defines your community? What words come to mind when you think of where you live?
- What benefits do you think Sydney Metro West might bring to you and your community? Response options included: More transport options, access to jobs, cafes and restaurants, local retail, access to recreational activities, faster and reliable transport service and reduced crowding on trains
- Tell us about your current modes of transport? What is the most common mode of transport you currently use? Modes included: train, bus, ferry, personal vehicle, light rail, other
- Are there local issues that Transport for NSW should consider when planning the alignment and station locations for Sydney Metro West?
- Click on any Blue precinct area (information about the area pops up and scrolls down during the survey). Which amenities do you think will be the most important at the station? (please rate by order of importance) open space or plaza area, retail shops, community facilities (such as libraries, community centres, cafes and restaurants, bike locking facilities, kiss and drop, other (please specify)).

The responses to the questions received were considered in ongoing project development.

During round two of consultation:

- There were 12,468 views of the Sydney Metro West overview web page
- 325 people registered for updates
- 1,245 people attended public information sessions
- 194 submissions were received via email, post, phone through the website or in person
- 854 comments were made on the interactive online map
- 600 survey questions were answered on the interactive online map.

The issues raised by local government, peak bodies, representative organisations and groups, and the community during the 2018 consultation are summarised in Appendix B.

5.5 Industry engagement

The NSW Government has been working with industry on Sydney Metro West to foster innovation and to help shape development, maximising industry input at the early stages.

5.5.1 Industry consultation 2017

The first stage of the industry engagement process took place in the second half of 2017 to build awareness of Sydney Metro West and to obtain market information to shape its scope and definition, so that the desired transport and land use outcomes are met. An industry briefing session was held by Sydney Metro on 2 November 2017 at the International Convention Centre. This briefing included information about Sydney Metro West.

There was a high level of interest with local and international industry stakeholders with:

- 209 enquiries from interested parties
- 178 registrations to participate in the industry engagement process
- 136 applications for one-on-one meetings
- 34 written submissions received
- 43 one-on-one meetings undertaken.

Feedback was used to develop an initial delivery strategy for Sydney Metro West.

5.5.2 Industry consultation 2018

A second industry briefing session was held on 19 April 2018 which released an initial delivery strategy for Sydney Metro West and an industry survey. This session also sought feedback on:

- The level of industry appetite and preference for packaging, contracting, and transaction process options as identified in the initial delivery strategy
- The initial delivery strategy, particularly the packaging of metro operations and maintenance, and integrated place-making, stations and development
- Specific issues to inform the development of the definition design and implementation considerations
- Options to enhance the benefits of Sydney Metro West through value sharing or the possible use of non-government land in partnership with the private sector to deliver greater value for money to the people of NSW.

Feedback has been used to develop a preferred delivery strategy for Sydney Metro West and inform the broader implementation strategy and objectives.

A broader industry briefing was also held on 6 December 2018 which outlined further development of the initial delivery strategy for Sydney Metro West.

5.6 Consultation during preparation of the Environmental Impact Statement

Community consultation

Sydney Metro will continue to consult with the community and stakeholders during the preparation of the Environmental Impact Statement for the Concept and Stage 1. A number of activities are planned during the preparation of the Environmental Impact Statement to collect feedback from stakeholders and the community to further inform the investigations being carried out. Key elements of this consultation are outlined below.

Place Managers

Place Managers have been established and will be 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 provide this feedback to the team.

Community contact and information

The community contact and information channels established for Sydney Metro West (outlined in Table 5.1) will remain in place for the duration of the Environmental Impact Statement and for the remainder of the planning approval process.

Government agency consultation

As part of the Department of Planning, Industry and Environment planning process, a scoping meeting was held on 27 May 2019.

Sydney Metro'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 so that key issues are appropriately addressed.

There will also be ongoing consultation with specific groups to inform technical assessments. For example, regular meetings are held to discuss the approach to relevant assessment with:

- The Traffic and Transport Working Group, which includes representatives from other sections of Transport for NSW
- The Heritage Working Group which includes representatives from the Department of Planning, Industry and Environment, Transport for New South Wales (including Heritage Specialists), heritage specialists from Sydney Trains Environment Division, representatives from the Heritage Council and local councils (as relevant)
- The Environment Protection Authority to consult on matters of environmental protection principally related to noise, water quality, waste and contamination matters.

Stakeholder consultation

Sydney Metro's stakeholder consultation team will ensure local members of Parliament, councils, peak bodies and industry groups are proactively engaged and informed about Sydney Metro West. Regular briefings will be held to keep stakeholders informed and to ensure that key issues raised are addressed.

5.7 Public exhibition of the Environmental Impact Statement

Public exhibition of the Environmental Impact Statement will be for a minimum of 28 days as stated in EP&A Act. Advertisements will be placed in newspapers to advise of the public exhibition and where the Environmental Impact Statement can be viewed, and details of proposed community consultation activities and information sessions.

Consultation activities during public exhibition of the Environmental Impact Statement will be consistent with those undertaken for previous consultation activities and include:

- Plain-English project overview document(s), translated into key culturally and linguistically diverse languages
- Media releases
- Community drop-in sessions
- Traditional and social media engagement
- Doorknocks with neighbouring properties
- Newsletter letterbox drop
- Email newsletters to addresses on the Sydney Metro West distribution list
- Information on the project webpages
- Newspaper advertising
- Displays at local councils
- Stakeholder meetings
- Local business engagement
- Government stakeholder engagement.

5.8 Consultation during construction and future stages

Should the Concept and Stage 1 be approved, Sydney Metro would continue to consult with the community and key stakeholders during construction and the planning for future stages. In general, this consultation would involve:

- Consultation in accordance with statutory requirements for future planning approvals stages
- Ongoing consultation with key stakeholders, local councils and other government agencies
- Provision of regular updates to the nearby communities
- Development and implementation of a community complaints and response management system.

6 Concept description

6 Concept description

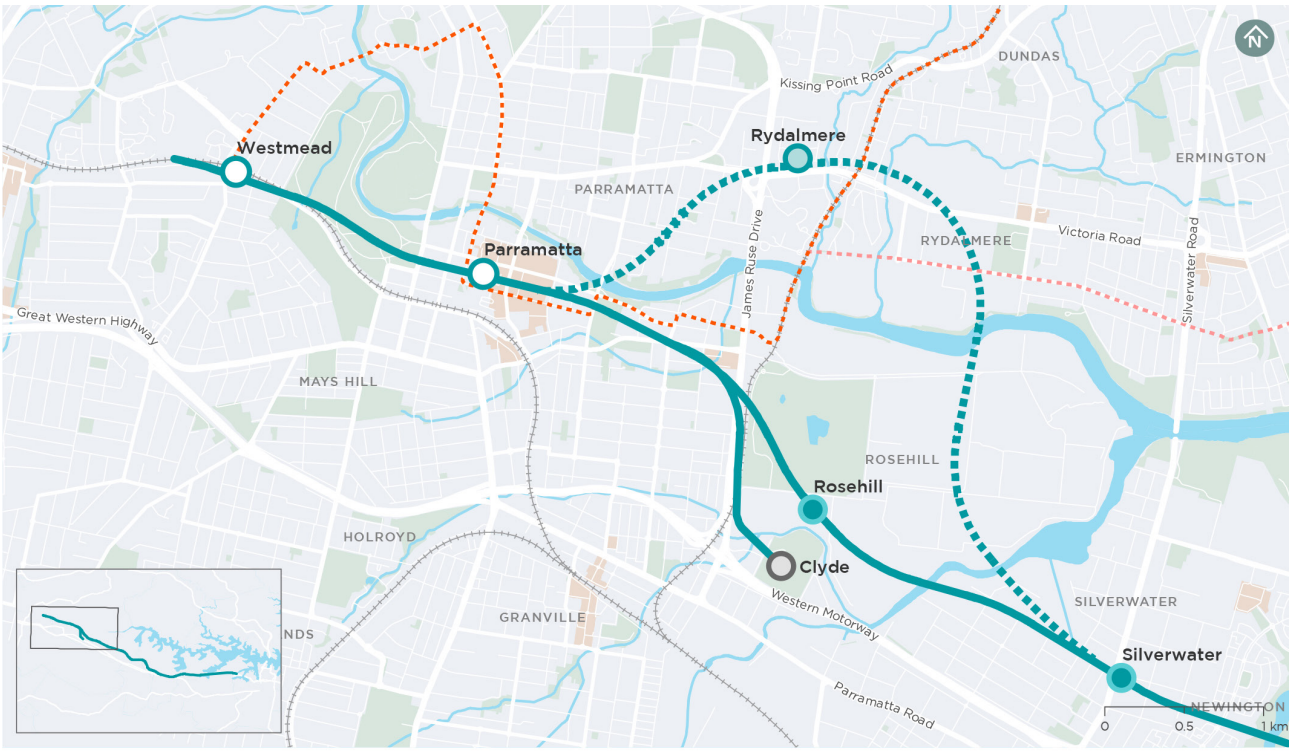
This chapter describes the Sydney Metro West Concept including metro operations, key features of the alignment, the proposed stations and other ancillary infrastructure. An outline of the construction work is also provided. The Concept components are subject to further design and changes or clarifications which may be made during the ongoing design development and stakeholder and community engagement processes. A description of Stage 1 is provided in Chapter 8.

6.1 Overview and key components

Sydney Metro West involves the construction and operation of a metro rail line, around 24 kilometres long between Westmead and the Sydney CBD.

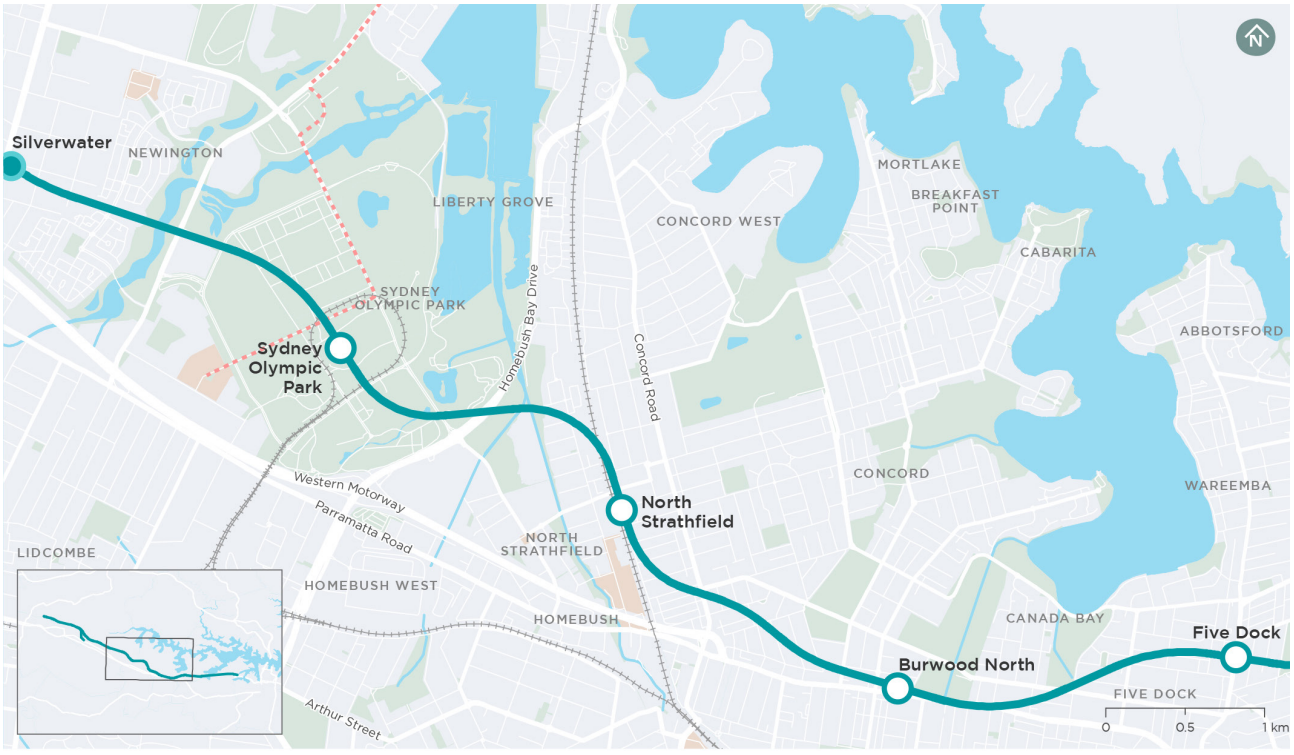
The indicative alignment and proposed station locations are shown on Figure 6-1 to Figure 6-3. The design will be further refined during the development of the Environmental Impact Statement. Key components of Sydney Metro West include:

- About 24 kilometres of twin tunnels between Westmead and the Sydney CBD
- New metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays and Sydney CBD. Potential stations at Rydalmere and Pyrmont are also under investigation
- A turn-up-and-go metro service operating early morning to late at night, between Westmead and Sydney CBD
- Pedestrian links and connections to other modes of transport (such as the existing suburban rail network and other parts of the metro network) and surrounding land uses
- Modification to existing suburban stations and associated rail infrastructure (including overhead wiring, signalling, access tracks/paths and rail corridor fencing) at Westmead and North Strathfield
- Services within each of the metro stations, including mechanical and fresh air ventilation equipment and electrical power substations to supply power for operation
- Services facilities at Rosehill (within the Clyde stabling and maintenance facility construction site), Silverwater and one between Five Dock and The Bays Precinct for fresh air ventilation and emergency evacuation
- A stabling and maintenance facility at Clyde, and associated aboveground and below ground tracks to connect to the mainline tunnels
- Alterations to pedestrian and traffic arrangements, cycling and public transport (e.g. bus) infrastructure around the new stations
- Ancillary facilities to support construction.



- Sydney Metro West (final alignment to be confirmed)
- Potential stations
- Services facility
- Stabling and maintenance facility
- Sydney Trains suburban network
- Parramatta Light Rail - Stage 1
- Planned Parramatta Light Rail - Stage 2

Figure 6-1: Overview of the Concept – Map 1



- Sydney Metro West (final alignment to be confirmed)
- Services facility
- Sydney Trains suburban network
- Planned Parramatta Light Rail - Stage 2

Figure 6-2: Overview of the Concept – Map 2

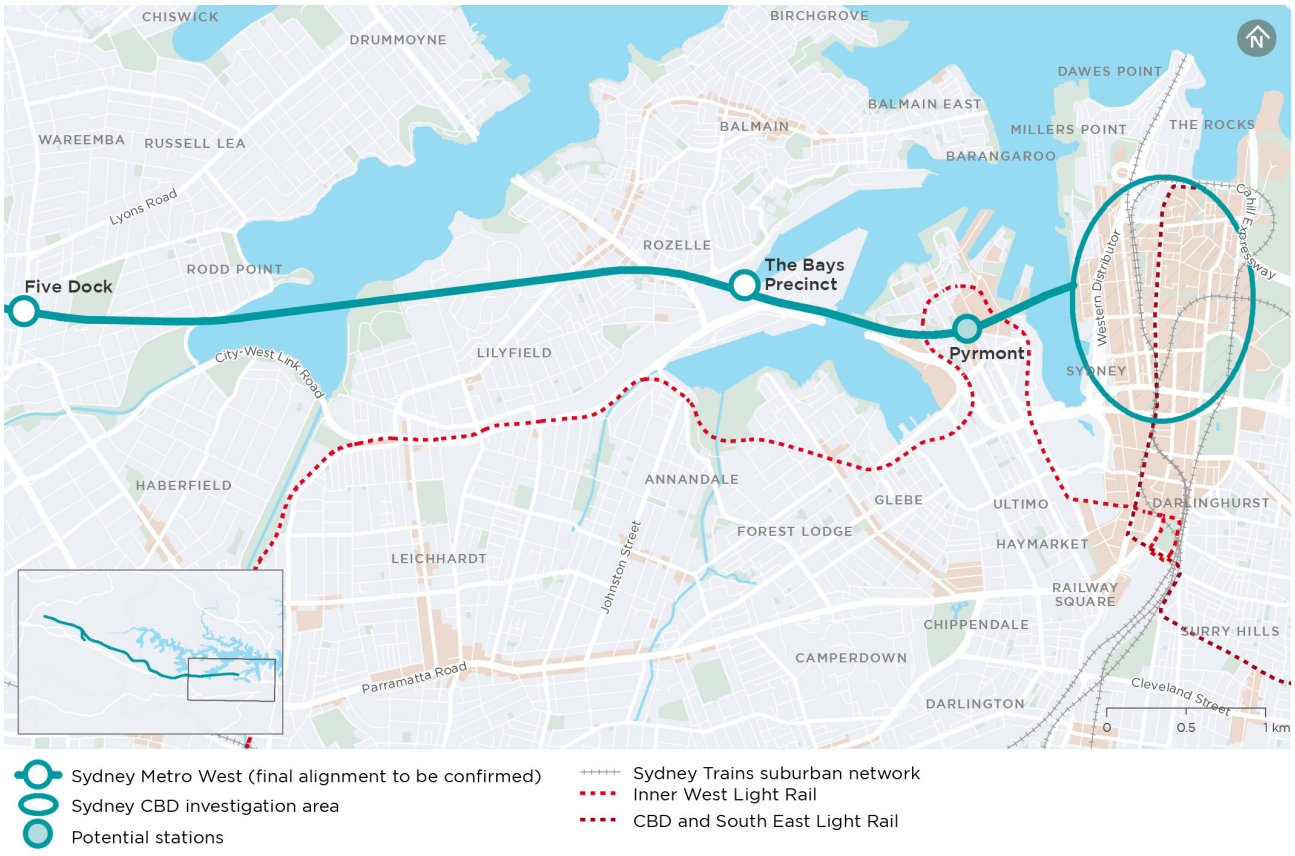


Figure 6-3: Overview of the Concept – Map 3

Additional metro stations are currently subject to further evaluation and may form part of the Concept scope assessed in the Environmental Impact Statement. These additional strategic station options are located at Rydalmere and Pyrmont.

6.2 Regional context

The Sydney Metro West corridor is located in a highly urbanised area and extends through densely populated and ethnically diverse regions. It would extend from the existing Westmead Station and pass through a number of suburbs in Western Sydney and the Inner West of Sydney before reaching the Sydney CBD. Sydney Metro West would span seven local government areas - Cumberland, The City of Parramatta, Canada Bay, Strathfield, Burwood, Inner West and City of Sydney. Figure 6-4 provides an overview of the local government areas within the corridor.

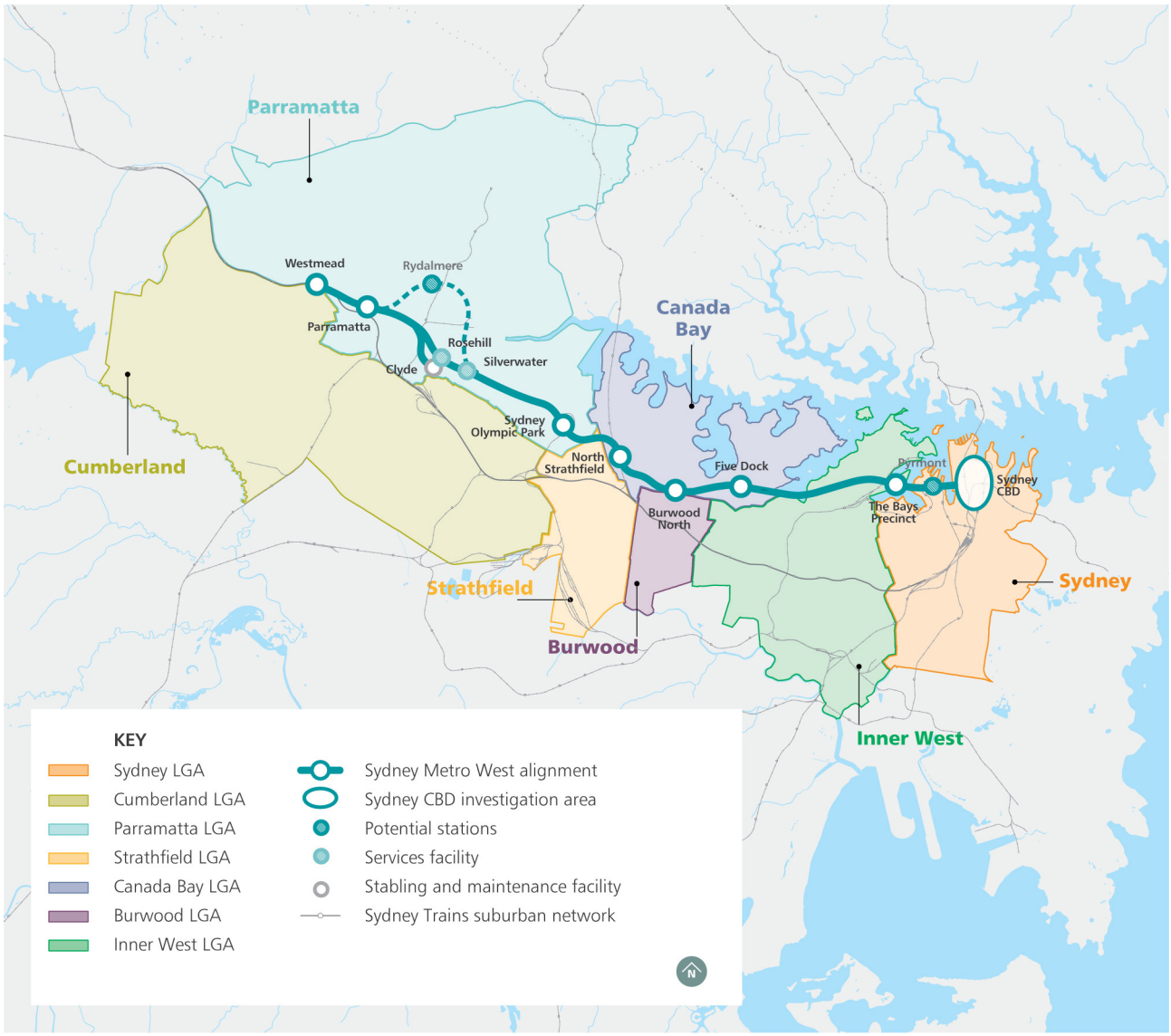


Figure 6-4: Local government areas across the Sydney Metro West corridor

The Sydney Metro West corridor has a population of about one million people and contains a number of sites of national and international importance including:

- Five out of nine major office markets in Sydney, including the Parramatta and Sydney CBDs
- The largest health district in NSW at Westmead
- More than 10 sports, events and convention facilities and one of the largest urban parklands in Australia at Sydney Olympic Park, which attracts 10 million visitors each year and 5,600 business and entertainment events each year

- One of the highest potential urban renewal sites at The Bays Precinct, which includes 95 hectares of largely government-owned land and 5.5 kilometres of harbour foreshore located two kilometres from Sydney CBD
- Significant heritage sites in Parramatta and the Sydney CBD including Old Government House and Domain in Parramatta Park and the World Heritage listed Sydney Opera House.

6.3 Sydney Metro West operations

The fully-automated Sydney Metro delivers a significant improvement in the capacity and customer experience of Sydney's transport network, with a high capacity, turn-up-and-go service that would stop at all stations along the metro line. The Concept would operate as a standalone railway line separate from the existing suburban and intercity rail network and separate from the Sydney Metro Northwest and City & Southwest lines.

Demand for the service would be managed through increased service frequency. The ultimate operational capacity of the Concept would be for 30 trains per hour in each direction – a train every two minutes each way.

6.3.1 Hours of operation

Sydney Metro West would operate from early morning to late at night, similar to Sydney Trains and Sydney Metro Northwest's existing service patterns. To accommodate for planned special events, the operating hours could be extended.

6.3.2 Train types

All trains would be new, single-deck metro trains similar to those in operation on Sydney Metro Northwest. The new-generation trains would deliver a fast, safe and reliable journey for customers with high performance standards and good customer amenities including:

- At least three doors per side per carriage, allowing fast boarding and alighting
- Air conditioning
- Emergency help points
- Accessible priority seating for mobility impaired, the elderly and people with a disability or using a wheelchair or mobility device
- Efficient seating and standing arrangements for boarding and alighting the metro
- Level access between the platform and train
- Clear transport information whilst on board the metro.

6.4 Urban design

Urban design principles would be developed for the new metro stations, station precincts and other infrastructure which has an interface with the public domain. These principles will be developed so that appropriate design quality is achieved for internal spaces and the public domain. They will also consider relevant local council strategies and the integrated design policy for NSW, 'Better Placed' (NSW Government Architect, 2017a). The design principles will be included in the Environmental Impact Statement for the Concept and Stage 1.

6.5 Tunnel alignment and configuration

The twin underground metro rail tunnels would be around 24 kilometres in length from Westmead to the Sydney CBD. The alignment is shown in Figure 6-1 to Figure 6-3.

The proposed corridor alignment was guided primarily by the general location of metro stations. The alignment within the corridor will be refined by the functional requirements of a metro network and the specific constraints of station design, namely:

- The location, depth and platform configurations of preferred metro stations
- Having a maximum vertical grade of 4.5 per cent
- Locating station platforms along a straight and level section of track (that is, a zero per cent grade)
- Providing a tunnel depth with suitable competent rock cover above the tunnel crown (the top surface of the tunnel structure), where possible, to minimise the requirement for ground support
- Requiring appropriate curvature to accommodate proposed operating speeds. Tighter radius curves have been adopted at some locations for a number of reasons, including to avoid subsurface constraints such as building basements and foundations.

The alignment will also be influenced by a number of environmental factors, including (but not limited to):

- Avoiding known built form constraints including existing buildings, basements, utilities and infrastructure (including other rail and road infrastructure)
- Minimising direct impacts on private property, as much as practicable
- Minimising impacts on environmental or social features such as heritage items and community facilities.

6.5.1 Key tunnel and underground track features

The metro rail tunnels would have a circular cross-section with a clear internal lined diameter of about six metres to accommodate the typical metro train, rail systems and infrastructure.

The tunnels would be lined with precast concrete segments to ensure the long-term life of the tunnels and to minimise groundwater ingress. The tunnels would provide space for the trains and tracks, and for other equipment and services including rail signalling, controls and communication, overhead traction power, fresh air ventilation, fire and life safety systems, lighting and drainage.

An indicative cross-section of the underground tunnel is shown in Figure 6-5.

Cross passages for emergency evacuation would link the tunnels along the alignment. Cross passages may be modified or the spacing increased in some locations such as to avoid poor ground conditions, or where the alignment passes beneath water bodies.

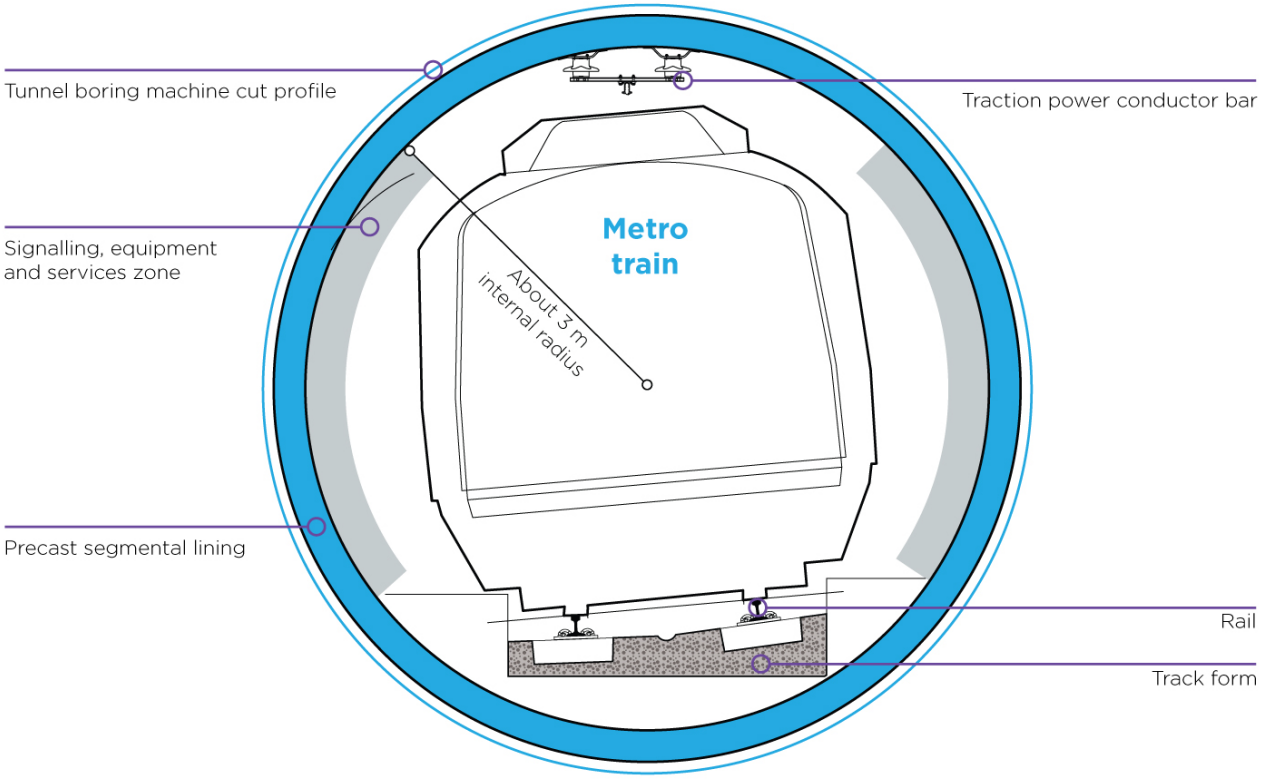


Figure 6-5: Indicative cross-section of a metro tunnel

6.5.2 Safeguarding for future extensions

Stub tunnels would be provided to the west of Westmead Metro Station and east of the Sydney CBD Station to safeguard potential extensions of Sydney Metro. The provision of stub tunnels would allow for minimal disruption to the operating line during the construction of future extensions, and also allow for overnight stabling and storage of failed trains during operations.

6.6 Stations

The new metro stations would be Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays and Sydney CBD. The potential for additional stations at Rydalmere and Pyrmont is currently being investigated.

6.6.1 Preliminary design principles for metro stations

The preliminary design principles to guide the design of the stations are provided in Table 6-1. The design principles would be further developed and identified in the Environmental Impact Statement.

Table 6-1: Preliminary station design principles

Station aspect	Design principle
Customer experience	Escalators, platforms, passageways, mezzanines and concourses would be designed to accommodate maximum customer flows and avoid and manage overcrowding and queuing during peak periods. The station and public access areas would be designed to be aesthetically pleasing, include public art and landscaping (where appropriate) and maximise the use of natural daylight. The design would also protect customers from weather (covered access paths, waiting shelters etc.) at stations and interchange areas. Furniture on station platforms would be provided to cater for a range of customers including seating and standing spaces.

Station aspect	Design principle
Customer information and wayfinding	Customers would be provided with accurate, comprehensive, consistent and real-time multimodal information during multiple phases of their trip (before their trip, at the station and aboard the train). Real-time information would be delivered to customers through multiple media. Sydney Metro would work with local councils to develop an easy, intuitive and consistent wayfinding system that facilitates efficient customer movements to, from and through stations.
Operations and system requirements	Stations would be designed in accordance with the operations and system requirements, including: • Meeting the demand for services at each station • Maintaining crowding at an acceptable and safe level of service standard • Securing platforms and critical infrastructure spaces from public access when services are not operating.
Safety and security	The safety of customers, staff and areas surrounding stations would be considered in station design in accordance with 'crime prevention through environmental design' principles. Well-designed and efficiently controlled lighting systems, visible closed circuit television surveillance and appropriate staffing during operational hours would contribute to safe station environments. Passive station design elements that promote safety would include clear visibility lines in and around stations and the use of natural daylight and adequately wide paths to avoid blind spots.
Accessibility and functionality	Efficient transfer between metro and other types of transport (such as suburban network trains, walking, cycling, light rail and buses) is important to station design. The Sydney Metro network would use the Opal smartcard ticketing system. Station design would be guided by an 'access for all' philosophy using 'priority of access' principles, with pedestrians and cyclists first, followed by light rail, buses, taxis and 'kiss and ride' customers. Station design includes emergency exit and access facilities, such as fire stairs to allow for customer evacuation and emergency services access.
Sustainability	Sustainability measures at stations would include (where feasible) natural light, solar panels, reuse of rainwater, passive ventilation and shading, use of durable and low maintenance materials, and energy-efficient lighting.
Place-making and activation	Sydney Metro West stations and precincts would provide a new public domain as well as integrate with the existing public realm and adjoining lands to develop and promote vibrant retail, community and other spaces, as appropriate to the context and locality. Each station location would include space for retail outlets that meet customer needs (e.g. café, newsagents, etc.), as well as providing spaces for temporary activation and public art where appropriate. Line-wide principles would be applied at each station locality so that stations and station entries are designed to make a positive contribution to the local area.

The locations of the proposed new stations are identified below. These locations are indicative and will be refined during ongoing design development. There may be the need to change station elements such as to respond to issues which might arise during ongoing design development, environmental and community impacts, and feedback from stakeholder and community consultation.

6.6.2 Integrated station and precinct development

New metro stations create opportunities for integrated station and precinct developments that provide for community needs including consideration of relevant planning controls and local character. An integrated station and precinct development refers to the proposed building(s) above and/or around the station that could deliver a range of uses like community facilities, new homes and green spaces, shops, restaurants and commercial office space.

Provision for integrated station and/or precinct developments are being made at Westmead, Parramatta, Sydney Olympic Park, Burwood North, Five Dock, The Bays and Sydney CBD.

Integrated station and precinct developments will be subject to separate environmental assessments and approvals processes. However, stations would need to provide some infrastructure requirements to enable future integrated station and precinct development. Elements incorporated into the station design for the purposes of making provision for future integrated station and precinct development will be identified and assessed as part of the Concept Environmental Impact Statement and/or future stage Environmental Impact Statements.

Sydney Metro will work closely with communities on how to best integrate station development and deliver stations and buildings that are thriving welcoming hubs for everyone to enjoy.

6.6.3 Westmead Metro Station

The preferred location of Westmead Metro Station is broadly adjacent to the existing Westmead Station. It would be strategically located to provide a direct interchange with the T1 Western Line and the T5 Cumberland Line at the existing Westmead Station and provide connectivity to the hospital precinct (with Parramatta Light Rail Stage 1).

Station strategy

Westmead Metro Station would provide increased accessibility to the Westmead employment, health and education hub, as well as residential areas experiencing growth and renewal.

The station strategy for Westmead Metro Station would:

- Add a more efficient rail link between Westmead and Parramatta and reinforce the role of Greater Parramatta
- Provide opportunities for interchange with the T1 Western Line, Parramatta Light Rail, T-Way and other bus services
- Serve, connect and support the revitalisation of both north and south Westmead
- Create safe and accessible public open spaces around the interchange.

The key features of Westmead Metro Station are provided in Table 6-2.

Table 6-2: Westmead Metro Station key features

Elements	Key feature
Proposed station entry	One entry on Hawkesbury Road
Customers	• Existing residents within walking and cycling distance • Employees and visitors to the Westmead health and education precinct • Customers transferring between rail services
Primary station function	Origin, destination and interchange
Catchment	Employment, residential, health and education
Transport interchange	• Suburban and some intercity rail • Walk • Cycle • Bus • Light rail • Taxi / point to point transport • Kiss and ride
Provision for future integrated station and precinct development (subject to separate future approvals)	Yes, including consideration of relevant planning controls and local character

6.6.4 Parramatta Metro Station

The preferred location of the Parramatta Metro Station is within the block bounded by George, Macquarie, Church and Smith streets. The Parramatta Metro Station would be strategically located to the north of the existing Parramatta Station and within the commercial core of Parramatta CBD.

Station strategy

Parramatta Metro Station would serve and support the growth of Parramatta as Sydney's second CBD, including boosting jobs and improving connections to recreational and tourist attractions. The new metro station would improve customer experience at the existing Parramatta Station by relieving demand in peak times.

The station strategy for Parramatta Metro Station would:

- Reinforce Parramatta as the Central River City, with a station located to support high-value employment growth and renewal of the CBD
- Integrate with and maximise the place-making outcomes offered by the future Civic Link from Parramatta Square in the south to the Parramatta River in the north
- Create an efficient pedestrian corridor to the existing Parramatta Station
- Create a second mass transit node in Parramatta to provide easy, efficient and accessible interchange with buses and the future Parramatta Light Rail.

The key features of Parramatta Metro Station are provided in Table 6-3.

Table 6-3: Parramatta Metro Station key features

Elements	Key feature
Proposed station entry	One station entry on the future Civic Link Potential additional entry to be determined
Customers	• Residents and visitors travelling to nearby employment, education and residential precincts • Customers transferring to and from light rail
Primary station function	Origin, destination and interchange
Catchment	Employment, residential, education and entertainment
Transport interchange	• Suburban and intercity rail (connection via Civic Link) • Walk • Cycle • Bus • Light rail • Taxi / point to point transport • Kiss and ride
Provision for future integrated station and precinct development (subject to separate future approvals)	Yes, including consideration of relevant planning controls and local character

6.6.5 Sydney Olympic Park Metro Station

Sydney Olympic Park Metro Station would be located south of the existing Olympic Park Station in the heart of the growing Sydney Olympic Park town centre and central precinct. The metro station would be located to the east of Olympic Boulevard between Herb Elliott Avenue and Figtree Drive. The Sydney Olympic Park Master Plan identifies this precinct as a higher density, mixed-use neighbourhood with commercial offices, retail and residential uses.

Station strategy

The new metro station would support commercial, residential, retail, hotel, education, sports and entertainment uses. This location also offers easy transfer with potential Parramatta Light Rail Stage 2, the T7 Olympic Line and buses.

The station strategy for Sydney Olympic Park Metro Station would:

- Support the transformation of Sydney Olympic Park into a mixed-use lifestyle super precinct
- Serve both the Sydney Olympic Park businesses and the residential community
- Support a safe, efficient and accessible multi-modal transport service during major events
- Provide an easy, efficient and accessible interchange with the planned Parramatta Light Rail Stage 2 and buses.

The key features of Sydney Olympic Park Metro Station are provided in Table 6-4.

Table 6-4: Sydney Olympic Park Metro Station key features

Elements	Key feature
Proposed station entry	Two entries, one between Herb Elliot Avenue and Figtree Drive and one off Dawn Fraser Avenue
Customers	• Residents or employees travelling to nearby residential and employment precincts • Visitors to events, venues, recreational facilities and parklands • Customers transferring to and from light rail
Primary station function	Destination, origin and interchange (light rail)
Catchment	Residential, employment, events and recreation
Transport interchange	• Suburban rail (indirect connection) • Walk • Cycle • Bus • Light rail • Taxi / point to point transport • Kiss and ride
Provision for future integrated station and precinct development (subject to separate future approvals)	Yes, subject to the Sydney Olympic Park Master Plan

6.6.6 North Strathfield Metro Station

North Strathfield Metro Station would be located at the existing North Strathfield Station and would provide direct interchange between the two networks. The station would be positioned with an entrance on the eastern side of the existing rail line fronting Queen Street.

Station strategy

A metro station adjacent to the existing North Strathfield Station would provide customers travelling on the busy T9 Northern Line an attractive interchange option to access key centres more quickly, as well as accessing new centres.

The station strategy for North Strathfield Metro Station would:

- Support city-shaping outcomes through better support for the precinct
- Improve pedestrian amenity through better east-west movements, and revitalisation and activation of spaces within the station locality
- Deliver increased public transport capacity to support best land use outcomes for the Homebush and Strathfield areas
- Provide a high-quality, easy interchange environment for customers from the T9 Northern Line to metro, which would relieve the rail network and Strathfield Station, and serve major events at Sydney Olympic Park.

The key features of North Strathfield Metro Station are provided in Table 6-5.

Table 6-5: North Strathfield Metro Station key features

Elements	Key feature
Proposed station entry	One new entry on Queen Street
Customers	• Residents and visitors travelling to nearby residential and education precincts • Visitors to local entertainment, retail or dining attractions • Customer transferring between rail services
Primary station function	Origin, interchange
Catchment	Residential, education and entertainment
Transport interchange	• Suburban rail, and potentially intercity services • Walk • Cycle • Bus • Taxi / point to point transport • Kiss and ride
Provision for future integrated station and precinct development (subject to separate future approvals)	No

6.6.7 Burwood North Station

Burwood North Station would be located at the corner of Parramatta Road and Burwood Road with access from both the north and south sides of Parramatta Road. The site would be bound to the north by Burton Street and to the east by Loftus Street.

Station strategy

A station at Burwood North would support new residential housing and employment growth in the surrounding catchment.

The station strategy for Burwood North Station would:

- Open a new rail catchment to provide customer benefits with a more frequent, reliable and fast mass transit service
- Offer a relatively efficient corridor alignment that supports efficient travel times between the Parramatta and Sydney CBDs
- Reinforce and facilitate development of the Burwood strategic centre
- Provide an opportunity to integrate with the existing bus networks along Burwood Road and Parramatta Road, and provide an efficient interchange for customers.

The key features of Burwood North Station are provided in Table 6-6.

Table 6-6: Burwood North Station key features

Elements	Key feature
Proposed station entry	Two entries on Burwood Road, one to the north of Parramatta Road and one to the south
Customers	• Residents within walking and cycling distance • Students, staff and visitors travelling to nearby schools
Primary station function	Origin, interchange
Catchment	Residential
Transport interchange	• Walk • Cycle • Bus • Taxi / point to point transport • Kiss and ride
Provision for future integrated station and precinct development (subject to separate future approvals)	Yes, including consideration of relevant planning controls and local character

6.6.8 Five Dock Station

Five Dock Station would be located in the core of the Five Dock local centre near Great North Road and Fred Kelly Place. Great North Road is the primary north-south spine through the locality leading from Parramatta Road to the peninsula suburbs of Abbotsford and Drummoyne. Significant bus services operate along this spine.

Station strategy

A station at Five Dock would support the local village centre. Five Dock is also a potential location for a new bus interchange and new active transport connections between Parramatta Road and Victoria Road.

The station strategy for Five Dock Station would:

- Open a new rail catchment to provide customer benefits with a frequent, reliable and fast mass transit service
- Provide some interchange opportunity with local buses
- Support renewal of the established Five Dock local centre
- Offer a corridor alignment that supports efficient travel times between the Parramatta and Sydney CBDs.

The key features of Five Dock Station are provided in Table 6-7.

Table 6-7: Five Dock Station key features

Elements	Key feature
Proposed station entry	One entry at Fred Kelly Place off Great North Road
Customers	• Residents within walking and cycling distance • Visitors to retail, commercial and recreational precincts
Primary station function	Origin, interchange
Catchment	Residential
Transport interchange	• Walk • Cycle • Bus • Taxi / point to point transport • Kiss and ride
Provision for future integrated station and precinct development (subject to separate future approvals)	Yes, including consideration of relevant planning controls and local character

6.6.9 The Bays Station

The Bays Station would be located at the apex of White Bay between Glebe Island and the White Bay Power Station. In the masterplan currently being developed for The Bays Precinct, the metro station would have a large scale open space to the west and the Glebe Island Precinct to the east. The station would have direct access to the Bays Waterfront Promenade, which would run north and south along White Bay.

Station strategy

The Concept would support the renewal and development of The Bays Precinct and provide access to highly productive business, technology and education districts with complementary residential and retail areas in a high-amenity harbourside setting. The station would provide access to The Bays Precinct, Balmain and Rozelle.

The station strategy for The Bays Station would:

- Provide new high-quality public transport access to The Bays Precinct catalysing the establishment and growth of the future living and employment precinct by improving access for visitors and workers
- Provide mass transit access to highly productive business, technology and education activities, generating efficient business-to-business connections and linking to knowledge and education precincts
- Improve connections to a part of Sydney's harbourside around Rozelle Bay, Blackwattle Bay and White Bay that has traditionally had limited public transport access.

The key features of The Bays Station are provided in Table 6-8.

Table 6-8: The Bays Station key features

Elements	Key feature
Proposed station entry	One entry to the south of White Bay, near the future Bays Waterfront Promenade
Customers	• Residents within the precinct • Employees and visitors to business, education, districts within The Bays Precinct • Visitors to retail, commercial and recreational attractions
Primary station function	Destination, origin
Catchment	Employment, residential, recreation
Transport interchange	• Walk • Cycle • Bus • Taxi / point to point transport • Kiss and ride
Provision for future integrated station and precinct development (subject to separate future approvals)	Yes, subject to the NSW Government's Bays Precinct Transformation Plan

6.6.10 Sydney CBD Station

The optimum location for the Sydney CBD Station is being explored. The metro station would enable interchange with existing public transport networks, including Sydney Metro City & Southwest, Sydney Trains, Light Rail and bus networks. The station strategy and key features for the Sydney CBD would be developed once the location is determined.

6.7 Additional station options

Rydalmere

Opportunities for an additional station at Rydalmere are currently being explored. A metro station at Rydalmere would provide increased accessibility to employment and education destinations, as well as residential areas experiencing growth and renewal. It would also support the Greater Parramatta Olympic Peninsula vision, including supporting the concept of 30-minute cities, and the provision of high quality public spaces to enhance liveability.

If progressed, the location of the station at Rydalmere would be refined during ongoing design development. A detailed description and assessment of the station may be provided in the Stage 1 Environmental Impact Statement, or in a future stage of the Concept.

Pyrmont

Opportunities for an additional station at Pyrmont are currently being explored. A metro station at Pyrmont would support existing residential, employment, entertainment and event land uses in the area and provide direct connections between The Bays Precinct and the Sydney CBD. It would also provide interchange connections with existing light rail and bus services and reduce reliance on private transport in the area.

If progressed, the location of the station at Pyrmont would be refined during ongoing design development. A detailed description and assessment of the station may be provided in a future stage of the Concept.

6.8 Operational ancillary infrastructure

6.8.1 Services facilities

Fresh air tunnel ventilation and emergency egress would generally be provided at the proposed stations. However, additional facilities would be required at Rosehill (within the Clyde stabling and maintenance facility construction site), Silverwater and one between Five Dock and The Bays Precinct (the optimum location would be determined in consultation with Inner West Council and other relevant stakeholders).

The services facilities would generally be located directly above the tunnel alignment. An aboveground building for mechanical, electrical and ventilation equipment would be provided at each location, with a shaft to connect to the tunnels below.

6.8.2 Traction substations

Traction power supply would be provided through dedicated traction substations. These would be co-located with other infrastructure where possible.

6.9 Stabling and maintenance

6.9.1 Infrastructure maintenance

Maintenance planning would generally allow for routine and major periodic maintenance of infrastructure to be undertaken with a view to maximising service availability and minimising impacts on customers. Scheduled maintenance would generally occur between the last and first train services, or during planned weekend maintenance periods, when train services would not be in operation on parts of the line.

Rail maintenance vehicles would be able to use the network, and the Concept has been developed to allow access for maintenance crews. The following types of maintenance activities would be required:

- Scheduled maintenance – involving routine inspections and repairs to enable operations at prescribed levels of safety, reliability and service frequency. This type of maintenance would be performed on a regular and recurring basis at specified intervals
- Non-scheduled maintenance – involving emergency repairs to address unexpected defects (such as signal failure), vandalism and breakage that would impact on prescribed levels of safety, reliability and/or service frequency. This type of maintenance would be performed as needed
- Overhaul and repairs – involving the repair, replacement and testing of infrastructure that has been removed from its working location.

6.9.2 Clyde stabling and maintenance facility

Operating trains would be stabled and maintained at a dedicated facility in Clyde. The Clyde stabling and maintenance facility would provide:

- Stabling roads to store trains
- Maintenance facility
- Train wash facility
- Wheel grinding and graffiti/train wash facilities
- Infrastructure maintenance sidings, depot and buildings
- Operations control centre
- A traction substation to provide power to the rail line and stations (described in Section 6.8.2)
- Operational water treatment plant to treat wastewater pumped from the tunnels, stations and other underground facilities
- Workshops for the maintenance of railway infrastructure components
- Offices, car parks, storage and pedestrian roads.

Connecting track

The Clyde stabling and maintenance facility would be connected to the mainline tunnels via a section of aboveground track, a dive structure and tunnel portal located in Rosehill and underground connecting tunnels.

6.10 Construction

6.10.1 Key construction activities

The key construction elements would include:

- Enabling work
- Tunnel excavation and associated tunnelling support activities such as segment production, segment storage and spoil management
- Station construction including excavation, fit-out and aboveground building construction
- Interchange support work at Westmead and North Strathfield stations
- Operational ancillary infrastructure construction including excavation of shafts, fit-out and aboveground building construction
- Construction of a stabling and maintenance facility, including the dive structure and tunnel portal
- Tunnel and rail systems fit-out.

Table 6-9 provides a conceptual overview of key construction activities. Further details on construction activities in Stage 1 are provided in Chapter 8.

Table 6-9: Construction activities

Construction activity	Overview of activity
Enabling work	Enabling work are activities that would typically be carried out before the start of substantial construction in order to make ready key construction sites and provide protection to the public. Enabling work may include: • Demolition of buildings • Utility supply including power and water • Utility adjustments and protection • Transport network modifications to roads, public transport, and pedestrian and cyclist facilities • Heritage investigations, protection and archival recordings • Additional geotechnical and contamination investigations and remediation where required.
Tunnel excavation	Tunnel excavation is likely to be carried out using tunnel boring machines with roadheaders used for caverns, stub tunnels and stabling facility connection tunnels from the mainline tunnels to the Rosehill dive structure. Tunnel boring machines are likely to be used to excavate the majority of the twin tunnels as they operate at a quicker rate than roadheaders and excavate the desired circular tunnel profile. It is anticipated the tunnel boring machines would be launched and supported from two sites: • The Westmead Metro Station construction site • The Bays Station construction site. These sites would provide the necessary support for the tunnelling operation including spoil storage and removal, power supply to the tunnel boring machines, fresh air ventilation, grout batching, water treatment and disposal, material storage, office facilities, worker amenities and parking. At this stage it is anticipated that a concrete segment facility would be constructed at Clyde as part of the Clyde stabling and maintenance facility construction site to provide concrete segments for the tunnel lining, although alternative locations are under investigation.
Station construction	Excavation of stations would generally be carried out in the following sequence: • Enabling work including protection or diversion of utilities and establishment of site access points • Demolition of structures on the site and clearance of landscaped vegetation • Excavation and structural work for station boxes and underground pedestrian passages including piled walls • Station fit-out including mechanical, electrical, lighting and fresh air tunnel ventilation equipment, signage and wayfinding equipment and station furniture.

Construction activity	Overview of activity
Interchange support at Westmead	Construction sites within the existing rail corridor would be located on land owned by Sydney Trains and vacant land along the rail corridor in the vicinity of stations. Interchange support work would involve: • Widening and lengthening of existing station platform(s) • Track slewing, rail systems and overhead wiring work • Construction of a new aerial concourse with new lifts and stairs to the existing platforms, and demolition of existing station elements • Adjustments to existing station entry points and the overhead concourse.
Interchange support at North Strathfield	Interchange support work would involve the construction of a new aerial concourse with new lifts and stairs to the existing platforms, and demolition of existing station elements. At the current stage of design, it is not expected that any below grade work is required.
Dive structure and tunnel portal construction	Dive structure and tunnel portal construction would generally involve: • Cast in-situ concrete piling along the edge of the dive structure to form the walls • Excavating below track level • Placing of precast and cast in-situ concrete for the cut-and-cover section and to form the tunnel portal.
Operational ancillary infrastructure construction	The operational ancillary infrastructure would be generally constructed in the following sequence: • Excavation of a vertical shaft to the tunnels below. This may be carried out using excavators and rock hammers, however, drill and blast or penetrating cone fracture techniques may also be used • Lining and reinforcement of the shaft • Building work for aboveground components • Installation of electrical equipment including transformers and electrical switchboards.
Stabling and maintenance facility construction	Construction of the stabling and maintenance facility would involve: • Enabling work including protection or diversion of utilities and establishment of site access points • Demolition of structures on the site and clearance of vegetation • Import and placement of fill material • Construction of structures for crossings of A'Becketts Creek and Duck Creek • Track and rail systems fit-out • Construction of buildings including the operational control centre.
Tunnel rail systems fit-out	Tunnel and tunnel rail systems fit-out work would include: • Fresh air tunnel ventilation fit-out • Track slab and rail fastening • Rail installation, fixing and welding • Cable and equipment installation including signalling, communications and electricity systems • Overhead traction power supply installation for rolling stock • Other equipment including lighting (including emergency lighting), drainage work, and fire and life safety systems (including walkways connecting to emergency egress and fire hydrant systems).

6.10.2 Construction sites

Most of the construction sites would be contained within the footprints of operational station and ancillary infrastructure. Additional construction areas would be required to support tunnel excavation and fit-out work.

The location and indicative footprint of the proposed main construction sites between Westmead and The Bays Precinct are shown in the description of Stage 1 in Chapter 8. Construction components to the east of The Bays Precinct through to the Sydney CBD would be subject to further design and would form part of the scope assessed in the Environmental Impact Statements for future stages.

6.11 Staging

Sydney Metro is proposing to stage the planning approvals process as follows:

- Obtain approval for the whole of Sydney Metro West (at concept level) concurrent with Stage 1. Stage 1 would involve the major civil construction work between Westmead and The Bays Precinct (this application)
- Future stage(s) would include the remaining major civil construction work from The Bays Precinct to the Sydney CBD, rail systems fit-out, station fit-out and aboveground building construction, and operation of the metro line (future application(s)).

Further details regarding Stage 1 are provided in Chapter 8.

7 Concept preliminary environmental assessment

7 Concept preliminary environmental assessment

This chapter provides a preliminary assessment of the environmental issues identified for the Sydney Metro West Concept, including a description of the existing environment and the identification of potential impacts during construction and operation. The proposed scope of further assessment to be undertaken as part of the Environmental Impact Statement for the Concept is also provided. As it is a preliminary assessment, the potential impacts may change through the design and impact assessment processes as more information becomes available. Any changes to environmental impacts will be assessed as part of the Environmental Impact Statement for the Concept or as part of future assessments for subsequent stages.

7.1 Traffic and transport

7.1.1 Existing environment

The existing transport network consists of the Sydney Trains suburban rail lines and NSW Trains intercity rail network, the road network, bus services, light rail, ferry services, and pedestrian and cyclist facilities. Sydney Metro Northwest has recently commenced operations while Sydney Metro City & Southwest is currently under construction.

Sydney Trains and NSW Trains network

Various suburban rail lines operate through the Sydney CBD, connecting to surrounding suburbs. The suburban rail and intercity network in the vicinity of the Concept includes:

- The T1 Western and T2 Inner West lines providing connections between the Sydney CBD and Parramatta and Western Sydney to the Blue Mountains Line
- The T9 Northern Line providing connections between suburbs in the north of Sydney to the Sydney CBD
- The T7 Olympic Park Line providing services from Lidcombe to Sydney Olympic Park
- The T5 Cumberland Line providing services from the T1 Western Line, west of Westmead to Harris Park, to suburbs south-west of Sydney to Campbelltown
- The T6 Carlingford Line providing services from Carlingford, then terminating at Clyde, where passengers change to connect to either T1 Western Line or T2 Inner West Line services. In 2020 this line will be decommissioned and partially converted to Parramatta Light Rail Stage 1
- Blue Mountains Line intercity trains between Bathurst and Central that stop at Parramatta and Strathfield, with a small number of services also stopping at Westmead
- The Central Coast and Newcastle Line which operates trains along the T9 Northern Line corridors via Strathfield or Gordon and stops at Strathfield and Central.

Between Strathfield and the Sydney CBD, a number of rail lines converge in the western rail corridor including the T1 Western Line, T9 Northern Line and T2 Inner West Line, resulting in capacity constraints and restricting the ability to increase rail services.

The Sydney CBD includes the convergence of most of the suburban rail lines, enabling passengers to alight and change rail lines, or interface with other modes of transport accessible within the Sydney CBD.

Road network

The road network in the area is currently dominated by the M4 Western Motorway, which connects the western suburbs and the Blue Mountains to Concord in the east.

Major arterial roads near the Concept corridor include:

- The Great Western Highway and Parramatta Road which are the key east-west arterial roads
- City West Link and the Anzac Bridge providing connections into the Sydney CBD
- James Ruse Drive, Silverwater Road, Homebush Bay Drive and Victoria Road providing important north-south links
- Numerous arterial and sub-arterial roads providing connections from the surrounding areas to these major arterial roads.

The majority of the motorway, arterial and sub-arterial road network experiences significant traffic volumes and congestion, especially during peak periods.

The WestConnex program is currently augmenting the motorway network in the area. This includes the recently opened easterly extension to the M4 Motorway (in tunnel) from Homebush to Haberfield (the M4 East project). A further extension to the underground motorway network will connect the M4 East to the New M5 project, including a new interchange at Rozelle.

Within the Parramatta CBD, the arterial road network generally comprises a grid pattern in the city centre. Key north-south streets include O'Connell Street, Church Street, Wilde Avenue, Smith Street and Harris Street. Key east-west streets include George Street, Macquarie Street and Phillip Street. James Ruse Drive, the Cumberland Highway and the M4 Motorway provide a vehicular bypass around the Parramatta CBD.

Within the Sydney CBD, the arterial road network generally forms a grid pattern. Key north–south roads include Elizabeth, York and Clarence streets. Key east–west roads include Park, Market and King streets. Many roads within the Sydney CBD are one-way and experience high traffic volumes and congestion, especially during peak periods.

Bus network

Buses perform a number of roles including cross-regional public transport and local services connecting residential areas to key transport interchanges. These bus services typically operate on the major arterial road network.

The current bus network is focussed on providing trunk route services to the Parramatta and Sydney CBDs and is supported by suburban services to centres such as Five Dock and Burwood. These suburban bus services also provide connections to rail stations where possible.

Key interchanges are located at Parramatta Station and within the Sydney CBD at Wynyard, Town Hall and Central stations. Parallel to the existing rail corridor, a number of bus services are provided from suburban station interchanges to connect suburbs within the area.

Light rail

The light rail network consists of one line between Dulwich Hill and Central via Lilyfield and Pyrmont (the Inner West Light Rail). It has frequent services over extended periods. While its share of passengers to the Sydney CBD is limited, it plays an important role in connecting the areas it serves to the Sydney CBD.

The CBD and South East Light Rail (under construction) will operate between Circular Quay and Randwick/Kingsford once opened. The route will be along George Street to Central Station, through Surry Hills to Moore Park, then to Kensington and Kingsford via Anzac Parade, and Randwick via Alison Road and High Street.

Parramatta Light Rail Stage 1 (currently under construction) will connect Westmead to Carlingford via the Parramatta CBD and Camellia with a two-way track spanning 12 kilometres. The planned Stage 2 would connect the Parramatta CBD to Ermington, Melrose Park, Wentworth Point and Sydney Olympic Park along a nine kilometre route.

Ferry

Parramatta River ferry services connect Parramatta and the Sydney CBD (at Barangaroo and Circular Quay). Ferry stops include Rydalmere and Sydney Olympic Park.

Sydney Metro

Sydney Metro Northwest has recently commenced operations and provides metro services between Rouse Hill and Chatswood. Customers are able to interchange at either Chatswood or Epping between metro services and rail services operating on the T1 North Shore or T9 Northern Lines

Sydney Metro City & Southwest is currently under construction and will extend metro services beneath Sydney Harbour and onto Bankstown through the upgrade of the existing T3 Bankstown Line. It is anticipated to commence operations in 2024.

Pedestrian and cyclist network

There is a fragmented cycle network across the area. The main cycling facilities in the area consist of:

- A predominately off-road cycle path connecting Meadowbank to Parramatta along the Parramatta River
- An extensive off-road cycle network through the Sydney Olympic Park and Bicentennial Park area
- A dedicated cycle facility across the Anzac Bridge connecting to the Sydney CBD
- A dedicated cycle facility along the M4 Motorway between Newington and Wentworthville.

Changes to cycle routes within the Sydney CBD are occurring as a result of the CBD and South East Light Rail project. The key cycle routes within the Sydney CBD will be Castlereagh (south of King Street), Kent, Liverpool, King, Park, and Pitt (north of King Street) streets.

Pedestrians are generally catered for locally through footpaths and dedicated road crossings. The areas surrounding the Concept generally have a high volume of pedestrians, especially within the Parramatta and Sydney CBD areas and within local town centres such as Five Dock.

7.1.2 Preliminary impact assessment

Construction

Potential traffic, transport and access impacts anticipated to occur during construction include:

- Worsening traffic performance on the road network surrounding construction sites due to construction vehicles, and temporary road or lane closures
- Temporary loss of on-street parking or removal or relocation of loading zones, servicing access, taxi ranks, and/or kiss and ride areas
- Removal or relocation of existing bus stops
- Delays or other impacts on the reliability of existing bus services including the potential diversions of bus services
- Reduced pedestrian and cyclist access or flows due to the presence of construction work. This would also include altered access to the existing Westmead and North Strathfield stations
- Altered access to private properties
- Impacts on the safety of motorists, pedestrians and cyclists due to potential conflicts with construction vehicles, particularly in the Parramatta and Sydney CBDs
- Impacts on the reliability of suburban and intercity rail services to allow for construction activities to safely occur within the rail corridor.

Strategies to minimise potential construction traffic and transport impacts will continue to be investigated during future Concept development, including options for spoil transport by non-road methods.

Operation

The design would aim to avoid or reduce impacts associated with operational traffic, transport and access. Notwithstanding, impacts that could occur during the operation include:

- Changes to traffic arrangements on the surrounding road network such as changes to local roads or traffic light phasing
- Changes or a loss of loading zones or parking spaces
- Altered pedestrian and cyclist arrangements.

Sydney Metro West would also deliver a number of significant traffic, transport and access benefits. These benefits are described in Chapter 2 and include:

- Increased capacity and reliability of Sydney's rail network
- Improved travel times and customer comfort between key destinations within the Greater Parramatta to Sydney CBD corridor
- Reduced crowding on trains and at some stations on the existing Sydney rail network
- Improved journey times for bus customers and other road users
- Improved connectivity and transfer opportunities between public transport modes.

7.1.3 Proposed assessments

A qualitative traffic and transport impact assessment will be carried out as part of the Environmental Impact Statement and will include:

- Description of how, at a conceptual level, Sydney Metro West will meet the transport related objectives of relevant strategic plans, including consideration of future growth areas
- Description of the overall strategy for managing construction sites to minimise potential adverse construction transport and traffic impacts
- Identification of the types of adverse impacts which could occur on the regional and local road network during construction including:
  - Pedestrian and cyclist movements around the construction sites
  - Impacts on access to existing stations at Westmead and North Strathfield
  - Impacts on public transport (including rail, buses, school buses and light rail)
  - Impacts on private transport such as school bus services
  - Impacts on the performance of the surrounding road network
  - Impacts on emergency services, residential property access and local businesses
- Identification of the likely traffic and transport impacts on the regional and local road network during operation and on existing and proposed public transport routes, taking into account relevant government transport planning strategies
- Identification of the transport related benefits at a conceptual level including the principles for integrating with and encouraging active transport
- The proposed scope of future traffic and transport assessments to be carried out as part of planning approvals for subsequent stages.

Consultation will be carried out with other sections of Transport for NSW and relevant local Councils to inform the traffic and transport impact assessment.

7.2 Noise and vibration

7.2.1 Existing environment

Sydney Metro West would traverse a well-established urban environment that contains a wide range of commercial, residential and industrial land uses of varying densities interspersed with recreational areas, medical facilities and community facilities (such as schools, childcare centres and places of worship).

The existing noise environment varies considerably along the length of the Sydney Metro West corridor. The dominant noise sources that are likely to influence existing background noise levels would include:

- Road traffic noise
- Suburban rail line operations and associated station activities
- Industrial activities occurring within existing industrial areas (such as at Silverwater, Rosehill and Clyde)
- Commercial activities in commercial centres including Parramatta and the Sydney CBD
- Construction activities (such as WestConnex, Parramatta Light Rail, building redevelopments, other road and housing construction)
- Sydney Harbour maritime traffic
- Occasional major sporting or other events at large sports facilities such as Rosehill Gardens Racecourse and at facilities within Sydney Olympic Park
- Aircraft noise.

7.2.2 Nearby receivers

Sydney Metro West would be within a corridor which mainly runs underground, however the development of stations and surface construction sites would occur in developed urban areas including:

- Residential areas dominated by single storey homes, however some areas contain multi-storey buildings
- Educational institutions, some of which would be located near construction sites and may have a direct line of sight to these sites
- Medical facilities, particularly in the vicinity of Westmead
- Community facilities such as childcare centres and places of worship located along the corridor
- A number of active recreation areas and parks located directly adjacent to the corridor, including public sports fields and stadiums (e.g. sportsgrounds within Sydney Olympic Park). A number of passive recreation areas are also located along the corridor, including parks, nature reserves and barbecue areas
- Commercial and industrial land uses located along the corridor, with commercial land uses generally centred around stations, and industrial land uses concentrated in Camellia/Rosehill, Clyde and Silverwater. Commercial properties are generally not considered to be as sensitive to noise and vibration, however in some situations they can be (e.g. medical facilities). Industrial land uses are generally not considered to be sensitive to noise and vibration.

7.2.3 Preliminary impact assessment

Construction

Construction would result in noise and vibration impacts on surrounding land uses and sensitive receivers. Construction activities with the greatest potential to result in significant noise and vibration impacts would include:

- Excavation of tunnels and related activities occurring at the tunnel support sites. Tunnel excavation and associated aboveground support activities are likely to be undertaken 24 hours per day, seven days per week
- Excavation, construction and fit-out of stations. Underground station excavation and associated aboveground support activities are likely to be undertaken 24 hours per day, seven days per week
- Construction of operational ancillary infrastructure
- Construction of the Clyde stabling and maintenance facility, including the connecting track work
- Interchange support work at Westmead and North Strathfield stations
- Construction road traffic associated with the delivery of construction plant, equipment, and materials and spoil removal.

Given the nature of the proposed work and the proximity of sensitive receivers, construction noise and vibration impacts are expected at some locations to exceed the noise management levels derived from the *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009). There is also the potential during construction for vibration impacts on receivers, buildings and structures along the route (including listed heritage buildings, performance venues and those buildings containing sensitive medical equipment).

Strategies to mitigate and manage the impacts of noise during construction, including cumulative noise and construction fatigue, will be developed.

Operation

Operation has the potential to increase noise and vibration levels at surrounding receivers and land uses due to the generation of:

- Ground-borne and structure-borne noise and vibration from trains operating within the tunnels
- Airborne noise from metro trains operating within aboveground track associated with the Clyde stabling and maintenance facility
- Airborne noise from the stabling and maintenance facility which would operate 24 hours per day
- Airborne noise from stations (such as station announcements)
- Airborne noise from tunnel and station fresh air ventilation systems
- Airborne noise from traction substations and other ancillary facilities.

Operational noise and vibration impacts are generally manageable through the design process, through the implementation of certain trackform, orientation of equipment and acoustic louvres. The specific need and location of these measures would be determined during future design and environmental impact assessment stages.

7.2.4 Proposed assessments

A qualitative and conceptual level construction and operational noise and vibration impact assessment will be carried out as part of the Environmental Impact Statement and will include:

- Identification of the types of construction activities likely to generate high noise and vibration levels, and the likely affected receivers
- Identification of potential operational noise and vibration impacts, with consideration of existing and future known land uses
- Strategies for noise mitigation and management
- The proposed scope of future noise and vibration assessments to be carried out as part of planning approvals for subsequent stages.

7.3 Non-Aboriginal heritage

7.3.1 Existing environment

Heritage listed items

No properties on the World Heritage or National Heritage lists are located within the vicinity of the proposed permanent aboveground elements. However, the Australian Convict Sites Old Government House and Government Domain (World Heritage) at Parramatta Park is located near the tunnel alignment.

A number of local and State listed heritage items are located along the Concept corridor. Some of these items may be close to proposed construction or operational sites or above the tunnels. Potential direct and indirect impacts on these items, such as vibration and visual impacts, will be considered as part of the Environmental Impact Statement.

Conservation areas

Sydney Metro West would also be located in or near various Heritage Conservation Areas. Some of these areas may be located near construction or operational sites or may be located above underground tunnel components. Potential impacts on these areas will be considered as part of the Environmental Impact Statement.

Non-Aboriginal archaeological potential

Greater Sydney including Parramatta was the first European settlement in Australia. Consequently, the Concept corridor includes areas of the earliest European settlement, generally within Parramatta and the Sydney CBD and clustered along Parramatta Road. The land along the existing railway line and major roadways was subdivided and developed in the late-nineteenth and early twentieth century to create suburbs that typically consist of small scale commercial precincts, surrounded by streets of low density housing such as those in Five Dock, Concord, Burwood, and Strathfield.

These suburbs have undergone minimal redevelopment and areas of the public domain, such as footpaths and roadways, are unlikely to contain significant archaeological evidence of earlier phases of occupation. Surviving estate houses and suburban areas are protected under heritage listings as heritage items and conservation areas.

Areas of industry were generally focused along waterways like the Parramatta River, such as the Glebe Island Abattoir, and Rozelle Rail Yards, or the State Abattoir and Brickworks at Homebush (now Sydney Olympic Park). Much of the foreshore areas retain an industrial character, such as at Rosehill and Silverwater. The nature of uses at these sites has required the redevelopment of facilities over time, and extensive changes to landforms. Portions of Parramatta River have been reclaimed or dramatically reshaped to facilitate these industries, including Haslams Creek which borders Sydney Olympic Park.

The historic core of Parramatta developed quickly after the establishment of Government House in 1788. Occupation along Phillip Street and Church Street is documented from the late eighteenth and early nineteenth centuries, including convict-related development. Construction of the existing twentieth century buildings has resulted in partial impacts to potential archaeology however Parramatta generally is a highly significant and relatively intact archaeological site.

7.3.2 Preliminary impact assessment

Construction

The Concept has been, and will continue to be, developed to minimise potential impacts on non-Aboriginal heritage. Notwithstanding, construction has potential to impact non-Aboriginal heritage through:

- Direct impacts (such as demolition) on heritage listed items
- Indirect impacts where construction is nearby to heritage listed items or conservation areas. This would include potential vibration and visual impacts
- Undertaking excavations and other land-disturbing work in areas of potential archaeological significance, which could result in damaging previously unrecorded archaeological relics, including archaeological material and deposits.

Operation

The following potential non-Aboriginal heritage impacts could occur during operations:

- Impacts on the heritage significance of listed heritage items and conservation areas due to the establishment of new infrastructure that detracts from the values of a heritage item and/or changes the visual outlook from a heritage item
- Ground-borne vibration impacts on listed heritage items, which may result in damage to the structural integrity and/or fabric of such items.

7.3.3 Proposed assessments

A non-Aboriginal heritage assessment will be carried out at a conceptual level as part of the Environmental Impact Statement and will include:

- Information on how the development of the Concept has avoided or minimised impacts on heritage items
- Identification of items, areas of heritage significance and archaeological resources that could be affected during its construction and operation
- A general assessment of the type of impacts that may affect heritage items
- An outline of potential mitigation measures and strategies
- The proposed scope of future non-Aboriginal heritage assessments to be carried out as part of planning approvals for subsequent stages
- Consultation with heritage specialists within the Department of Premier and Cabinet and local councils.

7.4 Aboriginal heritage

7.4.1 Existing environment

Previously recorded Aboriginal sites

Searches of the NSW Office of Environment and Heritage's Aboriginal Heritage Information Management System (AHIMS) database identified that a number of Aboriginal heritage items and sites have been previously recorded in the vicinity of the Concept corridor, with a number of sites present within the Sydney CBD, the Parramatta CBD, and along the Parramatta River. However this is likely to be a result of previous archaeological research in response to developments within Parramatta and its environs and the Sydney CBD, leading to a comparatively larger number of recorded heritage items recorded, rather than being a true representation of Aboriginal people's use of the landscape.

Archaeological potential

Some areas within the Concept corridor have no Aboriginal archaeological potential. These areas are where large-scale excavation work would have removed any Aboriginal archaeological deposits. These areas include Sydney Olympic Park, The Bays Precinct and parts of Rosehill, Clyde and Silverwater.

The likelihood of Aboriginal heritage sites surviving to the present is influenced by a range of factors, including the durability of the material evidence and the subsequent impacts that have occurred at that location. While large portions of the Concept corridor have been significantly altered by previous development, the data from other archaeological investigations undertaken in the Sydney and Parramatta CBDs indicate that some Aboriginal archaeological deposits do survive – even in highly developed locations. Some of these archaeological deposits have been subjected to varying levels of disturbance but still survive in small pockets of natural soil and/or at depth in truncated soil profiles. In other cases, Aboriginal objects (stone tools) may be present in historical archaeological stratigraphic layers.

The Parramatta CBD is known to be rich in Aboriginal archaeological resources and is also considered to have potential for contact archaeology demonstrating Aboriginal occupation and culture during the early colonial period. Furthermore, the Parramatta Sands Sheet has potential to contain stratified archaeological remains of Aboriginal occupation over many thousands of years, providing rare, datable material.

7.4.2 Preliminary impact assessment

Construction

Construction may potentially impact on previously recorded Aboriginal heritage sites.

There is also the potential for previously unrecorded items of Aboriginal heritage significance to be present within the Concept corridor (including sites, objects, remains, values, features or places). Therefore, construction has the potential to inadvertently impact on unrecorded Aboriginal items or sites. There is a particularly elevated risk of uncovering previously unrecorded items of Aboriginal heritage significance in the Parramatta locality.

Operation

Aboriginal heritage would not be impacted during operations, as widespread ground disturbance/ excavation would be restricted to the construction phase.

7.4.3 Proposed assessments

Aboriginal heritage assessment will be carried out at a conceptual level as part of the Environmental Impact Statement and will include:

- Further consideration of the Aboriginal archaeological potential along the Concept corridor
- Identification of the potential to disturb Aboriginal heritage
- An outline of potential mitigation measures and strategies
- Identification of the proposed scope of future Aboriginal heritage assessments, including the need for further archaeological testing and/or detailed archaeological excavations, that would be carried out as part of planning approvals for subsequent stages
- Consultation with heritage specialists within the Department of Premier and Cabinet, local councils and registered Aboriginal parties.

7.5 Property and land use

7.5.1 Existing environment

The Concept corridor would traverse well-established areas of commercial, residential and industrial land uses of varying densities interspersed with recreational areas (such as public open space), medical facilities and community facilities (such as schools, childcare centres and places of worship). Existing land use is described in Table 7-1.

Table 7-1: Existing land use

Location	Land use	Key features
Westmead	Residential Mixed use Education Health Nature reserves, parks and open space Special uses	Characterised by the Westmead health, education and research precinct, which forms a substantial concentration of highly skilled employment uses. This precinct also includes medium density homes and a local town centre with commercial, retail and health services. Other key features in the immediate locality include: • Existing Westmead Station • Western Sydney University's Westmead Campus • Westmead Public School • Parramatta Park • Future Parramatta Light Rail (Stage 1) Westmead Station stop.
Parramatta	Residential Commercial core Mixed use Education Nature reserves, parks and open space Major recreational and sporting venues Retail precincts Special uses	A highly developed centre, comprising a wide mix of commercial, commercial services, retail, government administration and community based uses. Key features in the immediate locality include: • Existing Parramatta Station and transport interchange • Greenway Plaza and Parramall Shopping Centre • Church Street entertainment precinct • Future Parramatta Square • Western Sydney University Peter Shergold Building • Leigh Memorial Church and St John's Anglican Cathedral • Parramatta justice precinct • Parramatta Park • Parramatta River • Future Parramatta Light Rail (Stage 1) stops.
Clyde	Industrial Recreational and sporting venue	Characterised by heavy and light industrial use and commercial uses and includes Sydney's Valvoline Raceway (Sydney Speedway). A'Becketts Creek and Duck Creek, upper tributaries of Duck River, are within the northern boundary of Clyde. The M4 Western Motorway, Parramatta Road and James Ruse Drive intersect the suburb. The T6 Carlingford rail line borders the western and southern boundary of Clyde. Rosehill Gardens Racecourse is also located nearby.
Silverwater	Industrial	Characterised by heavy and light industrial use and commercial uses. Further to the south and east are low to medium density residential areas.
Sydney Olympic Park	Residential Mixed use Nature reserves, parks and open space Major recreational and sporting venues Special uses	Characterised by land uses that are related to significant sporting and events facilities including exhibition facilities, halls and sporting grounds. To the south are commercial, education, residential, visitor accommodation and entertainment uses, while to the east are commercial buildings, beyond which are newly completed mixed use high density buildings comprising retail and commercial ground floors with residential uses above. Key features in the immediate locality include: • Existing Sydney Olympic Park Station • ANZ Stadium and Sydney Showground • Sydney Olympic Park Tennis Centre and the Hockey Centre • Sydney Olympic Park Aquatic and Athletic Centres • Bicentennial Park.

Location	Land use	Key features
North Strathfield	Residential Education	A local centre character, comprising local shops, commercial services and the McDonald College. The broader context of the site is generally residential, featuring medium density homes closer to the station and lower density homes further afield.
Burwood North	Residential Health Retail precincts Nature reserves, parks and open space Major recreational and sporting venues Special uses	A local centre character, with a number of retail, commercial services, commercial and residential developments focussed on the north-south spine of Burwood Road, and the east-west spine of Parramatta Road. Key features in the immediate locality include: • Parramatta Road • Concord Oval • Concord Private Hospital • St Lukes Park, including St Lukes Oval • St Luke's Anglican Church.
Five Dock	Residential Mixed use Education Nature reserves, parks and open space	A local centre character, comprising an array of different shops, entertainment uses, with some local education and health services, apartments and community facilities located throughout. The broader context of the site is low to medium density residential development, with commercial uses along the spine of the Great North Road. Key features in the immediate locality include: • Five Dock Town Centre • Five Dock Park • Five Dock Public School • Domremy Catholic College.
The Bays Precinct	Residential Industrial Nature reserves, parks and open space Special uses	Characterised by a mix of land uses, including maritime and port related employment uses. Residential uses occur to the north and the west in Rozelle. Key features in the immediate locality include: • White Bay Power Station site (disused) • White Bay Cruise Ship Terminal • Glebe Island cement and grain silos • City West Link, Western Distributor and Victoria Road • Glebe Island Bridge and Anzac Bridge.
Sydney CBD	Residential Commercial cores Retail precincts Special uses Parks and open space Recreational venues Health	A dominant commercial character but also including retail, high density residential, civic buildings and major public open space areas. The Sydney CBD is a major cultural, social and leisure destination.

Crown Land and Commonwealth Land

A number of parcels of Crown land have been identified near the Concept corridor. These include local council and community managed reserves as well as lands retained in public ownership for environmental purposes.

Parcels of Commonwealth land are also located near the Concept corridor. This includes Commonwealth owned land, such as existing defence land (e.g. the Lancer Barracks within Parramatta), and Commonwealth leased land used for other government purposes (such as post offices, Centrelink offices etc.).

Land use strategies

Sydney Metro West would support a number of land use strategies and masterplans. This includes:

- The Bays Precinct Urban Transformation Program
- Sydney Olympic Park Master Plan 2030
- Westmead Master Plan – under development
- Parramatta Road Corridor Urban Transformation Strategy (UrbanGrowth NSW, 2016).

7.5.2 Preliminary impact assessment

Construction

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

- Acquisition or leasing of property
- Temporary loss of public open space
- Temporary disruption to utilities, services, and transport assets and infrastructure to facilitate construction.

Operation

The operation of a metro would support planned growth and land use change in a number of precincts across the corridor, including The Bays Precinct, the Parramatta Road Corridor, Sydney Olympic Park, and Westmead. Potential land use changes and indirect positive impacts associated with opportunities for urban renewal may also occur around other station precincts.

In addition to supporting planned growth, potential property and land use impacts anticipated to occur during operation include:

- The permanent acquisition of property to enable the establishment and operation of Sydney Metro West infrastructure
- Potential restrictions on future development in some locations to protect subsurface tunnels or aboveground rail infrastructure.

Crown land and Commonwealth land

The Concept corridor may impact on Crown land, which will form part of the assessment undertaken in the Environmental Impact Statement.

The Concept corridor is not anticipated to impact on any Commonwealth owned land. However there may be Commonwealth leased land within the footprint of some sites. This is likely to comprise offices and other facilities for Commonwealth government departments. These facilities are likely to re-establish in another location in the vicinity and the impact of their loss would be negligible.

In addition, there may be some Commonwealth land (owned or leased) that may be subject to subsurface stratum acquisition (i.e. as a result of the proposed tunnel alignment).

7.5.3 Proposed assessments

A conceptual level property and land use assessment will be carried out as part of the Environmental Impact Statement. The assessment will include:

- Likely future land use based on zoning, planning proposals, major development applications and consultation with local councils and the Department of Planning, Industry and Environment
- Direct impacts on property and land use
- Indirect positive and negative impacts on property and land use, including potential land use integration issues, potential opportunities and/or benefits for urban renewal and development at and around metro stations
- The proposed scope of future property and land use assessments to be carried out for subsequent stages of the Concept.

7.6 Landscape character and visual amenity

7.6.1 Existing environment

The Concept corridor is generally highly urbanised with pockets of natural environments. Areas of high visual amenity value are likely to be associated with open space and parkland, reserves and waterways along the Parramatta River and its tributaries. Overall, the corridor consists of the following typical visual landscapes:

- Heavily built-up commercial areas, in particular around the major centres of the Parramatta CBD and the Sydney CBD, typically characterised by large scale commercial and mixed use buildings with limited amounts of street planting or other landscaping
- Smaller commercial centres such as Five Dock, typically consisting of a lower scale development with varying degrees of urban design and landscaping
- Low density residential areas consisting of predominantly detached homes and town houses such as Lilyfield, Five Dock, Concord and North Strathfield. These areas generally have established streetscapes and may have extensive street plantings or landscaping characteristics
- Medium and high density industrial and larger commercial warehouses which are typical of areas such as The Bays Precinct, Camellia/Rosehill, Clyde and Silverwater
- Open parks and reserves, both public and private, that provide significant amenity function for both passive and active users. Significant open space areas along the corridor include Parramatta Park, areas within Sydney Olympic Park, Bicentennial Park, Hyde Park and the Royal Botanic Gardens. Smaller neighbourhood parks and open space also provide significant amenity for the community.

7.6.2 Preliminary impact assessment

Construction

The construction may cause temporary adverse impacts on landscape character and visual amenity for those who work, study, reside, visit, or access businesses/community services within the areas near construction sites. These impacts may result from:

- The establishment and presence of construction sites
- Light spill from construction sites during out-of-hours construction
- Aboveground construction work particularly associated with the Clyde stabling and maintenance facility
- The erection of acoustic sheds and hoarding to mitigate construction noise impacts
- Construction vehicle movements both within construction sites and along haulage routes
- The removal of some trees. Landscaping and replacement tree planting would be provided where possible at the end of construction
- The loss of open space if portions of parks or reserves are required for temporary construction sites
- The parking and use of construction plant and equipment.

The impact of Sydney Metro West on individual sensitive receivers would be dependent on the stage of construction, their location and severity of the impact.

Operation

Potential landscape character and visual amenity impacts that could occur during the operation include:

- Changes to local visual character (both negative and positive) associated with the introduction of new stations, ancillary infrastructure, and the stabling and maintenance facility
- Changes to landscape character (both negative and positive) associated with the establishment of new stations, ancillary infrastructure, and the stabling and maintenance facility. In some locations, the presence of a new metro station may result in a positive landscape character outcome due to improved accessibility of public transport
- Light spill from stations, ancillary infrastructure, and the stabling and maintenance facility.

7.6.3 Proposed assessments

A concept level landscape character and visual amenity impact assessment will be carried out as part of the Environmental Impact Statement. The assessment will include:

- A high-level description of the visual character and qualities of the Concept corridor
- Identification of the types of visual impacts which may occur due to construction and operation
- Identification of potential landscape character changes due to the introduction of the Concept
- An outline of urban design principles and objectives to guide further design and help minimise the impacts of potential infrastructure on surrounding visual or urban form
- The proposed scope of future landscape character and visual amenity assessments to be carried out as part of planning approvals for subsequent stages of the Concept.

7.7 Groundwater and geology

7.7.1 Existing environment

The Sydney 1:100,000 Geological Map (Geological Survey of NSW, 1983) and the Penrith 1:100,000 Geological Map (Geological Survey of NSW, 1991) shows the Concept is mainly situated over the following geological landscapes:

- Ashfield Shale
- Hawkesbury Sandstone
- Quaternary deposits (silty to peaty quartz, sand, silt and clay)
- Fill.

The groundwater system is expected to consist of a deep groundwater system (where groundwater flows through the underlying rock layers) and a more localised surface groundwater system where groundwater flows through overlying residual soils and fill.

Recharge of the deep groundwater system is expected to be via either direct recharge (at locations where the bedrock is exposed) or via downward percolation through the residual soil or fill (at locations where bedrock is not exposed).

The expected groundwater quality derived from the geological units is as follows:

- Ashfield Shale – brackish groundwater, with salinity ranging from 5,000 to 20,000 milligrams per litre and a neutral pH. The concentration of dissolved metals and nutrients is expected to be low. Organic compounds are not naturally associated with this geological unit
- Hawkesbury Sandstone – fresh to brackish groundwater, with salinity ranging from 500 to 10,000 milligrams per litre and a neutral pH. The concentration of trace ions (such as iron and manganese) and dissolved metals and nutrients is expected to be low. Organic compounds are not naturally associated with this geological unit
- Mittagong Formation – fresh (<1,000 milligrams per litre as total dissolved solids) to brackish (1,000 to 20,000 milligrams per litre as total dissolved solids) with a neutral pH, reflecting its depositional history as interbedded shale and medium-grained quartz sandstone.

A review of the NSW Office of Water's PINNEENA database identified that there are existing groundwater users within or near the Concept corridor.

7.7.2 Preliminary impact assessment

Construction

Potential groundwater and geology impacts that could arise during construction are primarily related to tunnelling and underground excavations and include:

- Groundwater drawdown/lowering of the water table due to dewatering during tunnel and station excavations and/or drawdown incurred by bed cracking or interference with geological features beneath surface-water bodies and drainage lines
- Ground movement and settlement due to tunnelling, excavation and/or groundwater drawdown
- Impacts on groundwater users due to reduced groundwater yields, reduced groundwater quality and/or direct impacts and damage to existing groundwater bores.

Potential impacts on groundwater dependent ecosystems would be considered as part of the biodiversity assessment.

The tunnels would be lined to prevent significant volumes of groundwater ingress. Therefore, tunnel construction is anticipated to cause only a short-term disruption to groundwater levels as the system should adjust back to its natural state once excavation has passed and the permanent tunnel lining is installed. Also, cavern stations and cut-and-cover stations in some locations would be tanked to prevent significant volumes of groundwater ingress.

Where station excavations are not tanked, this would result in drawdown during construction depending on site-specific conditions, and the interaction of recharge sources and drainage measures. The generally low hydraulic conductivity of the Mittagong Formation, Hawkesbury Sandstone and Ashfield Shale geological units indicates the extent of groundwater drawdown may be limited by relatively low discharge rates compared to recharge sources.

Operation

Potential hydrogeological impacts that could arise during operation include:

- Ongoing groundwater drawdown/lowering of the water table due to station excavations, where untanked stations are proposed (as discussed previously, the low hydraulic conductivity of geological units in the area indicates the extent of groundwater drawdown may be limited by relatively low discharge rates compared to recharge sources)
- Impacts on groundwater users (if present) due to reduced groundwater yields as a result of groundwater drawdown.

7.7.3 Proposed assessments

A groundwater and geology assessment will be prepared at a conceptual level and will include:

- Identification of sensitive groundwater users (registered groundwater bores) near the Concept corridor
- Identification of the types of groundwater impacts (such as drawdown and settlement) that may occur during construction and operation
- The proposed scope of future groundwater and geology assessments to be carried out as part of planning approvals for subsequent stages of the Concept.

7.8 Soils and surface water quality

7.8.1 Existing environment

Soil landscapes

The Soil Landscapes of Sydney 1:100,000 Sheet (Department of Conservation and Land Management, 1989) shows the surface components of the Concept pass through a variety of soil landscapes. These landscapes and their relevant features are described in Table 7-2.

Table 7-2: Soil landscapes

Soil landscape	Key features
Blacktown	Occur on gently undulating rises with slopes generally less than five per cent. Moderate erodibility.
Disturbed terrain	Artificial fill. Dredged estuarine sand and mud, demolition rubble, industrial and household waste. Also includes rocks and local soil materials. Erodibility is highly variable from low to extreme.
Gymea	Occur on undulating to rolling low hills with slopes between 10 to 25 per cent. Erodibility ranges from low to high.
Deep Creek	Occur on gently undulating alluvial floodplain with slopes less than three per cent. Erodibility is generally low.
Lucas Heights	Occur on gently undulating crests and ridges with slopes less than 10 per cent. Erodibility ranges from moderate to very high.
Tuggerah	Occur on gently undulating to rolling coastal dunefields, generally between one to 10 per cent. Erodibility ranges from low to high.

Acid sulfate soils

Potential acid sulfate soils are waterlogged soil layers rich in iron sulphide; primarily pyrite, and generally occur in low lying areas. When excavation or drainage brings these soils into contact with oxygen, the pyrite is oxidised to form sulphuric acid. If the amount of acid exceeds the neutralising capacity of the soil, and the pH falls below 4, the soils are known as acid sulfate soils. Acid can run off these soils during rainfall, scalding vegetation and killing aquatic fauna.

The Concept corridor and surface sites have a low or extremely low probability of acid sulfate soils.

Surface water quality

Watercourses near the corridor are heavily urbanised and, in some locations, piped underground or concrete lined. Water quality is largely influenced by 'point source' water pollution such as stormwater drainage outlets and diffuse water pollution such as urban runoff that does not enter stormwater drains. Water quality is anticipated to be average to generally poor, typical of a heavily urbanised environment. The Parramatta River generally displays water quality indicative of the catchment history and current land use and is generally affected by nutrients from wastewater overflows and stormwater runoff. Recent analysis shows water quality in the Parramatta River catchment is improving as a result of catchment management measures (Parramatta City Council, 2016).

7.8.2 Preliminary impact assessment

Construction

Potential soil and surface water impacts during construction include:

- Soil erosion – construction would expose the natural ground surface and subsurface through the removal of vegetation, overlying structures and the excavation of construction footprints for stations, structures and foundations. Soil erosion potential could increase, particularly where construction is undertaken in soil landscapes characterised by a high and extreme erosion hazard
- 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
- Surface water quality – construction has the potential to adversely affect water quality in nearby watercourses through the pollution of stormwater runoff with sediments, fuel and other hazardous materials from construction sites and the discharge of treated groundwater from the tunnels and station excavations.

Operation

Operation is not anticipated to result in significant adverse impacts on surface water quality. All groundwater and surface water runoff from the proposed tunnels would be captured and pumped to water treatment plants prior to reuse and/or disposal.

Runoff from above ground elements (particularly the Clyde stabling and maintenance facility) have the potential to be contaminated with sediments, fuel/oils (for example, from maintenance activities) and/or other pollutants (such as litter), which could enter the surrounding stormwater system.

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

7.8.3 Proposed assessments

A soils and water quality assessment will be carried out at a conceptual level as part of the Environmental Impact Statement. The soils and water quality assessment will include:

- An overview of existing catchment and Water Quality Objectives for waterbodies within the Concept corridor
- Identification of potential impacts on soils and water quality including surface water quality, acid sulfate soils, erosion and sedimentation
- The proposed scope of future soil and water assessments to be carried out as part of planning approvals for subsequent stages
- Consultation with the Environment Protection Authority.

7.9 Contamination

7.9.1 Existing environment

There are a number of known and potentially contaminated areas within the Concept corridor. This includes:

- Current and former industrial areas within and around Clyde
- Areas of previous land fill activities including within and around Sydney Olympic Park
- Areas of previous land fill and land reclamation activities including Sydney Olympic Park, The Bays Precinct and Camellia/Rosehill
- Widespread or diffuse groundwater contamination such as persistent organic pollutants
- Localised potentially contaminating land uses such as service stations, dry cleaners and existing rail corridors.

In addition, minor levels of contamination could be encountered at other sites due to previous land fill activities or previous land uses.

7.9.2 Preliminary impact assessment

Construction

During construction, contamination is likely to be encountered at a number of locations due to previous filling activities or previous land uses. Contaminants that could be encountered during excavation and other ground disturbing activities include:

- Hydrocarbons and heavy metals associated with leaks and spills from fuel storage infrastructure
- Metals, hydrocarbons, pesticides, per- and polyfluoroalkyl substances, polychlorinated biphenyls and asbestos associated with land reclamation and other uncontrolled fill material
- Hydrocarbons, heavy metals and metalloids, solvents, phenolics, per- and polyfluoroalkyl substances, pesticides, and asbestos in soil associated with former and current industrial land uses
- Landfill leachate and/or hazardous ground gases including methane, hydrogen sulphide, and carbon monoxide associated with former landfill sites
- Metals, hydrocarbons, pesticides, nutrients, phenols, carbamates, pesticides, herbicides and asbestos in soils associated with existing railways
- Contaminated groundwater associated with the above soil contamination.

Operation

Operation 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 infrastructure, particularly activities undertaken at the Clyde stabling and maintenance facility.

7.9.3 Proposed assessments

A concept level contamination assessment will be carried out as part of the Environmental Impact Statement. The assessment will include:

- A review of available data and previous reports
- Identification of the potential to encounter contamination
- Identification of the proposed scope of future contamination assessments to be carried out as part of planning approvals for subsequent stages of the Concept
- Consultation with the Environment Protection Authority.

7.10 Social impacts and community infrastructure

7.10.1 Existing environment

The Concept corridor spans across seven local government areas. Community infrastructure within the corridor includes facilities and services that support community wellbeing and resilience. These include libraries, educational facilities, child care centres, open space and recreation facilities, medical centres, community centres and spaces, emergency services and cultural facilities.

7.10.2 Preliminary impact assessment

Construction

Potential social and community impacts that would occur during construction include:

- Community concern and disruption about property acquisition and proposed changes to the character of local areas
- Impacts on the amenity of local residents due to possible impacts from construction sites such as noise and vibration, visual, traffic and transport, and air quality
- Loss of community infrastructure within the footprint of the construction site

- Amenity impacts on community facilities where they are located close to construction sites (such as noise, vibration, air quality and visual changes), which may reduce the ability of certain community facilities to function, or the community's enjoyment of them
- Temporary disruptions to access to and from community facilities as a result of construction sites and activities
- Concerns in the community regarding construction fatigue related to the number of major projects being constructed in Sydney
- The potential human health impacts associated with long term construction noise.

Operation

The operation stage is expected to result in a number of long-term positive social and community impacts. This is due to the social benefits associated with the provision of a new rail line and transit-oriented development. Benefits would include:

- Increased walking and cycling trips could cause a rise in the percentage of the population achieving sufficient physical activity level to maintain health
- Potential to reduce travel related stress for people who switch modes in peak hours by reducing the time spent in congested conditions
- Amenity and place-making benefits from enhanced pedestrian environments, such as active transport links, improved surface and lighting
- Increased access to jobs, universities, services and social facilities can help to improve social cohesion and reduce social health related issues
- Improvements to local air quality due to less motor vehicle trips.

The following potential social and community impacts may also arise:

- Potential loss of community facilities – direct impacts would occur where a community facility exists within the footprint of the operating project. In some instances, alternative facilities may be available in the local area, or the facilities may be easily replaceable in the local area
- Community wellbeing and amenity impacts – community facilities are potentially more sensitive to amenity impacts such as noise, vibration, air quality and visual changes. The ability of certain community facilities to function, or the community's enjoyment of them, may be reduced where they are located close to operational infrastructure
- Changes to community character and the way of life – some of these impacts may be positive or negative
- Potential exposure to electric and magnetic fields, however substations will be designed to meet the limits for exposure set out in the International Commission for Non-Ionising Radiation Protection Guidelines for Limiting Exposure to Time Varying Electric and Magnetic Fields (1HZ – 100 kHZ) (ICNIRP, 2010).

7.10.3 Proposed assessments

A concept level assessment of potential social and community facility impacts will be carried out as part of the Environmental Impact Statement. This will include:

- Identification of the regional level social and community facilities along the corridor (including public open spaces and recreational areas)
- Identification of potential social impacts on the community and community facilities / services which could occur during construction and operation
- Identification and assessment of potential social benefits
- Identification of the proposed scope of future social impact assessments to be carried out as part of planning approvals for subsequent stages.

7.11 Business impacts

7.11.1 Existing environment

Sydney Metro West is located within the Greater Parramatta to Sydney CBD corridor, which runs through the heart of Parramatta to the Sydney CBD and includes the State's largest health and education precinct in Westmead, the rapidly growing central CBD of Parramatta, the lifestyle precinct of Sydney Olympic Park, the State significant precinct at The Bays and the global centre of the Sydney CBD.

Business types and activity across the Concept corridor vary considerably, ranging from high activity and a broad mix within Parramatta and the Sydney CBD, through to village type, strip retail centres in locations such as Five Dock and North Strathfield.

7.11.2 Preliminary impact assessment

Construction

Potential adverse business impacts that could occur during construction include:

- Disruptions to servicing, deliveries and access resulting in time and vehicle related costs
- Increased traffic congestion and/or travel times impacting customer, staff and servicing access
- Loss of power and utilities due to planned or accidental shutdowns
- Reduced visibility due to the presence of construction work, hoardings and other structures which may result in a loss of customers
- Deterioration of amenity (particularly due to noise, vibration, visual and air quality impacts), which may result in a reduction in customers for certain business types
- Property acquisition or termination of existing leases, and associated business displacement or loss.

Notwithstanding the above negative impacts, some businesses may also experience positive impacts during construction, including:

- Net gain in passing trade during construction owing to changes in pedestrian traffic and vehicle access
- Trade could increase for businesses located close to construction sites or en-route to construction sites that sell goods to construction workers and related industries
- Benefits to construction related businesses, such as construction recruitment agencies, construction companies and resource suppliers.

Operation

When operational it is anticipated there would be an overall benefit to businesses and the economy associated with improved public transport facilities, improved travel times and greater connectivity between key centres. These benefits would include:

- Increased business activity
- Increased trade generation
- Increased residential development opportunities
- Improved staff access, recruitment and retention
- Increased commercial rent values for property owners
- Improved business viability.

Importantly, Sydney Metro West would support future economic development within the station precincts by being a key enabler for renewal and redevelopment. The Concept would also provide opportunity for urban renewal at many station locations, appropriate to its local character, address current shortcomings in the functionality of some stations and improve linkages to the surrounding precinct.

There are also potential adverse business impacts that could occur during operation. These include:

- Increased commercial rent – as a result of the likely enhanced attraction of locating a business close to the corridor, competition for space and thereby commercial rents could increase. Where this occurs, there would be some negative impacts on smaller businesses that are not able to quickly absorb higher rents or businesses that are presently experiencing challenges to viability
- Changed behaviour during construction which continues to the operational stage – 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 (which 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
- Reduced amenity – deterioration of amenity (particularly due to noise, vibration, visual and air quality impacts) may result in a reduction in customers for certain business types.

7.11.3 Proposed assessments

A concept level local business impact assessment will be prepared as part of the Environmental Impact Statement. The assessment will include:

- Identification of the general types of businesses impacts (both direct and indirect) which could occur during construction and operation
- The proposed scope of future business impact assessments to be carried out as part of planning approvals for subsequent stages.

7.12 Hydrology and flooding

7.12.1 Existing environment

Hydrology

All aboveground components would be located within areas which ultimately drain to Parramatta River and Sydney Harbour.

All drainage catchments across the Concept corridor are highly urbanised, with large impervious surfaces created by roads, footpaths and buildings. These impermeable surfaces are mixed with permeable surfaces associated with parkland areas and other unsealed surfaces (such as vacant land and landscaped areas). Surface water is generally collected by developed stormwater networks that consist of road kerb and guttering, lined and unlined drainage channels, and subsurface pit and pipe networks.

Flooding

Based on existing data available in previous flood reports, areas of potential flooding have been identified within the immediate vicinity of the following stations and other surface infrastructure:

- Parramatta Metro Station – within the probable maximum flood and potentially within the one per cent Annual Exceedance Probability flood
- Clyde stabling and maintenance facility – within the probable maximum flood and potentially within the one per cent Annual Exceedance Probability flood
- The Bays Station – within the probable maximum flood and the one per cent Annual Exceedance Probability flood, and also subject to potential coastal flooding.

Other stations may be subject to some minor overland flooding, depending on the capacity of the local stormwater system.

7.12.2 Preliminary impact assessment

Construction

Construction would have the potential to alter existing stormwater flows and the existing stormwater drainage infrastructure due to the establishment of erosion and sediment control measures (such as redirecting stormwater runoff around the work site and/or establishment of detention basins).

Flooding of construction sites could result in stockpiles of construction materials (such as aggregate, fuels and other hazardous materials) and spoil being washed into nearby waterways, or floodwater entering the tunnels and excavations.

Construction also has the potential to locally alter existing flood behaviour due to the loss of flood plain storage (due to stockpiling construction materials and spoil, etc.) and in situations where alterations to existing stormwater drainage infrastructure are required.

Operation

When operational, there is a potential for alteration to existing stormwater catchment flows and the operation of existing stormwater drainage networks due to rerouting of drainage infrastructure (such as in situations where such infrastructure needs to be relocated and/or augmented).

As identified above, Parramatta Metro Station, the Clyde stabling and maintenance facility, and The Bays Station are anticipated to be at risk of flooding. Station entries and tunnel portals would be designed to protect the tunnels from the probable maximum flood level. The stabling and maintenance facility would also be designed to be above a certain flood level.

Due to the establishment of infrastructure within flood-prone areas and the need to protect this infrastructure from certain flood events, there is the potential to affect flood behaviour surrounding the sites due to the loss of floodplain storage and alteration of local catchment boundaries (which could change the distribution of stormwater between drainage networks).

7.12.3 Proposed assessments

A concept level hydrology and flooding assessment will be prepared as part of the Environmental Impact Statement. The assessment will include:

- Identification of the types of hydrology and flooding impacts which could occur during construction and operation
- The proposed scope of future hydrology and flooding impact assessments to be carried out as part of planning approvals for subsequent stages of the Concept.

7.13 Biodiversity

7.13.1 Existing environment

Vegetation communities

Most of the Concept corridor consists of urban and industrial development. Due to previous development, the sites identified for the proposed stations and other surface infrastructure have generally been subject to previous disturbance and clearing. Most of the remaining vegetation typically consists of planted street trees and vegetation within existing parklands, shrubs and other ground cover plants.

Several reserves and parks within the Concept corridor contain areas of native vegetation. The native vegetation is likely to be in varying conditions depending on edge effects from urban development and other urban impacts (such as weed infestations).

Threatened flora and fauna

No threatened flora or fauna species have been previously recorded within or adjacent to the footprint of any surface infrastructure site. A full assessment of flora and fauna impacts of the proposal will be undertaken as part of the Environmental Impact Statement.

Groundwater dependent ecosystems

A search of the National Atlas of Groundwater Dependent Ecosystems (BOM, 2018) identified the following terrestrial groundwater dependent ecosystems close to the Concept corridor:

- Cumberland River Flat Forest and Cumberland Shale Sandstone Transition Forest within Parramatta Park
- Estuarine Mangrove Forest along the banks of Duck River.

7.13.2 Preliminary impact assessment

Construction

Construction may result in the following biodiversity impacts:

- Loss of terrestrial fauna habitat and impacts on species due to clearing of terrestrial vegetation and demolition of existing buildings and structures
- Injury and mortality of fauna species during vegetation clearing and/or as a result of collisions with construction plant and vehicles
- Indirect impacts from light and noise, sedimentation, spread of weeds.

Operation

Ecological impacts during operation would primarily be restricted to:

- The injury/mortality of fauna species, which could result from collisions with trains and/or maintenance vehicles, although the alignment is mostly underground
- Disturbance of fauna species due to indirect impacts such as light and noise.

As Sydney Metro West would be predominantly located underground, within an urban environment, the potential for the above impacts to occur would be relatively minor. Furthermore, it is anticipated that fauna species likely to be occupying the area would be accustomed to noise and light impacts that are already occurring in urban environments.

7.13.3 Proposed assessments

A concept level biodiversity assessment will be carried out as part of the Environmental Impact Statement. The biodiversity assessment will include:

- Identification of the potential presence of any endangered ecological communities, threatened species or threatened species habitat and the nature of any potential impacts
- Identification of the proposed scope of future biodiversity assessments to be carried out as part of planning approvals for subsequent stages.

7.14 Air quality

7.14.1 Existing environment

Ambient air quality throughout the Sydney Basin is influenced by a number of factors, including topography, prevailing meteorological conditions (such as wind and temperature, which vary seasonally) and local and regional air pollution sources (such as motor vehicles, industrial facilities and bushfires). Consequently, regional air quality can be highly variable and impacted by events occurring a significant distance away.

A search of the Commonwealth Department of the Environment's National Pollutant Inventory (2017-18 data) and general site observations identified a number of air pollution sources close to the Concept which are likely to influence local air quality. These sources include:

- Industrial facilities at Silverwater, Clyde and Camellia/Rosehill. These facilities include petroleum and coal manufacturing, mineral, metal and chemical wholesaling, waste treatment, disposal and remediation, and cement, lime, plaster and concrete manufacturing

- Vehicle exhaust emissions from the road and rail networks
- Commercial businesses, such as service stations and smash repairs
- Domestic activities, such as wood-fired home heaters and lawn mowing
- Other construction projects.

Air quality data from monitoring stations at Parramatta North, Lindfield, Rozelle, Randwick and Earlwood shows that concentrations of air pollutants were generally below the applicable air quality criteria during 2018. On some occasions:

- Maximum 24-hour average concentration levels of particulate matter with a diameter less than 10 microns (PM_{10}) exceeded the applicable criterion of 50 micrograms per cubic metre
- Annual average and maximum 24-hour average concentration levels of particulate matter with a diameter less than 2.5 microns ($PM_{2.5}$) exceeded the applicable criterion of eight and 25 micrograms per cubic metre respectively
- The criteria for ozone were exceeded at the Parramatta North monitoring site.

7.14.2 Preliminary impact assessment

Construction

During construction, local air quality may be temporarily affected by particulate (dust) and gaseous emissions (such as emissions from the combustion of fuels, emissions from disturbance of contaminated soils/groundwater and/or storage of volatile organic compounds). Owing to the urban setting, there is also potential for dust emissions to contain contaminants and other hazardous materials.

There are a wide range of sensitive receivers in the vicinity of the Concept including residential properties, railway customers, community facilities, recreational areas, educational facilities, mixed-use, commercial and retail premises and hotels and apartment buildings. Without the implementation of adequate management measures, dust emissions from construction activities could result in reduced local air quality and dust deposition at local receivers due to the possible relatively small distances between some receivers and the construction sites. The volume of likely dust emissions is comparable to volumes generated by other similar infrastructure projects and the impacts readily manageable through standard environmental management measures.

Gaseous emissions would generally be restricted to minor localised emissions generated during the combustion of fuel in construction plant, machinery and equipment, emissions from disturbance of contaminated soils/groundwater as well as from the handling and/or onsite storage of fuel and other chemicals.

Operation

As the trains would be powered by electricity, emissions generated during operation are expected to be minimal and dispersed.

Sydney Metro West would include a fresh air ventilation system to circulate fresh air through the tunnels and underground stations and prevent the build-up of heat. Fresh air would be drawn into the tunnels and air would be extracted from the tunnels by mechanical ventilation at the stations and services facilities. Air would be discharged from the tunnels at each station and the services facilities. The stations would also provide separate fresh air ventilation systems to draw fresh air in and extract air from the station environment. Air discharged from the tunnels and stations would be well diluted and dispersed into the outdoor air.

Minor quantities of particulate matter (PM_{10}) emissions would be generated in underground tunnels, mainly due to train brake pad wear, vaporisation of metals due to sparking, wear of steel due to friction between wheels and rail, and recirculation of particulates from tunnel walls. Most of these emissions would be vented through the fresh air ventilation system in very low concentrations.

Vented air is also likely to comprise minor concentrations of carbon dioxide, volatile organic compounds and oxides of nitrogen as well as ash and soot particulates generated during maintenance. The ventilation outlet air would contain small quantities of particulates at low concentrations due to the large volumes of exhaust air. Given the low concentrations of particulates, the Concept is very unlikely to have air quality impacts on the surrounding environment, including sensitive receivers.

The fresh air ventilation system would also respond to emergency conditions such as fire incidents where smoke-laden air would be discharged through the emergency ventilation system to prevent smoke entering stations or recirculating through fresh air ventilation shafts. The design and location of the fresh air ventilation shafts at stations and services facilities would ensure sensitive receivers were not unnecessarily affected and suitable emergency plans would be in place for these circumstances.

When operational, Sydney Metro West is also expected to benefit local air quality by delivering an attractive alternative mode of public transport, which could result in a mode shift from road to rail. This has the potential to reduce air pollution emissions from road transport and congestion within the corridor (when compared to the emissions that would otherwise occur if the Concept was not delivered).

7.14.3 Proposed assessments

A concept level air quality assessment will be carried out as part of the Environmental Impact Statement. The assessment will include:

- Identification of the background air quality environment based on a desktop assessment
- Identification of potential sources of air emissions during both construction and operation
- The proposed scope of future air quality assessments to be carried out as part of planning approvals for subsequent stages.

7.15 Greenhouse gas and energy

7.15.1 Preliminary impact assessment

Construction

Construction would result in the generation of greenhouse gas emissions. The volume of greenhouse gas emissions generated would largely depend on the type and quantity of construction materials used, construction methodologies and equipment used, and the overall design.

Operation

Greenhouse gas emissions would primarily be associated with the consumption of electricity to power the metro trains, signalling, lighting, fresh air ventilation, closed-circuit television and communications systems, station facilities (including lighting, lifts and escalators), 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).

When operational, Sydney Metro West would provide an attractive alternative mode of public transport that may result in a mode shift from road to rail. If such a mode shift occurred, it would have the potential to reduce greenhouse gas emissions associated with road transport when compared to the emissions that would otherwise occur if the Concept was not constructed.

Opportunities to reduce Sydney Metro West's demand on electricity (and, therefore, greenhouse gas emissions) would be identified in the sustainability strategy and could include purchasing electricity derived from a renewable energy source (where available), selecting energy-efficient trains, using solar lighting at stations and other rail infrastructure facilities (such as water treatment plants), offsetting the operational power requirements and minimising electricity demand through detailed design.

7.15.2 Proposed assessments

A concept level greenhouse gas and energy assessment will be carried out as part of the Environmental Impact Statement. The assessment will include:

- Identification of the activities which are likely to be the major source of greenhouse gas emissions during construction and operation
- The proposed scope of future greenhouse gas assessments to be carried out as part of planning approvals for subsequent stages of the Concept.

7.16 Climate change adaptation

7.16.1 Preliminary impact assessment

Construction

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 the tunnels and/or construction sites.

These risks are anticipated to be adequately managed with standard management measures, such as increasing the capacity of erosion and sediment controls and minimising construction impacts on the capacity of existing stormwater drainage systems.

Operation

Climate change risks during operation are anticipated to include:

- Increased average temperatures and the frequency of heatwaves, which may cause critical equipment failure or affect the integrity of infrastructure (this could include sagging of overhead wires, overheating of trains, etc.) and affect train operations and customer and staff comfort (due to the difficulty in regulating temperatures in tunnels, at stations and in outdoor environments at the Clyde stabling and maintenance facility)
- Increased frequency and severity of extreme rainfall events, which may exceed the design capacity of the drainage system and lead to flooding of infrastructure, particularly the tunnels, stations, and the Clyde stabling and maintenance facility
- Changes in seasonality and the amount of precipitation, which may affect infrastructure (due to changes in soil moisture content and groundwater flows), landscaping (such as the viability of plantings at stations) and limit opportunities to capture, treat and reuse stormwater or groundwater as an alternative water source (such as for station toilets).

Possible measures to address the effects of climate change on the Concept would be considered during design and could include designing infrastructure to be resilient to the predicted changes in extreme weather events, based on the latest industry standards.

7.16.2 Proposed assessments

A concept level climate change adaptation assessment will be carried out as part of the Environmental Impact Statement. The assessment will include:

- Identification of potential climate change risks to the Concept
- Identification of high level adaptation measures to respond to the identified risks
- The proposed scope of future climate change assessments to be carried out as part of planning approvals for subsequent stages of the Concept.

7.17 Waste management and resource use

7.17.1 Preliminary impact assessment

Construction

A variety of solid and liquid wastes would be generated during construction. The main construction activities anticipated to generate waste include tunnelling, station excavations, cuttings and general earthworks, precast concrete segment production, tunnel and station fit-out and demolition of buildings and other structures.

The quantity of waste would be comparable to similar infrastructure projects (including other Sydney Metro projects and road tunnel projects) and would be adequately managed with standard waste management measures.

Construction would also require resources including electricity, fuel, oil, concrete, steel, water, paving materials, glass and timber. While this would increase demand on local and regional resources, it is unlikely that it would result in any resource becoming scarce or in short supply.

Operation

The main types of activities anticipated to generate waste during operation are outlined in Table 7-3 along with the likely waste materials produced.

Table 7-3: Operational waste generation

Activity	Waste material 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
Groundwater and stormwater ingress into tunnel and stations	Sediment-laden and/or potentially contaminated wastewater
Use of station customer facilities (such as toilets)	Sewage and grey water

The quantity of waste generated during operation would be relatively minor. The disposal of this waste is not anticipated to result in significant adverse environmental impacts.

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

While the operation stage would increase demand on local and regional resources (particularly electricity), it is unlikely that this alone would result in any resource becoming scarce or in short supply. There is also the potential to reduce resource use due to the mode shift from road to rail, and from private to public transport.

7.17.2 Proposed assessments

A concept level waste management and resource use assessment will be carried out as part of the Environmental Impact Statement. The assessment will include:

- Identification of the waste streams likely to be generated during construction and operation
- Identification of the expected resource use during construction and operation
- The proposed scope of future waste management assessments to be carried out as part of planning approvals for subsequent stages.

7.18 Hazard and risk

7.18.1 Preliminary impact assessment

Construction

The following hazards and risks have the potential to occur during construction:

- The onsite storage, use and transport of chemicals, fuels and materials
- The rupture of, or interference with, underground services
- Collapse of the underground tunnel.

Construction hazards and risks would be managed with standard management measures.

Operation

The main hazard likely to be encountered during operation 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).

Operational hazards and risks would be adequately managed with standard management measures.

7.18.2 Proposed assessments

A concept level hazard and risk assessment will be carried out as part of the Environmental Impact Statement. The hazard and risk assessment will include:

- Identification of the types of hazards and risks that could occur during construction and operation
- The proposed scope of future hazard and risk assessments to be carried out as part of planning approvals for subsequent stages.

7.19 Cumulative impacts

7.19.1 Overview of cumulative impacts

Cumulative impacts result from successive, incremental, or combined effects of an activity or project when added to other past, current, planned, or reasonably anticipated future impacts (Department of Planning and Environment, 2017b). The cumulative effects of multiple major projects (such as large residential or commercial developments, major road and rail projects, or other proposed major project developments) can result in a greater extent, magnitude or duration of impacts that would otherwise occur as a result of an individual project. Cumulative impacts may also arise where multiple or consecutive construction projects impact the same receivers (known as 'construction fatigue').

The extent to which another development or activity could interact with the construction and/or operation of Sydney Metro West would be dependent on its scale, location and/or timing of construction. Generally, the largest adverse cumulative impacts would be expected to occur where multiple long-duration construction activities are undertaken close to, and over a similar timescale of, construction activities or where consecutive construction activities occur on an area of receivers, meaning they are exposed to relatively long timescales of construction impacts.

7.19.2 Preliminary impact assessment

Construction

Potential cumulative impacts that could arise in situations where the construction would occur concurrently or consecutively with other known developments include:

- Increased construction traffic impacts, including traffic congestion, amenity impacts (such as noise, visual and air quality) on sensitive receivers near these construction traffic routes, loss of street parking and other kerbside uses, and disruptions to the reliability of public transport
- Increased construction noise, vibration and visual amenity impacts to nearby sensitive receivers
- Increased loss of public open space
- Increased business impacts
- Cumulative loss of fauna habitat caused by a number of other planned projects within the corridor
- Increased spoil generation – concurrent tunnelling projects, particularly WestConnex, the Western Harbour Tunnel and Beaches Link, and Sydney Metro City & Southwest, would increase the volume of spoil being generated within the Sydney metropolitan region, which may impact spoil reuse opportunities, and may exceed the road network's capacity to accommodate construction and spoil vehicles working in around the Bays Precinct.

Operation

Potential cumulative impacts that could arise during operation, concurrent with other known developments include:

- Non-Aboriginal heritage impacts – new 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
- Traffic – multiple transport related projects could result in changes to the distribution of traffic and access arrangements, and associated changes in amenity, including noise. The operation of multiple transport projects including rail transport projects also has the potential to provide cumulative benefits by extending the catchment of public transport infrastructure and improving travel times for customers
- Visual amenity and landscape character – introduction of built form from multiple projects could change the visual and landscape context of an area
- Property and land use – the operation of multiple projects could result in increased property impacts and increased opportunities for urban renewal.

7.19.3 Proposed assessments

Details of known surrounding developments with the potential to interact with the construction and/or operation will be identified through consultation with stakeholders and a review of the Department of Planning, Industry and Environment's Major Projects database and local council development application registers.

The assessment will identify the types of potential cumulative impacts which could arise from the interaction of these projects. The assessment will also identify the proposed scope of future cumulative impact assessments to be carried out as part of planning approvals for subsequent stages.

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8 Stage 1 description

8 Stage 1 description

This chapter describes Stage 1 including key features such as the tunnel alignment, excavation and construction work proposed for stations and ancillary infrastructure. A description of the Concept is provided in Chapter 6.

8.1 Overview and key components

Stage 1 would involve major civil construction work between Westmead and The Bays Precinct, including:

- Enabling work
- Tunnel excavation including tunnel support activities
- Station excavation for the new metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays
- Shaft excavation for services facilities at Rosehill (within the Clyde stabling and maintenance facility construction site), Silverwater and between Five Dock and The Bays Precinct
- Civil work for the stabling and maintenance facility at Clyde including earthworks and structures for crossings of A'Becketts Creek and Duck Creek
- A concrete segment facility for use during construction located at the Clyde stabling and maintenance facility construction site
- Excavation of a tunnel dive structure and associated tunnels at Rosehill to support a connection between the Clyde stabling and maintenance facility and the mainline metro tunnels.

Stage 1 components are subject to further design, and changes may be made during the ongoing design which take into account the outcomes of community and stakeholder engagement and environmental field investigations.

The location of Stage 1, including the underground tunnel and construction sites for the stations and ancillary infrastructure are shown on Figure 8-1.

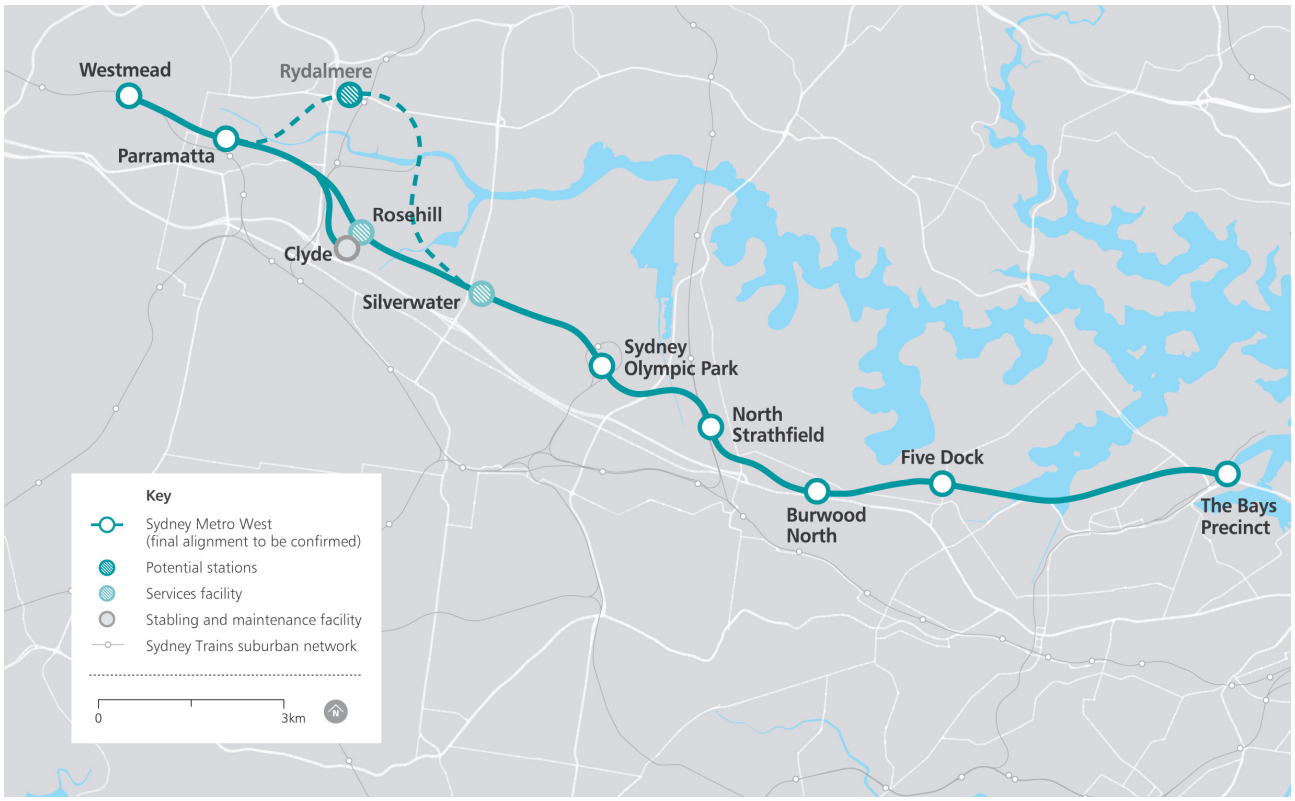


Figure 8-1: Overview of Stage 1 components

8.2 Enabling work

Enabling work are those activities that would typically be undertaken before the start of substantial construction in order to make ready the key construction sites and to provide protection to the public. Enabling work may include activities such as:

- Demolition of buildings and structures within the proposed construction footprint
- Utility supply to the construction sites including power and water
- Utility adjustments and protection
- Construction site establishment
- Transport network modifications to roads, public transport, and pedestrian and cyclist facilities
- Heritage investigations, protection and archival recordings
- Additional geotechnical and contamination investigations, and remediation where required.

The Environmental Impact Statement will identify in more detail the activities proposed to be carried out as enabling work.

8.3 Tunnelling

8.3.1 Tunnelling methods

Tunnel excavation is likely to be undertaken using four tunnel boring machines to excavate the majority of the twin tunnels as they operate at a quicker rate than roadheaders and excavate the desired circular tunnel profile. Roadheaders would be used for caverns, stub tunnels and the connecting tunnels between the Rosehill dive structure and the mainline tunnels.

The anticipated tunnel drive strategy for the tunnel boring machines is shown in Figure 8-2 and includes:

- Westmead Metro Station construction site – launch and support site for two tunnel boring machines heading east to Sydney Olympic Park
- The Bays Station construction site – launch and support site for two tunnel boring machines heading west to Sydney Olympic Park.

Figure 8-2: Anticipated tunnel drive strategy

These two construction sites would provide the necessary support for the tunnelling operation including spoil storage and removal, power supply to the tunnel boring machines, fresh air ventilation, grout batching, water treatment and disposal, material storage as well as office facilities, worker amenities and parking.

Work trains may be used within the tunnels to transport materials, concrete lining segments and the workforce to the cutting face. Alternatively, transport may be carried out with conveyor systems and special purpose rubber tyred vehicles.

Tunnel lining associated with the tunnel boring machines would be assembled from precast concrete segments as the tunnel boring machines move forward.

Roadheaders and rock hammers are likely to be used to construct stub tunnels, cross passages, crossover caverns and niches within the tunnels. These tunnels or features would generally be constructed following excavation of the main tunnels by the tunnel boring machines. Tunnel support for roadheader sections would consist of a primary lining (such as pattern rock bolting and shotcreting) and a final cast in-situ or sprayed concrete lining.

Depending on the geology encountered, or to minimise ground-borne noise impacts, drill and blast or penetrating cone fracture techniques may also be used as part of tunnel excavation.

8.3.2 Concrete segment facility

A concrete segment facility (or facilities) would be required as part of Stage 1 to manufacture the concrete tunnel lining segments. It is envisaged that one facility could be provided at the Clyde stabling and maintenance facility construction site to supply segments to the two tunnel boring machine launch sites. Alternative sites are also being considered. Storage of segments would be required at each of the tunnel boring machine launch sites.

8.4 Station construction

Excavation for seven metro stations would be carried out as part of Stage 1. The anticipated excavation types and details for each metro station are provided in Table 8-1.

Table 8-1: Indicative station excavation details

Station	Construction method	Tanked / untanked[1]	Depth (metres)	Indicative spoil generation (m³)
Westmead	Cut-and-cover	Untanked	22 – 32	255,000
Parramatta	Cut-and-cover	Tanked (as part of future stage)	24 – 25	145,000
Sydney Olympic Park	Cut-and-cover	Untanked	23 – 25	210,000
North Strathfield	Cut-and-cover	Untanked	23 – 31	115,000
Burwood North	Cut-and-cover	Untanked	24 – 32	260,000
Five Dock	Binocular cavern	Tanked	24 – 26	175,000
The Bays	Cut-and-cover	Tanked (as part of future stage)	28 – 32	210,000

Note 1: Tanked structures are designed to inhibit the inflow of groundwater, typically using concrete lining and waterproofing membrane.

Excavation of the stations would generally be carried out in the following sequence:

- Enabling work including protection or diversion of utilities and establishment of site access points
- Demolition of structures on the site and clearance of landscaped vegetation
- Excavation and temporary structural work for station boxes and underground pedestrian passages.

The construction sites for the stations would generally be contained within the Concept's operational footprint (that is, the land that would be occupied permanently by the station building and associated infrastructure/work). These construction sites are described in Section 8.9.

8.4.1 Cut-and-cover stations

Cut-and-cover stations (including the area for escalators and lifts) would be constructed by excavating the space from the surface. The structural elements (either temporary or permanent) would be constructed concurrently with the excavation. This approach is likely to be used at Westmead Metro Station, Parramatta Metro Station, Sydney Olympic Park Metro Station, North Strathfield Metro Station, Burwood North Station and The Bays Station.

8.4.2 Cavern stations

For cavern stations, an access shaft would preferably be constructed within the footprint of the future station entry and vertical transport (escalators and lifts) structure. Excavation machinery such as roadheaders and excavators would be lowered through the shaft to excavate the station cavern. This approach is likely to be used for Five Dock Station.

8.5 Rosehill dive structure and tunnel portal

A dive structure and tunnel portal would be constructed at Rosehill (as part of the Clyde stabling and maintenance construction site) to facilitate a surface connection to the Clyde stabling and maintenance facility. The construction of the dive structure and tunnel portal would generally involve:

- Piling work along the walls of the dive structure
- Excavation of existing material to below future track level
- Placement of precast concrete for the cut-and-cover section and to form the tunnel portal.

The dive structures would be designed and constructed to be protected from the probable maximum flood level.

8.6 Operational ancillary infrastructure

Stage 1 work for the operational ancillary infrastructure (services facilities at Rosehill (within the Clyde stabling and maintenance facility construction site), Silverwater and between Five Dock and The Bays Precinct) would typically involve:

- Enabling work including protection or diversion of utilities and establishment of site access points
- Demolition of structures on the site and clearance of landscaped vegetation
- Excavation of a vertical shaft to the tunnels below. This may be undertaken using excavators and rock hammers, however, drill and blast or penetrating cone fracture techniques may also be used
- Lining and reinforcement of the shaft.

8.7 Clyde stabling and maintenance facility

The work for the Clyde stabling and maintenance facility would typically involve:

- Enabling work including protection or diversion of utilities, establishment of site access points, demolition of structures on the site, clearance of vegetation (if present) and remediation (where required)
- Import and placement of fill material
- Construction of structures for crossings of A'Becketts Creek and Duck Creek.

The stabling and maintenance facility would be designed and constructed to be protected from the one per cent Annual Exceedance Probability flood event. In some areas, this may also involve the construction of retaining walls.

8.8 Construction sites

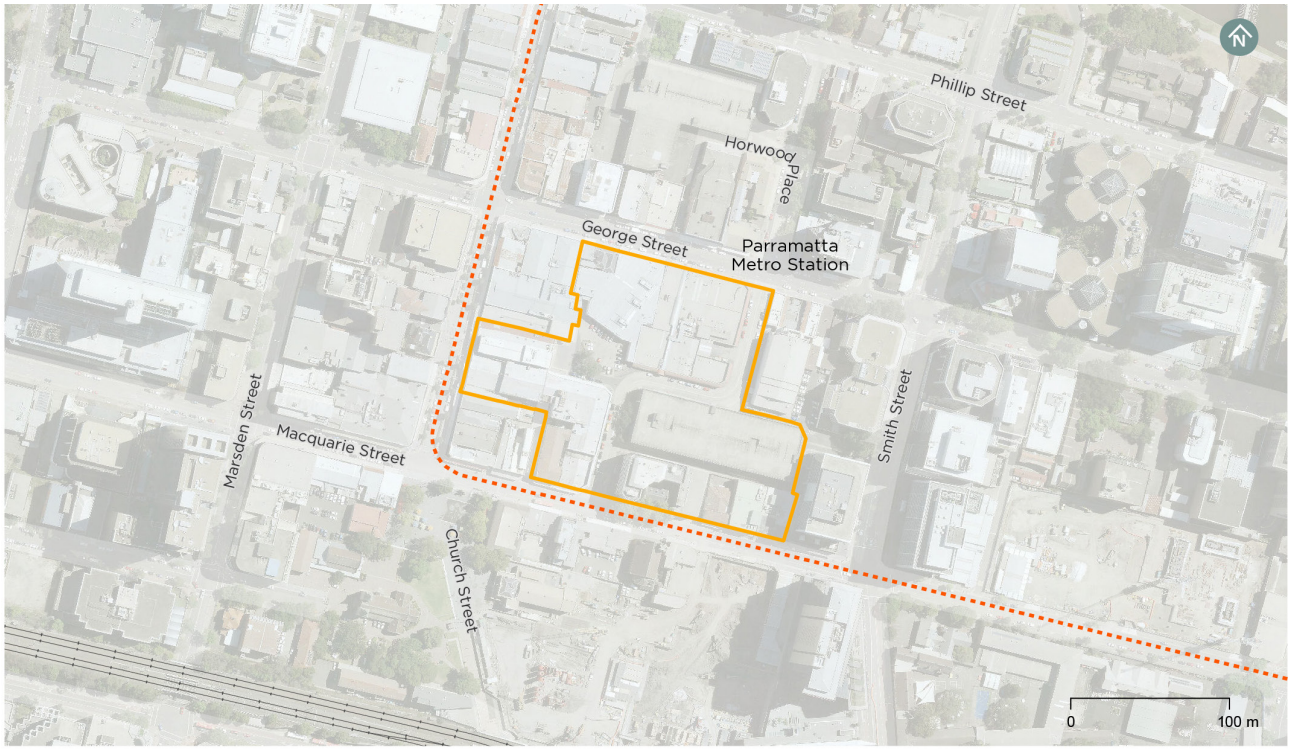
Most of the construction sites would be contained within the operational station footprints, and ancillary infrastructure sites. Additional areas may be required to support excavation work. The location and indicative footprint of the proposed main construction sites are shown in Figure 8-3 to Figure 8-11. Table 8-2 identifies the proposed main construction sites and associated uses.

Table 8-2: Construction sites and main activities

Construction site	Tunnel boring machine launch and support	Tunnel boring machine retrieval	Roadheader work and support	Spoil removal	Station excavation	Ancillary infrastructure excavation	Construction staff facilities	Concrete segment production	Stabling and maintenance facility civil work	Creek crossings
Westmead Metro Station	●		●	●	●		●			
Parramatta Metro Station				●	●		●			
Clyde stabling and maintenance facility				●		●	●	●	●	●
Silverwater services facility				●		●	●			
Sydney Olympic Park Metro Station		●		●	●		●			
North Strathfield Metro Station				●	●		●			
Burwood North Station			●	●	●		●			
Five Dock Station			●	●	●		●			
Services facility between Five Dock and The Bays				●		●	●			
The Bays Station	●			●	●		●			

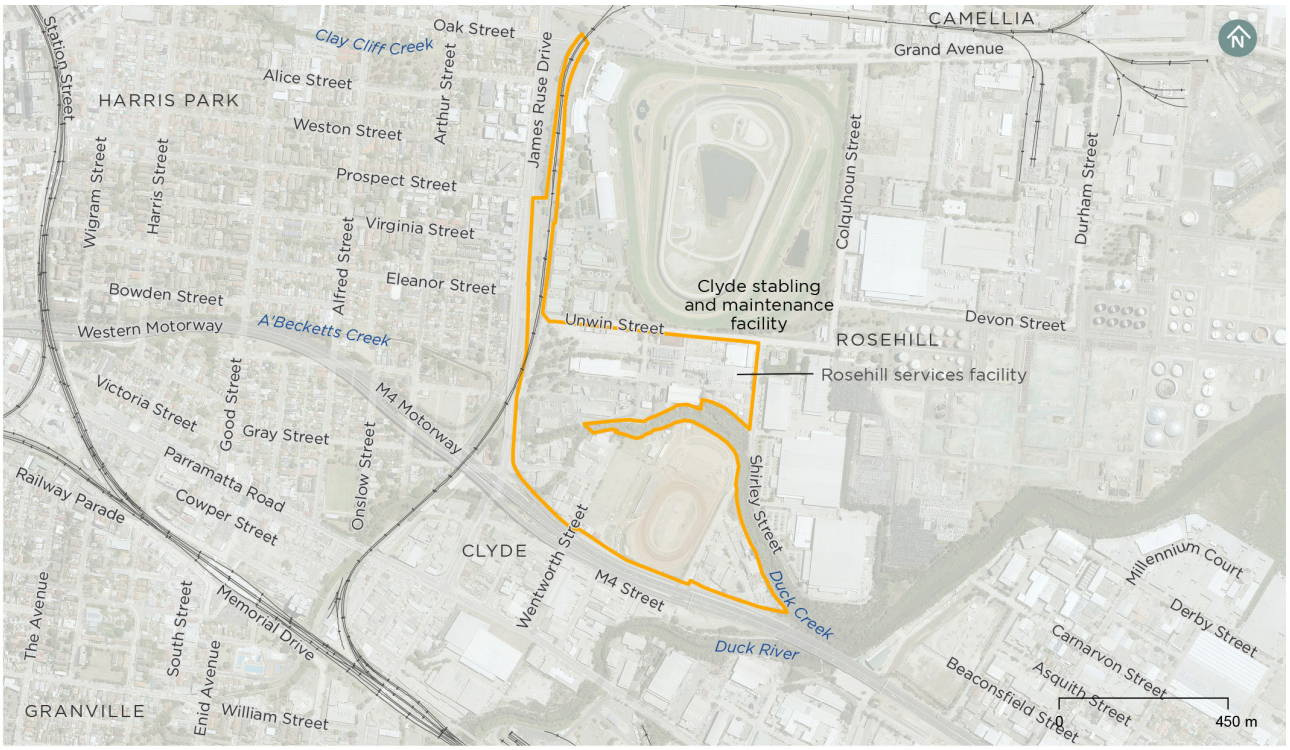
Proposed construction site area (indicative)
Parramatta Light Rail - Stage 1
Existing railway

Figure 8-3: Westmead Metro Station construction site



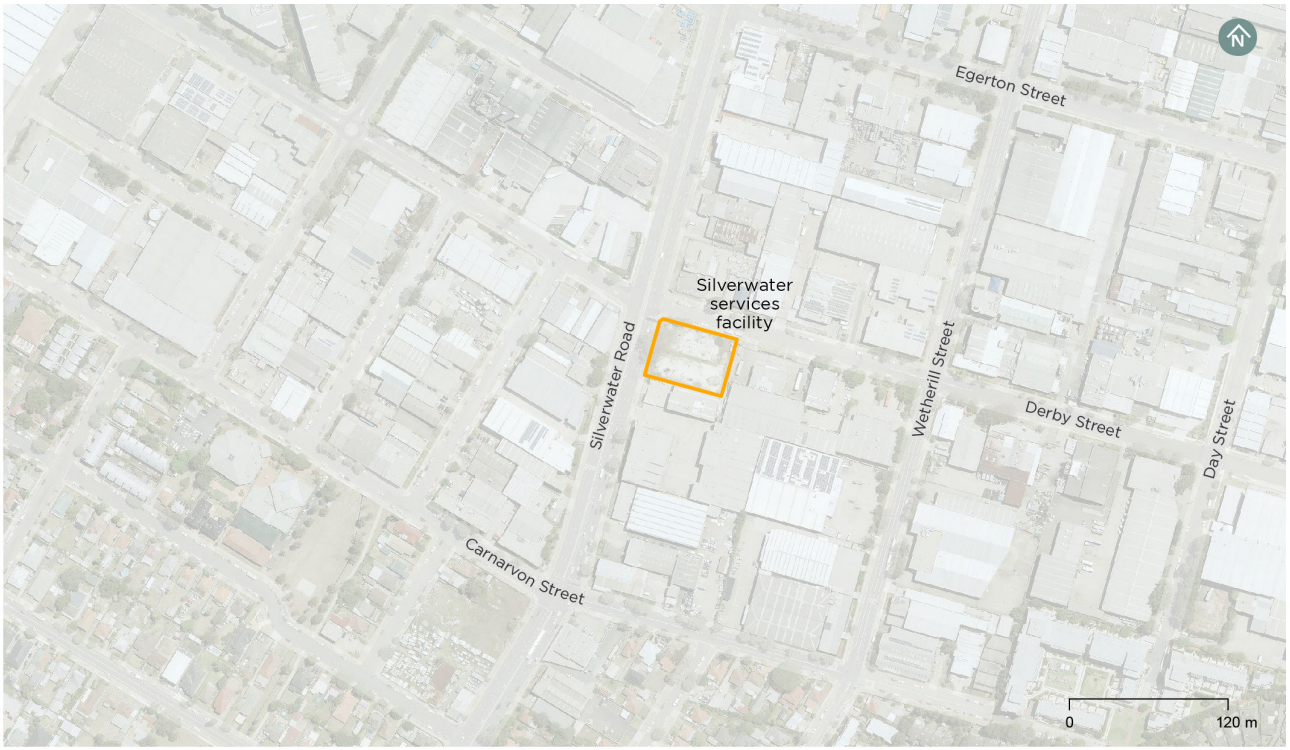
Proposed construction site area (indicative)
Parramatta Light Rail - Stage 1
Existing railway

Figure 8-4: Parramatta Metro Station construction site



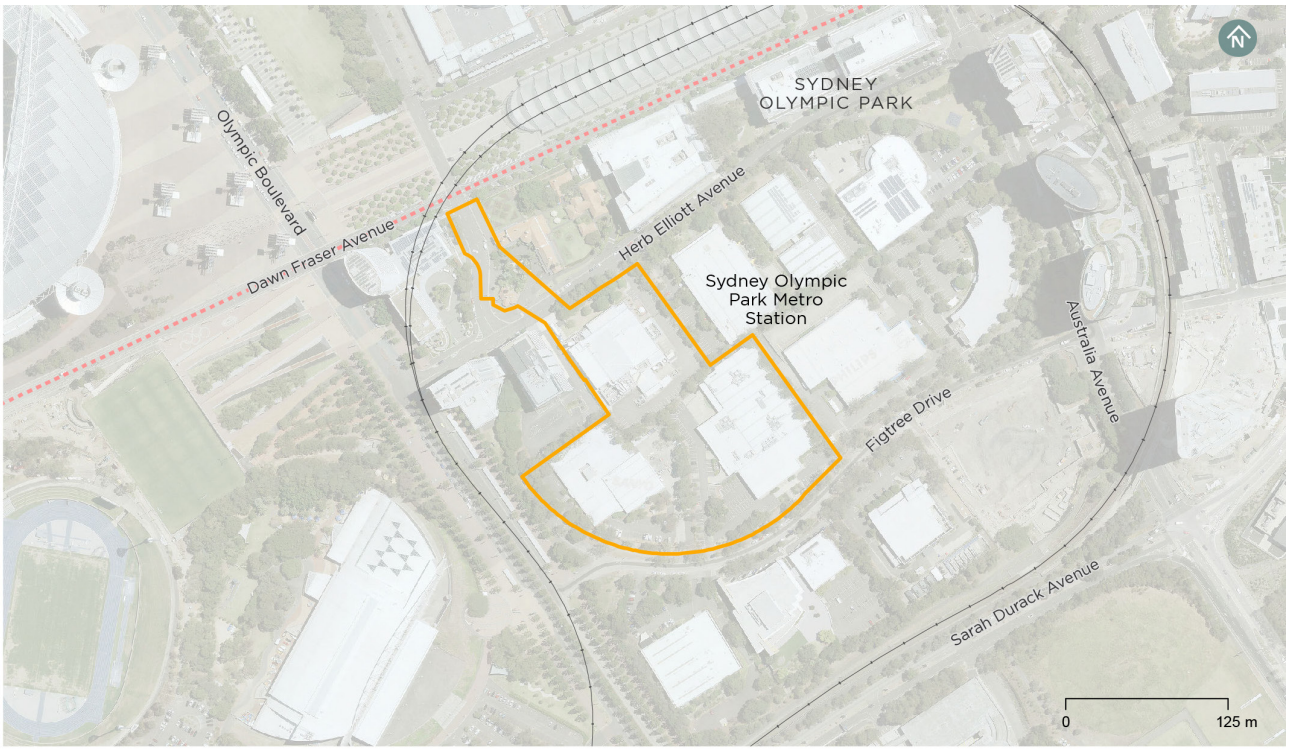
Proposed construction site area (indicative)
Existing railway

Figure 8-5: Clyde stabling and maintenance facility construction site



Proposed construction site area (indicative)

Figure 8-6: Silverwater services facility construction site



Proposed construction site area (indicative)
Existing railway
Planned Parramatta Light Rail - Stage 2

Figure 8-7: Sydney Olympic Park Metro Station construction site

Proposed construction site area (indicative)
Existing railway

Figure 8-8: North Strathfield Metro Station construction site

Proposed construction site area (indicative)

Figure 8-9: Burwood North Station construction site

Proposed construction site area (indicative)

Figure 8-10: Five Dock Station construction site

Figure 8-11: The Bays Station construction site

8.9 Other construction aspects

8.9.1 Transport network modifications

Anticipated key road modifications to facilitate Stage 1 construction work are outlined in Section 9.1.1. Other minor road modifications may be required near the construction sites to facilitate access and exit arrangements. Modifications to other transport infrastructure such as cycle paths, shared paths, footpaths and bus stops may also be required. These would be detailed in the Environmental Impact Statement.

8.10 Construction hours

The majority of the aboveground construction activities would be carried out during the following hours:

- 7am–6pm Monday to Friday
- 8am–1pm Saturdays
- No work on Sundays or Public Holidays.

Tunnel excavation, underground station excavation and supporting activities (including spoil haulage) are anticipated to be carried out up to 24 hours per day and seven days per week to help reduce the construction timeframe. Mitigation measures for noise and dust would be implemented and may include temporary acoustic sheds, noise barriers, providing respite periods and changes to the construction methodology or machinery to be used (refer to Chapter 9).

Other activities that would be carried out outside of the standard daytime construction hours would include:

- Work determined to comply with the relevant noise management level at the nearest sensitive receiver
- Work required to be carried out during rail possessions
- The delivery of materials outside approved hours as required by the NSW Police or other authorities for safety reasons
- Emergency situations where it is required to avoid the loss of lives and property and/or to prevent environmental harm
- Situations where agreement is reached with affected receivers.

8.11 Construction program

Enabling work (preliminary construction activities required to facilitate the start of substantial construction) would be likely to begin prior to the start of major construction work. The total period for Stage 1 construction work would be around four years. Major Stage 1 construction activities and durations include:

- Enabling work – up to one year
- Station excavation – around two years
- Tunnel excavation – around two years
- Ancillary infrastructure excavation – around one year
- Stabling and maintenance facility civil work – around two years.

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9 Stage 1 preliminary environmental assessment

9 Stage 1 preliminary environmental assessment

This chapter provides a preliminary assessment of the potential impacts identified for Stage 1. A description of the existing environment for each aspect is provided in Chapter 7. The proposed scope of investigations and assessment to be carried out as part of the Environmental Impact Statement for Stage 1 is also provided. As it is a preliminary assessment, the potential impacts may change through the design and environmental impact assessment process as more information becomes available. Any changes to environmental impacts will be assessed as part of the Environmental Impact Statement. A summary of the proposed Environmental Impact Statement scope for Stage 1 is provided in Chapter 11.

9.1 Traffic and transport

9.1.1 Potential impacts

Sydney Metro would aim to provide access and egress to and from the sites directly from arterial roads wherever possible and would minimise construction traffic and transport impacts. However, potential traffic, transport and access impacts anticipated to occur during the construction of Stage 1 include:

- Temporary impacts on the traffic performance on the surrounding road network due to construction vehicles. These impacts are likely to be greatest at construction sites within the Parramatta CBD (given the substantial capacity constraints and constrained bus network) and the road network near the proposed tunnel support sites (due to the numbers of vehicle movements to support the delivery of construction materials and removal of spoil)
- Temporary traffic impacts due to interim road or lane closures
- Adjustments to the road network due to the permanent realignment of Alexandra Avenue at the Westmead Metro Station construction site
- Removal of some parking, where unavoidable, and relocation of loading zones. In relation to the Horwood Place City Centre car park at the Parramatta Metro Station construction site, the closure of this car park is consistent with City of Parramatta Council plans envisaged within the draft Parramatta CBD Public Car Parking Strategy (City of Parramatta, 2017)
- Possible temporary removal or relocation of existing bus stops to nearby locations, with the community to be adequately notified
- Adjustments to existing scheduled bus services due to potential diversions of services (with the community to be adequately notified), an increase in heavy vehicle movements on the road network, and heavy vehicles entering and exiting construction sites
- Temporary changes to the existing pedestrian and cycling network surrounding construction sites. Based on the current understanding of Stage 1 and likely construction sites, this could include:
  - Partial or full temporary closures of footpaths with pedestrian and cyclist diversions to be put in place
  - Temporary alterations to customer access to the existing Westmead and North Strathfield stations, with customers to be adequately notified
  - Altered temporary access arrangements to private properties, although Sydney Metro would minimise these impacts
  - Service adjustments to suburban and intercity rail services to allow for construction activities to safely occur within the rail corridor.

A coordinated approach to the management of potential construction related traffic impacts would be developed. Sydney Metro is consulting with other sections of Transport for NSW and other relevant agencies to minimise cumulative traffic and transport impacts.

9.1.2 Proposed investigations and assessment

A detailed traffic and transport impact assessment will be undertaken as part of the Environmental Impact Statement for Stage 1 to determine any potential impacts traffic, transport and access. The following government guidelines will be considered as relevant during the preparation of the traffic and transport impact assessment:

- Guide to Traffic Management – Part 3 Traffic Studies and Analysis (Austroads, 2017)
- Cycling Aspects of Austroads Guides (Austroads, 2014)
- Guide to Traffic Generating Developments Version 2.2 (RTA, 2002).

The assessment will include the construction traffic and transport impacts of Stage 1 on the local and, to a lesser extent, the regional traffic network, including public transport, cyclists and pedestrians and will include:

- Identification of haulage routes, site access and egress points
- Daily and peak traffic movements likely to be generated and the potential impacts on the local and regional traffic network
- Service adjustments required to rail and bus services to allow for construction activities to safely occur
- Temporary adjustments to vehicular, pedestrian, cyclist, emergency services and public transport access
- Adjustments to parking supply, loading zones, servicing access and taxi zones
- Temporary altered access to private property
- Measures to minimise or mitigate identified impacts, including an assessment of available options and the expected effect of the measures proposed, in accordance with relevant best practice guidelines.

Consultation will be undertaken with other sections of Transport for NSW and relevant local councils as part of the traffic and transport impact assessment.

9.2 Noise and vibration

9.2.1 Potential impacts

The construction of Stage 1 would include activities at multiple construction sites resulting in noise and vibration impacts on surrounding land uses and sensitive receivers. Measures to reduce potential noise and vibration impacts during Stage 1 may include acoustic sheds and barriers, alterations to the proposed construction methods and consideration to the time of day of certain construction work.

Construction activities with the greatest potential to result in significant noise and vibration impacts would include:

- Activities occurring at the tunnel support sites (Westmead Metro Station construction site and The Bays Station construction site) including fresh air tunnel ventilation and high voltage power supply, grout batching plants, delivery of construction materials (such as concrete tunnel segments) and the extraction, stockpiling and removal of spoil via road trucks
- Activities associated with the manufacture of concrete segments including concrete batching, delivery of raw materials, and transport of manufactured segments via road trucks
- Excavation of tunnels using tunnel boring machines, roadheaders and rockbreakers. Tunnel excavation and associated aboveground support activities are likely to be undertaken 24 hours per day, seven days per week with mitigation measures to be implemented to minimise impacts
- Excavation of stations. Underground station excavation and associated aboveground support activities are likely to be undertaken 24 hours per day, seven days per week
- Excavation of services facility shafts at Rosehill (within the Clyde stabling and maintenance facility construction site), Silverwater and between Five Dock and The Bays Precinct
- Earthworks and structural work for the Clyde stabling and maintenance facility
- Excavation of the Rosehill tunnel dive and portal structure
- Construction road traffic associated with the delivery of plant, equipment and materials, and for spoil removal.

The extent of construction noise and vibration impacts on any individual receiver would be dependent on the construction sequencing adopted, plant and equipment used, working hours (that is, standard working hours or out-of-hours work) and the distance to surrounding receivers.

Generally, sensitive receivers located close to key construction sites such as the tunnel support sites, station sites and along construction haulage routes are anticipated to experience the greatest noise and vibration impacts. This would be due to the nature of activities proposed and/or the duration that these activities would occur.

Sensitive receivers located above the proposed tunnels are generally anticipated to be less adversely affected by the construction due to the depth of the tunnels and the overall transient nature of the proposed work.

Components of work would be required to be undertaken outside of standard daytime construction hours (that is, during the evening and night-time) to help reduce the length of the construction period and total duration of exposure to construction noise for some receivers. This could increase the potential for adverse noise impacts on surrounding sensitive receivers due to lower background noise levels and the potential for sleep disturbance. Given the proposed duration of Stage 1 construction, and the need to undertake work outside of standard daytime construction hours, there may also be potential impacts related to exposure to long term construction noise. Mitigation measures would be implemented to help reduce construction noise and vibration impacts to the community.

Given the nature of the proposed work and the proximity of sensitive receivers, construction noise and vibration impacts are expected to exceed the noise management levels derived from the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009) at some locations. There is also the potential for vibration impacts on receivers, buildings and structures along the route (including listed heritage buildings, performance venues and those buildings containing sensitive equipment or spaces).

Sensitive receivers that have the potential to be impacted would be identified as part of the Environmental Impact Statement.

9.2.2 Proposed investigations and assessment

A construction and operational noise and vibration impact assessment for Stage 1 will be carried out as part of the Environmental Impact Statement. The following government guidelines will be considered as relevant during the preparation of the noise and vibration assessment:

- Sydney Metro City & Southwest Construction Noise and Vibration Strategy (Sydney Metro, 2017)
- Interim Construction Noise Guideline (Department of Environment, Climate Change and Water, 2009)
- Noise Policy for Industry (Environment Protection Authority, 2017)
- NSW Road Noise Policy (Department of Environment, Climate Change and Water, 2011a)
- Assessing Vibration: A Technical Guideline (Department of Environment and Conservation, 2006a)
- Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (Australian and New Zealand Environment Council, 1990).

The construction noise and vibration impact assessment for Stage 1 will include:

- The nature of construction activities
- The intensity and duration of noise and vibration impacts. This will include a 'typical level' or 'typical range' in noise levels which would be expected as construction work move around the site as well as a realistic 'worst-case' noise level from each activity
- The correlation between the likely noise impacts and the anticipated duration and timing of the activity
- The nature, sensitivity and impact on potentially affected receivers, including consideration of particularly sensitive receivers if present within the vicinity (such as schools, hospitals, aged care facilities) and sensitive structures (particularly heritage structures and key utilities/infrastructure)

- Impacts associated with any work proposed to be undertaken outside standard daytime construction hours
- The potential impacts associated with long term construction noise
- Explanation of how the extent of potential impacts on sensitive receivers have been balanced against the duration of impacts
- 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.

9.3 Non-Aboriginal heritage

9.3.1 Potential impacts

Stage 1 has been, and will continue to be, designed to minimise potential impacts on non-Aboriginal heritage. Notwithstanding, Stage 1 construction work has the potential to impact non-Aboriginal heritage through:

- Construction occurring adjacent to a locally listed shop and potential archaeological site (at 41–59 George Street), which is located within the Parramatta Metro Station construction site
- Construction occurring adjacent to the locally listed Kia Ora and potential archaeological site (at 64 Macquarie Street), which is located within the Parramatta Metro Station construction site
- Construction occurring adjacent to the locally listed RTA Depot, which is located within the Clyde stabling and maintenance facility construction site
- Removal of landscaped areas as part of the locally listed State Abattoirs at Sydney Olympic Park Metro Station construction site
- Construction within the Section 170 listed North Strathfield Railway Station Group
- Construction within the curtilage of the State listed White Bay Power Station at The Bays Station construction site
- Establishing construction compounds and/or construction sites within the curtilages of or close to heritage listed items or heritage conservation areas
- Excavations and other land-disturbing work in areas of potential archaeological significance, which could result in unearthing and accidental damage to previously unrecorded archaeological relics, including archaeological material and deposits although this would be managed through the implementation of an unexpected finds procedure
- Potential damage to items above the tunnel alignment from vibration and settlement, although preliminary analysis indicates that vibration and settlement levels would be well below levels at which cosmetic damage would be expected to occur
- Potential indirect impacts (such as visual impacts or damage from vibration) to heritage items adjacent to construction work.

Consultation with heritage specialists within the Department of Premier and Cabinet and relevant local councils regarding non-Aboriginal heritage issues will occur during the assessment process.

9.3.2 Proposed investigations and assessment

A non-Aboriginal heritage assessment for Stage 1 will be carried out as part of the Environmental Impact Statement. The following guidelines will be used as relevant during the preparation of the non-Aboriginal heritage assessment:

- 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 Heritage Manual (NSW Heritage Office and Department of Urban Affairs and Planning, 1996)
- Assessing Heritage Significance (NSW Heritage Office, 2001)
- Statements of Heritage Impact (NSW Heritage Office, 2002)
- NSW Skeletal Remains: Guidelines for Management of Human Remains (NSW Heritage Office, 1998)
- Criteria for the Assessment of Excavation Directors (NSW Heritage Council, 2011).

The non-Aboriginal heritage assessment for Stage 1 will:

- Identify items and areas of heritage significance that would be materially affected by Stage 1, by field survey and research, including any buildings, work, 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 Stage 1, including items both above and below ground and, where such potential exists, the likely significance of those impacts
- 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.

9.4 Aboriginal heritage

9.4.1 Potential impacts

Stage 1 construction work would not impact on previously recorded Aboriginal heritage sites.

There is potential for previously unrecorded items of Aboriginal heritage significance to be present within the Stage 1 corridor, including sites, artefact scatters, objects, remains, values, features or places. Therefore, construction has the potential to unearth and accidentally impact on unrecorded Aboriginal heritage items and/or areas of Aboriginal cultural sensitivity, although this would be managed through the implementation of an unexpected finds procedure.

In particular, there is likely to be an elevated risk of uncovering previously unrecorded items of Aboriginal heritage significance during excavations for the Parramatta Metro Station.

The overall guiding principle for cultural heritage management would be to conserve Aboriginal sites in-situ, where possible. In situations where the conservation of an Aboriginal heritage site is not practical, management measures will be developed during the preparation of the Environmental Impact Statement and implemented to reduce the Aboriginal heritage impacts of Stage 1. These measures would include:

- Consultation with the Metropolitan Local Aboriginal Land Council in accordance with 'Aboriginal Cultural Heritage Consultation Requirements for Proponents' (Department of Environment, Climate Change and Water, 2010)
- Archaeological test excavation
- Preparation and implementation of an Aboriginal heritage management plan as part of the construction environmental management plan.

It is anticipated the above management measures would reduce the risk of impacting on previously unrecorded items of Aboriginal heritage significance and/or areas of Aboriginal cultural sensitivity.

9.4.2 Proposed investigations and assessment

An Aboriginal heritage assessment for Stage 1 will be prepared as part of the Environmental Impact Statement and will further consider the archaeological potential of the Stage 1 site. It will also document environmental management measures that would be implemented.

The following guidelines will be used as relevant during the preparation of the Aboriginal heritage assessment for Stage 1:

- Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (Department of Environment, Climate Change and Water, 2011b)
- Aboriginal Cultural Heritage Consultation requirements for proponents (Department of Environment, Climate Change and Water, 2010)
- Code of practice for archaeological investigation of Aboriginal objects in NSW (Department of Environment, Climate Change and Water, 2010)
- NSW Skeletal Remains: Guidelines for Management of Human Remains (NSW Heritage Office, 1998)
- Criteria for the Assessment of Excavation Directors (NSW Heritage Council, 2011).

The Aboriginal heritage assessment for Stage 1 will:

- Identify the potential for Stage 1 to disturb Aboriginal heritage (sites, objects, remains, values, features or places) and, where this is the case, to:
  - 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
- Identify any requirements for in-situ conservation of items and/or areas (as appropriate), and the need for further archaeological testing and/or detailed archaeological excavations
- Identify appropriate measures to avoid, minimise and/or mitigate potential impacts.

9.5 Property and land use

9.5.1 Potential impacts

Potential property and land use impacts associated with Stage 1 would include:

- Temporary or permanent acquisition or leasing of property to enable construction sites and/or construction work
- The potential temporary loss of public open space for construction sites
- Temporary service adjustments for utilities and other transport assets/infrastructure to enable construction
- Possible restrictions on future development within a defined corridor due to subsurface tunnels or the presence of aboveground rail infrastructure (associated with the Clyde stabling and maintenance facility).

9.5.2 Proposed investigations and assessment

The following guidelines will be used as relevant during the preparation of the property and land use assessment for Stage 1:

- Environmental Planning and Impact Assessment Practice Note: Socio-economic Assessment (Roads and Maritime Services, 2013)
- Better Placed (NSW Government Architect, 2017a)
- Draft Greener Places (NSW Government Architect, 2017b).

The Environmental Impact Statement will identify potential impacts on property and land use from Stage 1, including the following issues:

- Direct impacts on property and land use, including acquisition and leasing
- Impacts on Crown land and Commonwealth land.

9.6 Landscape character and visual amenity

9.6.1 Potential impacts

The Stage 1 construction work may cause temporary adverse impacts on landscape character and visual amenity for those who work, study, reside, visit, or access businesses/community services within the area. These impacts may result from:

- The establishment of construction sites, ancillary facilities (e.g. the concrete segment facility), and stockpiles, particularly at the proposed station locations and tunnel support sites
- The removal of some street trees
- The erection of fencing, barricades, gates and security lighting to provide safe and secure construction sites
- The erection of acoustic sheds and hoarding to mitigate construction noise impacts
- Light spill from construction sites during out-of-hours construction
- Aboveground construction work for the Clyde stabling and maintenance facility, and Rosehill dive structure and tunnel portal
- The parking and use of construction plant and equipment
- Construction vehicle movements within construction sites and along haulage routes
- Adjustments associated with traffic management measures (road diversions/interim closures) and/or construction traffic.

The impact of Stage 1 on individual sensitive receivers would depend on the stage of construction, their location and the severity of the impact. Visual amenity impacts during construction would be greatest where residential/sensitive receivers have unscreened views of the construction site. Temporary mitigation measures such as screening would be considered to reduce impacts on nearby receivers. Future stages of Sydney Metro West (to be assessed in subsequent Environmental Impact Statements) would include long-term landscape and visual amenity measures.

9.6.2 Proposed investigations and assessment

A landscape character and visual amenity impact assessment for Stage 1 will be carried out as part of the Environmental Impact Statement. The assessment will be guided as relevant by the following:

- Guidance note EIA-N04 Guidelines for Landscape Character and Visual Impact Assessment (Roads and Maritime Services, 2018)
- Guidelines for Landscape and Visual Impact Assessment (Landscape Institute and Institute of Environmental Management and Assessment, 2013)
- Guidance Note for Landscape and Visual Assessment (Australian Institute of Landscape Architects, 2018)
- AS4282-1997 Control of the obtrusive effects of outdoor lighting.

The assessment will:

- Describe the visual character and unique qualities of the area around Stage 1
- Consider the heritage and other social values of the site to establish the potential sensitivity of receivers and visual absorption capacity
- Identify the visual impacts of Stage 1 during daytime and night-time conditions (including lighting)
- Identify measures to avoid, minimise and/or mitigate potential impacts.

9.7 Groundwater and geology

9.7.1 Potential impacts

Potential groundwater and geology impacts that could arise from Stage 1 include:

- Groundwater drawdown/lowering of the water table due to dewatering during tunnel and station excavations and/or drawdown incurred by bed cracking or interference with geological features beneath surface-water bodies and drainage lines
- Ground movement and settlement due to tunnelling, excavation and/or groundwater drawdown although preliminary analysis indicates that settlement levels would be well below levels at which cosmetic damage would be expected to occur
- Impacts on groundwater users due to reduced groundwater yields, reduced groundwater quality and/or direct impacts and damage to existing groundwater bores
- Impact on groundwater quality associated with the generation of turbid, saline or contaminated water collected from within the tunnels and station excavations, which would require disposal; and potential contaminants such as oils and chemicals from construction activities leaking to the water table.

Potential impacts on groundwater dependent ecosystems would also be considered as part of the biodiversity assessment.

The tunnels would be tanked to prevent significant volumes of groundwater ingress. Therefore, tunnel construction is anticipated to cause only a short-term disruption to groundwater levels as the system should adjust back to its natural state once excavation has passed and the permanent tunnel lining is installed.

At the completion of Stage 1, all cut-and-cover station excavations are likely to be untanked and would result in drawdown depending on site-specific conditions, and the interaction of recharge sources and drainage measures. The generally low hydraulic conductivity of the Mittagong Formation, Hawkesbury Sandstone and Ashfield Shale geological units indicates that the extent of groundwater drawdown may be limited by relatively low discharge rates compared to recharge sources. Where higher groundwater inflow is anticipated, temporary measures would be put in place at the completion of Stage 1 to limit groundwater inflow. In the long-term, Parramatta Metro Station and The Bays Station would be tanked as part of future stages of the Concept. It is anticipated that cavern stations (Five Dock Station) would be tanked as part of Stage 1.

9.7.2 Proposed investigations and assessment

A hydrogeological assessment will be undertaken as part of the Environmental Impact Statement. The NSW Aquifer Interference Policy (Department of Primary Industries, 2012) will be considered as relevant during the preparation of the hydrogeology assessment.

The hydrogeological assessment will:

- Describe the aquifer system(s) traversed by Stage 1
- Identify existing groundwater levels along the alignment and near the stations and portals
- Identify sensitive groundwater receivers (registered groundwater bores)
- Discuss the nature and extent of potential impacts on groundwater associated with construction and the ongoing presence of infrastructure including tunnels and station excavations. This would take into account existing groundwater levels, the geological context, the extent to which the infrastructure is 'tanked' (designed to inhibit the inflow of groundwater) and experience on other projects (including groundwater inflow rates)
- Identify potential impacts on groundwater quality
- Propose monitoring/management measures to address identified impacts.

9.8 Soils and surface water quality

9.8.1 Potential impacts

Potential soil and surface water impacts are identified in Table 9-1.

Table 9-1: Soil and surface water impacts – Stage 1

Aspect	Impact
Soil erosion	Development of construction sites would expose the natural ground surface and subsurface 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 areas (generally slightly undulating), soil erosion would be adequately managed with standard management measures (which would be developed as part of the Environmental Impact Statement).
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. Acid sulfate soils, if present, would be adequately managed with standard management measures in accordance with the Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998).
Surface water quality	Construction has the potential to adversely affect surface 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 environmental management measures. These measures would be consistent with the principles and practices detailed in Managing Urban Stormwater: Soils and Construction (Landcom, 2004).

9.8.2 Proposed investigations and assessment

A soils and surface water quality assessment will be undertaken as part of the Environmental Impact Statement. The following government guidelines will be considered as relevant during the preparation of the soils and surface water quality assessment:

- Acid Sulfate Soils Assessment Guidelines (Department of Planning, 2008)
- Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004)
- Managing Urban Stormwater: Soils and Construction Volume 2 (Department of Environment and Climate Change, 2008)
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (Department of Environment and Conservation, 2004)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000)
- Using the ANZECC Guidelines and Water Quality Objectives in NSW (Department of Environment and Conservation, 2006b).

The soil and water quality assessment for Stage 1 will:

- Identify potential impacts on surface water quality
- Identify the potential to disturb acid sulfate soils and the associated impacts
- Consider the potential impacts associated with erosion and sedimentation
- Propose monitoring and management measures to address identified impacts.

9.9 Contamination

9.9.1 Potential impacts

Contamination is expected to be encountered during Stage 1. Based on an initial review, a summary of the existing contamination environment for Stage 1 is provided at Table 9-2.

The exposure of any contaminated materials during construction may increase the potential for contaminant mobilisation and may create additional exposure pathways to sensitive receivers (including environmental receptors), surface water bodies and groundwater bodies. These impacts are anticipated to be readily manageable through standard management measures. Potential risks associated with encountering contaminated soils and groundwater will be considered as part of the Environmental Impact Statement.

Stage 1 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 which are considered to be manageable through standard management measures.

Table 9-2: Summary of existing contamination environment

Location	Potential contamination
Westmead Metro Station	The north-eastern portion of the site is currently occupied by a car service centre. There is a potential for underground petroleum storage to be located at the site and there is a risk that this use could have impacted the site by direct release on-site. There is no other history of contaminating activities across the remainder of the site, however there is potential for some minor contamination in fill materials across the site which would be readily manageable.
Parramatta Metro Station	No history of contaminating activities, however there is potential for some minor contamination in fill materials across the site which would be readily manageable.
Clyde stabling and maintenance facility	Parts of the construction site have been historically occupied for industrial uses and may contain asbestos, polycyclic aromatic hydrocarbons, heavy metals including chromium, per- and polyfluoroalkyl substances, total recoverable hydrocarbons, tributyl tin, poly chlorinated biphenols and light non aqueous phase liquids.
Silverwater services facility	The site and surrounding area has historically been occupied for industrial purposes. Previous investigations indicate the site is likely to have hydrocarbon contamination.
Sydney Olympic Park Metro Station	The general Sydney Olympic Park area was formerly occupied by a number of historical landfills. Significant development and remediation of the area was undertaken prior to the 2000 Sydney Olympic Games. Remediation methods included cap and containment of contaminated soil and monitoring of groundwater and leachate. A Remediated Lands Management Plan (Sydney Olympic Park Authority, 2009) identified that the effectiveness of the containment of the Aquatic Centre Carpark landfill was under further investigation and suggested that a secondary undefined waste source may lie outside of the boundary of the Aquatic Centre Carpark landfill containment cell. This is further supported by groundwater sampling undertaken in 2010. As a result, there is potential for the station site to be impacted by landfill leachate and/or hazardous ground gases including methane, hydrogen sulphide and carbon monoxide. The fill material across the station site is also of unknown origin.
North Strathfield Metro Station	Soils within the excavation footprint, in the area immediately east of the existing station, are known to contain asbestos. There is a dry cleaner shopfront present within commercial shops on Queen Street, which presents a risk of potential chlorinated hydrocarbons in groundwater and soil.
Burwood North Station	The site and the Burwood/Concord area have been historically occupied for commercial and light industrial purposes. There is a potential for underground petroleum storage to be located at the site and within the immediate area and there is a risk that these uses could have impacted the site either by direct release on-site or potential migration of contaminated groundwater onto the site. Additionally, fill material of unknown origin would have likely been imported onto the site to achieve current site levels.

Location	Potential contamination
Five Dock Station	There is no specific history of contaminating activities at the site, however some adjacent lands are likely to be subject to moderate contamination and preliminary drilling indicates some contamination of nearby fill.
The Bays Station	Fill soils at the site are known to be contaminated by asbestos, polycyclic aromatic hydrocarbons and heavy metals. Preliminary data also suggests the potential for low concentrations of per- and polyfluoroalkyl substances at The Bays Precinct.
Metro rail tunnels	No significant data is available for tunnel alignment at the depth of the running tunnels. Hazards have therefore been identified on the basis of the known or suspected presence of significant contamination within shallow groundwater which has the potential to migrate to the invert of the proposed tunnel(s). Based on this analysis, there is potential to encounter contamination in the following areas during running tunnel excavation: • Clyde stabling and maintenance facility – polycyclic aromatic hydrocarbons, heavy metals and nutrients • Sydney Olympic Park – leachate, dense non-aqueous phase liquid, and per- and polyfluoroalkyl substances • The Bays Precinct – potential for low concentrations of per- and polyfluoroalkyl substances.

9.9.2 Proposed investigations and assessment

A contamination assessment for Stage 1 will be carried out as part of the Environmental Impact Statement. 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, reprinted 2011)
- Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (Environment Protection Authority, 2015)
- National Environmental Protection (Assessment of Site Contamination) Measure 1999, as amended 2013.

The contamination assessment for Stage 1 will include:

- A review of previous contamination assessments (where available)
- A review of historical aerial photography and plans to identify potential contamination sources along and/or adjacent to Stage 1 construction sites
- A review of publicly available data (web-based information searches)
- A site inspection to identify potential contamination sources and verify those potential areas of concern identified in the review of historical and available information
- Recommendations for additional investigations and/or management of potentially contaminated sites which could be encountered during construction.

Management of contamination and any resulting remediation would be undertaken on the basis of risk, in accordance with the relevant legislation, standards and guidelines, including but not limited to the *National Environmental Protection (Assessment of Contamination) Measure 1999, as amended 2013*, and all relevant guidelines made or approved under the *Contaminated Lands Management Act 1997* and the *Protection of the Environment Operations Act 1997.*

9.10 Social impacts and community infrastructure

9.10.1 Potential impacts

The preliminary assessment of potential social impacts has been informed by feedback from the community during consultation and engagement undertaken to date (refer to Chapter 5) and from experience from similar projects. Potential social and community impacts would be managed through the implementation of measures for other aspects such as traffic and transport, noise and vibration, visual amenity and air quality, and through active community consultation.

Potential social and community impacts that could occur during Stage 1 include:

- Concerns in the community regarding construction fatigue related to the number of major projects being constructed across Sydney
- Community concerns around property acquisition
- Potential changes to the character of local areas including the sense of place
- Potential changes to the way of life for people living, working, or accessing services, institutions or businesses near construction zones
- Impacts on the amenity of local residents from construction sites including noise, visual intrusion in the landscape including associated plant and equipment, air quality impacts, disruptions to traffic and access
- Wellbeing impacts on residents who are located close to construction sites, if the building phase is prolonged
- Potential to temporarily impact traffic conditions for road users (including motorists, pedestrians and cyclists) on existing road networks, particularly if there is congested traffic and parking in the area already
- Temporary or permanent loss of community infrastructure where it exists within the footprint of the construction site or permanent infrastructure
- Amenity impacts to community facilities which are potentially more sensitive to such impacts and may not be able to function, or be properly enjoyed by the community, where they are located close to a construction site
- Potential impacts if access to the natural environment or public open space changes
- Altered access to and from properties, public transport or community facilities. Changes to pedestrian access would also likely be more challenging for people with a disability.

9.10.2 Proposed investigations and assessment

An assessment of potential social and community facility impacts from Stage 1 will be carried out as part of the Environmental Impact Statement. Relevant government or industry guidelines that will be considered include:

- Social Impact Assessment: Guidance for assessing and managing the social impacts of projects (International Association for Impact Assessment, 2015)
- SIA principles: International Principles for Social Impact Assessment (Vanclay, 2003)
- Environmental Planning and Impact Assessment Practice Note: Socio-economic Assessment (Roads and Maritime Services, 2013)
- Principles from the Social Impact Assessment Guideline for State significant mining, petroleum production and extractive industry development (Department of Planning and Environment, 2017b).

The assessment will:

- Identify the existing social environment and any impacts to social conditions, communities and community values within the areas around the Stage 1 construction sites
- Review community characteristics, including identification of significant community infrastructure
- Assess the social impact on the directly affected community and its facilities and/or services around the Stage 1 construction sites

- Identify any community facilities that would be lost as a result of Stage 1, and if alternative facilities are available or if the facilities can be replaced in the local area
- Identify community facilities adjacent to construction sites that may be impacted by reduced amenity or access
- Propose mitigation and management measures for any potential impacts.

9.11 Business impacts

9.11.1 Potential impacts

Some businesses around Stage 1 may experience positive impacts during construction, including:

- Depending on their location, some businesses may benefit from a net gain in passing trade during construction owing to changes to pedestrian traffic and vehicle access
- Trade could increase for businesses located close to construction sites or en-route to construction sites, which sell goods to construction workers. Related industries, such as service stations, take-away food shops and hotels, could also benefit
- Stage 1 construction could benefit construction related businesses, such as construction recruitment agencies, construction companies and resource suppliers.

However, potential adverse business impacts that could occur during Stage 1 include:

- Adjustments to servicing, deliveries and access due to interim street closures, the relocation/ removal of car parking along the street frontage and the location of construction sites
- Increased traffic congestion and/or travel times – impacts on businesses as a result of traffic delays and congestion may be both direct and indirect. Businesses may be directly affected by delayed or hindered access to work places or servicing areas owing to local traffic constraints and congestion. A business may be indirectly affected by increased traffic and therefore travel times for staff or deliveries on major thoroughfares owing to construction work
- Loss of power and utilities – businesses may be disrupted by accidental or planned shutdowns of electricity or other utilities to enable construction work. Whilst significant advance notice would be given to all businesses of a power or utility shutdown, accidental events would be more difficult to manage
- Reduced visibility – the presence of construction work, hoardings and other structures may reduce the visibility of certain businesses
- Reduced amenity – deterioration of amenity (particularly due to noise, vibration, visual and air quality impacts) may result in a reduction in customers which could be minimised through implementation of mitigation measures such as acoustic sheds, hoarding, respite periods and changing the timing or staging of specific construction activities where possible
- Property acquisition – some businesses may not be able to relocate as easily as others.

The key characteristics of local businesses around each of the construction sites are provided in Table 9-3.

Table 9-3: Summary of business characteristics

Location	Local business characteristics
Westmead Metro Station	The business environment at Westmead is characterised by businesses supporting the Westmead health and education precinct, as well as smaller local businesses. There is a small retail centre north of the existing Westmead Station, including a grocer, tavern and food and beverage stores. There is a also a strip shopping centre south of the existing Westmead Station on Hawkesbury Road. There is a strong presence of medical services along Hawkesbury Road and the surrounding area, including medical centres. There are also some local businesses, including small food and beverage businesses, located along Hawkesbury Road.
Parramatta Metro Station	Parramatta includes a diversity of business activity. Commercial activity is present throughout the CBD, including office space primarily north of the existing railway station, and a range of local retail and services businesses. Food and beverage retail is concentrated on Church Street, and includes a mix of independent cafes/restaurants and franchised fast food. Parramatta Westfield is a major shopping centre located south of the existing railway line. This centre contains a wide range of stores from large retailers such as Myer, David Jones, Target, Kmart and Woolworths, to smaller retail stores.
Clyde stabling and maintenance facility	This site is located in an industrial precinct which also includes Valvoline Raceway (Sydney Speedway). Businesses within the locality include services such as automobile repairs, panel beaters and painters, electrical contractors and construction and demolition contractors. Sydney Helicopters, based adjacent to Valvoline Raceway is Sydney's only standalone heliport facility and runs tours, charters and provides assistance during emergencies such as bushfire, flood and community evacuation and support.
Silverwater services facility	The site is located in a light industrial precinct. Surrounding businesses include urban services such as automobile repairs, as well as some warehouse style retail and bulky goods businesses.
Sydney Olympic Park Metro Station	There is a diverse mix of businesses in Sydney Olympic Park. The locality includes multiple stadia and sporting facilities, including Qudos Bank Arena, ANZ Stadium, Sydney Olympic Park Aquatic Centre and Spotless Stadium, renamed recently as Giants Stadium, which attract significant visitation during events. There are multiple hotels in the locality. There is also a wide variety of food and beverage retail, ranging from fast food and takeaway shops to cafes and restaurants. There is a range of local retail and small businesses, including a newsagency, bank and sports medicine centre, as well as some commercial office space.
North Strathfield Metro Station	The business environment is characterised by local retail east of the existing station, with a small number of shops along Queen Street opposite the station, and a larger offering at Concord Road, including a pharmacy and hairdresser. Food and beverage retail includes a small group of restaurants, cafes and fast food outlets. The 'Bakehouse Quarter' on George Street, the site of the former Arnott's Biscuits factory, includes restaurants, cafes, supermarkets, shops and some office space.
Burwood North Station	Along Burwood Road, the business environment is characterised by older style main street shops, including cafes, takeaway food and medical centres. Some commercial and light industrial businesses are located along Parramatta Road. Westfield Burwood is a major shopping centre located north of the existing Burwood railway station on Burwood Road. This centre contains a wide range of stores from large retail stores such as David Jones, Kmart, Target, Coles and Woolworths, to smaller retail stores.
Five Dock Station	Retail and commercial activity is concentrated on Great North Road in a section between Lyons Road and Queens Road. This includes local businesses such as shops, restaurants, cafes and other services, including banks, a post office, a pub, gyms, pharmacies and real estate agents. Coles is the main supermarket in Five Dock, but there is also a range of speciality shops including a butcher and a seafood shop.
The Bays Station	The business environment at White Bay is characterised by businesses associated with the White Bay cruise terminal and wharves, including a boat dealer and travel agent. Some light industrial and urban services businesses are located north of White Bay Power Station.

9.11.2 Proposed investigations and assessment

A business impact assessment will be prepared for Stage 1 as part of the Environmental Impact Statement. The relevant government and industry guideline that will be considered is Environmental Planning and Impact Assessment Practice Note: Socio-economic Assessment (Roads and Maritime Services, 2013).

The assessment will:

- Identify businesses that would be directly impacted by Stage 1
- Identify nearby local businesses that may be indirectly impacted by Stage 1
- Assess the potential impacts of Stage 1 on local businesses
- Identify measures to avoid or mitigate the potential impacts.

9.12 Hydrology and flooding

9.12.1 Potential impacts

Construction has the potential to alter existing stormwater flows and the existing stormwater drainage infrastructure due to the establishment of erosion and sediment control measures (such as redirecting stormwater runoff around the work site and/or establishment of detention basins). Best practice stormwater management measures would be developed during preparation of the Environmental Impact Statement to minimise the potential impacts on downstream receiving environments.

The construction sites at Parramatta Metro Station, The Bays Station, the Clyde stabling and maintenance facility are anticipated to be at risk of flooding. Flooding of construction sites could result in stockpiles of construction materials (such as aggregate, fuels and other hazardous materials) and spoil being washed into nearby waterways, or floodwater entering the tunnels and excavations. Construction also has the potential to locally alter existing flood behaviour due to the loss of floodplain storage (due to stockpiling construction materials and spoil, etc) and in places where existing stormwater drainage infrastructure needs to be altered.

The earthworks to construct the Clyde stabling and maintenance facility (required to be protected from the one per cent Annual Exceedance Probability flood event), and the protection of the Rosehill dive structure and tunnel portal from the probable maximum flood event would result in potential ongoing risk associated with the loss of floodplain storage and the alteration of local drainage patterns. These potential impacts, and appropriate mitigation measures, would be identified in the Environmental Impact Statement.

9.12.2 Proposed investigations and assessment

The Environmental Impact Statement will include an assessment of potential hydrology and flooding impacts from Stage 1. The following government guidelines will be considered as relevant during the preparation of the hydrology and flooding assessment for Stage 1:

- Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) and Volume 2 (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E. Mines and Quarries) (Department of Environment and Climate Change, 2008)
- Floodplain Development Manual (NSW Government, 2005).

The assessment of potential hydrology and flooding impacts will include:

- Identification and assessment of potential impacts on stormwater quantity
- Broad assessment of the potential change in stormwater runoff (increase or decrease)
- Identification of potential impacts as a result of changes in surface water quantity, with respect to increases or decreases in stormwater runoff and the sensitivity of the downstream waters
- Identification of any potential changes to flood levels, discharges, velocities, duration of flood inundation and flood hazards for the five per cent and one per cent Annual Exceedance Probability flood events, and the probable maximum flood
- Identification of appropriate mitigation and management measures.

9.13 Biodiversity

9.13.1 Potential impacts

Based on the location of Stage 1, the potential for biodiversity impacts is anticipated to be limited. Notwithstanding, construction may result in the following potential impacts:

- Loss of native vegetation – there may be some minor clearing of native vegetation to facilitate construction in some locations. In most locations this is expected to be limited to street trees
- Loss of threatened fauna habitat – potential loss of native vegetation could result in loss of habitat for some threatened fauna or migratory species. Demolition of buildings and structures in some locations could also remove potential habitat for threatened micro bat species
- Injury and mortality of fauna species – fauna injury or mortality could occur during vegetation clearing and/or as a result of collisions with construction plant and vehicles. The majority of fauna species anticipated to occur are likely to be highly mobile bird species. These species are likely to be able to readily fly away from vegetation clearing activities. However, there is potential for hollow-dependent birds and mammals and less mobile fauna species to also be present
- Indirect impacts such as light and noise, sedimentation, spread of weeds – these risks would generally occur uniformly across the construction sites. Fauna species likely to be occupying the area are anticipated to be accustomed to noise and light impacts that are already occurring.

9.13.2 Proposed investigations and assessment

A biodiversity assessment will be prepared as part of the Environmental Impact Statement for Stage 1. The following government guidelines will be considered as relevant during preparation of the biodiversity assessment:

- 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)
- Commonwealth Department of the Environment and Energy – Nationally Threatened Ecological Communities and Threatened Species Guidelines (various)
- Commonwealth Department of the Environment and Energy – Survey Guidelines for Nationally Threatened Species (various)
- Biodiversity Assessment Method (Office of Environment and Heritage, 2017a)
- NSW Biodiversity Offsets Scheme (Office and Environment and Heritage, 2017b)
- Threatened species survey and assessment guidelines at http://www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm (various)
- Framework for Biodiversity Assessment (NSW Office and Environment and Heritage, 2014a)
- NSW Biodiversity Offsets Policy for Major Projects (NSW Office and Environment and Heritage, 2014b).

The biodiversity assessment for Stage 1 will be based on a desktop review of database searches, regional biodiversity mapping and any relevant existing site-specific reports, as well as site inspection and detailed targeted field surveys, if necessary. The biodiversity assessment will:

- Identify and describe the flora and fauna species, habitat, populations and ecological communities (including groundwater dependent ecosystems) that occur or are considered likely to occur
- Assess any direct and indirect impacts of Stage 1 on terrestrial and aquatic flora and fauna species, populations, ecological communities and their habitats, and groundwater dependent ecosystems
- Assess the significance of the impacts of Stage 1 on species, ecological communities and populations, and groundwater dependent ecosystems listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, the *Biodiversity Conservation Act 2016* and the *Fisheries Management Act 1994* that occur or are considered likely to occur

- Identify and describe mitigation measures using the principles of 'avoid, minimise, mitigate', and propose offsets where residual impacts would occur. Offsets would be determined in accordance with the NSW Biodiversity Offsets Policy for Major Projects (NSW Office and Environment and Heritage, 2014b).

9.14 Air quality

9.14.1 Potential impacts

During construction of Stage 1, local air quality may be temporarily affected by the generation of dust and gaseous emissions (such as emissions from the combustion of fuels and storage of volatile organic compounds).

Dust

The main potential air quality impacts during construction of Stage 1 would be associated with the generation of dust, which would include pollutants such as deposited dust, total suspended solids and particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$). Owing to the urban setting and the potential to encounter contamination at some construction sites, there is also potential for dust emissions to contain contaminants (mobilised through the disturbance of contaminated soils) and other hazardous materials (such as asbestos fibres mobilised through the demolition of buildings and other structures).

Construction activities with the greatest potential to generate dust would include:

- 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
- Concrete batching and precast activities
- Movement of construction plant, vehicles and equipment along unsealed haulage routes and surfaces.

Management measures would be implemented to minimise dust emissions from the above activities that could result in reduced local air quality and dust deposition at the nearest potentially affected receivers.

The volume of dust generated during a typical work day would vary depending on the types of activities occurring at each construction site and prevailing weather conditions (for example, dry windy conditions increase the potential for wind erosion). However, the overall volume of dust emissions would be comparable to volumes generated by other similar infrastructure projects and the impacts would be readily manageable through standard environmental management measures, such as wetting stockpiles and exposed surfaces and minimising dust-generating work during adverse weather conditions.

Gaseous emissions

Earthworks at the Clyde stabling and maintenance facility, including excavation, construction and remediation if required, may result in gaseous emissions that would need to be suitably controlled.

Gaseous emissions from other construction sites 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. These gaseous emissions during construction would be relatively minor and would be adequately managed with standard environmental management measures.

9.14.2 Proposed investigations and assessment

The Environmental Impact Statement will include an air quality impact assessment for Stage 1, which will:

- Identify and describe the background air quality environment based on a desktop assessment
- Identify potential sources of air emissions during Stage 1
- Identify potential sensitive receivers likely to be impacted by emissions to air during Stage 1
- Identify and describe mitigation measures using the principles of 'avoid, minimise, and mitigate'.

9.15 Greenhouse gas and energy

9.15.1 Preliminary impact assessment

Stage 1 would result in the generation of greenhouse gas emissions. The volume of greenhouse gas emissions generated would largely depend on the type and quantity of construction materials used, construction methodologies and equipment used, and the overall design (for example, station and tunnel depths). Activities that are anticipated to result in the largest quantities of greenhouse gas emissions include:

- Use of electricity for the tunnel boring machines and roadheaders
- 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 would not be possible to completely avoid the generation of greenhouse gas emissions during construction. However, opportunities to reduce the volume of greenhouse gas emissions would be explored 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 such materials from local suppliers and disposing of spoil at nearby 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 Stage 1 electricity needs through the generation or purchase of 'green power'
- Overall, the emission of greenhouse gas during construction is expected to be similar to other infrastructure projects of a similar nature and scale.

9.15.2 Proposed investigations and assessment

A greenhouse gas and energy assessment for Stage 1 will be included in the Environmental Impact Statement. The assessment will:

- Identify the potential greenhouse gas emissions from Stage 1
- Identify mitigation and management measures to reduce potential emissions of greenhouse gas.

9.16 Climate change adaptation

9.16.1 Preliminary impact assessment

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 the tunnels and/or construction sites.

These risks are anticipated to be adequately managed with standard management measures, such as increasing the capacity of erosion and sediment controls and minimising construction impacts on the capacity of existing stormwater drainage systems.

Stage 1 also includes earthworks to construct the Clyde stabling and maintenance facility (required to be protected from the one per cent Annual Exceedance Probability flood event), and the Rosehill dive structure and tunnel portal (required to be protected from the probable maximum flood event). Climate change risks associated with increased frequency and severity of extreme rainfall events will also need to be considered for this infrastructure as part of the Environmental Impact Statement.

9.16.2 Proposed investigations and assessment

The Environmental Impact Statement will include a climate change adaptation assessment for Stage 1.

The following government and industry guidelines will be considered as relevant during the preparation of the climate change adaptation assessment for Stage 1:

- Commonwealth Scientific and Industrial Research Organisation's Climate Change in Australia Technical Report 2015
- ISO 31000-2018; Risk Management – Principles and Guidelines
- AS 5334:2013 – Climate Change Adaptation for Settlements and Infrastructure – A risk based approach
- Australian Rainfall and Runoff Guidelines: A guide to flood estimation 2019
- Transport for NSW Climate Risk Assessment Guidelines (9TP-SD-081 Version 3.0, 2018)
- CoastAdapt Web Portal (https://coastadapt.com.au).

The climate change adaptation assessment for Stage 1 will:

- Identify possible climate related impacts with an emphasis on any that are projected to undergo a substantial change
- Identify Stage 1 components that may be vulnerable to the climate change impacts
- Identify possible current and future controls that may increase the resilience of particular Stage 1 components to climate impacts
- Recommend what should be considered, and how to establish if further information is needed, to adequately assess climate change risk.

9.17 Waste management and resource use

9.17.1 Preliminary impact assessment

Waste

A variety of solid and liquid wastes would be generated during Stage 1. The main construction activities anticipated to generate waste are outlined in Table 9-4 along with the likely waste materials produced.

Table 9-4: Construction waste generation

Activity	Waste material produced
Tunnelling, station excavations and general earthworks	Spoil comprising virgin excavated natural material, tunnel boring machine cutter heads and associated equipment replacement (conveyor belts etc.), tunnel boring machine lubricants (bentonite slurry or similar); contaminated materials and potential acid sulfate soils.
Precast 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).
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 tunnels and station excavations.
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 largest volumes of construction waste would be generated during the excavation of tunnels and underground stations (spoil and wastewater) and the demolition of buildings and other structures (general construction wastes such as steel and concrete). In total, Stage 1 is expected to generate around 3.2 million cubic of metres of spoil from tunnelling, station and shaft excavations.

The quantity of waste would be comparable to similar infrastructure projects (including other Sydney Metro projects and road tunnel projects) and would be adequately managed with standard waste management measures.

Resource use

The main resources used during Stage 1 would include:

- Electricity
- Fuel
- Lubricating oil
- Concrete
- Steel
- Water
- Timber.

While Stage 1 would increase demand on local and regional resources, it is unlikely that it would result in any resource becoming scarce or in short supply.

9.17.2 Proposed investigations and assessment

A waste and resource assessment for Stage 1 will be carried out as part of the Environmental Impact Statement. This assessment will include:

- A review of the likely waste streams and volumes generated during Stage 1, including spoil, wastewater and demolition materials
- A review of the likely resources required during Stage 1, including energy, fuel and steel
- Development of management strategies to adequately address waste during Stage 1. Measures would likely include:
  - Measures for managing construction waste through the waste hierarchy established under the *Waste Avoidance and Resource Recovery Act 2001* (i.e. avoidance of waste, resource recovery, disposal of waste)
  - Targets for the beneficial reuse of spoil, wastewater and other construction wastes in accordance with a future Sydney Metro West sustainability plan
  - An approach for the assessment, handling, stockpiling and disposal of potentially contaminated materials and wastewater, in accordance with the Waste Classification Guidelines (Environment Protection Authority, 2014)
  - Identification of opportunities to reduce the demand on electricity and other resources
  - Identification of how spoil would be managed, including likely volumes, likely nature and classification of excavated material, opportunities for recycling, potential disposal sites, stockpile management, and method(s) and route of transportation. This would consider the cumulative effects of spoil haulage and disposal activities associated with other Sydney based tunnel projects, including other Sydney Metro projects, WestConnex and Western Harbour Tunnel and Beaches Link.

9.18 Hazard and risk

9.18.1 Preliminary impact assessment

The following hazards have the potential to occur during Stage 1:

- 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 used to identify the presence of services at the start of construction
- Tunnel collapse. To manage this risk, best-practice tunnelling methods and processes would be employed to ensure the structural integrity of the tunnels and excavations.

Construction hazards and risks would be adequately managed with standard management measures.

9.18.2 Proposed investigations and assessment

A high level hazard and risk assessment will be carried out for Stage 1, and management 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, 2011a)
- International Standard (ISO/IEC 31010:2009) Risk Management – Risk Assessment Techniques
- Australian Code for the Transport of Dangerous Goods by Road and Rail (edition 7.6) (National Transport Commission, 2018)
- Model Code of Practice: How to manage and control asbestos in the workplace (Safework Australia, 2018)
- Code of Practice: How to Safely Remove Asbestos (Safework NSW 2016)
- Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005), noting this Code is a guide for processes and controls to manage risks and is not to be relied upon to ascertain requirements under the Work Health and Safety Regulation 2011.
- Australian Standard AS 2885 Pipelines – Gas and liquid petroleum
- Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis (Department of Planning, 2011b)
- Multi-Level Risk Assessment (Department of Planning, 2011c).

9.19 Cumulative impacts

9.19.1 Approach

Cumulative impacts are impacts that result from the successive, incremental, or combined effects of an activity or project when added to other past, current, planned, or reasonably anticipated future impacts (Department of Planning and Environment, 2017a). Stage 1 has the possibility of interacting with a number of other projects along the planned corridor or proposed construction sites. This includes:

- Parramatta Light Rail (Stages 1 and 2)
- WestConnex Stage 3 (M4-M5 Link)
- Western Harbour Tunnel and Beaches Link
- Sydney Metro City & Southwest
- Development of The Bays Precinct.

Sydney Metro has commenced consultation with other sections of Transport for NSW and proponents of other major projects, to identify processes and measures to mitigate potential cumulative impacts. This may include coordination or adjustments to construction programs, activities, traffic management arrangements or haul routes and a coordinated approach to community consultation.

9.19.2 Preliminary impact assessment

Potential cumulative impacts could arise in situations where construction of Stage 1 occurs concurrently or consecutively with other known developments or nearby major projects. Cumulative impacts could include:

- Construction traffic – increased traffic congestion may occur where multiple construction projects use the same construction traffic routes at the same time, or where construction traffic impacts occur not long after construction traffic impacts have ceased from another project
- Temporary loss of on-street parking and/or other kerbside uses (such as loading zones) – parking availability could be further affected by the construction of a number of other projects which would also intend to affect the availability of parking, such as Parramatta Light Rail
- Disruptions to public transport – multiple construction sites could result in longer commuter travel times due to disruptions to bus and/or rail services
- Construction noise, vibration and visual amenity – increase in impacts due to other nearby construction sites operating either simultaneously with or before or after Stage 1. This could include construction fatigue, increased overall noise levels, additional out of hours work, and increased extent and/or duration of visual amenity impacts
- Loss of public open space – temporary reduction in the availability and/or enjoyment of public open space and natural environments
- Social and business impacts – the above cumulative impacts could also result in increased social and business impacts
- Spoil management – concurrent tunnelling projects particularly WestConnex, Western Harbour Tunnel and Beaches Link and Sydney Metro City & Southwest, will increase the volume of spoil being generated within the Sydney metropolitan region, which has the potential to affect spoil reuse opportunities. This may influence spoil management for Stage 1.

There may also be cumulative impacts with future stages of the Concept. As this would be dependent on the relative timing of the future stages, the potential for cumulative impacts would be addressed in the relevant environmental impact assessment for the future stage.

9.19.3 Proposed investigations and assessment

Details of known surrounding developments and major projects with the potential to interact with the Stage 1 construction work will be identified through consultation with stakeholders and a review of relevant local environmental plans, the Department of Planning, Industry 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, where appropriate.

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10 Preliminary environmental risk analysis

10 Preliminary environmental risk analysis

This chapter provides a preliminary environmental risk analysis for Sydney Metro West in order to identify the key and other issues for the Environmental Impact Statement.

10.1 Overview

The purpose of this chapter is to:

- Identify potential environmental and social constraints and opportunities associated with Sydney Metro West
- Undertake a preliminary environmental risk analysis of the Concept and Stage 1
- Assist in minimising environmental and social impacts during future project and design development.

10.2 Methodology

The environmental risk analysis was undertaken in accordance with the principles of the Australian and New Zealand standard AS/NZS ISO 31000:2018 Risk Management – Principles and Guidelines. This involved ranking the risks by identifying the consequence of the impact and the likelihood of each impact occurring. 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 future environmental assessments) was not applied.

The first step in the risk analysis involved the identification of the consequence, should an impact occur, followed by identification of the likelihood of the impact occurring. The definitions of the consequences used are provided in Table 10-1 and the definitions of likelihood are provided in Table 10-2. The risk rating was then determined by combining the consequence and likelihood to identify the level of risk as shown in the matrix in Table 10-3.

Table 10-1: 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 on stakeholder(s) or customers.
Insignificant	• No appreciable or noticeable changes to the environment • Negligible impact on environment, stakeholder(s) or customers.

Table 10-2: 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 10-3: Risk matrix

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

10.3 Risk analysis

Using the framework described above, a preliminary environmental risk analysis was carried out and is presented in Table 10-4. 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 for the Concept in Chapter 7 and for Stage 1 in Chapter 9. This risk analysis will be re-examined at key stages during future environmental assessments for Stage 1 and subsequent stages.

Table 10-4: Preliminary risk analysis

Potential impact	Relevance	Risk analysis	Discussion
Construction traffic and transport			
Deterioration of traffic performance on surrounding road network to an unacceptable level of service due to construction vehicles and temporary road or lane closures **Temporary loss of parking spaces or loading zones substantially undermining accessibility to transport, services and/or businesses** **Reduced pedestrian and cyclist access or flows due to construction** **Impacts on access to private property** **Reduced safety and amenity for traffic, pedestrians and cyclists due to construction activities, including within existing stations, and due to potential conflicts with construction vehicles** **Impacts on reliability of public transport services (Sydney Trains and buses), including relocation of bus stops, bus diversions and activities within the rail corridor**	Concept Stage 1	Consequence: Moderate Likelihood: Almost certain Risk rating: High	Heavy vehicles would be required to transport material to and from construction sites. Additionally, construction activities may require: • The temporary or permanent closure or realignment of some sections of roadway • Alterations to pedestrian and cyclist facilities • Alterations to existing public transport infrastructure or timetables.
Operational traffic and transport			
Deterioration of traffic performance on surrounding road network due to altered traffic arrangements **Deterioration of traffic performance due to road or lane closures** **Loss of parking spaces or loading zones** **Traffic, pedestrian and cyclist safety** **Altered (poorer) pedestrian and cyclist arrangements**	Concept	Consequence: Minor Likelihood: Unlikely Risk rating: Low	The Concept would improve the transport system by providing a stand-alone railway network with the capacity to operate 30 trains an hour in each direction. It would integrate with the existing transport network, help to relieve congestion on the existing rail network and stations, and reduce the number of cars on the surrounding road network. Changes to the network would likely include alterations to bus stop locations or the provision of a small number of kiss and ride and/or taxi spaces around the stations to enhance transport interchange. The Concept would not involve the provision of any major traffic generating features such as park-and-ride.
Construction noise and vibration			
Exceedances of noise management levels from tunnelling and surface construction sites during standard construction hours **Exceedances of noise management levels from tunnelling and surface construction sites outside standard construction hours** **Construction traffic resulting in an increase in traffic noise greater than 2 dB** **Vibration from tunnelling or surface activities exceeding human comfort or damage levels** **Ground-borne noise from tunnelling exceed the criteria**	Concept Stage 1	Consequence: Major Likelihood: Almost certain Risk rating: Very high	Construction activities would involve the use of multiple construction sites. Many construction sites would be directly adjacent residential areas/properties – including North Strathfield, Burwood North, Five Dock and Westmead. Construction activities would likely exceed the relevant noise management levels for at least some locations and for some of the time. Additionally, activities outside of standard daytime construction hours would likely be required.

Potential impact	Relevance	Risk analysis	Discussion
Operational noise and vibration			
Exceedances of criteria from airborne noise associated with the stabling and maintenance facility **Exceedances of criteria from airborne noise at stations or other at surface ancillary infrastructure from fresh air ventilation, mechanical and electrical equipment, substations, public address systems, etc** **Vibration impacts from train operations resulting in exceedance of human comfort levels** **Vibration impacts from train operations resulting in exceedance of building or structure damage levels** **Exceedances of ground-borne noise criteria from train operations**	Concept	Consequence: Moderate Likelihood: Rare Risk rating: Low	Train operation would mainly occur underground within twin tunnels. Ground-borne noise and vibration levels from operating trains are anticipated to be minor with the implementation of standard environmental management measures. The Clyde stabling and maintenance facility would be located aboveground, but within an industrial area with minimal sensitive receivers.
Non-Aboriginal heritage			
Unsympathetic design of operational infrastructure that detracts from the heritage significance of nearby heritage item(s) **Direct impacts on local and s170 register listed items during construction** **Direct impacts on State Heritage Register listed items during construction** **Direct impacts on Commonwealth, National and world heritage during construction** **Damage to heritage items from vibration and settlement during tunnelling, construction and operation** **Change to the values of a heritage conservation area during construction** **Construction impacts of activities within the curtilage of listed items, but with no direct impacts on the significant components** **Impacts on unknown heritage items (e.g. archaeological items) during construction**	Concept Stage 1	Consequence: Moderate Likelihood: Almost certain Risk rating: High	Components of the Concept may impact heritage listed items or conservation areas during construction and operation, but would be designed to minimise potential impacts. Stage 1 construction activities would: • Avoid direct impacts on State, Commonwealth, National and World Heritage items • Result in negligible impacts from vibration on the Parramatta Park World Heritage site which is above the tunnel alignment • Have direct or indirect impacts on a small number of local and s170 listed items • Ensure that any archaeological items of State significance (potentially in Parramatta) would be appropriately treated.
Aboriginal heritage			
Impacts on known Aboriginal heritage items **Impacts on areas of known Aboriginal cultural sensitivity** **Impacts on unidentified Aboriginal heritage items**	Concept Stage 1	Consequence: Major Likelihood: Possible Risk rating: High	Components of the Concept may impact on previously recorded Aboriginal heritage sites. Stage 1 construction activities are expected to avoid impacts to known Aboriginal heritage items, however there would be potential impacts to items within the Parramatta Sands Body.

Potential impact	Relevance	Risk analysis	Discussion
Property and land use			
Incompatibility between project infrastructure and facilities and intended future surrounding land use (including restrictions on future development due to subsurface tunnels conflicting with a strategic plan) Property acquisition for construction Direct impacts on other infrastructure during construction including utilities and Sydney Trains property	Concept Stage 1	Consequence: Major Likelihood: Likely Risk rating: High	The proposed stations at Westmead, Parramatta and The Bays would support planned growth and opportunities to integrate with existing or planned land use objectives. The proposed stations at Westmead, Parramatta, Sydney Olympic Park and Sydney CBD would be located within existing (or future) major commercial/strategic centres. The proposed stations at Sydney Olympic Park and The Bays could potentially delay the development and delivery of masterplans for these precincts. Stage 1 would require the acquisition and demolition of properties for the proposed station sites, stabling facility, ancillary infrastructure and construction sites.
Landscape character and visual amenity			
Adverse visual impacts during operation associated with the introduction of new stations and other surface infrastructure (stabling facility, fresh air tunnel ventilation facilities, etc) Adverse impacts on landscape character during construction activities associated with compounds for new stations, ancillary infrastructure, and the stabling and maintenance facility (e.g. loss of street trees, parking/use of plant and equipment etc) Impacts on visual amenity from private/ public places as a result of acoustic sheds and hoardings associated with construction compounds Light spill from construction sites, including the stabling and maintenance facility, at night	Concept Stage 1	Consequence: Major Likelihood: Likely Risk rating: High	The stations, stabling and maintenance facility and ancillary infrastructure would introduce new built elements into the surrounding environment. The introduction of a new metro station may result in a positive landscape character impact. Stage 1 would demolish buildings for surface infrastructure resulting in a change to the current visual environment. The introduction of construction sites and use of acoustic sheds would result in a change in the visual landscape for several years.
Groundwater and geology			
Groundwater drawdown/lowering of the water table due to dewatering during tunnel and station excavations and/or drawdown incurred by bed cracking or interference with geological features beneath surface-water bodies and drainage lines Impacts on groundwater users due to reduced groundwater yields, reduced groundwater quality and/or direct impacts and damage to existing groundwater bores Ground movement/ settlement due to tunnelling and other excavations Ongoing operational changes to groundwater flows and levels from underground stations and other untanked structures	Concept Stage 1	Consequence: Moderate Likelihood: Possible Risk rating: Medium	Based on previous experience, ground movement and settlement is expected to be negligible. The excavation of the tunnels and underground stations during Stage 1 construction activities may result in localised changes to the hydrogeological environment associated with groundwater drawdown. The tunnels and the majority of stations are proposed to be tanked, which would limit the potential impacts of this component of the Concept to the construction phase.

Potential impact	Relevance	Risk analysis	Discussion
Soils and water quality			
Erosion of soils resulting in offsite sedimentation of waterways during construction resulting in exceedances of water quality criteria **Exposure of acid sulfate soils during construction resulting in offsite discharge of acidic water** **Exposure of soil salinity/saline soils during construction resulting in offsite discharge of saline water resulting in exceedances of water quality trigger levels** **Water quality impacts on nearby watercourses due to discharge of treated groundwater, contaminated water, or spills during construction and operation** **Contamination of land or groundwater due to spills and leaks during construction**	Concept Stage 1	Consequence: Minor Likelihood: Unlikely Risk rating: Low	Potential impacts such as erosion and sedimentation, and spill or leaks are anticipated to be manageable through the implementation of standard environmental management measures. Groundwater captured from the tunnel excavation would be treated prior to discharge. Acid sulfate soils are likely to occur at the following construction sites and would need to be managed: Parramatta, Clyde stabling and maintenance facility, and The Bays.
Contamination			
Disturbance of contaminated land during construction causing impact on human health or receiving environments **Disturbance of contamination (soil or groundwater) potentially exacerbating existing contamination risks by mobilising otherwise stable contamination in groundwater** **Contamination of groundwater and land due to spills and leaks during operation**	Concept Stage 1	Consequence: Major Likelihood: Possible Risk rating: High	Known contaminated sites could be encountered and disturbed at Clyde stabling and maintenance facility, Sydney Olympic Park and The Bays construction sites. Localised contaminated soils could also be encountered at other locations. Appropriate management approaches would be developed to manage contamination.
Social impacts and community infrastructure			
Health and liveability benefits associated with public transport **Permanent loss of community facilities/ open space, and changes in access to community facilities during operation** **Community concern and disruption to people from property acquisition and/or termination of existing residential leases** **Community concern with proposed changes to the character of local areas** **Social impact on broader community from construction activities** **Impacts, or temporary loss of, community facilities/open space due to construction activities and/or changes to access during construction**	Concept Stage 1	Consequence: Major Likelihood: Likely Risk rating: High	The Concept would facilitate transit-oriented development through the generation of new rail catchment areas. Health and liveability benefits would primarily be associated with increased active transport opportunities around stations. Stage 1 would require the acquisition of residential properties for the proposed station sites and construction areas. Construction activities may result in some social impacts, at the individual and community level at various sites along the corridor. Construction activities may result in the temporary or permanent loss of community facilities and/or public open space. Opportunities to minimise these impacts (such as replacement of facilities within the local area) would be explored.

Potential impact	Relevance	Risk analysis	Discussion
Business impacts			
Alterations to access, visibility and amenity during operation Disruptions to servicing, deliveries and access during construction (including from traffic congestion) Loss of power and utilities by planned or accidental shutdowns during construction Reduced visibility through the presence of construction activities, hoardings and other structures Deterioration of amenity (particularly due to noise, vibration, visual and air quality impacts) Property acquisition or termination of existing leases, and associated business displacement or loss	Concept Stage 1	Consequence: Major Likelihood: Likely Risk rating: High	Operation of the Concept would provide benefits for some businesses located close to new metro stations. Stage 1 would require the acquisition of businesses for the proposed station sites and construction areas. Businesses adjacent to construction site may also be temporarily impacted by changes to amenity, access and visibility of the business. Increased business activity would be facilitated for businesses that supply to construction and certain business types near construction sites.
Hydrology and flooding			
Alterations to existing stormwater flows and the existing stormwater drainage infrastructure Impacts on construction activities due to flooding Impacts on flood-prone areas (e.g. increase in flood risk outside the construction sites) due to new structures or filling Flooding of the tunnels or other infrastructure during construction and operation	Concept Stage 1	Consequence: Moderate Likelihood: Likely Risk rating: High	A number of sites 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.
Biodiversity			
Impacts on threatened ecological communities within or proximate to the construction footprint Impacts on groundwater dependent ecosystems Impact on native vegetation Impacts on threatened flora species Impacts on threatened fauna species, migratory and endangered populations due to clearing of habitat, demolition of existing buildings and structures and/or as a result of collisions with construction plant and vehicles Indirect impacts on biodiversity values such as from light and noise impacts, sedimentation, spread of weeds	Concept Stage 1	Consequence: Minor Likelihood: Likely Risk rating: Medium	The potential for biodiversity impacts is anticipated to be limited. While sites proposed for construction may provide suitable habitat for some threatened fauna species and endangered populations, the potential removal of this habitat (developed structures and isolated trees) is considered to be minor and these species are likely to be highly mobile and would able to re-locate to other areas. Any species present would likely to be accustomed to existing urban impacts such as noise and light spill which are already occurring.

Potential impact	Relevance	Risk analysis	Discussion
Air quality			
Impacts on local air quality due to construction plant and equipment and increase in vehicle movements **Impacts on local air quality during construction due to dust generation from exposed surfaces, spoil stockpiles or spoil haulage** **Impacts on local air quality during operation**	Concept Stage 1	Consequence: Minor Likelihood: Unlikely Risk rating: Low	Potential air quality impacts during construction and operation are anticipated to be similar to other infrastructure projects of this nature and scale. These impacts would be manageable through the implementation of standard environmental management measures. The Concept could contribute to long-term improvements in air quality if a mode shift by customers occurs from road to rail.
Greenhouse gas and energy			
Emissions of greenhouse gases from embodied energy in materials **Emissions of greenhouse gases from construction activities including energy use for tunnel boring machines over and above emissions for similar projects of a comparable scale**	Concept Stage 1	Consequence: Minor Likelihood: Unlikely Risk rating: Low	The Concept could contribute to a long-term reduction in greenhouse gas emissions associated with a potential mode shift by customers from road to rail. The generation of greenhouse gas emissions during construction would be similar to other infrastructure projects of this nature and scale. These impacts would be manageable through the implementation of standard environmental management measures. Options to reduce greenhouse gas emissions and energy use when compared to other metro projects would be investigated.
Climate change adaptation			
Impact of climate change on rail operations and infrastructure **Impact of climate change on customer and staff comfort**	Concept	Consequence: Moderate Likelihood: Rare Risk rating: Low	Potential climate change impacts have been considered through design development and would be manageable through the implementation of appropriate design standards.
Waste management and resource use			
Impacts associated with inappropriate management of waste during construction and operation **Impacts associated with the management and disposal of excess spoil from tunnel construction** **Increased demand on electricity and water supply during construction and operation** **Increased demand on local and regional resources including sand and aggregate during construction** **Increased diesel use during construction**	Concept Stage 1	Consequence: Minor Likelihood: Unlikely Risk rating: Low	The generation of waste and the anticipated resource consumption during construction would be similar to other infrastructure projects of this nature and scale. These impacts would be manageable through the implementation of standard environmental management measures (such as application of the waste management hierarchy). Strategies for spoil management will be developed. Construction activities would be unlikely to result in any resource becoming scarce or in short supply.

Potential impact	Relevance	Risk analysis	Discussion
Hazard and risk			
Incidents associated with transport and storage of hazardous substances and dangerous goods during construction **Potential for tunnel collapse during construction**	Concept Stage 1	Consequence: Moderate Likelihood: Rare Risk rating: Low	Potential hazards and risks during construction and operation would be manageable through the implementation of appropriate design standards and construction methodologies.
Cumulative impacts			
Cumulative construction noise and traffic associated with other major projects **Spoil management and disposal from multiple tunnelling projects in Sydney** **Construction fatigue of local communities affected by multiple projects either at the same time or closely following each other**	Concept Stage 1	Consequence: Major Likelihood: Almost certain Risk rating: Very high	Construction activities may be carried out concurrently with, or consecutively to, a number of other major infrastructure projects in Sydney. This may result in cumulative impacts associated with noise and traffic during construction, particularly around Parramatta and The Bays Precinct. Strategies for spoil management would consider coordination with other projects.

10.4 Issue categorisation

Based on the consequence and likelihood definitions, 'key' issues are identified as those with a risk rating of high or very high, and 'other' issues are those with a risk rating of low or medium. A summary of risk ratings and issues categorisation is included in Table 10-5.

Key issues are considered to warrant a more detailed assessment in the Environmental Impact Statement and may require specific mitigation to be developed to manage potential impacts. Other issues are not expected to raise major environmental risks and/or have well known and tested standard mitigation and management strategies.

Based on consideration of the location and types of impacts that could arise, the inclusion of one or both of the strategic station options (at Rydalmere and Pyrmont) would not change the overall risk rating or categorisation for any issue.

Table 10-5: Summary of risk ratings and issue categorisation

Potential impact	Relevance	Risk rating	'Key' or 'other' issue
Construction traffic and transport	• Concept • Stage 1	High	Key issue
Operational traffic and transport	• Concept	Low	Other issue
Construction noise and vibration	• Concept • Stage 1	Very high	Key issue
Operational noise and vibration	• Concept	Low	Other issue
Non-Aboriginal heritage	• Concept • Stage 1	High	Key issue
Aboriginal heritage	• Concept • Stage 1	High	Key issue
Property and land use	• Concept • Stage 1	High	Key issue
Landscape character and visual amenity	• Concept • Stage 1	High	Key issue
Groundwater and geology	• Concept • Stage 1	Medium	Other issue
Soils and water quality	• Concept • Stage 1	Low	Other issue
Contamination	• Concept • Stage 1	High	Key issue
Social impacts and community infrastructure	• Concept • Stage 1	High	Key issue
Business impacts	• Concept • Stage 1	High	Key issue
Hydrology and flooding	• Concept • Stage 1	High	Key issue
Biodiversity	• Concept • Stage 1	Medium	Other issue
Air quality	• Concept • Stage 1	Low	Other issue
Greenhouse gas and energy	• Concept • Stage 1	Low	Other issue
Climate change adaptation	• Concept	Low	Other issue
Waste management and resource use	• Concept • Stage 1	Low	Other issue
Hazard and risk	• Concept • Stage 1	Low	Other issue
Cumulative impacts	• Concept • Stage 1	Very high	Key issue

11 Summary of proposed Environmental Impact Statement scope

11 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.

This chapter provides a summary of the proposed Environmental Impact Statement assessment scope for the Concept and Stage 1, based on the outcomes of the preliminary environmental risk analysis (Chapter 10) and preliminary environmental assessments for the Concept (Chapter 7) and Stage 1 (Chapter 9).

The proposed Environmental Impact Statement scope generally focuses on carrying out further specialist assessment for the 'key' environmental issues, based on the potential significance of the resulting impacts.

Some further assessment of the 'other' environmental issues will also be carried out. This will be used to help confirm the current assumption that these 'other' environmental issues would not result in a significant impact on the environment and could be appropriately managed through the application of design and/or best practice environmental management measures. Should any 'other' environmental issue be identified as being significant during the environmental assessment process, the likely impacts would be adequately assessed and documented in the Environmental Impact Statement.

11.1 Concept level assessment

11.1.1 Proposed Environmental Impact Statement scope for key issues

Table 11-1 provides a summary of the proposed Environmental Impact Statement assessment scope for 'key' environmental issues for the Concept. This scope will be refined (if necessary) following receipt of the Secretary's Environmental Assessment Requirements.

Table 11-1: Proposed Environmental Impact Statement assessment scope for Concept key issues

Issue	Proposed Environmental Impact Statement scope
Traffic and transport	The traffic and transport assessment will include: ○ Description of how, at a conceptual level, Sydney Metro West will meet the transport related objectives of relevant strategic plans, including consideration of future growth areas ○ Description of the overall strategy for managing construction sites to minimise potential adverse construction transport and traffic impacts ○ Identification of the types of adverse impacts which could occur on the regional and local road network during construction including: • Pedestrian and cyclist movements around the construction sites • Impacts on access to existing stations at Westmead and North Strathfield • Impacts on public transport (including rail, buses, school buses and light rail) • Impacts on private transport such as school bus services • Impacts on the performance of the surrounding road network • Impacts on emergency services, residential property access and local businesses ○ Identification of the likely traffic and transport impacts on the regional and local road network during operation and on existing and proposed public transport routes, taking into account relevant government transport planning strategies ○ Identification of the transport related benefits at a conceptual level including the principles for integrating with and encouraging active transport ○ The proposed scope of future traffic and transport assessments to be carried out as part of planning approvals for subsequent stages.

Issue	Proposed Environmental Impact Statement scope
Noise and vibration	The noise and vibration assessment will include: • Identification of the types of construction activities likely to generate high noise and vibration levels, and the likely affected receivers • Identification of potential operational noise and vibration impacts, with consideration of existing and future known land uses • Strategies for noise mitigation and management • The proposed scope of future noise and vibration assessments to be carried out as part of planning approvals for subsequent stages.
Non-Aboriginal heritage	The non-Aboriginal heritage assessment will include: • Information on how the development of the Concept has avoided or minimised impacts on heritage items • Identification of items, areas of heritage significance and archaeological resources that could be affected during its construction and operation • A general assessment of the type of impacts that may affect heritage items • An outline of potential mitigation measures and strategies • The proposed scope of future non-Aboriginal heritage assessments to be carried out as part of planning approvals for subsequent stages • Consultation with heritage specialists within the Department of Premier and Cabinet and local councils.
Aboriginal heritage	The Aboriginal heritage assessment will include: • Further consideration of the Aboriginal archaeological potential along the Concept corridor • Identification of the potential to disturb Aboriginal heritage • An outline of potential mitigation measures and strategies • Identification of the proposed scope of future Aboriginal heritage assessments, including the need for further archaeological testing and/or detailed archaeological excavations, that would be carried out as part of planning approvals for subsequent stages • Consultation with heritage specialists within the Department of Premier and Cabinet, local councils and registered Aboriginal parties.
Property and land use	The property and land use assessment will include: • Likely future land use based on zoning, planning proposals, major development applications and consultation with local councils and the Department of Planning, Industry and Environment • Direct impacts on property and land use • Indirect positive and negative impacts on property and land use, including potential land use integration issues, potential opportunities and/or benefits for urban renewal and development at and around metro stations • The proposed scope of future property and land use assessments to be carried out for subsequent stages of the Concept.
Landscape character and visual amenity	The landscape character and visual amenity assessment will include: • A high-level description of the visual character and qualities of the Concept corridor • Identification of the types of visual impacts which may occur due to construction and operation • Identification of potential landscape character changes due to the introduction of the Concept • An outline of urban design principles and objectives to guide further design and help minimise the impacts of potential infrastructure on surrounding visual or urban form • The proposed scope of future landscape character and visual amenity assessments to be carried out as part of planning approvals for subsequent stages of the Concept.
Contamination	The contamination assessment will include: • A review of available data and previous reports • Identification of the potential to encounter contamination • Identification of the proposed scope of future contamination assessments to be carried out as part of planning approvals for subsequent stages of the Concept • Consultation with the Environment Protection Authority.

Issue	Proposed Environmental Impact Statement scope
Social impacts and community infrastructure	The social impact assessment will include: • Identification of the regional level social and community facilities along the corridor (including public open spaces and recreational areas) • Identification of potential social impacts on the community and community facilities / services which could occur during construction and operation • Identification and assessment of potential social benefits • Identification of the proposed scope of future social impact assessments to be carried out as part of planning approvals for subsequent stages.
Business impacts	The business impact assessment will include: • Identification of the general types of businesses impacts (both direct and indirect) which could occur during construction and operation • The proposed scope of future business impact assessments to be carried out as part of planning approvals for subsequent stages.
Hydrology and flooding	The hydrology and flooding assessment will include: • Identification of the types of hydrology and flooding impacts which could occur during construction and operation • The proposed scope of future hydrology and flooding impact assessments to be carried out as part of planning approvals for subsequent stages of the Concept.
Cumulative impacts	The cumulative impact assessment will include: • Identification of known surrounding developments with the potential to interact with the construction of the Concept • Qualitative assessment of the potential cumulative impacts arising from the interaction of these projects • Consideration of the management approach to identified impacts and performance outcomes for cumulative impacts • Identification of matters that would be addressed in applications for future stages.

11.1.2 Proposed Environmental Impact Statement scope for other environmental issues

Table 11-2 provides a summary of the proposed Environmental Impact Statement assessment scope for 'other' environmental issues for the Concept. This scope will be refined (if necessary) following receipt of the Secretary's Environmental Assessment Requirements for the Environmental Impact Statement. 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 11-2: Proposed Environmental Impact Statement assessment scope for Concept other issues

Issue	Proposed Environmental Impact Statement scope
Groundwater and geology	The groundwater and geology assessment will include: • Identification of sensitive groundwater users (registered groundwater bores) near the Concept corridor • Identification of the types of groundwater impacts (such as drawdown and settlement) that may occur during construction and operation • The proposed scope of future groundwater and geology assessments to be carried out as part of planning approvals for subsequent stages of the Concept.
Soils and surface water quality	The soils and surface water quality assessment will include: • An overview of existing catchment and Water Quality Objectives for waterbodies within the Concept corridor • Identification of potential impacts on soils and water quality including surface water quality, acid sulfate soils, erosion and sedimentation • The proposed scope of future soil and water assessments to be carried out as part of planning approvals for subsequent stages • Consultation with the Environment Protection Authority.
Biodiversity	The biodiversity assessment will include: • Identification of the potential presence of any endangered ecological communities, threatened species or threatened species habitat and the nature of any potential impacts • Identification of the proposed scope of future biodiversity assessments to be carried out as part of planning approvals for subsequent stages.
Air quality	The air quality assessment will include: • Identification of the background air quality environment based on a desktop assessment • Identification of potential sources of air emissions during both construction and operation • The proposed scope of future air quality assessments to be carried out as part of planning approvals for subsequent stages.
Greenhouse gas and energy	The greenhouse gas and energy assessment will include: • Identification of the activities which are likely to be the major source of greenhouse gas emissions during construction and operation • The proposed scope of future greenhouse gas assessments to be carried out as part of planning approvals for subsequent stages of the Concept.
Climate change adaptation	The climate change adaptation assessment will include: • Identification of potential climate change risks to the Concept • Identification of high level adaptation measures to respond to the identified risks • The proposed scope of future climate change assessments to be carried out as part of planning approvals for subsequent stages of the Concept.
Waste management and resource use	The waste management and resource use assessment will include: • Identification of the waste streams likely to be generated during construction and operation • Identification of the expected resource use during construction and operation • The proposed scope of future waste management assessments to be carried out as part of planning approvals for subsequent stages.
Hazard and risk	The hazard and risk assessment will include: • Identification of the types of hazards and risks that could occur during construction and operation • The proposed scope of future hazard and risk assessments to be carried out as part of planning approvals for subsequent stages.

11.2 Stage 1 assessment

11.2.1 Proposed Environmental Impact Statement scope for key issues

Table 11-3 provides a summary of the proposed Environmental Impact Statement assessment scope for 'key' environmental issues for Stage 1. This scope will be refined (if necessary) following receipt of the Secretary's Environmental Assessment Requirements.

Table 11-3: Proposed Environmental Impact Statement assessment scope for Stage 1 key issues

Issue	Proposed Environmental Impact Statement scope
Construction traffic and transport	A detailed construction traffic and transport impact assessment will be carried out as part of the Environmental Impact Statement. Relevant government guidelines that will be considered include: • Guide to Traffic Management – Part 3 Traffic Studies and Analysis (Austroads, 2017) • Cycling Aspects of Austroads Guides (Austroads, 2014) • Guide to Traffic Generating Developments Version 2.2 (RTA, 2002). The assessment will include the construction traffic impacts on the local and regional traffic network, including public transport, the existing rail network, cyclists and pedestrians, and will include: • Identification of haulage routes, site access and egress points • Daily and peak traffic movements likely to be generated and the potential impacts on the local and regional traffic network • Service adjustments required to rail and bus services to allow for construction activities to safely occur • Temporary adjustments to vehicular, pedestrian, cyclist, emergency services and public transport access • Adjustments to parking supply, loading zones, servicing access and taxi zones • Temporary altered access to private property • Measures to minimise or mitigate identified impacts, including an assessment of available options and the expected effect of the measures proposed, in accordance with relevant best practice guidelines.
Construction noise and vibration	A detailed construction noise and vibration impact assessment will be carried out as part of the Environmental Impact Statement. Relevant government and industry guidelines that will be considered include: • Sydney Metro City and Southwest Construction Noise and Vibration Strategy (Sydney Metro, 2017) • Interim Construction Noise Guideline (Department of Environment, Climate Change and Water, 2009) • Noise Policy for Industry (Environment Protection Authority, 2017) • NSW Road Noise Policy (Department of Environment, Climate Change and Water, 2011a) • Assessing Vibration: A Technical Guideline (Department of Environment and Conservation, 2006a) • Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (Australian and New Zealand Environment Council, 1990). The noise and vibration impact assessment will consider: • The nature of construction activities • The intensity and duration of noise and vibration impacts. This will include a 'typical level' or 'typical range' in noise levels which would be expected as construction work moves around the site as well as a realistic 'worst-case' noise level from each activity • The correlation between the likely noise impacts and the anticipated duration and timing of the activity • The nature, sensitivity and impact on potentially affected receivers, including consideration of particularly sensitive receivers if present within the vicinity (such as schools, hospitals, aged care facilities) and sensitive structures (particularly heritage structures and key utilities/infrastructure) • Impacts associated with any work proposed to be carried out outside standard daytime construction hours • The potential impacts associated with long term construction noise

Issue	Proposed Environmental Impact Statement scope
Construction noise and vibration cont.	○ Explanation of how the extent of potential impacts on sensitive receivers have been balanced against the duration of impacts ○ 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.
Non-Aboriginal heritage	A non-Aboriginal heritage assessment will be carried out as part of the Environmental Impact Statement. The following government guidelines will be considered as relevant during the preparation of the non-Aboriginal heritage assessment: ○ 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 Heritage Manual (NSW Heritage Office and Department of Urban Affairs and Planning, 1996) ○ Assessing Heritage Significance (NSW Heritage Office, 2001) ○ Statements of Heritage Impact (NSW Heritage Office, 2002) ○ 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 Stage 1, by field survey and research, including any buildings, work, 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 Stage 1, including items both above and below ground and, where such potential exists, the likely significance of those impacts ○ 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.
Aboriginal heritage	An Aboriginal heritage assessment will be carried out as part of the Environmental Impact Statement. The following government guidelines will be considered as relevant 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, 2011b) ○ Aboriginal Cultural Heritage Consultation Requirements for Proponents (Department of Environment, Climate Change and Water, 2010) ○ Code of practice for archaeological investigation of Aboriginal objects in NSW (Department of Environment, Climate Change and Water, 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 Stage 1 to disturb Aboriginal heritage (sites, objects, remains, values, features or places) and, where this is the case, to: • 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 ○ Identify any requirements for in-situ conservation of items and/or areas (as appropriate), and the need for further archaeological testing and/or detailed archaeological excavations ○ Identify appropriate measures to avoid, minimise and/or mitigate potential impacts.

Issue	Proposed Environmental Impact Statement scope
Property and land use	A property and land use assessment will be carried out as part of the Environmental Impact Statement. The following guidelines will be used as relevant during the preparation of the property and land use assessment for Stage 1: • Environmental Planning and Impact Assessment Practice Note: Socio-economic Assessment (Roads and Maritime Services, 2013) • Better Placed (NSW Government Architect, 2017a) • Draft Greener Places (NSW Government Architect, 2017b) The Environmental Impact Statement will identify potential impacts on property and land use, including the following issues: • Direct impacts on property and land use, including acquisition and leasing • Impacts on Crown land and Commonwealth land
Landscape character and visual amenity	A visual and urban design assessment will be carried out as part of the Environmental Impact Statement. The following guidelines will be used as relevant during the preparation of the visual and urban design assessment for Stage 1: • Guidance note EIA-N04 Guidelines for Landscape Character and Visual Impact Assessment, (Roads and Maritime Services, 2018) • Guidelines for Landscape and Visual Impact Assessment (Landscape Institute and Institute of Environmental Management and Assessment, 2013) • Guidance Note for Landscape and Visual Assessment (Australian Institute of Landscape Architects, 2018) • AS4282-1997 Control of the obtrusive effects of outdoor lighting. The assessment will: • Describe the visual character and unique qualities of the Stage 1 area • Consider the heritage and other social values of the site to establish the potential sensitivity of receivers and visual absorption capacity • Identify the visual impacts of Stage 1 during daytime and night-time conditions (including lighting) • Identify measures to avoid, minimise and/or mitigate potential impacts.
Contamination	A contamination assessment will be carried out as part of the Environmental Impact Statement. Relevant government guidelines that will be considered include: • 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, reprinted 2011) • Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (Environment Protection Authority, 2015) • National Environmental Protection (Assessment of Site Contamination) Measure 1999, as amended 2013. The contamination assessment will include: • A review of previous contamination assessments (where available) • A review of historical aerial photography and plans to identify potential contamination sources along and/or adjacent to Stage 1 construction sites • A review of publicly available data (web-based information searches) • A site inspection to identify potential contamination sources and verify those potential areas of concern identified in the review of historical and available information • Recommendations for additional investigations and/or management of potentially contaminated sites which could be encountered during construction.

Issue	Proposed Environmental Impact Statement scope
Social impacts and community infrastructure	An assessment of potential social impacts will be carried out as part of the Environmental Impact Statement. Relevant government guidelines that will be considered include: • Social Impact Assessment: Guidance for assessing and managing the social impacts of projects (International Association for Impact Assessment, 2015) • SIA principles: International Principles for Social Impact Assessment (Vanclay, 2003) • Environmental Planning and Impact Assessment Practice Note: Socio-economic Assessment (Roads and Maritime Services, 2013) • Social Impact Assessment Guideline for State significant mining, petroleum production and extractive industry development (Department of Planning and Environment, 2017b). This assessment will: • Identify the existing social environment and any impacts to social conditions, communities and community values within the areas around the Stage 1 construction sites • Review community characteristics, including identification of significant community infrastructure • Assess the social impact on the directly affected community and its facilities and /or services around the Stage 1 construction sites • Identify any community facilities that would be lost as a result of Stage 1, and if alternative facilities are available or if the facilities can be replaced in the local area • Identify community facilities adjacent to construction sites that may be impacted by reduced amenity or access • Propose mitigation and management measures for the potential impacts.
Business impacts	A business impact assessment will be prepared as part of the Environmental Impact Statement. The assessment will consider relevant government and industry guidelines including the Environmental Planning and Impact Assessment Practice Note: Socio-economic Assessment (Roads and Maritime Services, 2013). The assessment will: • Identify businesses that would be directly impacted by Stage 1 • Identify nearby local businesses that may be indirectly impacted by Stage 1 • Assess the potential impacts of Stage 1 on local businesses • Identify measures to avoid or mitigate the potential impacts.
Hydrology and flooding	A hydrology and flooding impact assessment will be prepared as part of the Environmental Impact Statement. Relevant government guidelines that will be followed include: • Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) and Volume 2 (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E. Mines and Quarries) (Department of Environment and Climate Change, 2008) • Floodplain Development Manual (NSW Government, 2005). The assessment will include: • Identification of potential impacts on stormwater quantity • Broad assessment of the potential change in stormwater runoff (increase or decrease) • Identification of potential impacts as a result of changes in surface water quantity, with respect to increases or decreases in stormwater runoff and the sensitivity of the downstream waters • Identification of any potential changes to flood levels, discharges, velocities, duration of flood inundation and flood hazards for the five per cent and one per cent Annual Exceedance Probability flood events, and the probable maximum flood • Identification of appropriate mitigation and management measures.
Cumulative impacts	An assessment of potential cumulative impacts will be carried out as part of the Environmental Impact Statement. This assessment will include: • Identification of known surrounding developments with the potential to interact with Stage 1 construction (these will be identified through consultation with stakeholders and a review of relevant local environmental plans, the Department of Planning, Industry and Environment's major projects database and local council development application registers) • Qualitative assessment of the potential cumulative impacts arising from the interaction of these projects • Management and mitigation measures, where appropriate.

11.2.2 Proposed Environmental Impact Statement scope for other environmental issues

Table 11-4 provides a summary of the proposed Environmental Impact Statement assessment scope for 'other' environmental issues for Stage 1. This scope will be refined (if necessary) following receipt of the Secretary's Environmental Assessment Requirements. Should any of these 'other' environmental issues 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 11-4: Proposed Environmental Impact Statement assessment scope for Stage 1 other issues

Issue	Proposed Environmental Impact Statement scope
Groundwater and geology	A desktop-based hydrogeological assessment will be carried out as part of the Environmental Impact Statement. The NSW Aquifer Interference Policy (Department of Primary Industries, 2012) will be considered as relevant during the preparation of the hydrogeology assessment. The hydrogeological assessment will: • Describe the aquifer system(s) traversed by Stage 1 • Identify existing groundwater levels along the alignment and near the stations and portals • Identify sensitive groundwater receptors (registered groundwater bores) • Discuss the nature and extent of potential impacts on groundwater associated with construction, including tunnels, portals and station excavations. This would take into account existing groundwater levels, the geological context, the extent to which the infrastructure is 'tanked' (designed to inhibit the inflow of groundwater) and experience on other projects (including groundwater inflow rates) • Identify potential impacts on groundwater quality • Propose monitoring/management measures to address identified impacts
Soils and surface water quality	A soils and surface water quality assessment will be carried out as part of the Environmental Impact Statement. The following government guidelines will be considered as relevant: • Acid Sulfate Soils Assessment Guidelines (Department of Planning, 2008) • Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004) • Managing Urban Stormwater: Soils and Construction Volume 2 (Department of Environment and Climate Change, 2008) • Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (Department of Environment and Conservation, 2004) • Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000) • Using the ANZECC Guidelines and Water Quality Objectives in NSW (Department of Environment and Conservation, 2006b). The soils and surface water quality assessment will include: • Identify potential impacts on surface water quality • Identify the potential to disturb acid sulfate soils and the associated impacts • Consider the potential impacts associated with erosion and sedimentation • Propose monitoring and management measures to address identified impacts.
Biodiversity	A biodiversity assessment will be prepared as part of the Environmental Impact Statement. The following government guidelines will be considered as relevant during preparation of the ecology assessment: • Commonwealth EPBC 1.1 Significant Impact Guidelines – Matters of National Environmental Significance (Commonwealth of Australia, 2013) • Commonwealth EPBC 1.2 Significant Impact Guidelines – Actions on, or Impacting upon, Commonwealth Land and Actions by Commonwealth Agencies (Commonwealth of Australia, 2013) • Commonwealth Department of the Environment and Energy – Nationally Threatened Ecological Communities and Threatened Species Guidelines (various) • Commonwealth Department of the Environment and Energy – Survey Guidelines for Nationally Threatened Species (various) • Biodiversity Assessment Method (Office of Environment and Heritage, 2017a) • NSW Biodiversity Offsets Scheme (Office and Environment and Heritage, 2017b)

Issue	Proposed Environmental Impact Statement scope
Biodiversity cont.	• Policy and Guidelines for Fish Habitat Conservation and Management – Update 2013 (Department of Primary Industries, 2013) • Threatened species survey and assessment guidelines at http://www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm (various). The biodiversity assessment will be based on a desktop review of database searches, regional biodiversity mapping and any relevant existing site-specific reports, as well as site inspection and detailed targeted field surveys, if necessary. The biodiversity assessment will: • Identify and describe the flora and fauna species, habitat, populations and ecological communities (including groundwater dependent ecosystems) that occur or are considered likely to occur • Assess the direct and indirect impacts of Stage 1 on terrestrial and aquatic flora and fauna species, populations, ecological communities and their habitats, and groundwater dependent ecosystems • Assess the significance of the impacts of Stage 1 on species, ecological communities and populations, and groundwater dependent ecosystems listed under the EPBC Act, the Biodiversity Conservation Act 2016 and *Fisheries Management Act 1994* that occur or are considered likely to occur • Identify and describe mitigation measures using the principles of 'avoid, minimise, mitigate', and propose offsets where residual impacts would occur. Offsets would be determined in accordance with the NSW Biodiversity Offsets Scheme (Office and Environment and Heritage, 2017b).
Air quality	An air quality impact assessment will be prepared as part of the Environmental Impact Statement. The assessment will: • Identify and describe the background air quality environment based on a desktop assessment • Identify potential sources of air emissions during Stage 1 • Identify potential sensitive receivers likely to be impacted by emissions to air during Stage 1 • Identify and describe mitigation measures using the principles of 'avoid, minimise, and mitigate'.
Greenhouse gas and energy	A greenhouse gas and energy assessment will be prepared as part of the Environmental Impact Statement. The assessment will: • Identify the potential greenhouse gas emissions from Stage 1 • Identify mitigation and management measures to reduce potential emissions of greenhouse gas.
Climate change adaptation	A climate change adaptation assessment will be prepared as part of the Environmental Impact Statement. The following guidelines will be considered as relevant: • Commonwealth Scientific and Industrial Research Organisation's Climate Change in Australia Technical Report 2015 • ISO 31000-2018; Risk Management – Principles and Guidelines • AS 5334 – Climate Change Adaptation for Settlements and Infrastructure • Australian Rainfall & Runoff Guidelines: A guide to flood estimation 2019 • Transport for NSW Climate Risk Assessment Guidelines (9TP-SD-081 Version 3.0, 2018) • AS 5334:2013 Climate change adaptation for settlements and infrastructure – A risk based approach • CoastAdapt Web Portal (https://coastadapt.com.au) The assessment will: • Identify possible climate related impacts with an emphasis on any that are projected to undergo a substantial change • Identify Stage 1 components that may be vulnerable to the climate change impacts • Identify possible current and future controls that may increase the resilience of particular Stage 1 components to climate impacts • Recommend what should be considered, and how to establish if further information is needed, to adequately assess climate change risk.

Issue	Proposed Environmental Impact Statement scope
Waste management and resource use	A desktop waste and resource assessment will be carried out as part of the Environmental Impact Statement. This assessment will include: ○ A review of the likely waste streams and volumes from Stage 1 construction, including spoil, wastewater and demolition materials ○ A review of the likely resources required for Stage 1 construction, including energy, fuel and steel ○ Management strategies to adequately address waste and resource use during construction. These strategies would likely include: • Measures for managing construction waste through the waste hierarchy established under the *Waste Avoidance and Resource Recovery Act 2001* (i.e. avoidance of waste, resource recovery, disposal of waste) • Targets for the beneficial reuse of spoil, wastewater and other construction wastes in accordance with a future Sydney Metro West sustainability plan • An approach for assessing, handling, stockpiling and disposing of potentially contaminated materials and wastewater, in accordance with the Waste Classification Guidelines (Environment Protection Authority, 2014) • Identification of opportunities to reduce demand on electricity and other resources ○ Identification of how spoil would be managed during construction including likely volumes, likely nature and classification of excavated material, opportunities for recycling, potential disposal sites, stockpile management, and method(s) and transport routes. This would consider the cumulative effects of spoil haulage and disposal activities associated with other Sydney based tunnel projects.
Hazard and risk	A high level, desktop hazard and risk assessment will be prepared as part of the Environmental Impact Statement and mitigation measures will be proposed, where relevant. This assessment will incorporate an assessment of potential impacts on key identified active or disused public trunk utilities infrastructure (including communications, electricity, gas, and water and sewerage) and any crossings of existing high pressure fuel line(s). Relevant government and industry guidelines that will be followed include: ○ Hazardous and Offensive Development Application Guidelines: Applying SEPP 33 (Department of Planning, 2011a) ○ International Standard (ISO/IEC 31010:2009) Risk management – Risk assessment techniques ○ Australian Code for the Transport of Dangerous Goods by Road and Rail (edition 7.6) (National Transport Commission, 2018) ○ Model Code of Practice: How to manage and control asbestos in the workplace (Safework Australia, 2018) ○ Code of Practice: How to Safely Remove Asbestos (Safework NSW, 2016) ○ Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005), noting this Code is a guide for processes and controls to manage risks and is not to be relied upon to ascertain requirements under the Work Health and Safety Regulation 2011. ○ Australian Standard AS 2885 Pipelines – Gas and liquid petroleum ○ Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis (Department of Planning, 2011b) and Multi-Level Risk Assessment (Department of Planning, 2011c).

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12 Conclusion

12 Conclusion

This chapter provides a conclusion to the report and identifies the next steps following receipt of the Secretary's Environmental Assessment Requirements.

Given the current and forecast extra 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 the capacity of the transport network, through initiatives like Sydney Metro West, are critical.

Sydney Metro West is an integrated land use and transport project that would connect Greater Parramatta and the Sydney CBD in around 20 minutes, and significantly improve the customer experience with ultimate 'turn-up-and-go' services every two minutes.

Sydney Metro West would provide a fast, reliable and frequent link between Greater Parramatta and the Sydney CBD to:

- Relieve the congested T1 Western Line, T9 Northern Line and T2 Inner West Line
- Provide travel-time savings for customers in Western Sydney and along the corridor
- Reduce crowding at some stations
- Provide rail transport to areas where it is currently not available
- Connect Greater Parramatta and Sydney CBDs to support the vision for a metropolis of three cities
- Support delivery of the '30-minute city' as identified Future Transport Strategy 2056
- Reinforce Greater Parramatta as the Central River City
- Improve connectivity to major attractions and key precincts located along the corridor, including Sydney Olympic Park and The Bays Precinct
- Support urban renewal and increase housing supply
- Increase accessibility across Sydney and provide customers with a new world-class metro service.

Sydney Metro is seeking approval for the Sydney Metro West Concept, between Westmead and the Sydney CBD, and for the first stage (Stage 1), being the major civil construction work between Westmead and The Bays Precinct.

Sydney Metro is seeking a declaration for Sydney Metro West to be State significant infrastructure and critical State significant infrastructure under sections 5.12(4) and 5.13 of the EP&A Act, respectively. Therefore, Sydney Metro West would be subject to assessment and approval by the Minister for Planning and Public Spaces under Part 5, Division 5.2 of the EP&A Act.

A preliminary environmental risk analysis has identified the following 'key' environmental issues that are relevant to the assessment of both the Concept and Stage 1:

- Construction traffic and transport
- Construction noise and vibration
- Non-Aboriginal heritage
- Aboriginal heritage
- Property and land use
- Landscape character and visual amenity
- Contamination
- Social impacts and community infrastructure
- Business impacts
- Hydrology and flooding
- Cumulative impacts.

Following the receipt of the Secretary's Environmental Assessment Requirements, Sydney Metro will prepare and publicly exhibit an Environmental Impact Statement, in accordance with the requirements of Division 5.2 of the EP&A Act, at which time the community will be encouraged to have their say via a formal submission.

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13 References

13 References

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14 Glossary and abbreviations

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Term / acronym	Definition
AHIMS	NSW Office of Environment and Heritage's Aboriginal Heritage Information Management System
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AS	Australian Standard
Core stations	Stations at Parramatta, Sydney Olympic Park, The Bays Precinct and Sydney CBD that would provide connections to key centres along the corridor
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Infrastructure SEPP	*State Environmental Planning Policy (Infrastructure) 2007*
ISO	International Organization for Standardization
Kiss and ride	A place to temporarily park a car for the dropping off and picking up of passengers
pH	A figure expressing the acidity or alkalinity of a substance on scale on which seven is neutral, lower values are more acid and higher values more alkaline
PM	Particulate matter
The proponent	Sydney Metro
S170 Register	Section 170 Register under the NSW *Heritage Act 1977*
SEPP	State environmental planning policy
Stage 1	Stage 1 would involve major civil construction work between Westmead and The Bays Precinct.
State and Regional Development SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
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. The Sydney Metro City & Southwest involves two core components – the Chatswood to Sydenham tunnelling project and the South west extension to Bankstown
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. The Sydney Metro Northwest is the first stage of the NSW Government's plan to develop a metro rail system in Sydney
Sydney Metro West Concept	The Sydney Metro West Concept involves construction and operation of a 24 kilometre metro rail line between Westmead and the Sydney CBD.

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Appendix A

Requirements of the Environmental Planning and Assessment Regulation 2000

Appendix A

Requirements of the Environmental Planning and Assessment Regulation 2000

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

- Details of any approval that would, but for section 5.23 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), be required for the carrying out of the State significant infrastructure
- Details of any authorisations that must be given under section 5.24 of the EP&A Act if the application is approved, and
- A statement as to the basis on which the proposed infrastructure is State significant infrastructure including, if relevant, the capital investment value of the proposed infrastructure.

The above requirements are provided in the following sections.

Approvals that would otherwise apply

Approvals that may be required to carry out Sydney Metro West, if not for section 5.23 of the EP&A Act, would be:

- Permits under sections 201, 205 and 219 of the *Fisheries Management Act 1994*
- Approvals under Part 4 or excavation permits under section 139 of the *Heritage Act 1977*
- Aboriginal heritage impact permits under section 90 of the *National Parks and Wildlife Act 1974*
- Bush fire safety authority under section 100B of the *Rural Fires Act 1997*
- Various approvals under the *Water Management Act 2000*, including water use approvals under section 89, water management work approvals under section 90, and activity approvals (other than aquifer interference approvals) under section 91.

In addition, Division 8 of Part 6 of the *Heritage Act 1977* does not apply to prevent or interfere with the carrying out of the State significant infrastructure.

Section 5.23 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 potential relevance to Sydney Metro West would be:

- An interim protection order (within the meaning of *National Parks and Wildlife Act 1974)*
- An order under Division 1 (Stop work orders) of Part 6A of the *National Parks and Wildlife Act 1974,* or Division 7 (Stop work orders) of Part 7A of the *Fisheries Management Act 1994*
- A remediation direction under Division 3 (Remediation directions) of Part 6A of the *National Parks and Wildlife Act 1974*
- An order or direction under Part 11 (Regulatory compliance mechanisms) of the *Biodiversity Conservation Act 2016*
- 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.*

Authorisations if the application is approved

Authorisations under section 5.24 of the EP&A Act that may be required for Sydney Metro West if approved would be:

- Environmental protection licence (EPL) under Chapter 3 of the *Protection of the Environment Operations Act 1997*
- A consent under section 138 of the *Roads Act 1993*, which requires consent for 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, among other things. Section 138 of the *Roads Act 1993* only applies to a public authority where the activity affects a classified road.

Other legislation and regulations that may be applicable

A number of other planning related legislation and regulations may still be applicable to an approved critical State significant infrastructure project and based on current scope, may be relevant to Sydney Metro West. The legislation is identified in Table A-1.

Table A-1: Potentially relevant legislation to Sydney Metro West

Legislation	Requirement
Aboriginal Land Rights Act 1983	This Act establishes the NSW Aboriginal Land Council and local Aboriginal land councils. This Act applies to Crown lands that are not lawfully needed for an essential public purpose; referred to as claimable Crown land. No Crown land which is currently under claim would be affected by Sydney Metro West.
Biodiversity Conservation Act 2016	This Act provides a biodiversity assessment framework for relevant work in NSW. The purpose of this Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. The Environmental Impact Statement would include an assessment of biodiversity impacts.
Biosecurity Act 2015	This Act would apply to the control of all noxious weeds encountered during the construction of Sydney Metro West.
Contaminated Land Management Act 1997	This Act outlines the circumstances in which the notification of the Environmental Protection Authority is required in relation to the contamination of land. This may become relevant during the construction and / or operation of Sydney Metro West.
Crown Land Management Act 2016 (NSW)	Sydney Metro West would pass underneath a number of parcels of Crown land. In addition, there is potential for construction compounds to be temporarily located on Crown land. Any affected Crown lands would be managed in accordance with the objectives of this Act.
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 the NSW Government and assist local Councils' council plans or proposals relating to development in the Greater Sydney Region. The Greater Sydney Commission will not have a formal statutory role for Sydney Metro West but will be consulted with respect to its core functions.
Heritage Act 1977 (section 146)	The Heritage Council must be notified if a relic is uncovered during construction and if it is reasonable to believe that the Heritage Council is unaware of the location of the relic. The Heritage Council must also be notified if an item listed on a Government Agency's Section 170 Heritage Register is demolished.
Land Acquisition (Just Terms Compensation) Act 1991	This Act would apply to the acquisition of land for Sydney Metro West.
Marine Pollution Act 2012	This Act includes provisions to protect the sea and waters from pollution by oil and other noxious substances discharged from vessels. Any construction activities requiring the use of a vessel (e.g. a barge) must comply with the requirements of this Act and the Marine Pollution Regulation 2014.

Legislation	Requirement
Native Title (NSW) Act 1994	This Act provides for native title in relation to land or waters. Sydney Metro West would not affect land subject to native title or to which an Indigenous Land Use Agreement applies.
Protection of the Environment Operations Act 1997	An environment protection licence is required for scheduled activities or development work listed by the Act. Schedule 1 lists activities that require a licence and relevantly include: Part 1, clause 33 railway activities—railway infrastructure construction meaning: (a) the construction of railway infrastructure (including the widening or rerouting of existing railway infrastructure) and any related tunnels, earthworks and cuttings. Part 1, clause 33A railway activities—railway infrastructure operations, meaning the operation or the on-site repair, maintenance or replacement of existing railway infrastructure. Part 1, clause 33B railway activities—rolling stock operations, meaning the operation of rolling stock (being railway vehicles used or intended to be used to transport passengers). Air pollution-related sections 124 to 126 (Chapter 5, Part 5.4, Division 1) of the Act require activities to be conducted in a proper and efficient manner, while section 128 (Chapter 5, Part 5.4, Division 1) of the Act requires that all necessary practicable means are used to prevent or minimise air pollution. Pollution of land and waste is covered by Part 5.6 of the Act. It defines offences relating to waste and sets penalties and establishes the ability to set various waste management requirements via the *Protection of the Environment Operations (Waste) Regulation 2014.*
Protection of the Environment Operations (Waste) Regulation 2014	This Regulation provides for exemptions from environment protection licencing for certain resource recovery activities and establishes tracking and reporting requirements for the transport of waste. Any waste generated must be tracked and recorded in accordance with the requirements of the Regulation.
Parramatta Park (Old Government House) Act 1967	The Act appoints the National Trust of Australia (New South Wales) as trustee of the land under the *Crown Lands Act 1989.* The National Trust may use the land for such purposes as the responsible Minister may from time to time approve. Sydney Metro West is not expected to require surface use or access to Parramatta Park, but would be considered against this Act as required.
Parramatta Park Trust Act 2001	This Act controls the current administration and management of Parramatta Park by a statutory trust. Section 9 of the *Parramatta Park Trust Act 2001* prohibits the disposal or compulsory acquisition of principal trust lands except by an Act of Parliament. Leases, easements and licences can only be granted with the approval of the Minister. Sydney Metro West is not expected to require surface use or access to Parramatta Park, but would be considered against this Act as required.
Roads Act 1993	Section 138 of this Act states *A person must not (a) erect a structure or carry out a work in, on or over a public road, or (b) dig up or disturb the surface of a public road, or (c) remove or interfere with a structure, work or tree on a public road, or (d) pump water into a public road from any land adjoining the road, or (e) connect a road (whether public or private) to a classified road, otherwise than with the consent of the appropriate roads authority.* Under Section 38N of the *Transport Administration Act 1988*, Section 138 of the Roads Act 1993 does not apply to Sydney Metro activities in relation to classified roads for which a council is the roads authority. However, consent from Roads and Maritime Services is still required under Section 38N(2) of the *Transport Administration Act 1988* for those activities described in Section 138(1) of the *Roads Act 1993*, when carried out in relation to a classified road.
Transport Administration Act 1988	This Act also applies to compulsory acquisitions for the purpose of underground rail facilities.
Waste Avoidance and Resource Recovery Act 2001	This Act, among other things, encourages the most efficient use of resources and to reduce environmental harm.

Legislation	Requirement
Water Management Act 2000	The NSW Aquifer Interference Policy (Department of Primary Industries, 2012) documents the requirement for approval of 'aquifer interference activities' under the *Water Management Act 2000*. Requirement for this approval would be confirmed as part of the ongoing design development including the final alignment details and depth of groundwater.

State significant infrastructure statement

Clause 79 of State Environmental Planning Policy (Infrastructure) 2007 (the 'Infrastructure SEPP') permits development for the purpose of a railway or rail infrastructure facilities to be carried out by or on behalf of a public authority without consent, provided that the proposal is not carried out on land reserved under the NSW *National Parks and Wildlife Act 1974* (NPW Act).

As Sydney Metro West comprises a railway that would be carried out by or on behalf of Sydney Metro on land not reserved under the NPW Act, it can be assessed under Part 5 of the EP&A Act. Development consent (under Part 4 of the EP&A Act) from the relevant Council is not required.

Sydney Metro West is permissible without consent by virtue of Clause 79 of the Infrastructure SEPP, meaning that the project is an activity within the meaning of Part 5 of the EP&A Act and Sydney Metro is the determining authority. Sydney Metro, as the proponent and determining authority, has formed the view that Sydney Metro West is likely to significantly affect the environment.

It is also intended to declare Sydney Metro West, by Ministerial Order, to be State significant infrastructure and critical State significant infrastructure under sections 5.12(4) and 5.13 of the EP&A Act respectively. Schedule 5 of State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP) would also be amended to include Sydney Metro West as critical State significant infrastructure.

On this basis Sydney Metro West would be critical State significant infrastructure and subject to Part 5.1 of the EP&A Act.

Appendix B

Stakeholder and community feedback from project scope consultation

Appendix B

Stakeholder and community feedback from project scope consultation

Two rounds of formal stakeholder engagement have been carried out since 2017 based around the release of:

- First Project Scope in 2017
- Project Overview report in 2018.

In addition, ongoing consultation and engagement has been carried out with government agencies, local government and Precinct Partners (Sydney Olympic Park Authority, The Bays, and Westmead Alliance).

A summary of the outcomes of this engagement relevant to the Scoping Report is provided below.

Summary of feedback from local government stakeholders

Sydney Metro has engaged with local councils situated within the Greater Parramatta to Sydney CBD corridor since 2016. These councils are shown in Figure 1 and include Cumberland Council, City of Parramatta Council, Municipalities of Strathfield and Burwood, City of Canada Bay Council, Inner West Council and City of Sydney. Table 1 summarises the key aspects of the Concept relevant to each Council area, which has also guided the types of issues discussed with each council (Table 2).

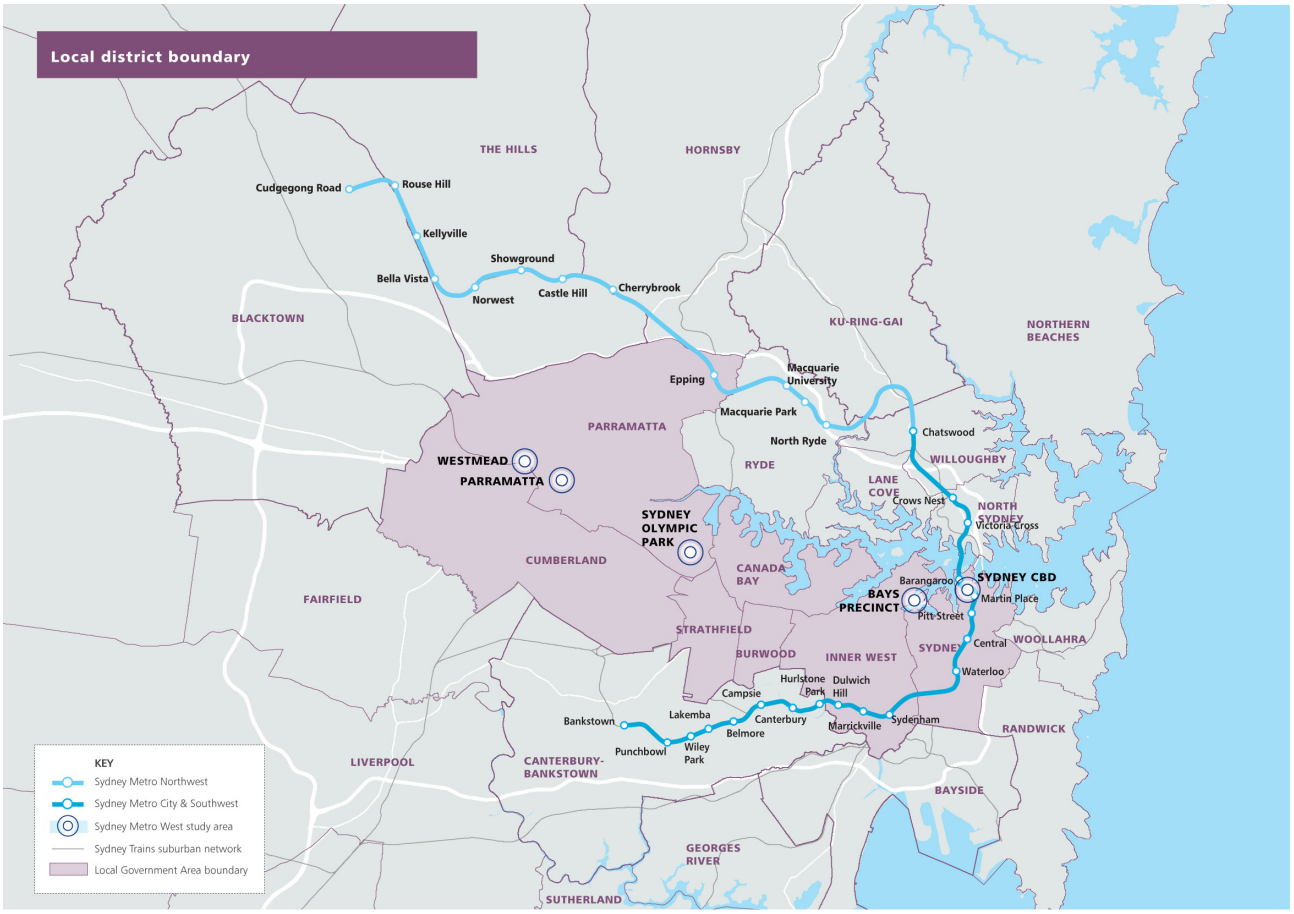

Figure 1: Local councils consulted since 2016

Table 1: Geographical interfaces with local councils

Council	Geographical interface
Cumberland Council	• Westmead (south of existing rail line)
City of Parramatta Council	• Westmead (north of existing rail line) • Parramatta CBD • Sydney Olympic Park • Investigations of potential intermediate station options in the Greater Parramatta Olympic Peninsula area including Rydalmere as a strategic station option
Strathfield Council	• Implications of potential intermediate stations (not located in local government area boundary)
Burwood Council	• Implications of Burwood North Station
City of Canada Bay Council	• T9 Northern Line connection at North Strathfield • Intermediate station options investigations including Burwood North, Kings Bay and Five Dock
Inner West Council	• The Bays Precinct • Implications of Five Dock Station (not located in local government area boundary)
City of Sydney Council	• Overall alignment • Potential Sydney CBD station options • Pyrmont as a strategic station option

Table 2: Key issues covered through local council engagement

Theme	Items covered
General project updates	• Updates on project scope, development and milestones • Sydney Metro West Project objectives • Informing of upcoming formal consultation periods • Overview of feedback from previous engagement
Travel time	• Overview of drivers and customer benefits of a travel time target of about 20 minutes between Parramatta and the Sydney CBD
Station optionality	• Overview of station location evaluation processes for stations relevant to each local government area
Station location analysis	• Overview of station options with a geographical interface with the local government area • High level station design, where relevant
Transport integration	• Sydney Metro West transport integration principles • Overview of transport integration opportunities for stations with a geographical interface with the local government area – including active transport and bus integration • Drivers and benefits of rail interchanges – including the T9 Northern Line (City of Canada Bay Council and Municipality of Strathfield); and the T1 Western Line (City of Parramatta Council and Cumberland Council)
Urban design and place	• Station locality plans and urban design considerations
Local planning	• Council updates on development applications and planning proposals which may impact the Concept • Progress on council-led projects where relevant

Table 3 summarises the feedback from local government from the two rounds of stakeholder engagement and explains how Sydney Metro has considered the feedback received. Table 4 summarises the feedback from peak bodies, representative organisations and groups from the first round of engagement. Table 5 summarises the feedback from Precinct Partners.

Table 3: Summary of feedback from local government stakeholders

Organisation	Summary of feedback – round one	Summary of feedback – round two and from ongoing engagement	Sydney Metro response
City of Parramatta Council	○ Identified that the City of Parramatta (as part of the Westmead Alliance) is undertaking a masterplan for Westmead that will identify opportunities to coordinate with Sydney Metro West	NA	○ Sydney Metro has consulted with the Westmead Innovation District master planning team in determining the most appropriate location for the Westmead Metro Station. This engagement will continue during future development of Sydney Metro West, including consideration of integrated station and precinct development
	○ Previously (in a joint submission with the Sydney Business Chamber) recommended a fast train service linking Western Sydney Airport, and the Parramatta and Sydney CBDs	NA	○ Sydney Metro Greater West has been announced. This metro would connect travellers from the new airport to the rest of Sydney's public transport system, with stations at St Marys, Western Sydney Airport and the Aerotropolis
	○ Recommended the following options: • Use of the existing rail corridor • Intermediate stations at Croydon and Lidcombe, and then Pitt Street Station • Intermediate stations at White Bay and Sydney Olympic Park, and then Pitt Street Station • Barangaroo to Parramatta CBD, with intermediate stations at White Bay and Ryde, with a subsequent connection to Western Sydney Airport	○ Support for connection with T9 Northern Line and T1 Western Line ○ Under 20-minute travel time between Parramatta and the Sydney CBD ○ Strong support for a station at Westmead and an interchange with T1 Western Line, Parramatta Light Rail, T-Way and active transport	○ The Concept establishes a new corridor to improve the public transport network accessibility to key economic centres across the Greater Parramatta to Sydney CBD corridor. Connections with the T1 Western Line and T9 Northern Line are provided at Westmead and North Strathfield respectively. Connections to Parramatta Light Rail are proposed at Westmead and Sydney Olympic Park
	NA	○ Sydney Metro West is aligned with Council's vision for Parramatta ○ Support for a metro station close to or on Civic Link and clear legibility with other transport modes ○ Civic Link Framework Plan and related Development Control Plan needs to be integrated with any future metro station	○ The Parramatta Metro Station is positioned for good connections with the existing and planned civic spaces, including Parramatta Square, Church Street and the proposed Civic Link. The Civic Link Framework Plan and related Development Control Plan will be considered during future development of Sydney Metro West, including integrated station and precinct development

Organisation	Summary of feedback – round one	Summary of feedback – round two and from ongoing engagement	Sydney Metro response
City of Parramatta Council cont.	NA	• Council requests direct involvement in planning for Metro at Sydney Olympic Park	• Engagement with Council will continue during future development of Sydney Metro West
	NA	• Council resolved to advocate a station in the Newington/North Lidcombe area (north of the M4 motorway) • Support for a station at either Camellia or Rydalmere – preference for Camellia • Retain employment lands at Rydalmere	• A strategic station option at Rydalmere has been identified and is still under investigation
Canterbury Bankstown Council	• Acknowledged that Sydney Metro West does not directly impact the Canterbury Bankstown area, however requested that the southwest is given the same level of investment and focus to maximise the benefits possible from this new infrastructure	NA	• Significant investment is proposed as part of Sydney Metro City & Southwest, which includes upgrade and conversion of all 11 stations between Sydenham and Bankstown to metro standards
Strathfield Council	• Recommended stations within the Strathfield and Homebush priority precincts to support additional dwellings and jobs	• Support for Sydney Metro West • Connection and integration to North Strathfield supported	• The Concept includes the opportunity to transfer to and from the T9 Northern Line at North Strathfield
	NA	• Welcomed further briefing once more information is available including decision on funding • Welcomed continued engagement and briefing with Council staff	• Sydney Metro will continue to work with Strathfield Council as the Concept and Stage 1 progress
City of Canada Bay Council	• Support for Kings Bay Station option to serve future development associated with the Parramatta Road Urban Transformation Strategy • Recommended two additional station locations at Burwood and Strathfield/ Homebush	• Support for a connection to the T9 Northern Line at either North Strathfield or Concord West and requests further information	• The Concept includes metro stations at Five Dock and Burwood North and a connection to the T9 Northern Line at North Strathfield

Organisation	Summary of feedback – round one	Summary of feedback – round two and from ongoing engagement	Sydney Metro response
City of Canada Bay Council cont.			
	NA	• Endorses Five Dock in addition to Burwood North within the Parramatta Road Corridor Urban Transformation Strategy area	• With metro stations at North Strathfield, Burwood North and Five Dock, the Concept supports the overall vision for the Parramatta Road Corridor as a high quality multi-use corridor with improved transport choices
	NA	• Requests community consultation sessions held in Five Dock	• Community consultation will continue during the preparation and exhibition of the Environmental Impact Statement. This will include community drop-in sessions across the alignment
Burwood Council	NA	• Support for a metro station at the intersection of Burwood Road and Parramatta Road to serve demand from the north and south	• The Concept includes Burwood North Station near the intersection of Parramatta Road and Burwood Road
	NA	• Plan for a connection between Burwood North Station and Burwood Station including a pedestrian-only link across Parramatta Road	• An entry to the metro station is proposed to be provided on the southern side of Parramatta Road, with a pedestrian underpass
	NA	• Plan for new bus services to connect Burwood North Station with Burwood Station and Strathfield Station • Restore peak hour suburban rail services stopping at Burwood Station. This should be enabled by decreased pressure on the T1 Western Line with the construction of Sydney Metro West	• Bus and rail servicing will be discussed with operators during future development of Sydney Metro West
City of Sydney Council	• Recommended that Sydney Metro West should connect to Central Station (via a new station at Railway Square) • Recommended additional stations at Pyrmont, Ultimo and Green Square East	• Strongly supports Pyrmont station • Supports a station at Central Station to help renew the southern CBD and build upon the education precinct • An interchange at Central could connect to the health and innovation district at Ultimo and Camperdown/ Sydney University	• The Concept includes a strategic station option at Pyrmont. The Concept includes a station in the Sydney CBD that would enable transfer to and from with existing public transport networks, including Sydney Metro City & Southwest, Sydney Trains, Light Rail and bus networks. Further investigation is currently underway to identify an optimum location within the Sydney CBD

Organisation	Summary of feedback – round one	Summary of feedback – round two and from ongoing engagement	Sydney Metro response
City of Sydney Council	• Recommended that opportunities west of Parramatta at Badgerys Creek Airport and east of Green Square at Randwick and Maroubra should be considered	NA	• Potential station locations beyond the Sydney CBD would be considered as part of planning for a future extension to the south-east • Sydney Metro Greater West has been announced. This metro would connect travellers from the new airport to the rest of Sydney's public transport system, with stations at St Marys, Western Sydney Airport and the Aerotropolis.
	NA	• Supports the broad Sydney Metro West concept • Supports accelerated delivery of Sydney Metro West – no later than 2028	• Further information on delivery timeframes for Sydney Metro West will be provided as part of the Environmental Impact Statement
Southern Sydney Regional Organisation of Councils (SSROC)	• Recommended a station at Burwood to support its role as a strategic or district centre	NA	• The Concept includes Burwood North Station near the intersection of Parramatta Road and Burwood Road

Table 4: Early feedback from peak bodies, representative organisations and groups

Organisation	Summary
10,000 Friends of Greater Sydney (FROGS)	Recommendations include: • Need to augment the capacity of the current heavy rail lines in the western rail corridor • Use of single-deck rolling stock • Various station locations • Need for a second station at Parramatta • Need for a fast rail link from Parramatta to Western Sydney Airport, joining to the Sydney CBD with a separate line from Sydney Metro West in the future
Action for Public Transport (NSW) Inc	• Recommended that metro should provide cross-platform interchange to other rail services and that stations should be not too far apart • Suggested that Sydney Metro West provides an opportunity to transform Parramatta Road • Suggested route alignments and station locations for east, south and south-west of the Sydney CBD
Australian Rugby Union (ARU)	• Recommended a station at Moore Park to address the need for better public transport connections for sports fans
Cricket NSW	• Recommended a station at Moore Park to support the multiple sporting events and align with other domestic and international sporting precincts by providing better public transport connectivity
Kings Bay Partnership	• Supported a Kings Bay Station option
Liverpool Transport Taskforce	• Recommended four metro tracks between the Sydney CBD and Parramatta to enable both express and all-stops services • Supported a Concord West Station option rather than Strathfield • Suggested station locations for east of the Sydney CBD • Recommended faster and more connected services for Liverpool
NSW Rugby Union	• Suggested the Moore Park area would benefit from an integrated public transport system

Organisation	Summary
Royal Agricultural Society	• Recommended that the Olympic Park Station for Sydney Metro West should be located in the south-east of the Sydney Showground site (in or around the existing P6 car park site)
Sydney Cricket and Sports Ground Trust	• Recommended a station at Moore Park to significantly decrease traffic congestion during major events, to the benefit of event attendees, as well as local businesses and residents
Sydney Swans Ltd	• Supports Sydney Metro West • Recommended a station at Moore Park
Western Sydney University	• Recommended a station at Westmead to support jobs within the education and health super precinct

Table 5: Summary of feedback from Precinct Partners

Precinct Partners	
• Sydney Olympic Park Authority • UrbanGrowth NSW Development Corporation • Ports Authority of NSW • Westmead Alliance	• Alignment with master planning processes • Coordination and alignment on staging and implementation of masterplan outcomes and other infrastructure • Joint decision making on station location, design, transport integration and economic benefit realisation

Community information and engagement – round one

The "have your say" survey from round one yielded useful information to further inform the development of Sydney Metro West.

Key insights from the 1,000 people that participated in the survey included:

- Top five suggested station locations (apart from the four key precincts announced) included Five Dock, Wentworth Point, Newington, North Strathfield and Westmead
- Thirty-nine per cent requested a metro station in their own suburb, 41 per cent did not request a metro station in their own suburb, and 20 per cent did not state a metro station location preference
- Majority of survey respondents use public transport daily and want a train service that is frequent, with no timetable
- Top five community attributes that are valued (in order) include:
  - parks and recreational facilities
  - cafes restaurants and shops
  - natural environment
  - a sense of community
  - walking and cycling links
- Seventy-four per cent stated they were not concerned about a metro station being built in their suburb, 15 per cent replied they would be concerned, 10 per cent replied that maybe they would be concerned (one per cent did not answer this question).

For the survey respondents that expressed concern about a metro station being built in their suburb (15 per cent), a follow-up question asked for more information. Figure 2 summarises the concerns provided by this group of survey respondents.

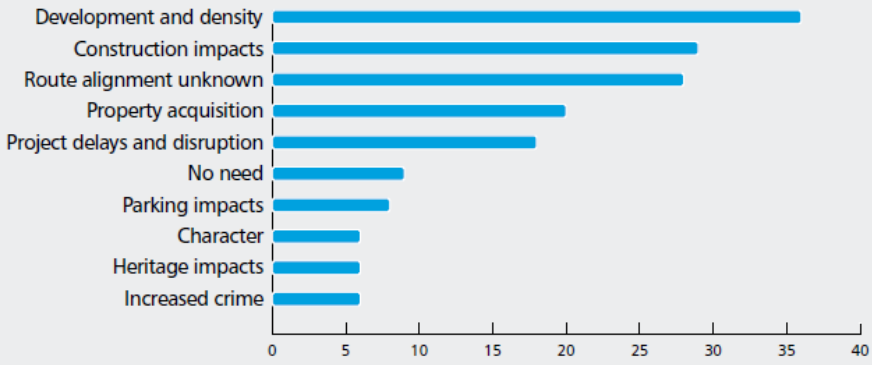

Figure 2: Survey results from question: 'Why are you concerned about a metro station being built in your suburb?

In addition to the 1,000 "have your say" survey responses, 39 submissions were received from members of the community, with 38 submissions from individuals and one submission from the Save North Strathfield Residents Action Group. The majority of community submissions were supportive of Sydney Metro West.

A summary of the key themes from 39 community submissions received during round one of the community information and engagement is provided in Table 6.

Table 6: Summary of key themes from round one community information and engagement

Topic	Issue raised	Sydney Metro West response
Strategic objectives and justification	Some submissions felt Sydney Metro West should be delivered earlier than the late 2020s, to support forecast population growth and relieve congestion on the T1 Western Line. It was also felt that consideration should be given to connecting communities that are currently not serviced by rail, while being aware of the impact of high-density development as a result of urban renewal.	Sydney Metro will continue to investigate ways to deliver Sydney Metro West as efficiently as possible. The delivery of Sydney Metro Northwest and Sydney Metro City & Southwest will provide some relief from congestion for the T1 Western Line when it opens in full configuration in 2024. The Concept includes stations in areas not currently serviced by rail (Burwood North, Five Dock and The Bays) and interchange opportunities with the suburban rail network at Westmead, North Strathfield and in the Sydney CBD.
Land use and development	Urban renewal, including employment and higher-density housing, could be associated with Sydney Metro West. Many submissions had a view that effective public transport solutions needed to accompany new developments in the corridor, and that Sydney Metro West should consider these areas in addition to areas marked for growth. There were mixed views on development potential according to the area.	A range of station options within the corridor have been considered to determine which would benefit most from a metro service and how to best integrate with land use planning along the corridor. As part of its ongoing analysis, Sydney Metro will look at how the existing bus network can be optimised to achieve better customer outcomes, and opportunities presented to optimise the broader public transport network.
Project cost and funding	Some submissions expressed concern about the value-capture process and how it would not meet the long-term local and social infrastructure needs of urban renewal locations.	Various funding options including value-capture mechanisms are being considered. This is beyond the scope of the planning approval process.

Topic	Issue raised	Sydney Metro West response
Project definition – train type, journey times and station frequency	Some submissions felt that service on the new line would need to be frequent, support the population and employment areas, and be significantly less than a 25 to 27 minute journey time to compete with the T1 Western Line. Others felt that the journey time should be between 10 and 20 minutes. There were mixed views about providing a fast- or high-speed rail service versus the number of stations. Submissions wanting greater accessibility for communities west of Parramatta from the Western Sydney Airport to the Sydney CBD wanted a fast service. Submissions from locations between the Parramatta and Sydney CBDs that currently do not have access to a mass-transit solution, generally requested a metro station within their area. It was also mentioned that fewer stations would provide less opportunity for people to use the service.	To achieve the optimum balance, Sydney Metro have looked at a combination of speed of travel, frequency of service, the number of stations, and the reliability of the service. There is also the need to link communities not currently serviced by rail to major job centres. The optimal combination of all these factors to provide the best outcome for the majority of customers informed the development of the Concept.
Transport integration	Many submissions expressed concern about the need to relieve congestion on the T1 Western Line, and also the need to integrate rail lines to create a north–south connection. Other comments included the need to provide connections to ferries and to local bus routes within the corridor. Respondents felt that the new line should not duplicate the current T1 Western Line, even though there was congestion on that line, but should instead service new areas.	The Greater Sydney Service and Infrastructure Plan released as part of the Future Transport 2056 strategy includes several mass transit links for further investigation around Parramatta to expand 30-minute access to education, jobs and services. This includes links from the north to south, including potential links between Parramatta–Epping and Parramatta–Kogarah. Relieving the T1 Western Line is a key objective for Sydney Metro West. All areas within the study area have been investigated, and the Concept would provide new areas with rail services.
Road network performance	Many submissions welcomed Sydney Metro West, as they felt that it would reduce congestion on the roads. They also raised the importance of a metro station within the Parramatta Road Corridor to cater for growth and support the Parramatta Road Urban Transformation Strategy.	The Greater Sydney Service and Infrastructure Plan released as part of the Future Transport 2056 strategy proposes a range of transport initiatives to support growth and improve journey times. This includes Parramatta Road public transport improvements with planning underway. The Concept has been developed with reference to strategic investigations to support broader land use planning within the corridor, such as the Parramatta Road Urban Transformation Strategy, The Bays Urban Transformation Program, the Sydney Olympic Park Master Plan, and the Greater Sydney Commission's vision for the Greater Parramatta and the Olympic Peninsula (GPOP). Directly relevant to these plans and strategies, the Concept includes new metro stations at Sydney Olympic Park, North Strathfield, Burwood North and The Bays Precinct.
Local amenity, precinct planning and place-making	Some submissions felt that station locations should be walkable and cycle friendly and include pick-up and drop-off points.	All stations forming part of the Concept would prioritise walking and cycling access, and would provide cycle parking options, to encourage active transport connections. Stations would also be designed to provide easy transfer to other transport services, such as buses, and include kiss-and-ride, ride share and taxi zones.

Topic	Issue raised	Sydney Metro West response
Project design and construction	One submission provided advice on design and construction considerations to ensure benefits of the new Sydney Metro West and T1 Western Line could both be realised.	All submissions providing technical advice and comments were provided to the project team for consideration.
Options outside study area	Some submissions raised the importance of connecting a north–south line to Sydney Metro West, as well as providing a connection to Western Sydney Airport. One submission suggested using the same branding for metro as heavy rail to avoid confusion for passengers.	The Future Transport Strategy 2056 proposes future initiatives and potential future transport solutions, including rail lines. Sydney Metro Greater West has been announced. This metro would connect travellers from the new airport to the rest of Sydney's public transport system, with stations at St Marys, Western Sydney Airport and the Aerotropolis. For ease of customer information and wayfinding, Sydney Metro and Sydney Trains will continue to have individual branding.
Location specific considerations	Location-specific considerations outlining issues, constraints and opportunities, were provided in submissions for many locations.	Further detail on Sydney Metro West, including proposed and potential station locations was provided to the community as part of the second round of community information and engagement. Location specific considerations were therefore considered in more detail as part of the second round (refer below).

Community information and engagement – round two

The overview document, Sydney Metro West: A new railway for Western Sydney – Project overview (March 2018), provided a summary of Sydney Metro West. This included station locations at Westmead, Parramatta CBD, Sydney Olympic Park, The Bays Precinct and the Sydney CBD.

Sydney Metro West: A new railway for Western Sydney – Project overview (March 2018) also outlined potential intermediate stations that were being investigated at Rydalmere/Camellia, Burwood North/Kings Bay/Five Dock and Pyrmont, as well as a connection to the T9 Northern Line at either North Strathfield or Concord West.

Most submissions received were broadly positive and supportive of Sydney Metro West and/or the metro network, while some others outlined concerns and raised questions.

Fifteen submissions were received from major stakeholders, including local governments, peak bodies, education providers, community groups and others. Many submissions raised multiple issues, resulting in a total greater than the total number of submissions.

An overview of all submission topics, as well as feedback provided through interactive maps, is provided in Figure 3.

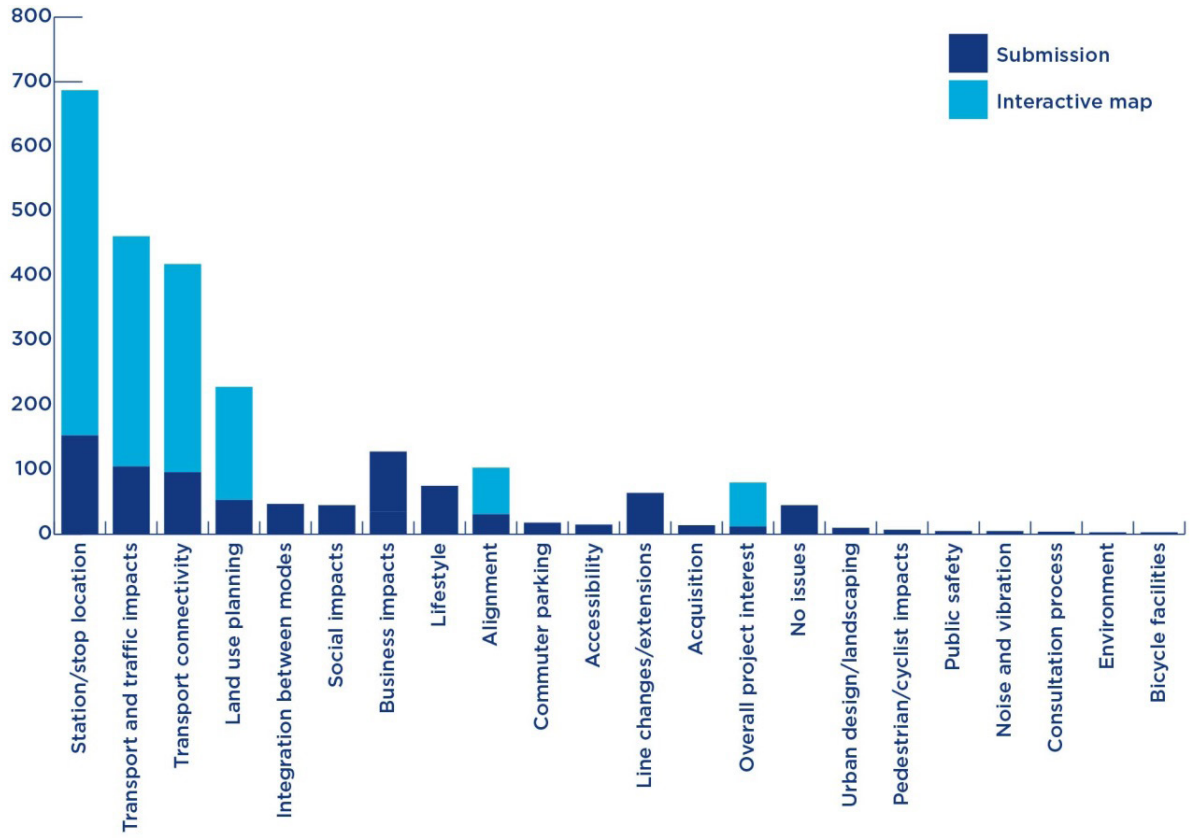

Figure 3: Submission issues raised by category

Table 7 outlines the feedback received as part of the second phase of consultation regarding Sydney Metro West and how this has been considered in refining the scope of Sydney Metro West or in defining the scope of the Environmental Impact Statement.

Table 7: Feedback from the round two of community consultation and engagement

Topic	Key Issues raised	Sydney Metro West response
Confirmed stations		
Westmead Metro Station	Support for a station at Westmead and an opportunity to create a transport interchange.	Support for Westmead Station is acknowledged.
	Concern about parking availability around Westmead Station.	The Environmental Impact Statement will include an assessment of parking changes around Westmead as a result of the Concept and Stage 1.
	Suggestion that the station should be closer to Westmead Hospital instead of the current proposed station location.	The proposed Westmead Metro Station would be located at the existing Westmead Station to provide opportunity for transfer to and from the T1 Western Line. Connections to the hospital precinct would be available via the future Parramatta Light Rail. Further information on the options assessment for Westmead Station is provided in Chapter 3.
Parramatta Metro Station	Support for a station at Parramatta with some comments supporting an interchange and other comments supporting a new location.	Support for a station at Parramatta is acknowledged. The proposed Parramatta Metro Station would be located to the north of the existing station within the Parramatta CBD. Further information on the options assessment for Parramatta Metro Station is provided in Chapter 3.

Topic	Key Issues raised	Sydney Metro West response
Sydney Olympic Park Metro Station	Concern about the similarities with the current train line and light rail.	The need for Sydney Metro West is identified in Chapter 2. The planned Parramatta Light Rail Stage 2 and Sydney Metro West would provide complementary services.
	Recommendation for transport planning to identify interchanges with light rail and bus services.	Interchange between Sydney Metro West and both the proposed Parramatta Light Rail Stage 2 and buses is proposed at Sydney Olympic Park. The Environmental Impact Statement will provide information related to transport interchange principles. Details of interchange potential at each station will form part of the assessment of future stages of Sydney Metro West.
The Bays Station	Support for a station at The Bays Precinct, particularly near the White Bay Power Station and the development of a multi modal transport plan to facilitate transport to surrounding areas.	The support for The Bays Station is acknowledged. The Environmental Impact Statement will provide information related to transport interchange principles. Details of interchange potential at each station will form part of the assessment of future stages of Sydney Metro West.
Potential intermediate stations		
Rydalmere	Support for a station at Rydalmere to service the Western Sydney University campus and provide an interchange between metro, light rail and ferries.	The preferred option for a station between Parramatta and Sydney Olympic Park is at Rydalmere. Rydalmere has been included as a strategic station option. Further information is provided in Chapter 3.
Camellia	Support for a station at Camellia to facilitate expected growth related to the draft Camellia Town Centre Master Plan and to include interchange with a light rail stop.	A station at Camellia is not proposed. Further information is provided in Chapter 3.
Burwood North	Mixed response to a station at Burwood North with some support.	Sydney Metro West includes a proposed station at Burwood North. The proposed station would provide a more frequent, reliable and fast mass transit service. It would also support the development of the Burwood strategic centre and would create an opportunity to integrate with the existing bus networks along Burwood Road and Parramatta Road, providing an efficient interchange for customers. Further information is provided in Chapters 3 and 6.
Kings Bay	Small amount of support for a station at Kings Bay which could complement the Kings Bay precinct plan that is part of the Parramatta Road Urban Transformation Strategy.	A station at Kings Bay is not proposed. Further information is provided in Chapter 3.
Five Dock	Support for a station at Five Dock as the area needed better public transport connections with current long journey times to the CBD, compared to Burwood.	The Concept includes proposed stations at both Burwood North and Five Dock. Further information is provided in Chapters 3 and 6.
Pyrmont	Support for a station at Pyrmont due to limited capacity and reliability with existing transport modes.	Sydney Metro is continuing to investigate the potential for a station at Pyrmont. Further information is provided in Chapter 3.
T9 Northern Line connection	More support for a station at North Strathfield rather than a station at Concord West.	The proposed location for a T9 Northern Line connection is North Strathfield. Further information is provided in Chapters 3 and 6.

Topic	Key Issues raised	Sydney Metro West response
North Strathfield	Support included relieving congestion on the T9 Northern Line.	The support for North Strathfield Metro Station is acknowledged. The Concept includes a proposed station at North Strathfield.
	Qualified support due to concerns about property acquisitions.	The support for North Strathfield Station is acknowledged. Property acquisition required for North Strathfield Metro Station is identified in Chapter 8 and the need for private property acquisition has largely been avoided. The Environmental Impact Statement will provide further information regarding the process for and impacts of property acquisition.
	Concerns about changing the character of the area, potential to worsen the constricted road network and concerns about increasing the density of the suburb.	Land use change around North Strathfield Metro Station is planned as part of the Parramatta Road Urban Transformation Plan. The Environmental Impact Statement will provide further information regarding how Sydney Metro West would support planned growth.
Concord West	Support for a station at Concord West due to easing traffic congestion, revitalising the area and providing access to cultural and recreational facilities.	A station at Concord West is not proposed. Further information is provided in Chapter 3.
	Not supportive of a station due to potential heritage impacts and there is fewer growth opportunities.	A station at Concord West is not proposed. Further information is provided in Chapter 3.
Alternative Stations		
Support for other potential station locations	Support for a station at either Silverwater or Newington, with Newington receiving almost twice the amount of support.	The preferred option for a station between Parramatta and Sydney Olympic Park is at Rydalmere. Further information is provided in Chapter 3.
Other issues		
Transport and traffic impacts	Concern about the transport and traffic impacts during construction.	The Environmental Impact Statement will provide an assessment of potential construction traffic and transport impacts.
	Concern about additional growth within planned precincts and the need for Metro to support existing and future development.	The Environmental Impact Statement will provide further information regarding how Sydney Metro West would support planned growth.
	The Concept would take cars off the road, reduce future car need and reduce road congestion.	The support for the benefits of Sydney Metro West is acknowledged. The Environmental Impact Statement will provide additional information regarding the traffic and transport benefits of Sydney Metro West.
Transport connectivity	Suggestions outlined alternative connections to existing networks, such as Sydney Metro Northwest, Sydney Metro City & Southwest and Dulwich Hill light rail.	The Concept includes opportunity to interchange with the Sydney Metro City & Southwest line in the Sydney CBD. Additional information regarding transport integration principles would be provided in the Environmental Impact Statement with further detail provided in the environmental impact assessment of future stages.
	Concerns about ensuring integration with other modes of transport.	The Environmental Impact Statement will provide further information regarding transport integration principles with further detail provided in the environmental impact assessment of future stages.
	Strong desire for place-making and good design outcomes at interchanges.	The Environmental Impact Statement will provide urban design and place-making principles for stations and interchanges. Further detail will be provided in the environmental impact assessment of future stages.

Topic	Key Issues raised	Sydney Metro West response
Land use planning	Concern that Sydney Metro West would lead to an increase in residential densities near the stations.	The Environmental Impact Statement will provide information regarding how Sydney Metro West would support planned growth.
	Resulting high-rise developments would add to congestion and make street parking more difficult.	The Environmental Impact Statement will provide information regarding how Sydney Metro West would support planned growth.
	Concerns about increased land use without a mass transit solution as there are constraints on the existing road and rail networks.	The Environmental Impact Statement for the Concept will provide information regarding how Sydney Metro West would support planned growth.
Social impacts	Support for the positive social impacts of Sydney Metro West, including providing connections to services, businesses, education and medical facilities.	The support for the benefits of Sydney Metro West is acknowledged. The Environmental Impact Statement will provide information on the social benefits of Sydney Metro West.
	Benefits due to reduced commuting times and increasing family and social time.	The support for the benefits of Sydney Metro West is acknowledged. The Environmental Impact Statement will provide information on the social benefits of Sydney Metro West.
	Project would reduce congestion and increase amenity in many areas.	The support for the benefits of Sydney Metro West is acknowledged. The Environmental Impact Statement will provide information on the congestion and amenity benefits of Sydney Metro West.
	Propose an active transport (walking and cycling) corridor to improve the Inner West cycling network.	The Environmental Impact Statement will provide information regarding transport integration principles, including prioritising walking and cycling access to and from each station. Further details regarding transport integration would be provided as part of the assessment of future stages.
Business impacts	Support for increased access to businesses for employees and customers which would increase the productivity and economic output of the area.	The support for the benefits of Sydney Metro West is acknowledged. The Environmental Impact Statement will provide information on the wider economic benefits of Sydney Metro West.
	Support for stations to be near business, retail and employment centres instead of being near residential areas.	Sydney Metro West is being planned to provide a balance of station types. Station servicing business and employment centres are required as destination stations and to provide economic benefits. Stations servicing residential areas are also required as origin stations and to provide land use and housing benefits.
	Concern about the negative impact of businesses near stations during construction.	The Environmental Impact Statement will provide an assessment of the potential impacts of construction on local businesses.
Alignment and network	Many submissions suggested alternative alignments or extensions which are outside of the scope of Sydney Metro West, with some people outlining complete rail networks for Greater Sydney and regional NSW.	Alternative alignments are discussed in Chapter 3. Extensions to the Concept are not within the current scope of Sydney Metro West.
Commuter parking	Concern about the need for commuter car parking at stations, particularly at Westmead, North Strathfield and Concord West Stations.	The Environmental Impact Statement will provide information regarding transport integration and interchange principles. Based on the proximity of the proposed stations to CBD locations, commuter parking is not proposed at any stations.

Topic	Key Issues raised	Sydney Metro West response
Accessibility	Concern about accessibility at stations.	All Sydney Metro West stations would be fully accessible. Further details are provided in Chapter 6.
	Concern about decrease in seating on metro train compared to Sydney Trains.	The Environmental Impact Statement will provide information on the proposed rolling stock. It is anticipated that metro trains will have a mixture of seating and standing room.
	Concern there would be insufficient time for people to board or exit the train in the peak period of trains every four minutes.	The Environmental Impact Statement will provide information on the proposed rolling stock and design principles for boarding. The metro product would provide level access between the platform and train, reduced gaps between the platform and train and at least three double doors per side per carriage. These features would allow efficient and safe boarding and alighting including for customers with special needs.
Acquisition	Concern about property acquisition associated with Sydney Metro West. Concern about property acquisition and suggestions that stations be placed on or under land that is open space, industrial or community use.	Sydney Metro would only acquire properties necessary to facilitate construction or operation of the project. Sydney Metro has minimised the need for private property acquisition. Sydney Metro will contact those property owners whose properties will need to be acquired. The property acquisition process will be detailed in the Environmental Impact Statement.
	Questions about when residents will be advised about the type of development (higher density housing, retail, commercial) that will accompany stations.	The Concept supports planned growth. Future stages of will provide opportunity for Council and community engagement and input into the types of development Council and residents would like to access in their station precincts. Any proposed future development associated with station precincts will be subject to separate planning assessment processes and approvals.
Urban design and landscaping	Support for public spaces such as squares and parks at station entrances.	Design principles for stations and station precincts will be provided as part of the Environmental Impact Statement.
	Support for safeguarding extensions within station design.	The support for safeguarding extensions is acknowledged.
	No support for over station development outside of the core CBD area.	New metro stations provide an opportunity for transit-oriented development. This involves integrating land use planning with existing or planned infrastructure to create revitalised local communities, greater access to public transport and a broader range of housing and employment options. Any developments proposed to be integrated with new metro stations would be subject to a separate planning approvals process in accordance with the EP&A Act.
Pedestrians and cyclists	Stations should be planned to ensure the largest number of people possible can walk or cycle to stations.	The Environmental Impact Statement will provide information regarding transport integration principles, including prioritising walking and cycling access to and from each station. Further details regarding transport integration would be provided as part of the assessment of future stages.
	Support for bicycle parking facilities or bicycle transport areas.	The Environmental Impact Statement will provide information regarding transport integration principles, including prioritising walking and cycling access to and from each station (including bicycle parking facilities). Further details regarding transport integration would be provided as part of the assessment of future stages.

Topic	Key Issues raised	Sydney Metro West response
Public safety	Concern about public safety.	Design principles, including public safety considerations, for stations and station precincts will be provided as part of the Environmental Impact Statement.
	Suggestions that all stations include a police station.	
	Concern that a metro would increase crime.	
Noise and vibration	Concern about noise and vibration, mainly from construction tunnelling.	The Environmental Impact Statement will provide an assessment of potential construction noise and vibration impacts including those from tunnelling.
	Concern that properties would be impacted by the construction of tunnels and during operation of the metro.	The Environmental Impact Statement will provide an assessment of potential noise and vibration impacts on nearby properties during construction and operation.
	Suggestion that Sydney Metro fund dilapidation reports for properties above the tunnel.	The Environmental Impact Statement will provide an assessment of potential impacts to properties including identification of mitigation measures such as existing condition surveys.
Consultation	Concern about the consultation process for Sydney Metro West and requests that detailed communication for the entire design and construction phases be provided.	Sydney Metro is committed to consulting with the community through all phases of the project. Further details regarding consultation undertaken to date and proposed future consultation are provided in Chapter 5.
	Concern that it is difficult to comment without decision on station locations, design and integration.	The Environmental Impact Statement will provide information on the station locations. There will be more opportunities provided through the planning assessment process and ongoing community and stakeholder feedback to provide comment input into station design and integration.
	Request for transparency for the project at every stage.	Sydney Metro is committed to consulting with the community through all phases of the project. Further details regarding consultation undertaken to date and proposed future consultation are provided in Chapter 5.
	Request for a clear and understandable explanation of the cost-benefit of Sydney Metro West.	The Environmental Impact Statement will provide further details regarding the potential impacts and benefits of Sydney Metro West.
Environment	Support environmental benefits of public transport.	The support for the benefits of Sydney Metro West is acknowledged.
	Importance of trees, to make place liveable, provide shade and reduce carbon dioxide.	The Environmental Impact Statement will provide principles relating to urban design and place-making around stations and operational ancillary facilities.
	Concern about what would happen to the spoil from the tunnelling process.	The Environmental Impact Statement will include information regarding the management of spoil.
	Concern about existing construction impacts in Parramatta causing poor noise and air quality. Sydney Metro West should consider this and not contribute further impacts.	The Environmental Impact Statement will provide an assessment of potential cumulative construction impacts.
Timeframe/ staging	Request for the project to be delivered faster.	The Environmental Impact Statement will provide an indicative delivery timeframe.

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